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The Yield difference between Green and Conventional Bonds during the COVID-19
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Abstract

Nowadays, the use of sustainable financial instruments and sustainable investment approaches is increasing more and more. Investors, companies and financial institutions are increasing their investments and the use of these kind of instruments to obtain more funding and better face what will be one of the main challenges of the future, that is complying with environmental challenges that can be reflected both by physical and transition risk. Therefore, investors are becoming more sensitive about this thematic and more interested to sustainable financial instruments, while financial institutions are increasing the issuance of such instruments to satisfy the investors' demand, resulting in a market growth without precedent. For this reason, the governments around the world, but particularly in Europe and in the US, are implementing regulations to safeguard the investors asking for more transparency about the green instruments' financial disclosures.

Considering the importance that this market is gaining, the aim of this research is to give a look at how the market of sustainable debt financial instruments is structured and to study the yield difference between green and conventional bonds to understand whether the green instruments are convenient from a financial point of view for investors and institutions. In particular, this work is focused on the period between January 2020 and October 2022 to see how the Yield difference between green and brown bonds is changed during a period of uncertainty given by the COVID-19 pandemic and Russian-Ukrainian conflict and how investors behaved during this period, if they shift their investment choices toward instruments that guarantee fewer concerns about the future in favour of a more sustainable financial developments in the long-term or if they prefer more financial stability in the short-term.

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Introduction

Sustainable Investing has grown rapidly in recent decades. Originally its roots were in religious movements which introduced the concept of social responsibility, prohibiting investments on unethical activities such as liquor, tobacco and gambling. In this way, they opened the path to the so called SRI approach (Social Responsible Investing approach) for investments.

During the 20th century, many movements against the war and for human rights moved important steps for the social and economic development. An increasing interest for social responsibility and corporate ethic, led the investors to become more and more aware about the role of the companies in the society and about the importance to allocate the capital not only efficiently (as neoclassicism taught us) but even responsibly to increase the financial performance of the markets.

Ethical and environmental movements in the second half of the 1900s significantly shaped present approaches to Sustainable Investing (SI). During the 1960, social investing becomes mainstream when investors contribute to a variety of causes, such as women or civil rights and the anti-war movement.

Throughout the 20th century, more and more rights were recognized to minorities and repressed categories, such as voting, independence and working rights were recognized for women and minorities. During the 1970s the Reverend Leon Sullivan drew up a code of conduct to practice business with South Africa during the Apartheid. The Sullivan Principles led the US government to examine how many companies and private investors were investing in South Africa, which led to a massive withdraw of investments form South Africa as a sort of protest against the Apartheid policy. This led to the revision of the apartheid that brought to more equality for black people and underlined a new trend where investors began to allocate money into projects that fostered civil rights. These events led to a greater social and economic inclusion for women and people with different ethnicities and now, gender equality and inequalities reductions, are two of the objectives for the sustainable development agenda of the United Nations.

In 1971, The Pax World Mutual Fund which avoids investments in companies involved in the arms trade industry, were launched in the United States. It is one of the first ethical funds that allowed to shift financial resources to ethical and sustainable activities.

During the 1970s and 1980s, some events as the oil crisis and the explosion of the nuclear reactor of Chernobyl brought attention to the environmental risks and on the necessity to pay attention to the use of natural resources avoiding unnecessary waste.

In 1988, was established the Intergovernmental Panel on Climate Change (IPCC) by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO), with the role to gather scientific information on anthropogenic activities and publish that information to make recommendations to member states of the UN about the climate change and political, social and economic impact of the society, giving the possibility to develop response strategies for these issues. Two years later, the Domini 400 Social Index (today named MSCI KLD 400 Social Index) was launched. This index was designed to help investors to weigh social and environmental factors in their investment choice.

