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Corporate green bonds in Europe

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Abstract

This work investigates whether the issuance of green bonds by European banks positively affects their stock returns and whether it allows them to raise capital at a lower cost than traditional bonds. The methodology adopted is an event study – designed on the basis of a seminal work based on a different sample – where the returns of two alternative indices are assumed as a proxy of market returns. When using the first, geographic market index, due to a high volatility in daily returns, the study does not find significant cumulative abnormal returns (CARs), although the average value is positive; even when using the second, industry index, there is no significant evidence of abnormal returns. Hence, the stock performance in the European banking industry does not seem to be significantly sensitive to green bond issuances. However, independently of the index used, CARs are higher when a bank's green bond is issued for the first time or with a third-party certificate. In addition, the analysis of yields at issue reveals that so far green bonds have not represented a cheaper source of funding for European banks.

Introduction

Once the economist Milton Friedman argued that the sole purpose of a business is to generate profits for its shareholders. He believed that "the discussions of the social responsibilities of business […] were notable for their analytical looseness and lack of rigor[1]" and that, in practice, "the doctrine of social responsibility was frequently a cloak for actions that are justified on other grounds rather than a reason for those actions". The social responsibility of business is to increase its profits. He went on to argue that the companies that did adopt "responsible" attitudes would be faced with more binding constraints than companies that did not, rendering them less competitive.

In the same years, in Italy, one of the most important Italian entrepreneurs of the nineties, Adriano Olivetti, said: "The firm cannot only look at the profit index. It must distribute wealth, culture, services, democracy. I think factory for man, not man for factory". What happened? Why this so different view of doing business?

From a formal point of view, Milton Friedman's opinion is fully in line with the classical microeconomic theory which assumes that the firm's objective is to maximize its profits and that cost minimization is a necessary condition for profit maximization. It can be shown that under the assumption of price-taking behaviour, the purpose of the firm is to maximize profits[2].

Profits allow the company to remain in existence without external support and to pursue its objectives. Moreover, shareholders request remuneration for their investment in the form of dividends and/or capital gain and the managers need to generate profits to save their place.

Friedman's view prevailed until the first half of the 20th century. Then something changed. In the second half of the century, a shift in the business paradigm of companies can be observed: from shareholders to stakeholders. Profit maximization was no longer the sole priority of companies. They started to include social responsibility in their way of doing business - there are even cases in which shareholders can mingle with stakeholders [3]. Nowadays, there are different ways through which a firm can signal its social responsibility. The Corporate Social Responsibility (CRO) can take the form of volunteering, grants or even social investments. Some of the most important and widely used instruments that make the company perceived as

[1] Friedman M., 1970, *Titolo.* The New York Times.

[2] See Mass-Colell, A., Whinston, M.D., Green, J.R., 1995, *Microeconomic Theory*, pag 153.

3 Mitbestimmung is one of the pillars of the social partnership in Germany. Employees co-manage (mitbestimmen) the company with the shareholders since they can elect or designate representatives. As Teichmann and Monsenepwo (2018) pointed out: "This social cohesion undoubtedly constitutes one of the essential elements behind the performance of German companies".

responsible and stakeholder-oriented are: B-Corp certifications, Social bonds, Sustainability Bonds and Green bonds.

There are more than 500 firms all over the world that have the B-Corp certification. It is a designation that a business is meeting high standards of verified social and environmental performance, accountability, and transparency ascertained considering various aspects from employee benefits and charitable giving to supply chain practices and input materials.

As defined by the International Capital Market Association (ICMA), Social Bonds are any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance in part or in full new and/or existing eligible Social Projects and which are aligned with the four core components of the Social Bond Principles. In 2022 there are four types of Social Bonds: Standard Social Use of Proceeds Bonds, Social Revenue Bonds, Social Project Bond and Secured Social Bonds[4].

Since Social Projects may also have environmental co-benefits and that the classification of a use of proceeds bond as a Social Bond should be determined by the issuer based on its primary objectives for the underlying projects, bonds that intentionally mix green and social projects are referred to as Sustainability Bonds.

Green bonds are fixed income instruments whose proceeds are used to finance green projects. There are several definitions of green projects. At a European level the EU Taxonomy Regulation establishes a classification system which identifies whether or not a particular economic activity should be considered environmentally sustainable. Green projects are those who are consistence with the Regulation. At a global level the Sustainable Development Goals define 17 goals that are supposed to be 'green' by definition. Both the EU Taxonomy Regulation and the Sustainable Development Goals are goal-oriented. The aim of the EU Taxonomy Regulation is to provide a common and clear definition of sustainability in order to direct investments towards sustainable investment to meet the EU's climate and energy targets for 2030 and reach the objectives of the European green deal. On the other hand, the Global Goals, adopted by the United Nations in 2015, can be seen as a universal call to action to end poverty, protect the planet and ensure that by 2030 all people enjoy peace and prosperity.

The United Nations[5] estimates that the target of the Paris Agreement will require around $3 trillion in investment each year until 2050. World Economic Forum (WEF) claimed that "to

[4] ICMA, 2021, *Social Bond Principles. Voluntary Process Guidelines for Issuing Social Bonds*.

[5] The intergovernal panel on climate change (UN), *Mitigation pathways compatible with 1.5°C in the context of sustainable development*

raise these huge sums, governments and companies are increasingly turning to green bonds"[6]. According to the WEF, companies will increase green bonds emissions all over the world.

Since its inception Europe is one of the most active areas in the issuance of corporate green bonds and the banking sector is the industry that issued the most in Europe from 2013 to 2021. These two reasons led me to study the corporate green bond market in EU with a quantitative focus on the banking sector.

The study is structured as follows. In the first chapter, I provide a detailed descriptive analysis of the status of the European corporate green bonds. In this section all the industries and issuances are considered from the origin to December 31, 2021. In the second chapter, I analyse the legal framework behind the issuance of corporate green bonds. The first paragraphs cover the most important standards at a global level, ICMA Principles and the CBI Standard. The following are devoted to the European legal framework: EU Taxonomy Regulation and the Commission proposal for a Regulation of the European Parliament and of the Council on European Green Bonds. The last chapter is dedicated to the quantitative analysis of the corporate green bonds issued by European banks.

I move my analysis from the consideration that companies decide to issue green bonds, among all the possible rationales, to signal their environmental commitment and/or to obtain cheaper financing. Previous works have shown that eco-friendly corporates' behaviour have a positive effect on the stock market returns (e.g., Flammer, 2013; Klassen and McLaughlin, 1996; Krueger, 2015). From this consideration, stock market returns are supposed to respond positively to the issuance of corporate green bonds. A credible green commitment would be shown by positive stock market returns after the announcement of a green bond issuance. Another important rational that previous studies proved to be real, is that green bonds represent a cheaper source of capital. According to the supporters of this theory, investors are willing to accept a lower return on their investment for social benefits. However, several surveys show that investors would not invest in green bonds unless they are competitive.

In conducting the analysis, I replicated the paper of the Caroline Flammer, *Corporate green bonds* (2021). The empirical analysis involved all corporate green bonds issued in Europe from 2013 to 2021 by European banks. I drew the dataset from Bloomberg's fixed income database. Using an event study methodology, I investigated whether the issuance of corporate green bonds signals a credible green commitment to the market. Then, I compared the behaviour of the seasoned issuances (i.e. the issuances following the first) with the first one and I examined

[6] World Economic Forum. 2021. *What are green bonds and why is this market growing fast?*

the behaviour of certified and non-certified corporate green bonds. I did this using two difference indexes: a geographic index, Stoxx50, and a sectorial one, Stoxx 600 banks.

In the last section, I examined whether the issuance of green bonds represents a cheaper source of financing compared to the traditional bonds. As the author, I followed the methodology used by Larcker and Watts (2020) in the contest of municipal bonds. For each green bond I found a brown bond by the same issuer with similar characteristics. This allowed me to ensure that the only difference between the two bonds where the greenness.

The work intends to provide a contribution to the study of corporate green bond market in Europe with a particular focus on the banking sector and contributes to the growing literature on impact investing.

1. Corporate green bonds market in Europe

The chapter consists of three paragraphs. Firstly, I describe the dataset used to study the corporate green bonds market in Europe. The second paragraph is devoted to the descriptive analysis of the market. In the third paragraph, I describe the green bonds market by industries.

1.1 Corporate Green Bonds Data

To compile a dataset of corporate green bonds, I extracted all corporate bonds in Bloomberg's fixed income database that are labelled as "green bonds" (specifically, bonds for which the field "Green bond indicator" is "Yes"). I excluded bonds whose issuer's BICS (Bloomberg Industry Classification System) is "Sovereigns or Government Agencies or Supernationals" and I included only European countries. Then, I decided not to include those securities whose issuer's industry was "Government Agency" or "Government Regional". A total of 1168 corporate green bonds meeting the above criteria were issued from January 1, 2013 to December 31, 2021.

1.2 The European green bonds market

The first corporate green bond issue in Europe took place in 2013. Gecina SA, a real estate company, issued in France a debt instrument with the following characteristics: i) maturity of 10 years ii) amount issued of 300 bln iii) coupon rate of 2,875% and iv) proceeds' allocation focus on the financing or the refinancing of a portfolio of eligible green assets.

Table 1

Corporate green bonds over time.

This table reports the number of corporate green bonds issued from 2013 to 2021 on an annual basis in Europe and the corresponding amount (€ B).

Year	# Bonds	€ Amount issued (billion)
2013	1	0.300
2014	7	3.940
2015	20	7.324
2016	37	15.186
2017	57	23.779
2018	89	32.158
2019	169	65.813
2020	289	67.239
2021	499	123.038
Total	1168	338.777

Many different players have issued corporate green bonds since the origin in Europe. **Table 1** reports the evolution of the number of corporate green bonds issuances through the years and the corresponding amount issued. From 2013 to 2021 the corporate green bond market has grown fast both in terms of number and amount of green bonds issued. For the first, the average growth is around 70% if we consider the years from 2015[7] to 2021 with a median value of 72%. The average amount, instead, grew slightly less (65%). This is mainly due to the fact that in the two-period 2019 and 2020 the average amount issued remained the same, while the number of new securities issued increased by 71%.

[7] I chose to start the computation from 2015 to smooth out the sensitivity of the average to extreme values. From 2015 to 2021, in fact, the average variation is around 70% on an annual basis. If I had included the two-year period 2013-2014, I would have obtained an annual variation on average more than 150%! This is mainly due to the fact that the variation between 2013/2014 is exactly 600%!

Table 2

Corporate green bonds by country (of risk).

This table reports the number of corporate green bonds issued in Europe between 2013 and 2021 for each country of risk, as defined by Bloomberg, the corresponding total amount and the average amount (€ B) .

Country (of risk)	# Bonds	€ Amount (billion)	€ Average amount (billion)
Germany	390	99.893	0.256
France	142	49.751	0.350
Netherlands	64	37.614	0.588
Spain	81	30.561	0.377
Sweden	140	14.467	0.103
United Kingdom	72	20.095	0.279
Italy	37	22.075	0.597
Norway	48	13.714	0.286
Luxembourg	25	7.967	0.319
Finland	20	7.060	0.353
Denmark	11	3.580	0.325
Switzerland	30	5.690	0.190
Austria	26	4.586	0.176
Belgium	19	3.610	0.190
Greece	6	2.410	0.402
Ireland	3	1.700	0.567
Hungary	14	1.002	0.072
Island	5	0.942	0.188
Romania	5	1.228	0.246
Lithuania	4	0.645	0.161
Others	26	10.187	0.392
Total	1168	338.777	0.290

Table 2 provides a breakdown of the green bonds market by countries. As can be seen, Germany is the country that issued green bonds the most. German firms issued 390 bonds corresponding to nearly 100 bln. However, theirs average amount is around 250 mln which is below the global average amount issued in the same period, 290 mln. The same behaviour is shown, among the top 10 European issuers, by Sweden and Switzerland. In the rank of the countries which issued the most, after Germany we find French and Sweden with respectively 142 and 140 emissions. Italy is the country whose average amount issued is the highest in Europe. Italian companies issued 37 fixed income green bonds with an average amount of almost 600 mln.

Table 3

Corporate green bonds by currency of emission.

This table reports the number of corporate green bonds issued in Europe between 2013 and 2021 for each country of emission, the corresponding amount (€ B) and the average. Moreover, it reports the share (%) of the market for securities and amount outstanding.