Then, in 1997, 192 countries signed the Kyoto Protocol which formally acknowledged the effects of global warming and committed to reduce greenhouse gas emissions that cause the global warming. On one hand, with this event the Environment came at the attention of the public opinion. On the other hand, investors continued to believe in the Friedman doctrine, an influent doctrine developed during the second half of the twentieth century, which argues that the only responsibility for the companies is to maximize the returns for the shareholders, while social responsibility (that should remain on the shoulders of the governments and of the shareholders) and ethical investments were likely to reduce the financial performance. Investors were particularly suspicious about SRI investments because of a too general definition of the social and environmental principles and a lack of awareness about the impact of investments in the society; therefore, was not clear for them which investments were coherent or not with those principles, especially between different cultures with different rights conception against ethnicities and genders. For these reasons institutions did not accelerate the adoption of sustainable principles for investments because this incoherence could have

led to a lack of geographical, sectorial and currency diversification of the portfolio, producing a sub-optimal risk-return combination.

In 1998, John Elkington published a book in which he identified a new emerging cluster of financial, environmental and social considerations that should be involved in the process to evaluate a company or its equity value. And, in 1999, Dow Jones Sustainability Indices was created to track sustainability performance of the most advanced companies on sustainability topics. Today, it is one of the longest-running global sustainability benchmark worldwide and have become a reference point for investors and companies that make sustainable investments.

The Environmental, Social and Governance approach (ESG approach) saw a growing interest at the beginning of the twenty first century, when some banks (as the Brazilian Unibanco) provided selective investment services and numerous research, which reported that the integration of ESG factors into financial practice can improve the financial performance, appeared. For instance, Alex Edmand during the 2011 published a paper in *the Journal Financial Economics* where he showed that a list of the best-practicing Companies to Work for in the US regarding corporate social responsibility, outperformed their peers in stock returns by 2-3% a year in the period between 1984-2009. Another example is given by the study published by Michael Barnett (2006) in which analysed mutual funds' performance and concluded that the financial performance of an investment portfolio can be maximized with a selective or with a non-selective investment practice, but a middle way of selection practices can deteriorate portfolio's performance.

The term ESG appeared for the first time in a study of the 2005 entitled "*Who cares win*", published by the UN Global Compact which reports a deepening where institutional investors, asset managers, global consultants, analysts, government bodies and regulators discussed about the role of "environmental, social and corporate governance" analysis in asset management and financial research.

During the 2006, the United Nations published the Principles for Responsible Investments (PRI) that are based on the notion that ESG issues (as climate change, human rights, etc.) affect the investment portfolios' performance, with the aim to stimulate the sustainable responsible investments between institutional investors, which were called to underwrite and observe these principles. With PRI publication, investors

were committed to include the ESG criteria into their investments analysis, investment processes, politics and corporate practices to document activities (giving more transparency to their transition progress) and to promote environmental and social responsibility into their industry. In this way, the Socially Responsible Investments (SRI) were integrated to different levels of environmental, social and governance factors.

First with the Enron scandal and then with the financial crisis of the 2008 (a crisis which started by a relaxation of standards for US mortgages due to a weak oversight and fragmentation of the mortgage market) the “bad governance” issue came at the attention of investors and governments. The crisis event accelerated the passage from a financial industry focused principally on competitive returns (as intended by the Friedman doctrine) to a new era, where ESG principles must come in the forefront. Governments asked to the banks to change their capital allocation policies, in order to allocate more capital into “sustainable areas” to solve more effectively environmental and social issues.

Further steps in ESG adoption were made during the 2015, with the achievement of the Paris agreement, where member states of the United Nations defined a path to maintain the worldwide average mean temperature below two degrees Celsius by 2100. With this agreement each subscriber country must present its national plan to mitigate and monitor greenhouse gas emission, including their commitment to align financial flows with a low-carbon and climate resilient development. Moreover, with the arrangement of the Sustainable Development Goals (SDG), a series of 17 objectives, were defined by the ONU for a sustainable development that include an inclusive and sustainable economic growth, social and gender equality and climate change and environmental protection; that, given the subjectivity of Environmental, Social and Governance principles between countries and cultures, can be used as guidelines to define ESG standards.

In the same year the Task Force in Climate Related Financial Disclosures (TCFD) was established to improve the reporting of climate-related financial information, with the aim to provide information to investors about what the companies are doing to mitigate the climate change related risks, increasing the transparency about the way in which companies are governed.