Currency	# Bonds	€ Amount (billion)	% Security	% Amount outstanding	€ Average amount (billion)
Euro	761	261.402	0.652	0.799	0.343
Swedish Krona	104	9.030	0.089	0.028	0.087
US Dollar	62	23.778	0.053	0.073	0.384
British Pound	54	15.326	0.046	0.047	0.284
Norwegian Krone	45	5.253	0.039	0.016	0.117
Swiss Franc	33	5.008	0.028	0.015	0.152
Hungarian Forint	16	1.105	0.014	0.003	0.069
Taiwan Dollar	19	1.205	0.016	0.004	0.063
Australian Dollar	11	1.665	0.009	0.005	0.151
Japanese Yen	13	0.662	0.011	0.002	0.051
Turkish Lira	12	0.018	0.010	0.000	0.001
South African Rand	7	0.086	0.006	0.000	0.012
China Renminbi	5	0.476	0.004	0.001	0.095
Romanian Leu	4	0.441	0.003	0.001	0.110
Hong Kong Dollar	3	0.114	0.003	0.000	0.038
Polish Zloty	3	0.201	0.003	0.001	0.067
Czech Koruna	2	0.054	0.002	0.000	0.027
Canadian Dollar	3	1.348	0.003	0.004	0.449
Iceland Krona	2	0.042	0.002	0.000	0.021
Brazil Real	3	0.026	0.003	0.000	0.009
Russian Ruble	1	0.021	0.001	0.000	0.021
Indian Rupee	2	0.006	0.002	0.000	0.003
Mexican Peso	1	0.041	0.001	0.000	0.041
Vietnam Dong	1	0.009	0.001	0.000	0.009
Indonesian Rupiah	1	0.001	0.001	0.000	0.001
Total	1168	327.317	1	1	

Table 3 represents the number of green bonds issued and the amount outstanding for each currency of emission[8]. From the first issuance in 2013 to December 31, 2021, 1168 corporate green bonds have been issued, representing more than 325 bln in outstanding[9]amount. Not

[8] All the data are converted in Euro if the emission took place with different currency. The exchange rate is the one of 16/7/2022 from BBG.

[9] The amount outstanding is less than that issued since there have been issued callable securities.

surprisingly, Euro dominated green bonds dominate the European corporate green bonds market.

There were issued 761 securities denominated in euros between 2013 and 2021. The amount outstanding is approximately 260 bln with an average of 343 mln. They correspond to more than 60% of the number of total emissions in Europe and 80% in terms of amount outstanding.

Issuances in dollars are 62 with more than 20 bln of amount outstanding. They correspond to 5% of the number of total issues in Europe and 7% in terms of amount outstanding with an average amount of 383 mln. This value is more than four time the one referred to the issuances in Swedish Krona. Indeed, although there were issued 104 securities denominated in Swedish Krona, corresponding to 9% of the total, they represent only 3% of the total outstanding with an average amount of only 83 mln. This makes the Swedish Krona the currency whose average amount issued is the lowest among the top 5 currencies.

Canadian Dollar is the currency whose average amount is the highest. It corresponds to almost 450 mln. Indonesian Rupiah is the one with the lowest. It is slightly more than 1 mln.

The evolution of the average coupon rate and the average maturity for the green bond market in Europe is shown in **Table 4.** Both the coupon rate and the maturity decrease through the years - **see Graph 1 a) and b).** Except for the emissions that took place in 2016, the maturity curve is downward sloping – see **Graph 1 a).** The coupon line behaves in the same way – see **b**). This trend is perfectly explained by comparing the first-ever issue in Europe with the last one of 2021. As said before, the first green bond issuance has the following characteristics: i) 300 mln of amount issued (€), ii) 10 years of maturity and iii) 2,875% coupon rate. The last issue of 2021: i) 5 mln of amount issued (€) ii) 7 years to maturity and iii) 0,75% coupon rate. Excluding the early years in which the market was too young, the higher coupons were offered in 2018, while the emission in 2016 are those with the highest maturity.

Table 4

Corporate green bonds average coupon, maturity and amount issued.

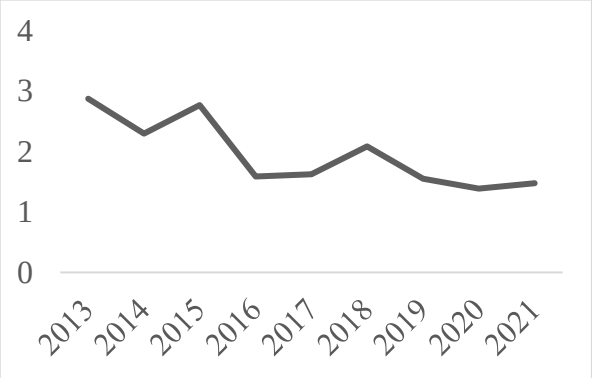
This table reports the evolution of the average coupon (%), maturity (years) and amount issued (€ B) of all corporate green bonds issued in Europe from 2013 to 2021 on an annual basis.

Year	Average coupon rate (%)	Average Maturity (years)	€ Average amount issued (bln)
2013	2.875	10.0	0.300
2014	2.299	9.8	0.563
2015	2.770	10.3	0.366
2016	1.585	16.8	0.410
2017	1.625	9.8	0.417
2018	2.084	8.8	0.361
2019	1.553	8.9	0.389
2020	1.387	7.8	0.233
2021	1.475	7.6	0.247

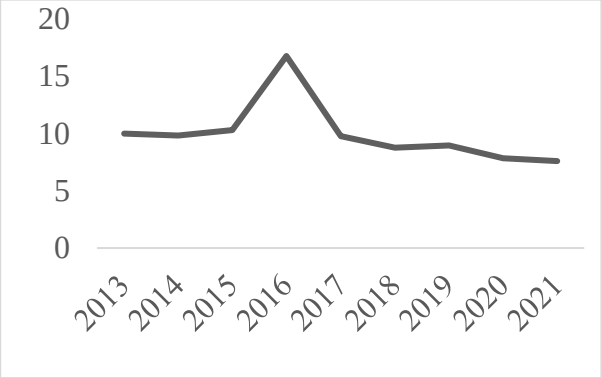
Graph 1

Coupon rate (%) and average maturity (years) evolution through the years.

Graph 1 a). It represents the evolution of the coupon rate (%) of corporate green bonds issued in Europe from 2013 to 2021



Graph 1 b). It represents the evolution of the maturity (years) of corporate green bonds issued in Europe from 2013 to 2021

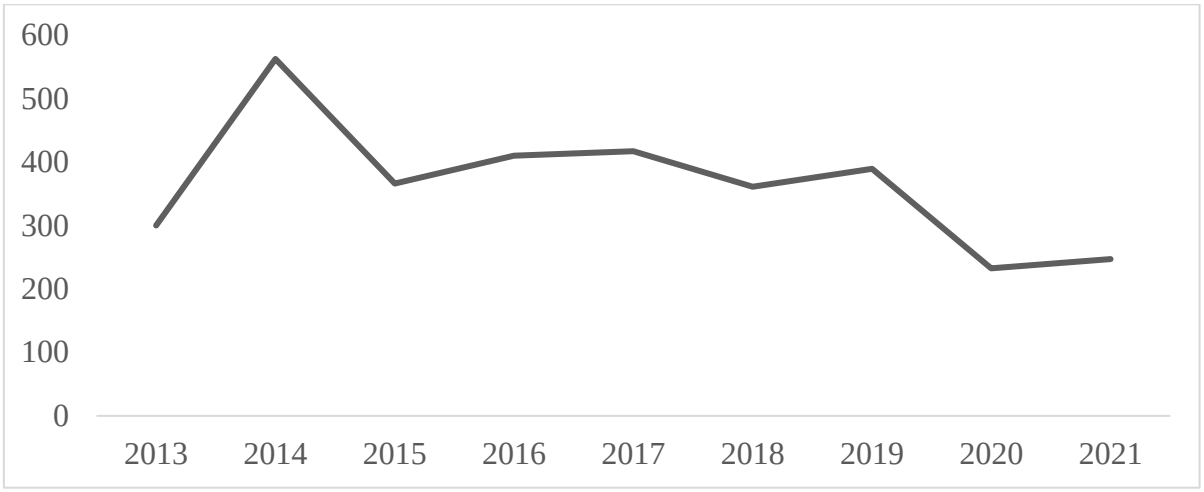


Does the amount issued follow the coupon rate and maturity evolution? The situation is comparable to the one just mentioned. As **Graph 2** shows, the trend is about the same. The only difference is that the spike occurred when the market was at an early stage. The line that describes the evolution of the average amount issued is downward sloping with a peak in 2014. It is the year in which the amount issued on average was the highest.

Graph 2

Average amount issued of corporate green bonds (€ mln) evolution in Europe.

The graph represents the evolution of the amount issued (€ mln) of corporate green bonds in Europe from 2013 to 2021.

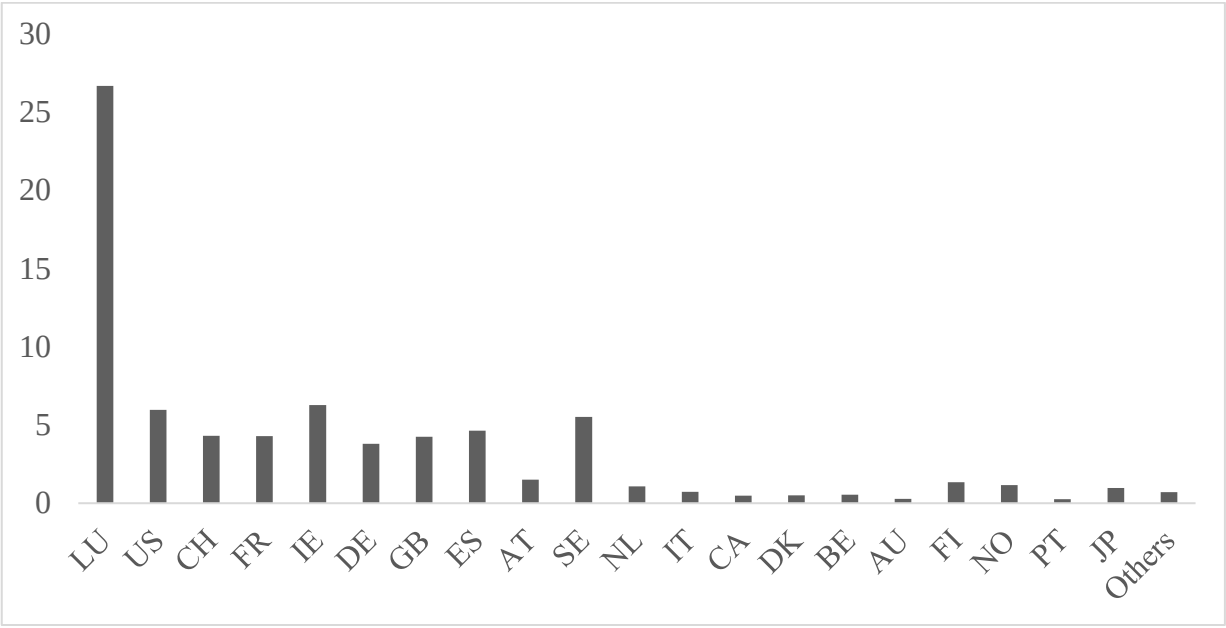


In the last part of this section, I will provide a brief description of the holders of European green bonds on 16/07/2022. **Graph 3** represents the total amount in the portfolio of each investor and the holder country/region. Luxemburg is by far the holder country with the highest number of green bonds in investors' portfolios. Its volume is around that of USA, Switzerland, France, Germany, Great Britain and Spain all together.

Graph 3

Holders' country/region amount hold by investors.

The graph represents the amount hold by investors regarding all corporate green bonds issued in Europe from 2013 to 2021 at 16/07/2022.

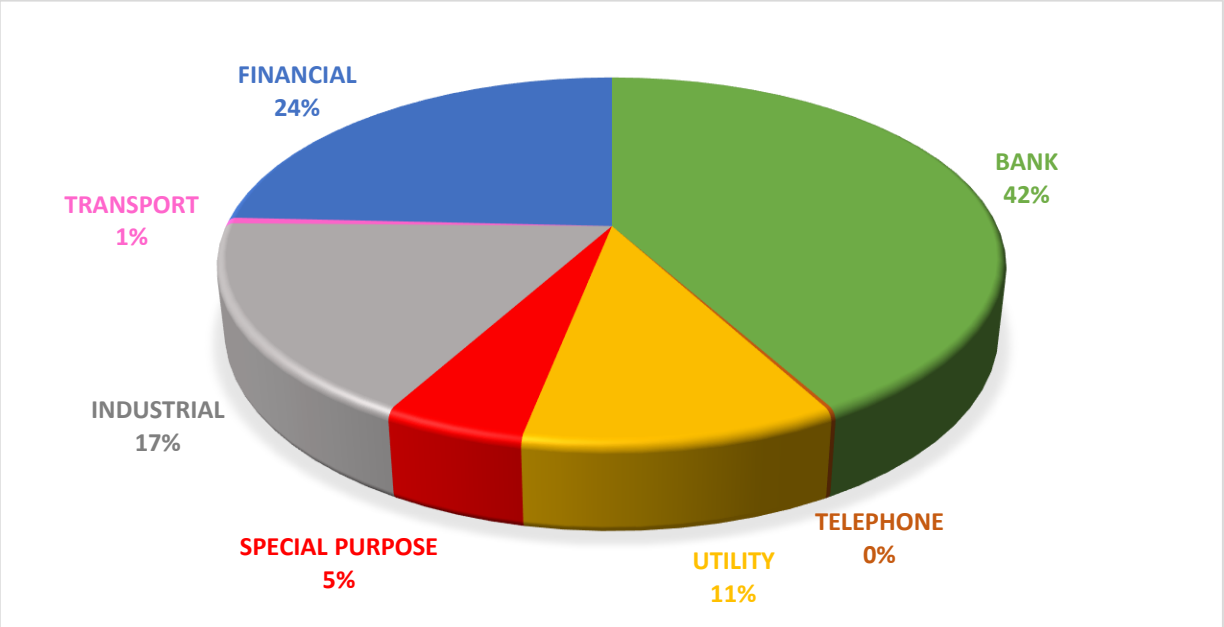


The number of all the green bonds holders is 1068. However, the top 20[10] have more than 50% of the total amount in their portfolio. Several of them have their headquarter in France or Germany. Others in northern Europe. The most important holders in terms of amount hold are BlackRock followed by Alliance and BNP Paribas, world's best bank for sustainable finance in 2021. Its environmental commitment is one of the tree pillars of the 2025 Strategic Plan, Growth Technology and Sustainability (GTS). BNP Paribas group pledges to mobilise 350 bln by 2025 through loans and sustainable issuances, related to environmental and social topics and to manage 300 bln in sustainable and responsible investment by the same period.

1.3 European green bond market by industry

Even if the market is not mature yet, there are signals that some industries are more active than others. **Graph 4** provides a breakdown of the number of corporate green bonds issues by industry.

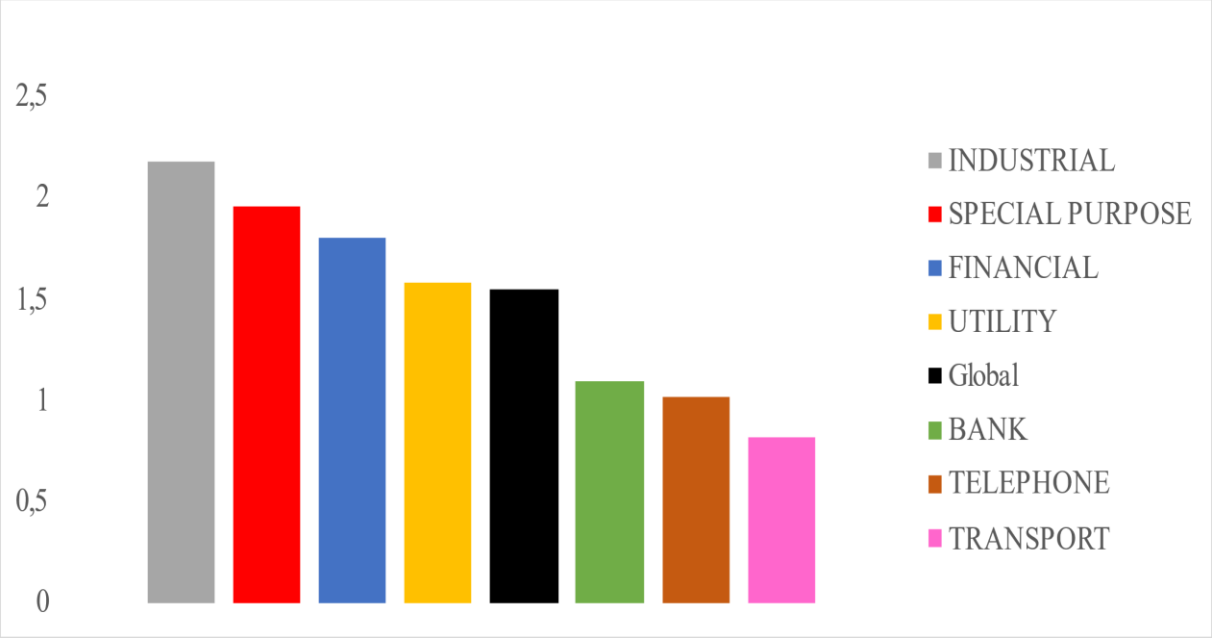
Graph 4
European corporate green bonds market share by industry.
The graph represents the green bond market share (%) by industry in Europe.



[10] They are: Blackrock, Allianz Se, Bnp Paribas, Credit Agricole Groupe, Vanguard Group, Deutsche Bank Ag, Swedbank Ab, Nordea Bank Apb, Ubs, Axa, Intesa Sanpaolo Spa, Union Investment, Schroders Plc, Zurcher Kantonalbank (Zurich Can Svenska Handelsbanken), Credit Suisse Group Ag, Nn Group Nv, Dekabank Deutsche Girozentrale, Ibercaja Gestion Sgiic Sa/Spain, Banco Santander Sa.

Banks and financials are the most dynamic players in the green bonds market. They issued 773 green bonds between 2013 and 2021. It corresponds to more than 60% of the total number. However, the average amount issued both for banks and financials is below the global average (290 mln) respectively: 255 mln and 223 mln. The highest amount comes from utility firms. Although they issued only 128 green bonds that correspond to more than 15% of the entire issuances, their notional amount on average is around 477 mln. This is more than the double of the financial one!

Graph 5
Average coupon by industry.
The graph represents the average coupon (%) by industry in Europe.

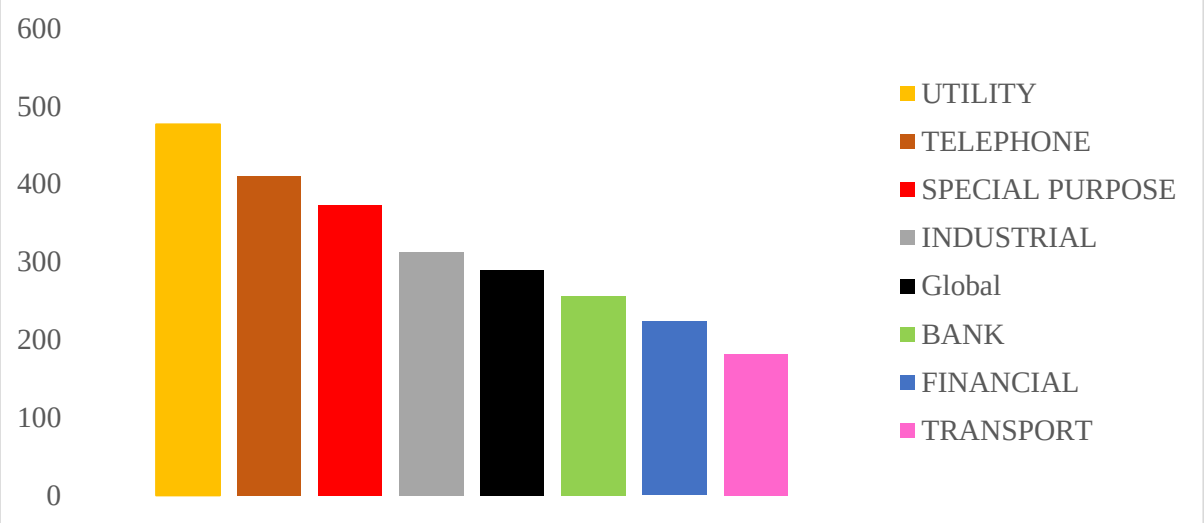


The situation changes if the average coupon and maturity are analysed.

Among the industries mentioned before, only bank's coupons are below the global average while both financial and utility are above it - see **Graph 5**.

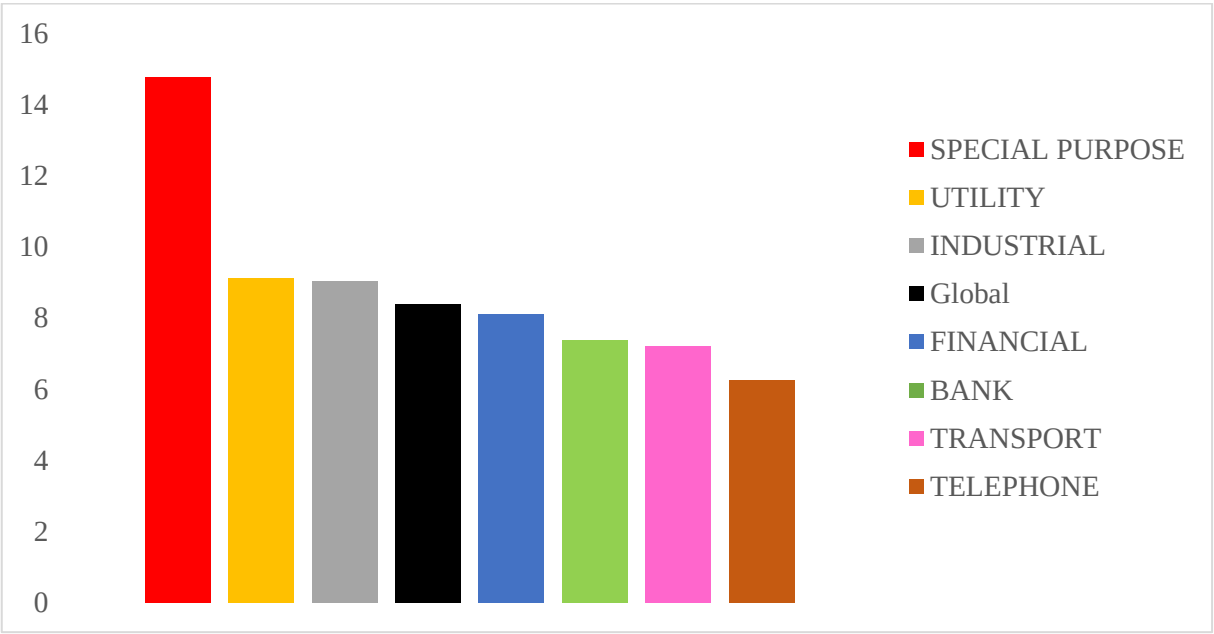
Industrial is the other sector whose coupons and amounts on average are above the global mean with respectively: 2,175% and 313 mln - see **Graph 6.**

Graph 6
Average amount (€ mln) issued by industry.
The graph represents the average amount (€ mln) by industry in Europe.



The situation is almost the same as that of the coupon regarding the analysis of the average maturity – see **Graph 7**. In this case, the only difference with the previous analysed industries, is the fact that financial are no more above the average but notch below it. Industrials and utilities average maturity are still above the global one such bank issues green bonds with an average maturity that is below it.

Graph 7
Average maturity (years) issued by industry.
The graph represents the average maturity (years) by industry in Europe



2. Legal framework in Europe

In 2007, European Investment Bank issued the first ever green bond. Since then, Sovereign and corporates have been issuing green bonds all over the world. Although there are currently several types of Green Bonds in the market, there is no global standard that certifies a particular bond as green, rather there are guidelines drawn up by the International Capital Market Association (ICMA), the Climate Bond Initiative (CBI) and, at the European level, European Commission. The chapter consists of 3 paragraphs. The first one reports ICMA Principles and CBI Standard. The second paragraph analyses the Commission proposal for a Regulation of the European Parliament and of the Council on European Green Bonds. The last explains the role of the European Taxonomy Regulation.

2.1 ICMA Principles and CBI Standard

Green bonds are any type of bond instrument whose proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing green projects. There are currently four types of Green Bonds: Standard Green Use of Proceeds Bonds, Green Revenue Bonds, Green Project Bonds, Secured Green bonds. The first are like traditional bonds except for the use of proceeds that must finance green projects. They are unsecured debt obligations with full recourse-to-the-issuer only. The credit exposure in Green Revenue Bonds, instead, is to the pledged cash flows of the revenue streams, fees and taxes. The use of proceeds goes to related or unrelated Green Project(s). They are non-recourse-to-the-issuer debt obligations. The Green Project Bonds are a mixture of the previous two. There may or may not be potential recourse to the issuer. Lastly, the Secured Green Bonds are those environmentally sound secured bonds where, as the ICMA states, the net proceeds will be exclusively applied to finance or re-finance either a Secured Green Collateral Bond or a Secured Green Standard Bond (a Secured Green Standard Bond may be a specific class or tranche of a larger transaction).

Although there are currently several types of Green Bonds in the market, there is no global standard that certifies a particular bond as green, but there are guidelines drawn up by the International Capital Market Association (ICMA), the Climate Bond Initiative (CBI) and, at the European level, the European Commission.

The Green Bond Principles (GBP) provided by ICMA are a collection of voluntary frameworks that seek to support issuers in financing environment-friendly and sustainable projects by clarifying the approach for issuance of a Green Bond. Even if they are no mandatory and the issuer is free to depart from them, they represent the first step to create a level playing field in which all market participants share the same rules. The stated mission is to promote "the role that global debt capital markets can play in financing progress towards environmental and social sustainability"[11].