Important steps were moved by the European Commission in the 2020 with the endorsement of the European Green Deal. A set of policy initiatives to make the European Union the first continent climate neutral within the 2050. The green deal is aimed to introduce new legislations on innovation, building renovation and increase renewable energy production usage which will be accompanied by the European Green Deal Investment Plan, which is expected to mobilize €1 trillion of sustainable investments over the next decade, to mobilise European funds and create a framework to stimulate the public and private investments needed for the transition to a green, competitive, climate-neutral and inclusive economy. The most important regulation in the context of the European Green Deal was the EU Taxonomy for sustainable activities (or green taxonomy), a classification system established to classify which investments are environmentally sustainable with the purpose to help investors make more sustainable choices and to prevent the green washing. In the same year the EU commission presented its 2030 climate target plan, aimed to reduce the emissions of 55% by 2030, compared to 1990, investing €350 billion every year for the entire decade.

In 2021, the Sustainable Finance Disclosure Regulation (SDFR) came into effect in Europe. The purpose of this regulation is to give information to the subjects that participate to the financial market about the risks that they can face with the integration of the sustainability in their investment process and the negative impact that sustainability can have in their decision-making process.

The European Union and other international institutions are developing other policy objectives for the mitigation of climate change and to improve social inclusion and governance transparency, in order to achieve not only the objectives to limit global warming as stated in the Paris agreement, but even to eliminate social inequality and to guarantee the sustentation in the long term of the economy to favour a sustainable and inclusive growth and limit future damages and catastrophic events.

CHAPTER 1 ESG Investments

1.1) The three pillars of sustainable investments: The E, the S and the G

As a result of the above-described historical events and the development of awareness about climate change, social inclusion and governance sustainability, the value of an investment for investors is no longer just about returns. With the storm created by the COVID-19 pandemic, an increasing number of investors are also looking for their investments to make a positive impact on the society. According to a Bloomberg Intelligence research analysis, the global ESG assets are forecasted to exceed \$53 trillion by 2025 at a global level, assuming a 15% growth (a half-pace of the past 5 years) and are expected to constitute about a third of the \$140.5 trillion in projected assets under management (AUM). These forecasts are based on past ESG assets increase which jumped from \$22.8 trillion in 2016 to \$30.6 trillion in 2018 and to about \$35 trillion in 2021, with an increase of more than 30% over the past 5 years. Until 2020, the European market accounted for about a half of the total ESG market but starting from the 2022 the US has seen the strongest expansion which led them to become the primary market with more than a half of ESG assets traded.

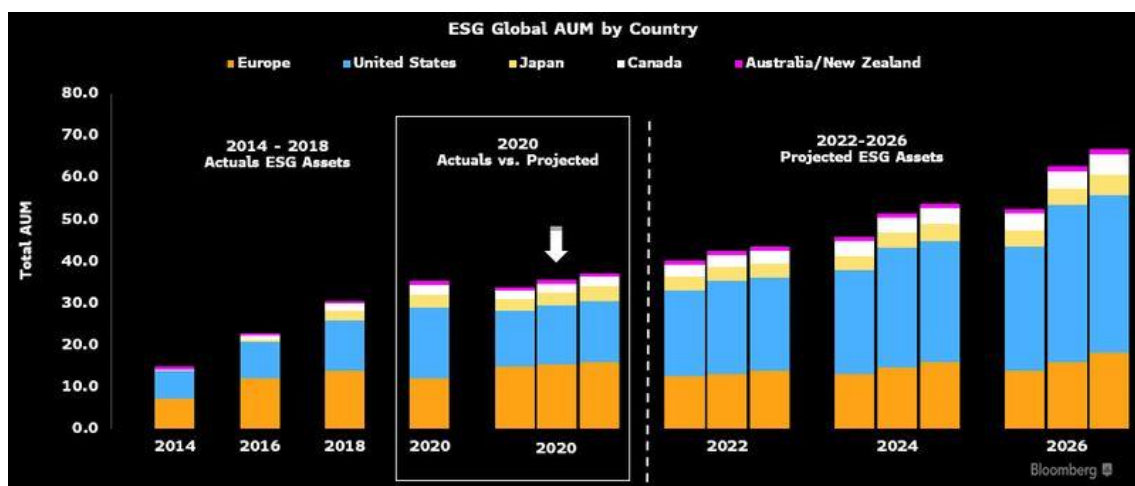


Figure 1. Actual vs Projected ESG global assets under management growth by country from 2014 to 2026.