The Green Bond Principles set out best practises and recommendations that want to underpin market integrity through the promotion of transparency and disclosure. The issuer, in fact, is encourage to define ex ante how the proceeds will be used if it succeeds in rising them. The GBPs promote a step change in transparency that facilitates the tracking of funds to environmental projects. In this vein, the key recommendations are the Green Bond Framework and the External Reviews.

The first document consists of four sections: Use of Proceeds, Process for Project Evaluation and Selection, Management of Proceeds and Reporting. In the first section the issuer defines the Eligible Assets and the Exclusion Criteria. The Eligible Assets are those financial instruments that meet both the Financial Eligibility Criteria and the Green Eligibility Criteria. In the Process for Project Evaluation and Selection the issuer, in a clear way, communicates to investors how to evaluate, monitor and select the Eligible Green assets and what is the environmental sustainability objectives of the Eligible Green Projects. In the third section, it chooses whether to follow an income management approach on a per-bond basis or a portfolio approach (i.e. managing income on an aggregate basis for multiple GBs). In addition, it makes known to investors how it intends to use the unallocated proceeds. Yearly, the issuer must provide a report that contains at least the following information: brief description of the projects, their expected impact and the amount allocated. Usually, the annual report consists of two sections, the Allocation Report and the Impact Report. In these documents the issuer should be very clear and precise in providing the data. Both the documents are very detailed in terms of qualitative and quantitative information. In particular for the Impact Report, due to the importance of this document, ICMA provides guidance and templates in the Harmonised Framework for Impact Reporting.

The other recommendation pertains to the External Reviews. It should contain pre-issuance and post-issuance reviews. The pre-issuance opinion provides an assessment whether or not the Green Bonds Framework is aligned with the four core components of the GBP (analysis of the

[11] ICMA, 2021, *Green Bond Principles. Voluntary Process Guidelines for Issuing Green Bonds*.

greenness). The post-issuance opinion, instead, assures that the proceeds were allocated to eligible projects. The external auditor or other third party should verify the internal tracking and allocation of funds.

The other widely accepted standard is that provided by the Climate Bonds Initiative (CBI). CBI is an international investor-focused not-for-profit organisation that seeks to mobilise investors, industry and government to catalyse green investments at the speed and scale required to avoid dangerous climate change and meet the goals of the Paris Climate Agreement. Its instruments are the Climate Bonds Standard (CBS) and Certification Scheme, Policy Engagement and Market Intelligence Work.

The Climate Bonds Standard & Certification Scheme is the most robust climate-aligned investment criteria available in international market guidelines for issuers, investors, governments and regulators. The Certification under the Climate Bond Standard (CBS) ensures that the financial instrument is fully aligned with the Green Bond Principles and/or the Green Loan Principles, that the issuer uses best practice for internal controls, tracking, reporting and verification and that the financing assets are consistent with achieving the goals of the Paris Climate Agreement. If on the one hand getting the certification is very time consuming and expensive, on the other hand it enhances both investors protection and market integrity. These elements make "greenwashing" - the practise of making unsubstantiated or misleading claims about the company's environmental commitment – not a suitable strategy to masquerade as green their brown activities. The rigorous controls the company must undergo, the possibility of revoking certification by the CIB if the debt instrument no longer meets standards and the absence of a premium for corporate green bonds showed by Flammer (2021), make certified green bonds less likely to be a form of greenwashing (Yeow and Ng 2021).

The accountability of CBI and the disclosure requirements make the certification a powerful instrument to make the market more transparent, mitigate adverse selection and reduce the risk of green washing.

Two are the key components for the CBS[12]: the Green Bond Framework and the Ongoing Reports.

The Green Bond Framework is almost the same as the one of ICMA. It consists of the four traditional sections with the addition of the external reviews. All issuers are required to disclose the Framework to the market and it is the primary reference for the verifier when undertaking the review.

[12] For more details see: climate-bonds-standard-v3-20191210.pdf (climatebonds.net)

Every year all issuers must submit a report to maintain the certification. The ongoing reports are three: Allocation report, Eligibility report and the Impact report. They share the same characteristics with those of ICMA.

The main difference between GBP and CBS has to do with the certification mechanism. While ICMA does not provide a certification, the CBI does. The requirements can be divided in two phases: Pre-issuance requirements and post-issuance requirements. The ex-ante requirements need to be met in order to get the certifications, while the ex-post ones are necessary to avoid to lose it.

Once the issuer has defined its Green Bond Framework, it needs to engage an Approved Verifier for pre- and post-issuance certification providing it with relevant information. The verifier has to assure that the Climate Bonds Standard requirements are met. Only after the verifier's report, the issuer can get the certification and issue the bond under the Certified Climate Bond mark. However, the certification must be confirmed. Whitin 2 years the issuer must submit the Verifier's Post-insurance report. Then, it has to report annually, until the expiry date of the bond, to bond holders and CBI on the allocation, the impact and the eligibility of the use of proceeds.

Even if this process increases enormously the transparency in the market and would almost surely enhance investor protection due to the accountability of the CBI and the reputation of the issuer, currently less than 10% of all the labelled bonds aligned with CBI definition of green are Certified Climate Bonds and in 2021, about a quarter of the world's green bonds were issued under the CBI Standard. In order to increase transparency and to make their bonds more attractive, issuers can commission external reviews. The most important are: the Second-Party Opinion (SPO) and the Third-Party Opinion (TPO). Both of them can be pre-issuance and post-issuance, but while SPO is given by Environmental Social Governance (ESG) service providers or scientific experts, the TPO is provided by accounting or audit firms. Pre-issuance SPO provides an assessment whether or not the Green Bonds Framework is aligned with the core components of the GBP (analysis of the 'greenness'). Pre-issuance TPO has more to do with a reputable international framework. Both the post-SPO and the post-TPO assure that the proceeds were allocated to eligible projects.

Another crucial element that is contained in the CBS is the Climate Bonds Taxonomy. It identifies the assets, activities and projects needed to deliver a low carbon economy. There are 8 contents: Energy, Transport, Water, Buildings, Land use & marine resources, Industry, Waste & pollution control and ICT. They define the areas in which the proceeds must be allocated in order to make the bond assessed as green for CBS. Besides the certification, the other

noteworthy difference between ICMA Principles and CBI Standard is related to the fact that GBP lack of an own taxonomy. However, the taxonomy is the basis used by the Climate Bonds Initiative to screen bonds and determine whether the assets or projects underlying an investment are eligible for green or climate finance.

The latest version of the Climate Bonds Standard has been developed to be fully compatible with the European Union Green Bond Standard (EU GBS).

2.2 European Green Bond Standard

From the first emission, the corporate green bond market in Europe has been growing fast. The number of new emissions almost doubled each year until 2021. However, this rapid growth has been occurred in a very fragmented legislative context. There is not a uniform standard to certify whether a bond is green within the EU. This is the reason why in the resolution on sustainable finance of 2018, European Parliament underlined the need to regulate green bonds: the forthcoming regulation should have been based on EU Sustainable Taxonomy. Moreover, the Parliament recognized that the regulatory vacuum would have made the market vulnerable to the risk of misleading marketing. Green bonds would have been verified and supervised by public authorities and included periodic reporting.

On 11 December 2020, EU leaders highlighted the importance of promoting the development of common, global standards for green finance. The European Council also invited the Commission to put forward a legislative proposal for an EU GBS. Both the Parliament and the European Council shared the same view about the green bond market: Europe needs a regulation.

In June 2018, the European Commission set up a Technical Expert Group on sustainable finance (TEG) to assist, among the others activities, in the developing of the green bond market. The following year, the TEG published its report that proposed the content of a draft EU-GBS. The experts suggested the creation, in charge of the Commission, of "voluntary, non-legislative EU Green Bond Standard to enhance the effectiveness, transparency, comparability and credibility of the green bond market and to encourage the market participants to issue and invest in EU green bonds"[13].

The Commission proposal for a Regulation of the European Parliament and of the Council on European Green Bonds layed " the foundation for a common framework of rules regarding the

[13] EU Technical Expert Group On Sustainable Finance1, 2019, *Report on EU Green Bond Standard*.

use of the designation 'European green bond' or 'EuGB' for bonds that pursue environmentally sustainable objectives within the meaning of Regulation (EU) 2020/852" [14] (Taxonomy Regulation). It also established a "system for registering and supervising companies that act as external reviewers for green bonds aligned with this framework".

The Commision proposal is made of six titles and 64 articles. The first title contains the subject matter and the definitons. The second defines the conditions for the use of the designation of European green bond. The third disciplines external reviewers for European green bonds. The fourth analyses the Supervision by competent authorities and ESMA. The fifth and the sixth are the Delegated act and the Final provisions.

The regulator identifies 4 pillars:

i) Allignment with EU Taxonomy. Article 6 of the proposal, in fact, stipulates that the use of proceeds under Article 4 must relate to economic activities that meet the requirements of the taxonomy or will meet them within a defined period of time, as determined by regulation. As the TEG pointed out proceeds from EU Green Bonds should go to finance or re-finance projects/activities that (a) contribute substantially to at least one of the six taxonomy environmental objects of the taxonomy, (b) do not significantly harm any of the other objectives and (c) comply with minimum social safeguards. Where technical screening criteria have been developed, funded projects or activities shall meet these criteria, allowing, however, for specific cases where they are not directly applicable;

ii) Publication of a Green Bond Framework. Prior to issuing a European green bond, issuers shall complete the European Green Bond Factsheet. Like for ICMA and CBI, the above document will contain all the relavant information;

iii) Mandatory reporting. Article 9 requires the issuer to prepare annual reports on the allocation of European green bonds until the bond proceeds are fully allocated and to publish them within three months after the end of the reporting year. On the other hand, article 10 sets out the requirement for the issuer to draw up an impact report after the full allocation of the proceeds at least once during the lifetime of the bond;

iv) Mandatory verification. External reviewers, in fact, as stipulated in Article 30, shall publish and make available free of charge on their websites both the pre-issuance and the post-issuance review withith a resonable time.

An important novelty that the (proposal for) Regulation introduces is the institution of the register for external reviews for European green bonds. Article 14, indeed, stipulates that external auditors for European green bonds must register with ESMA before undertaking their

[14] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (OJ L 198, 22.6.2020, p. 13).

activities. Moreover, they shall meet the condition for registration laid down in Art.15(2) at all times. This novelty not only increases the protection for investors but also the acconutability of the issuers.

Title IV introduces a supervisory system by competent autorities and the European Securities and Market Authoruty (ESMA). Competent authorities shall have the power to required furhter information both to the issuers and to the auditors. Moreover, they can prohibit advertisements or even suspend an offer of European green bonds for a maximum of 10 consecutive working days. They can carry out on-site inspections or investigations and make public the fact that an issuer of European green bonds is failing to comply with its obligations.

ESMA's role is disciplined by the chapter 2 of the same Title. It may be required to provide all necessary information to carry out its duties or to conduct investigations of persons or site inspections. Where ESMA finds that a person has committed any of the infringements listed in Article 52(2), it shall temporarily prohibit the external reviewer from pursuing the activities under this Regulation throughout the Union, until the infringement has been brought to an end or even withdraw the registration of the external reviewer or the recognition of an external reviewer located in a third country. It can impose fines and periodic penalty payments. ESMA shall maintain the register of external reviewers and third-country external reviewers. Its coordinating role between the competent authorities remains in place.

The regulation introduces the right of Member States to provide for and impose criminal sanctions. Member States shall, in accordance with national law, provide for competent authorities to have the power to impose administrative sanctions and take other appropriate administrative measures which shall be effective, proportionate and dissuasive (art.41).

At the end of May 2022, the Committee on Economic and Monetary Affairs (ECON) of the European Parliament published its report based on the Commission Proposal. Many amendments have been suggested. They involve, among the others:

i) "Dual track" approach regarding disclosure requirements. The Committed proposed to increase disclosure requirements and to extend the scope of the EU GBS to all issuers of "bonds marketed as environmentally sustainable" in the EU and issuers of sustainability linked bonds. This new approach expects stringent requirement only on "European green bonds". According to the Report, whether the proceeds will be intended to be allocated to fossil gas and energy related activities, additional requirement are introduced;

ii) Transition plan. Article 7b stipulates that before issuing a European green bond or a sustainability-linked bond, issuers of such bonds that are subject to an obligation to create transition plans shall be required to have received a positive opinion by an auditor

on the alignment of the transition plan with the objective to achieve climate neutrality by 2050 at the latest;

iii) Administrative sanctions. The ECON proposed to expand administrative sanctions (Article 41) and administrative measures to apply to infringements of the additional disclosure requirements. According to the ECON Report, competent authorities shall have the power to prohibit the natural person or entity responsible from issuing European green bonds for a period of time not exceeding one year (Article 2 ba).

iv) Securitization. New article 6a of the Report claims that where a European green bond is used for securitisation purposes, the requirements of Article 6 shall apply to the entity from which the issuance economically originates[15].

2.3 Green taxonomy

Green bonds are debt instruments whose proceeds are used to finance 'green' projects. But what is green and what is not? What does sustainable mean?

As several academics have pointed out, mandatory disclosure of sustainable investments and engagements would be insufficient to incentivize sustainable corporate governance if institutional investors could freely define the concept of sustainability. Currently, there are several institutions that have already given their own definition of green or sustainable. The most important are CBI, UN and the European Commission. Since I have already presented both the Goals of UN and the Climate Bond Taxonomy of CBI, this chapter/paragraph is devoted to the analysis of the Taxonomy Regulation by the European Commission.

The EU Taxonomy Regulation 2020/852 is a classification system that establishes a list of environmentally sustainable economic activities. It states that an economic activity shall qualify as environmentally sustainable if it: i) contributes substantially to one or more of the environmental objectives set out in Article 9, in accordance with Articles 10 to 16; ii) does not significantly harm any of the environmental objectives set out in Article 9, in accordance with Article 17; (iii) is carried out in compliance with the minimum safeguards laid down in Article 18; and (iv) complies with technical screening criteria that have been established by the Commission in accordance with Article 10(3), 11(3), 12(2), 13(2), 14(2) or 15(2)[16].

Therefore, economic activities not only have to substantially contribute to one of the six environmental objectives, but also cannot significantly harm any of the others.

[15] This provision is widely viewed in the securitization markets as a helpful step in the right direction (Clifford Chance)

[16] EU Taxonomy Regulation 2020/852.

The principle of “do no significant harm” is specified by regulatory technical standards drafted by the European Supervisory Authorities (ESAs).

As for the UN Sustainable Goals and the Climate Bond Taxonomy, the European Taxonomy Regulation is goal-oriented. For the purposes of the Regulation, the environmental objectives are: (i) climate change mitigation; (ii) climate change adaptation; (iii) the sustainable use and protection of water and marine resources; (iv) the transition to a circular economy; (v) pollution prevention and control; (vi) the protection and restoration of biodiversity and ecosystems.

Delegated acts discipline in more detail quantitative threshold with respect to the above environmental objectives. The first one defines the technical screening criteria for determining the conditions under which an economic activity qualifies as a substantial contribution to climate change adaptation and/or mitigation and for determining whether that economic activity does not cause significant harm to any of the other environmental objectives. The remaining goals will be defined in depth in the second delegated act that is expected to be published this year.

On March 9 2022, the Commission added, under strict conditions, specific nuclear power and gas activities to the list of economic activities covered by the EU taxonomy.

3. Quantitative analysis

In this chapter I investigate whether the green bonds issuance in the banking sector provides a credible signal of the company's commitment toward the environment and whether it allows companies to raise capital at a lower cost than traditional bonds. In the first paragraph, I describe the dataset and the information providers used to construct it. I provide descriptive statistics in order to better define the sample. In the next paragraphs, I introduce the first research question reporting the so far literature regarding stock market reaction to bond announcement. Then, I present the event study methodology and the results. In the final part of the chapter I investigate whether there is a premium on corporate green bonds. Firstly, I introduce the topic reporting the so far literature, then I explain the event study methodology and comment the results.

3.1 Dataset

The dataset is obtained in the following way. From the original dataset[17] I extracted all the firms whose Bloomberg "Issuer industry" is "Bank". I obtained 80 firms that issued 490 green bonds. More than half of them are unlisted companies, private companies or for which the provider has no data. Therefore, I decided to exclude them. The final dataset consists of 28 listed banks all over the Europe that issued 61 corporate green bonds from the origin to 2021 in Europe.

3.2 Summary statistics at the issuer level

The firm-level data are obtained from different sources as described below.

Accounting data. I extracted the relevant accounting information from Bloomberg. Then I constructed the variable as Flammer (2021) did with the only difference being the currency: I used Euro; she used US Dollar. The size is represented by the natural logarithm of the book value of total assets. Return on assets (ROA) is computed as the ratio of the operating income before depreciation to the book value of total assets. Tobin's Q is the ratio of the market value of total assets (obtained as the book value of total assets plus the market value of common stock minus the book value of common stock) to the book value of total assets. Leverage is the ratio of debt (long-term debt plus short-term debt) to the book value of total assets.

Stock Market data. Stock market date came from Refinitiv Eikon and Bloomberg.

[17] See Corporate Green Bonds Data.

Table 5 shows the summary statistics with respect to the characteristics just mentioned. As Flammer (2021), the statistics are recorded in the fiscal year that ends before the green bond issue data – therefore, if the emission took place in 2019, the accounting data come from the 2018 financial statement. The comparison group is made of non-green bonds issuers that belong to the same country of those banks that issued green bonds and whose issuance occurred in the same year.

Table 5
Summary statistics at issuer level.
In the first column I report the number of banks. The second column contains the statistics for green bond issuers in the year preceding the green bond issue. The statistics are: Log(asset) that is the natural logarithm of the book value of total assets; return on assets (ROA) is the ratio between operating income before depreciation and the book value of total assets; Tobin's Q is the ratio of the market value of total assets (obtained as the book value of total assets plus the market value of common stock minus the book value of common stock) to the book value of total assets; leverage is the ratio of debt (long-term debt plus short-term debt) to the book value of total assets. For each statistic, the first line contains the mean, while the std dev is in parenthesis just below it. The third column contains the statistics for non green bond banks in the same country and year as the green bond issuer. The last column contains the p-value of the difference-in-means test

	N	Green bond issuers	(Non green) bond issuers in the same country	P-value (diff. in means)
Log (assets)	28	5,36 (0,7012)	4,93 (0,7449)	0,0381
ROA	28	0,0059 (0,003835)	0,0051 (0,006998)	0,5975
Tobin's Q	28	0,99 (0,0252)	1 (0,05615)	0,7362
Leverage	28	0,34 (0,12164)	0,33 (0,1956)	0,818

3.3 Stock market reaction to the issuance of corporate green bonds

The issuance of corporate green bonds can be interpreted through the lens of signal theory (Flammer 2021). Companies know themselves more than investors. The information asymmetry between them induces the first one to try to reduce the adverse selection (Akerlof

1970) and the others to investigate - transaction cost – to reduce the asymmetry. Good companies do not want that their products are perceived as "lemons". Their interest is to reduce the information asymmetry by sending a signal. The aim of the signal is to reveal some piece of relevant information to the other party (Spence 1973), making the knowledge as symmetrical as possible. However, not all the signals are the same. The most important are those that are perceived as credible. In signal theory, a signal is credible if it is costly to mimic by firms with less desirable characteristics (Riley, 1979; Spence 1973).

In financial market investors, often, do not have sufficient information to evaluate the environmental commitment of a company (e.g., Lyon and Maxwell, 2011; Lyon and Montgomery, 2015). They base their investment decisions on the signals that companies give to the market.

Issuing green bonds is a potential credible signal toward an environmental commitment since the proceeds collected are tied up to green projects. For those green bonds that are certified by third parties, is reasonable to expect that the signal is stronger. Getting the CBI Certification, as already analysed, is expensive and time-consuming. Being compliant with the certification is costly too. On the other hand, the primary purpose of an independent bond review is to mitigate adverse selection.

3.3.1 Event study methodology

The event study methodology I am going to present is the same as the one used by Caroline Flammer (2021). It examines the stock price reaction around the announcement day of an event. The announcement date is the event we are interested in. It is the day on which companies announce that they are going to issue new securities. With the announcement, they provide the market with new information. The issue date, instead, is simply the day in which companies place their securities and no more information are provided to the market. Therefore, prices are supposed not to change according to Market efficient hypothesis (i.e prices incorporate all available information).

In the analysis of corporate returns, the announcement date is the event date (day 0). Since it is possible that some information may have been known to the public prior the announcement date, in accordance with Krueger (2015) and Flammer (2021), I considered the interval [-5,10]. In order to investigate whether there is a price variation before and after the announcement date, I also included the following event window: [-20, -11], [-10, -6] with respect to pre-issuance movement and [11, 20], [21, 60] with respect to post-issuance movement.

Market model

Firstly, I estimated the coefficients α_i and β_i . They are obtained by ordinary least squares (OLS) based on 200 trading days prior to the interval [-20, -1] using daily returns. This means that the trading days used in the regressions go from 220 days before the announcement date to 21 days prior it. It corresponds to the event window [-220, -21]. The regression is the following:

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it}$$

R_{it} is the stock return for company *i* on day *t*; R_{mt} is the daily market return; ε_{it} is the residual of company *i* on day *t*. The market return is computed using the prices of the Stoxx50.

I used the coefficients obtained from the above regression to compute the estimated return of company *i* on day *t*.

Formally, it is given by:

$$\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i * R_{mt}$$

Then I calculated the abnormal daily return (AR) of company *i* on day *t* as follows:

$$AR_{it} = R_{it} - \hat{R}_{it}$$

I computed the cumulative abnormal returns (CAR) for each event window by summing up the abnormal returns within that interval. I performed this for the periods [-20, -11], [-10, -6], [11, 20], [21, 60] and [-5, 10].

Finally, I computed the CAR. Let [s, m] the event window, the cumulative abnormal return for firm *i* from *s* to *m* is:

$$CAR_i = \sum_{t=s}^{m} \mathrm{AR_{it}}$$

3.3.2 Final Results

Empirical evidence shows that while equity issues have a negative impact on the stock prices, bonds issues do not. Moreover, Bayless and Chaplinsky (1991) showed that debt issue announcements, when an equity issue was expected by the market, have a positive 1% average abnormal stock return in 1 day. This is consistent with the peaking order theory of Meyers and Majluf (1984). Issuing debt signals an undervalued stock, while equity issues send the opposite signal to the market – market return are expected to be low. The announcement of equity offering, indeed, reduces stock priced significantly (Paul Asquith and David W. Mullins, 1986). Prices of firms after the announcement of equity offering discount the low expected revenues, while there is no significant price variation for those firms that announce a debt emission. Shareholder of healthy firms won't issue new equity, but they prefer to finance their projects by debt.

Differently from traditional bonds, green bonds announcement blended two pieces of information: i) a bond issuance ii) a signal of the market company's commitment to the environment. The positive CARs, see **Table 6**, apparently suggest that the stock market responds positively to the issuance of green bonds. Since the stock market is typically unresponsive to conventional bond issues, the positive stock market reaction to green bond issues is likely to reflect the latter component. This is consistent with prior studies that show positive CARs in response to the announcement of companies' eco-friendly actions (e.g., Flammer, 2013; Klassen and McLaughlin, 1996; Krueger, 2015) and the results of Flammer (2021). I reported the average cumulative abnormal return in the second column and the standard deviation in the third.

Table 6
Stock market reaction to the announcement of corporate green bond issuance.
This table reports the average Cumulative Abnormal Returns for all the banking green bonds issuances in Europe. The sample consist of N=61 observation green bond issuance events. The third column is dedicated to the standard deviation

Event time	CAR (%)	Std. err.
[-20, -11]	0,309	4,281
[-10, -6]	-0,092	3,3
[-5, 10]	0,529	4,402
[11, 20]	-0,108	2,922
[21, 60]	-0,279	9,675

3.3.2.1 First time issuances vs Seasoned Issuances

I decided to split the sample in two groups: first-time issuances and seasoned issuances. The first group contains all the first issuances of the banks. The other group consists of all the issuances following the first. The first group is made of 28 observations, by construction, one for each bank, the other is made of 31 corporate green bonds. **Table 7** shows a higher CAR for the first-time issues than the seasoned. It means that in the banking sector the environmental commitment is stronger for the first issuance than for the following ones.

Table 7
First time issuances vs seasoned issuances
This table reports the average Cumulative Abnormal Returns for first-time ever issue and those seasoned. The second column shows the standard deviation.

	CAR [-5, 10]	Std. err.
First-time issue (N=28)	0,635	4,593
Seasoned (N=33)	0,439	4,192

3.3.2.2. Certified bonds vs Non-Certified Bonds

Lastly, I decided to check whether certified green bonds[18] signal a more credible environmental commitment than those that are non-certified. In doing this, I focused my attention only on the first issuances since all the certified green bonds are first-time issuances. This allowed me to ensure that the only difference between the two groups was the certification. Five banks issued certified corporate green bonds at their first-time ever issue. The others never requested the certification at any of their issues.

Table 8
Certified vs non-certified green bonds
This table reports the average Cumulative Abnormal Returns for certified and non-certified green bonds. The second column is dedicated to the standard deviation.

Event time	CAR [-5, 10]	Std. err.
Certified (N=5)	1,708	2,682
Non-certified (N=23)	0,401	4,810

[18] The Certification is released by Climate Bond Initiative.

The results in **Table 8** show that the green commitment arising from certified corporate green bonds is stronger than the one of non-certified bonds. Certification process, as already mentioned, is expensive and time consuming due to reporting obligations and third-party opinions. Moreover, non-compliance with certification is costly as well (Flammer 2021). Being not compliant with the certification can generate a green default - the certified green bond loose the certification - if compliance is not restored within a reasonable time. It is reasonable to expect that the loss of the certification would have an impact on the stock price of the issuer company. In 2017 Repsol's stock price, indeed, dropped by about 1% after its 500 mln € green bond was deemed noncompliant (green default).

3.3.3. Stoxx 600 banks

Since the previous results were no significant due to the high volatility of the data and the fact that, differently from Flammer, I focused my attention only on banks, I decided to see if the previous results undergo a change using an industry index, the Stoxx 600 banks, rather than a geographic one, like the Stoxx 50.

Using the same methodology as above, the Stoxx 600 banks returns different values, but almost the same trend. To be more precise, it reports: i) a moderate negative CAR, **Table 9** ii) a negative CAR for the non-certified green bonds, **Table 11** and iii) a negative CAR for the seasoned issuances, **Table 10**. On the other hand, the certified green bonds signal a stronger commitment toward the environment than those non certified and the first issuances have a stronger effect than those seasoned.

Table 9
Stock market reaction to the announcement of corporate green bond issuance.
This table reports the average Cumulative Abnormal Returns for all the banking green bonds issuances in Europe using Stoxx 600 banks. The sample consist of N=61 green bond issuance events. The third column shows the standard deviation

Event time	CAR	Std. err.
[-20, -11]	0,042	2,59
[-10, -6]	-0,391	2,798
[-5, 10]	-0,014	3,943
[11, 20]	-0,117	2,682
[21, 60]	-0,405	7,328

Table 10

First time issuances vs seasoned issuances

This table reports the average Cumulative Abnormal Returns for first-time ever issue and those seasoned using Stoxx 600 banks. The second column shows the standard deviation.

	CAR [-5, 10]	Std. err.
First-time issue (N=28)	0,134	4,279
Seasoned (N=33)	-0,139	3,697

Table 11

Certified vs non-certified green bonds

This table reports the average Cumulative Abnormal Returns for certified and non-certified green bonds using Stoxx 600 banks. The second column showsthe standard deviation.

	CAR [-5, 10]	Std. err.
Certified (N=5)	1,714	2,622
Non-certified (N=23)	-0,217	4,431

The reason why using a sectorial index green bonds issuance does not signal a green commitment while taking into account all the firms, can be object of further analysis. The author of the original paper indeed: i) used a geographic index without taking into account industry's issuer and ii) presented the aggregate results, therefore is not possible to exclude that some industries reported negative CAR.

In my case, I can say that the negative value of all emissions is mainly due to the negative sign of the non-certified issuances. The negative sign could be read as a sign of a lack of recognition of commitment to the environment. The negative sign recorded by non-certified green bonds may suggest that the banking sector in Europe is very sensitive to certifications (the CAR for certified bonds is positive and very high). Subsequent issues of non-certified bonds would seem to mitigate this effect (the sign remains negative, but for seasoned bonds the absolute value is lower). The increase in the number of issues, even if not certified, could signal a higher green commitment of the same issuer. From this perspective, it is not surprising that the absolute value of the CAR for recurring issues is lower than that for the first uncertified issues. Moreover, since the number of seasoned issues is higher than for first issuances, the total value, albeit slightly, turns out to be negative.

3.4 Is there a premium for corporate green bonds?

The literature - Karpf and Mandel (2017), Barker et al. (2018), Zerbib (2019), Antonelli Doronzo and Siracusa (2021) - has been focusing its attention primarily on the pricing of municipal green bonds and sovereigns. At this stage, there is no remarkable difference in the performance of the sovereign green bonds and brown bonds (Antonelli, Doronzo and Siracusa 2021). The other works, even if they prove that the green bond emissions represent a cheaper source of funding, obtained different results in magnitude. Therefore, Larker and Watts (2020) revisited these findings and claimed that "the mixed evidence from prior studies is the result of methodological design misspecifications that produce biased estimates". They argued that Karpf and Mandel (2017) did not take into account the role of taxation in the municipal market and that Barker et al. (2018) did not take into account enough differences between green bonds and brown bonds. To avoid the problem, the authors "use a very tight matching methodology, in which they match each green bond to a quasi-identical brown bond of the same issuer. When using this refined matching, they find that the green bond premium is essentially zero"[19].

The Larcker and Watts's (2020) approach was used by Caroline Flammer (2021) in order to understand whether there is a premium or not for corporate green bonds. It consists of a two-step matching procedure that aims to find the corporate brown bond (traditional bond) as similar as possible to a given corporate green bond except for the greenness. First, from all brown bonds and green bonds issued by a given company in a given period, it is required that the credit rating among the securities is the same. In the second step, using the Mahalanobis distance, it is picked up the brown bond that is more similar to a given green bonds in terms of: i) log (issuance amount), ii) maturity, iii) coupon, and iv) the number of days in between the green and brown bond issuance. In doing my analysis I add another variable, the currency of emission, in order to make the comparison stronger. In this way the matched brown bond is as similar as possible to the green one except for the "greenness".

Out of the green bonds issued in Europe between 2013 and 2021 by banks, only 5 securities have the "Green bond indicator" in Bloomberg's fixed income database, the "Yield at issuance" and the Bloomberg's composite rating. Then, I extracted from Bloomberg's fixed income dataset all the brown bonds issued by the same issuer of the just mentioned green bonds from January 1, 2013 to December 31, 2021. Then following the above procedure, I found the matched non green bonds.

[19] Flammer (2021)

Table 12
Is there a premium on corporate green bonds?
This table reports the mean of the *yield at issue* for green bonds and matched non green bonds of the same issuer. The two bottom lines report the difference-in-means test and the corresponding p-value.

		Yield at issue (%)
	Obs	Mean
Green bonds	5	1,4225
Matched non green bonds	5	1,4128
Difference		0,0097
p-value (difference)		0,9936

Table 12 shows that there is no noticeable difference between the yields at issuance of corporate green bonds and brown bonds in the banking sector in Europe. The mean difference, 0.0097%, is statistically insignificant (p-value=0,9936). This finding is consistent with those of Larcker and Watts's (2020), Flammer (2021). This evidence also implies that the stock market reaction is unlikely to be driven by a cost of capital argument. Issuing green bonds do not represent a cheaper source of capital.

In **Table 13** I provide a robustness check. Out of the corporate green bonds issued by banks in Europe with non-missing information on the offering yield (item "yield at issue" in Bloomberg's fixed income database), I expanded the sample considering those green bonds that lack of the Bloomberg's composite rating. I obtained 18 green bonds. The matched brown bonds are obtained following the Larcker and Watts's (2020) methodology described above.

Table 13

Robustness

This table reports the mean of the *yield at issue* for green bonds and matched non green bonds of the same issuer without taking into account the Bloomberg's composite rating. The two bottom lines report the difference-in-means test and the corresponding p-value.

	Yield at issue (%)	
	Obs	Mean
Green bonds	18	1,3614
Matched non green bonds	18	1,345
Difference		0,0164
p-value (difference)		0,9691

Table 13 shows that the results are robust. Even if the difference between the average yield at issue of corporate green bonds and the matched brown bonds increases, it remains low and statistically insignificant. The corresponding p-value decreases, but it is still very high (p-value=0.9691).

Conclusion

This work sheds light on corporate green bonds in Europe. In fact, this area is one of the most active in terms of new issuances and amount outstanding. The number of new issues has been increasing since the origin, almost doubling yearly. All the biggest industries are involved.

Among all the possible rationales, companies issue green bonds to signal their environmental commitment to the market and/or to obtain cheaper financing. The study shows that European banks that issued green bonds did not access to a cheaper source of funding. There is no pricing difference in the market between traditional bonds and corporate green bonds in Europe. The finding is consistent with Flammer (2021) and Larker and Watts's (2020) works.

When using a geographic market index, due to a high volatility in daily returns, the study does not find significant cumulative abnormal returns (CARs), although the average value is positive; even when using a different index, industry index, there is no significant evidence of abnormal returns. Hence, the stock performance in the European banking industry does not seem to be significantly sensitive to green bond issuances. However, independently of the index used, CARs are higher when a bank's green bond is issued for the first time or with a third-party certificate.

As more data become available, the sectorial analysis can involve other industries. The analysis can check whether this behaviour occurs in other sectors or it is limited to the banking one. The Certification mechanism in Europe is in the form of private governance, but as long as certifications support the credibility of the signal provided to the market, also an analysis of the impact of a mandatory external review in the European market would deserve attention.

Appendix

Table A.1
Covariate balance for the within-issuer matching of green bonds to non green bonds.
This table presents descriptive statistics comparing bonds and matched non green bonds of the same issuer without taking into consideration Bloomberg's composite rating. Log(*amount issued*) is the natural logarithm of the issuance amount. *Maturity* is the maturity of the bond expressed in years. *Coupon* is the coupon rate (%). The last column reports the p-value of the difference-in-means.

		Obs	Mean	Std Dev	p-value (diff. in means)
Log (amount issued)	Green bond	18	7,841	0,834	0,907
	Matched nongreen bond	18	7,806	0,898	
Maturity (years)	Green bond	18	7,5	3,819	0,648
	Matched nongreen bond	18	8,167	4,573	
Coupon (%)	Green bond	18	1,349	1,279	0,983
	Matched nongreen bond	18	1,340	1,157	

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Abstract

This work investigates whether the issuance of green bonds by European banks positively affects their stock returns and whether it allows them to raise capital at a lower cost than traditional bonds. The methodology adopted is an event study – designed on the basis of a seminal work based on a different sample – where the returns of two alternative indices are assumed as a proxy of market returns. When using the first, geographic market index, due to a high volatility in daily returns, the study does not find significant cumulative abnormal returns (CARs), although the average value is positive; even when using the second, industry index, there is no significant evidence of abnormal returns. Hence, the stock performance in the European banking industry does not seem to be significantly sensitive to green bond issuances. However, independently of the index used, CARs are higher when a bank's green bond is issued for the first time or with a third-party certificate. In addition, the analysis of yields at issue reveals that so far green bonds have not represented a cheaper source of funding for European banks.

Introduction

The United Nations[20] estimates that the target of the Paris Agreement will require around $3 trillion in investment each year until 2050. World Economic Forum (WEF) claimed that "to raise these huge sums, governments and companies are increasingly turning to green bonds"[21]. According to the WEF, companies will increase green bonds emissions all over the world.

Since its inception Europe is one of the most active areas in the issuance of corporate green bonds and the banking sector is the industry that issued the most in Europe from 2013 to 2021. These two reasons led me to study the corporate green bond market in EU with a quantitative focus on the banking sector.

The study is structured as follows. In the first chapter, I provide a detailed descriptive analysis of the status of the European corporate green bonds. In this section, all the industries and issuances are considered from the origin to December 31, 2021. In the second chapter, I analyse the legal framework behind the issuance of corporate green bonds. The first paragraphs cover

[20] The intergovernal panel on climate change (UN), *Mitigation pathways compatible with 1.5°C in the context of sustainable development*

[21] World Economic Forum. 2021. *What are green bonds and why is this market growing fast?*

the most important standards at a global level, ICMA Principles and the CBI Standard. The following are devoted to the European legal framework: EU Taxonomy Regulation and the Commission proposal for a Regulation of the European Parliament and of the Council on European Green Bonds. The last chapter is dedicated to the quantitative analysis of the corporate green bonds issued by European banks.

I move my analysis from the consideration that companies decide to issue green bonds, among all the possible rationales, to signal their environmental commitment and/or to obtain cheaper financing. Previous works have shown that eco-friendly corporates' behaviour have a positive effect on the stock market returns (e.g., Flammer, 2013; Klassen and McLaughlin, 1996; Krueger, 2015). From this consideration, stock market returns are supposed to respond positively to the issuance of corporate green bonds. A credible green commitment would be shown by positive stock market returns after the announcement of a green bond issuance. Another important rational that previous studies proved to be real, is that green bonds represent a cheaper source of capital. According to the supporters of this theory, investors are willing to accept a lower return on their investment for social benefits. However, several surveys show that investors would not invest in green bonds unless they are competitive.

In conducting the analysis, I replicated the paper of the Caroline Flammer, *Corporate green bonds* (2021). The empirical analysis involved all the corporate green bonds issued in Europe from 2013 to 2021 by European banks. I drew the dataset from Bloomberg's fixed income database. Using an event study methodology, I investigated whether the issuance of corporate green bonds signals a credible green commitment to the market. Then, I compared the behaviour of the seasoned issuances (i.e. the issuances following the first) with the first one and I examined the behaviour of certified and non-certified corporate green bonds. I did this using two difference indexes: a geographic index, Stoxx50, and a sectorial one, Stoxx 600 banks.

In the last section, I examined whether the issuance of green bonds represents a cheaper source of financing compared to the traditional bonds. As the author, I followed the methodology used by Larcker and Watts (2020) in the contest of municipal bonds. For each green bond, I found a brown bond by the same issuer with similar characteristics. This allowed me to ensure that the only difference between the two bonds where the greenness.

The work intends to provide a contribution to the study of corporate green bond market in Europe with a particular focus on the banking sector and contributes to the growing literature on impact investing.

1. Corporate green bonds market in Europe

The chapter consists of two paragraphs. In the first one, I describe the dataset used to study the corporate green bonds in Europe. The second paragraph is devoted to the description of the market.

1.1 Corporate Green Bonds Data

To compile a dataset of corporate green bonds, I extracted all corporate bonds in Bloomberg's fixed income database that are labelled as "green bonds" (specifically, bonds for which the field "Green bond indicator" is "Yes"). I excluded bonds whose issuer's BICS (Bloomberg Industry Classification System) is "Sovereigns or Government Agencies or Supernationals" and I included only European countries. Then, I decided not to include those securities whose issuer's industry was "Government Agency" or "Government Regional". A total of 1168 corporate green bonds meeting the above criteria were issued from January 1, 2013 to December 31, 2021.

1.2 The European green bonds market

Many different players have issued corporate green bonds since the origin in Europe. **Table 1** reports the evolution of the number of corporate green bonds issuances through the years and the corresponding amount issued. From 2013 to 2021 the corporate green bond market has grown fast both in terms of number and amount of green bonds issued. For the first, the average growth is around 70% if we consider the years from 2015[22] to 2021 with a median value of 72%. The average amount, instead, grew slightly less (65%). This is mainly due to the fact that in the two-period 2019 and 2020 the average amount issued remained the same, while the number of new securities issued increased by 71%. Banks are the most active players.

Graph 1 reports the evolution of the average coupon rate and the average maturity for the green bond market in Europe. Both the coupon rate and the maturity decrease through the years - **see Graph 1 a) and b)**. Same situation for the average amount issued s- see **Graph 2.**

[22] I choose to start the computation from 2015 to smooth out the sensitivity of the average to extreme values. From 2015 to 2021, in fact, the average variation is around 70% on an annual basis. If I have included the two-year period 2013-2014, I would have obtained an annual variation on average more than 150%. This is not fair. It is mainly due to the fact that the variation between 2013/2014 that is exactly 600%!

Table 1

Corporate green bonds over time.

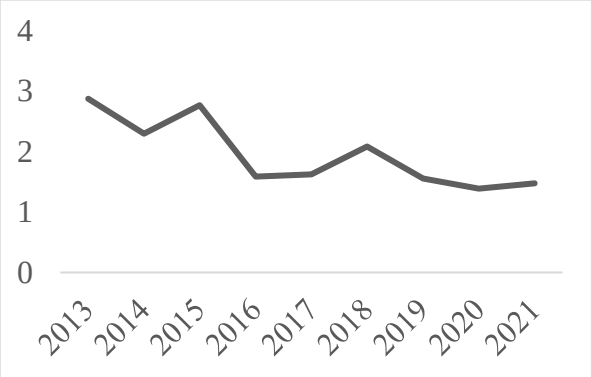
This table reports the number of corporate green bonds issued from 2013 to 2021 on an annual basis in Europe and the corresponding amount (€ B).

Year	# Bonds	€ Amount issued (billion)
2013	1	0.300
2014	7	3.940
2015	20	7.324
2016	37	15.186
2017	57	23.779
2018	89	32.158
2019	169	65.813
2020	289	67.239
2021	499	123.038
Total	1168	338.777

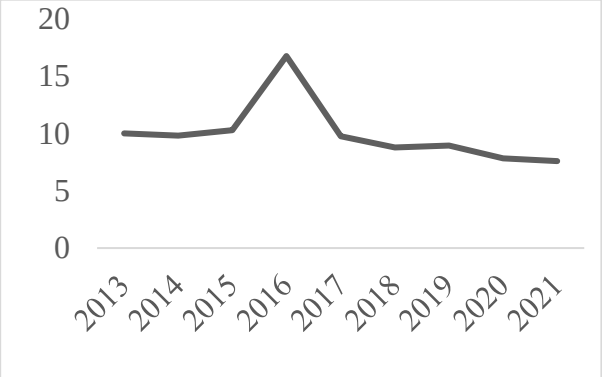
Graph 1

Coupon rate (%) and average maturity (years) evolution through the years.

Graph 1 a). It represents the evolution of the coupon rate (%) of corporate green bonds issued in Europe from 2013 to 2021



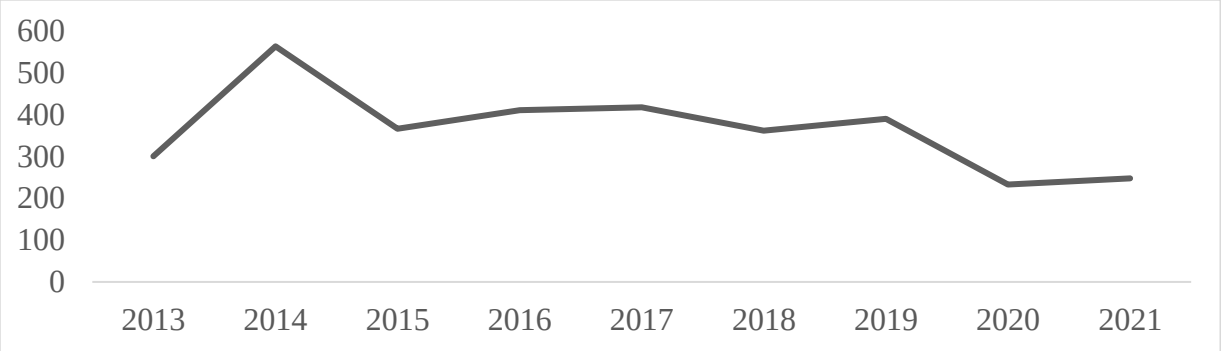
Graph 1 b). It represents the evolution of the maturity (years) of corporate green bonds issued in Europe from 2013 to 2021



Graph 2

Average amount issued of corporate green bonds (€ mln) evolution in Europe.

The graph represents the evolution of the amount issued (€ mln) of corporate green bonds in Europe from 2013 to 2021.



2. Legal framework in Europe

In 2007, European Investment Bank issued the first ever green bond. Since then, Sovereign and corporates have been issuing green bonds all over the world. Although there are currently several types of Green Bonds in the market, there is no global standard that certifies a particular bond as green, rather there are guidelines drawn up by the International Capital Market Association (ICMA), the Climate Bond Initiative (CBI) and, at the European level, European Commission. The chapter consists of 2 paragraphs. The first one reports ICMA Principles and CBI Standard. The second paragraph analyses the Commission proposal for a Regulation of the European Parliament and of the Council on European Green Bonds and it explains the role of the European Taxonomy Regulation.

2.1 ICMA Principles and CBI Standard

Green bonds are any type of bond instrument whose proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing green projects. There are currently four types of Green Bonds: Standard Green Use of Proceeds Bonds, Green Revenue Bonds, Green Project Bonds, Secured Green bonds. Although there are currently several types of Green Bonds in the market, there is no global standard that certifies a particular bond as green, but there are guidelines drawn up by the International Capital Market Association (ICMA), the Climate Bond Initiative (CBI) and, at the European level, the European Commission.

The Green Bond Principles (GBP) provided by ICMA are a collection of voluntary frameworks that seek to support issuers in financing environment-friendly and sustainable projects by clarifying the approach for issuance of a Green Bond. Even if they are no mandatory and the issuer is free to unfollow them, they represent the first step to create a level playing field in which all market participants share the same rules.

The other widely accepted standard is that provided by the Climate Bonds Initiative (CBI). Its instruments are the Climate Bonds Standard (CBS) and Certification Scheme, Policy Engagement and Market Intelligence Work.

The Climate Bonds Standard & Certification Scheme is the most robust climate-aligned investment criteria available in international market guidelines for issuers, investors, governments and regulators. The Certification under the Climate Bond Standard (CBS) ensures that the financial instrument is fully aligned with the Green Bond Principles and/or the Green Loan Principles, that the issuer uses best practice for internal controls, tracking, reporting and verification and that the financing assets are consistent with achieving the goals of the Paris

Climate Agreement. If on the one hand getting the certification is very time consuming and expensive, on the other hand it enhances both investors protection and market integrity making certified green bonds less likely to be a form of greenwashing (Yeow and Ng 2021).

Two are the key components for the CBS[23]: the Green Bond Framework and the Ongoing Reports.

The main difference between GBP and CBS has to do with the certification mechanism. While ICMA does not provide a certification, the CBI does. The requirements can be divided in two phases: Pre-issuance requirements and post-issuance requirements. The ex-ante requirements need to be met in order to get the certifications, while the ex-post ones are necessary to avoid to lose it.

Another crucial element that is contained in the CBS is the Climate Bonds Taxonomy. Besides the certification, the other noteworthy difference between ICMA Principles and CBI Standard is related to the fact that GBP lack of an own taxonomy. However, the taxonomy is the basis used by the Climate Bonds Initiative to screen bonds and determine whether the assets or projects underlying an investment are eligible for green or climate finance.

2.2 European Green Bond Standard and Green Taxonomy

The Commission proposal for a Regulation of the European Parliament and of the Council on European Green Bonds layed " the foundation for a common framework of rules regarding the use of the designation 'European green bond' or 'EuGB' for bonds that pursue environmentally sustainable objectives within the meaning of Regulation (EU) 2020/852" [24] (Taxonomy Regulation). It also established a "system for registering and supervising companies that act as external reviewers for green bonds aligned with this framework".

The regulator identifies 4 pillars:

i) Allignment with EU Taxonomy. Article 6 of the proposal, in fact, stipulates that the use of proceeds under Article 4 must relate to economic activities that meet the requirements of the taxonomy or will meet them within a defined period of time, as determined by regulation;

ii) Publication of a Green Bond Framework. Prior to issuing a European green bond, issuers shall complete the European Green Bond Factsheet. Like for ICMA and CBI, the above document will contain all the relavant information;

[23] For more details see: climate-bonds-standard-v3-20191210.pdf (climatebonds.net)

[24] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (OJ L 198, 22.6.2020, p. 13).

iii) Mandatory reporting. Article 9 requires the issuer to prepare annual reports on the allocation of European green bonds until the bond proceeds are fully allocated and to publish them within three months after the end of the reporting year. On the other hand, article 10 sets out the requirement for the issuer to draw up an impact report after the full allocation of the proceeds at least once during the lifetime of the bond;

iv) Mandatory verification. External reviewers, in fact, as stipulated in Article 30, shall publish and make available free of charge on their websites both the pre-issuance and the post-issuance review withith a resonable time.

An important novelty that the (proposal for) Regulation introduces is the institution of the register for external reviews for European green bonds and a supervisory system by competent autorities and the European Securities and Market Authoruty (ESMA). The regulation introduces the right of Member States to provide for and impose criminal sanctions.

The EU Taxonomy Regulation 2020/852 is a classification system that establishes a list of environmentally sustainable economic activities. Economic activities, in order to be qualified as environmentally sustainable, have to substantially contribute to one of the six environmental objectives set out in Article 9 and not significantly harm any of the others.

The principle of "do no significant harm" is specified by regulatory technical standards drafted by the European Supervisory Authorities (ESAs).

3. Quantitative analysis

In this chapter, I investigate whether the green bonds issuance in the banking sector provides a credible signal of the company's commitment toward the environment and whether it allows companies to raise capital at a lower cost than traditional bonds. In the first paragraphs, I described the dataset and the information providers used to construct it. Then, I introduce the first research question and review the literature emerged up to date regarding stock market reaction to bond announcement. Then, I present the event study methodology and the results. The final part of the chapter investigates whether there is a concession on corporate green bonds. Firstly, I introduce the outcomes reported by the literature so far; then I describe the event study methodology and comment the results.

3.1 Dataset

The dataset is obtained in the following way. From the original dataset[25] I extracted all the firms whose Bloomberg "Issuer industry" is "Bank". I obtained 80 firms that issued 490 green bonds. More than half of them are unlisted companies, private companies or for which the provider has no data. Therefore, I decided to exclude them. The final dataset consists of 28 listed banks all over the Europe that issued 61 corporate green bonds from the origin to 2021 in Europe.

3.2 Stock market reaction to the issuance of corporate green bonds

The issuance of corporate green bonds can be interpreted through the lens of signal theory (Flammer 2021). Companies know themselves more than investors. The information asymmetry between them induces the first one to try to reduce the adverse selection (Akerlof 1970). Their interest is to reduce the information asymmetry by sending a signal. The aim of the signal is to reveal some piece of relevant information to the other party (Spence 1973), making the knowledge as symmetrical as possible. However, not all the signals are the same. The most important are the credible signals. Issuing green bonds is a potential credible signal toward an environmental commitment since the proceeds collected are tied up to green projects.

3.2.1 Event study methodology

The event study methodology I am going to present is the same as the one used by Caroline Flammer (2021). It examines the stock price reaction around the announcement day of an event.

In the analysis of corporate returns, the announcement date is the event date (day 0). Since it is possible that some information may have been known to the public prior the announcement date, in accordance with Krueger (2015) and Flammer (2021), I considered the interval [-5,10]. In order to investigate whether there is a price variation before and after the announcement date, I also included the following event window: [-20, -11], [-10, -6] with respect to pre-issuance movement and [11, 20], [21, 60] with respect to post-issuance movement.

Market model

Firstly, I estimated the coefficients α_i and β_i . They are obtained by ordinary least squares (OLS) based on 200 trading days prior to the interval [-20, -1] using daily returns. This means that the trading days used in the regressions go from 220 days before the announcement date to 21 days prior it. It corresponds to the event window [-220, -21]. The regression is the following:

[25] See Corporate Green Bonds Data.

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it}$$

R_{it} is the stock return for company *i* on day *t*; R_{mt} is the daily market return; ε_{it} is the residual of company *i* on day *t*. The market return is computed using the prices of the Stoxx50.

I used the coefficients obtained from the above regression to compute the estimated return of company *i* on day *t*.

Formally, it is given by

$$\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i * R_{mt}$$

Then I calculated the abnormal daily return (AR) of company *i* on day *t* as follows:

$$AR_{it} = R_{it} - \hat{R}_{it}$$

I computed the cumulative abnormal returns (CAR) for each event window by summing up the abnormal returns within that interval. I performed this for the periods [-20, -11], [-10, -6], [11, 20], [21, 60] and [-5, 10].

Finally, I computed the CAR. Let [s, m] the event window, the cumulative abnormal return for firm *i* from *s* to *m* is:

$$CAR_i = \sum_{t=s}^{m} \mathrm{AR_{it}}$$

3.2.2 Final Results

Empirical evidence shows that while equity issues have a negative impact on the stock prices, bonds issues do not.

Differently from traditional bonds, green bonds announcement blended two pieces of information: i) a bond issuance ii) a signal of the market company's commitment to the environment. The positive CARs, see **Table 6**, apparently suggest that the stock market

responds positively to the issuance of green bonds. Since the stock market is typically unresponsive to conventional bond issues, the positive stock market reaction to green bond issues is likely to reflect the latter component. This is consistent with prior studies that show positive CARs in response to the announcement of companies' eco-friendly actions (e.g., Flammer, 2013; Klassen and McLaughlin, 1996; Krueger, 2015) and the results of Flammer (2021). I reported the average cumulative abnormal return in the second column and the standard deviation in the third.

Table 6
Stock market reaction to the announcement of corporate green bond issuance.
This table reports the average Cumulative Abnormal Returns for all the banking green bonds issuances in Europe. The sample consist of N=61 observation green bond issuance events. The third column shows the standard deviation

Event time	CAR (%)	Std. err.
[-20, -11]	0,309	4,281
[-10, -6]	-0,092	3,3
[-5, 10]	0,529	4,402
[11, 20]	-0,108	2,922
[21, 60]	-0,279	9,675

3.2.2.1 First time issuances vs Seasoned Issuances

I decided to split the sample in two groups: first-time issuances and seasoned issuances. The first group contains all the first issuances of the banks. The other group consists of all the issuances following the first. The first group is made of 28 observations, by construction, one for each bank, the other is made of 31 corporate green bonds. **Table 7** shows a higher CAR for the first-time issues than the seasoned. It means that in the banking sector the environmental commitment is stronger for the first issuance than for the following ones.

Table 7
First time issuances vs seasoned issuances
This table reports the average Cumulative Abnormal Returns for first-time ever issue and those seasoned. The second column is dedicated to the standard deviation.

	CAR [-5, 10]	Std. err.
First-time issue (N=28)	0,635	4,593
Seasoned (N=33)	0,439	4,192

3.2.2.2. Certified bonds vs Non-Certified Bonds

Lastly, I decided to check whether certified green bonds[26] signal a more credible environmental commitment than those that are non-certified. In doing this, I focused my attention only on the first issuances since all the certified green bonds are first-time issuances. This allowed me to ensure that the only difference between the two groups was the certification. Five banks issued certified corporate green bonds at their first-time ever issue. The others never requested the certification at any of their issues.

Table 8
Certified vs non-certified green bonds
This table reports the average Cumulative Abnormal Returns for certified and non-certified green bonds. The second column is dedicated to the standard deviation.

Event time	CAR [-5, 10]	Std. err.
Certified (N=5)	1,708	2,682
Non-certified (N=23)	0,401	4,810

The results in **Table 8** show that the green commitment arising from certified corporate green bonds is stronger than the one of non-certified bonds. Certification process, as already mentioned, is expensive and time consuming due to reporting obligations and third-party opinions.

3.2.3. Stoxx 600 banks

Since the previous results were no significant due to the high volatility of the data and the fact that, differently from Flammer, I focused my attention only on banks, I decided to see if the previous results undergo a change using an industry index, the Stoxx 600 banks, rather than a geographic one, like the Stoxx 50.

Using the same methodology as above, the Stoxx 600 banks returns different values, but almost the same trend. To be more precise, it reports: i) a moderate negative CAR, **Table 9** ii) a negative CAR for the non-certified green bonds **Table 11** and iii) a negative CAR for the seasoned issuances **Table 10**. On the other hand, the certified green bonds signal a stronger

[26] The Certification is released by Climate Bond Initiative.

commitment toward the environment than those non certified and the first issuances have a stronger effect than those seasoned.

Table 9

Stock market reaction to the announcement of corporate green bond issuance.
This table reports the average Cumulative Abnormal Returns for all the banking green bonds issuances in Europe using Stoxx 600 banks. The sample consist of N=61 green bond issuance events. The third column shows the standard deviation

Event time	CAR	Std. err.
[-20, -11]	0,042	2,59
[-10, -6]	-0,391	2,798
[-5, 10]	-0,014	3,943
[11, 20]	-0,117	2,682
[21, 60]	-0,405	7,328

Table 10

First time issuances vs seasoned issuances
This table reports the average Cumulative Abnormal Returns for first-time ever issue and those seasoned using Stoxx 600 banks. The second column is dedicated to the standard deviation.

	CAR [-5, 10]	Std. err.
First-time issue (N=28)	0,134	4,279
Seasoned (N=33)	-0,139	3,697

Table 11

Certified vs non-certified green bonds
This table reports the average Cumulative Abnormal Returns for certified and non-certified green bonds using Stoxx 600 banks. The second column is dedicated to the standard deviation.

	CAR [-5, 10]	Std. err.
Certified (N=5)	1,714	2,622
Non-certified (N=23)	- 0,217	4,431

The reason why using a sectorial index green bonds issuance does not signal a green commitment while taking into account all the firms, can be object of further analysis. The author of the original paper indeed: i) used a geographic index without taking into account industry's issuer and ii) presented the aggregate results, therefore is not possible to exclude that some industries reported negative CAR.

In my case, I can say that the negative value of all emissions is mainly due to the negative sign of the non-certified issuances. The negative sign could be read as a sign of a lack of recognition of commitment to the environment. The negative sign recorded by non-certified green bonds may suggest that the banking sector in Europe is very sensitive to certifications (the CAR for certified bonds is positive and very high). Subsequent issues of non-certified bonds would seem to mitigate this effect (the sign remains negative, but for seasoned bonds the absolute value is lower). The increase in the number of issues, even if not certified, could signal a higher green commitment of the same issuer. From this perspective, it is not surprising that the absolute value of the CAR for recurring issues is lower than that for the first uncertified issues. Moreover, since the number of seasoned issues is higher than for first issuances, the total value, albeit slightly, turns out to be negative.

3.3 Is there a premium for corporate green bonds?

The literature - Karpf and Mandel (2017), Barker et al. (2018), Zerbib (2019), Doronzo Siracusa and Antonelli (2021) - has been focusing its attention primarily on the pricing of municipal green bonds and sovereigns. At this stage there is no remarkable difference in the performance of the sovereign green bonds and brown bonds (Doronzo, Siracusa and Antonelli, 2021). The other works, even if they prove that the green bond emissions represent a cheaper source of funding, obtained different results in magnitude. Therefore, Larker and Watts (2020) revisited these findings and claimed that "the mixed evidence from prior studies is the result of methodological design misspecifications that produce biased estimates". They argued that Karpf and Mandel (2017) did not take into account the role of taxation in the municipal market and that Barker et al. (2018) did not take into account enough differences between green bonds and brown bonds. To avoid the problem, the authors "use a very tight matching methodology, in which they match each green bond to a quasi-identical brown bond of the same issuer. When using this refined matching, they find that the green bond premium is essentially zero"[27].

The Larcker and Watts's (2020) approach was used by Caroline Flammer (2021) in order to understand whether there is a premium or not for corporate green bonds. It consists of a two-step matching procedure that aims to find the corporate brown bond (traditional bond) as similar as possible to a given corporate green bond except for the greenness. First, from all brown bonds and green bonds issued by a given company in a given period, it is required that the credit rating among the securities is the same. In the second step, using the Mahalanobis distance, it is picked up the brown bond that is more similar to a given green bonds in terms of: i) log (issuance amount), ii) maturity, iii) coupon, and iv) the number of days in between the green and brown

[27] Flammer (2021)

bond issuance. In doing my analysis I add another variable, the currency of emission, in order to make the comparison stronger. In this way the matched brown bond is as similar as possible to the green one except for the "greenness".

Out of the green bonds issued in Europe between 2013 and 2021 by banks, only 5 securities have the "Green bond indicator" in Bloomberg's fixed income database, the "Yield at issuance" and the Bloomberg's composite rating. Then, I extracted from Bloomberg's fixed income dataset all the brown bonds issued by the same issuer of the just mentioned green bonds from January 1, 2013 to December 31, 2021. Then following the above procedure, I found the matched non green bonds.

Table 12
Is there a premium on corporate green bonds?
This table reports the mean of the *yield at issue* for green bonds and matched nongreen bonds of the same issuer. The two bottom lines report the difference-in-means test and the corresponding p-value.

		Yield at issue (%)
	Obs	Mean
Green bonds	5	1,4225
Matched non green bonds	5	1,4128
Difference		0,0097
p-value (difference)		0,9936

Table 12 shows that there is no noticeable difference between the yields at issuance of corporate green bonds and brown bonds in the banking sector in Europe. The mean difference, 0.0097%, is statistically insignificant (p-value=0,9936). This finding is consistent with those of Larcker and Watts's (2020), Flammer (2021). This evidence also implies that the stock market reaction is unlikely to be driven by a cost of capital argument. Issuing green bonds do not represent a cheaper source of capital. In **Table 13** I provide a robustness check. Out of the corporate green bonds issued by banks in Europe with non-missing information on the offering yield (item "yield at issue" in Bloomberg's fixed income database), I expanded the sample considering those green bonds that lack of the Bloomberg's composite rating. I obtained 18 green bonds. The matched brown bonds are obtained following the Larcker and Watts's (2020) methodology described above.

Table 13
Robustness
This table reports the mean of the *yield at issue* for green bonds and matched nongreen bonds of the same issuer without taking into account the Bloomberg's composite rating. The two bottom lines report the difference-in-means test and the corresponding p-value.

	Yield at issue (%)	
	Obs	Mean
Green bonds	18	1,3614
Matched non green bonds	18	1,345
Difference		0,0164
p-value (difference)		0,9691

Conclusion

This work sheds light on corporate green bonds in Europe. In fact, this area is one of the most active in terms of new issuances and amount outstanding. The number of new issues has been increasing since the origin, almost doubling yearly. All the biggest industries are involved.

Among all the possible rationales, companies issue green bonds to signal their environmental commitment to the market and/or to obtain cheaper financing. The study shows that European banks that issued green bonds did not access to a cheaper source of funding. There is no pricing difference in the market between traditional bonds and corporate green bonds in Europe. The finding is consistent with Flammer (2021) and Larker and Watts's (2020) works.

When using a geographic market index, due to a high volatility in daily returns, the study does not find significant cumulative abnormal returns (CARs), although the average value is positive; even when using a different index, industry index, there is no significant evidence of abnormal returns. Hence, the stock performance in the European banking industry does not seem to be significantly sensitive to green bond issuances. However, independently of the index used, CARs are higher when a bank's green bond is issued for the first time or with a third-party certificate.

As more data become available, the sectorial analysis can involve other industries. The analysis can check whether this behaviour occurs in other sectors or it is limited to the banking one. The Certification mechanism in Europe is in the form of private governance, but as long as certifications support the credibility of the signal provided to the market, also an analysis of the impact of a mandatory external review in the European market would deserve attention.