Source: ESG by the numbers: Sustainable investing hit records in 2021.

Initially, ESG phenomenon was born as an equity phenomenon as investors found more easily applicable a sustainable-selective investment strategy approach to this asset class. Today, it is still the more selected asset class for sustainable investments but, as we can see in figure 2, ESG investing spread even in other asset classes such as real estates, commodities and debt market.

Despite the inflation that characterized investment decisions since the end of 2021 because of the emerging economies from the pandemic lockdowns and supply-chain shortages, in addition to Ukraine war which exacerbated this situation, equities' (80%) and bonds' (58%) markets remained the most popular between global investors to gain exposure to ESG investments, even if their percentage is reduced from the 2021. The 2022 trend showed a stronger preference by investors for inflation-linked assets such as alternative markets (from 41% in 2021 to 47% in 2022), real estates (from 24% to 27%) and especially commodities (that increased from 8% to 25%), to protect their purchase power reduced by inflation. Moreover, even emerging markets were a popular way to gain exposure to ESG (from 28% to 36%), between investors that see developed markets ESG as overcrowded and are looking for unexploited opportunities.

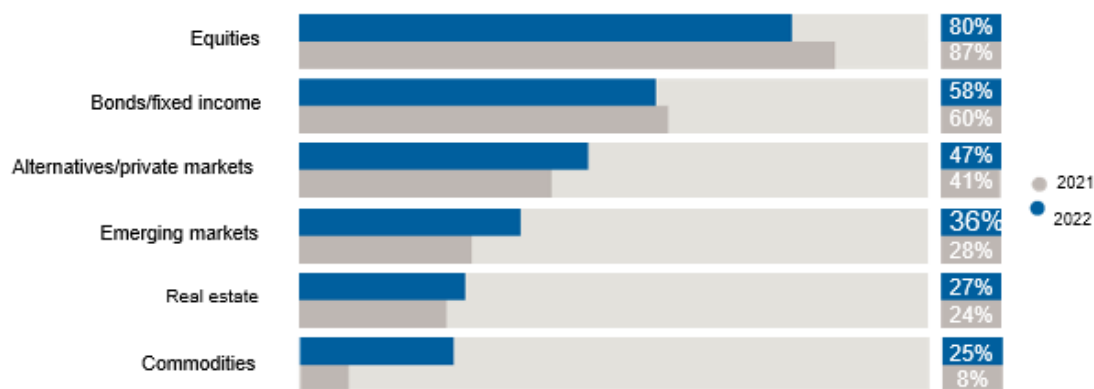


Figure 2. Which asset classes and sectors do institutional investors use to gain exposure to ESG factors? (Multiple answers allowed).

Source: ESG global study 2022. Harvard law School.

The debt market which has seen an issuance exceeding \$1.6 trillion in 2021, with total transactions for more than \$4 trillion globally since its inception, is mostly boosted by sustainability-linked bonds and green bonds. An increase in ESG investment is given by

ESG-focused mutual funds and exchange traded funds which reached \$2.7 trillion in 2021 according to Morningstar.

Only in the US, this trend incremented by 51% from December 2020 to December 2021, with a 60% of sustainable assets managed actively and 40% passively using Exchange traded funds (ETFs) or Mutual funds (percentage increased from the 20% during the 2020), driven by Coronavirus pandemic and the Black Lives Matter movement.

While, always in December 2021, in the more developed European market which accounts for about a third of global ESG assets, mutual funds and ETFs reached the \$1,1 trillion according to Morningstar direct. The number of global ESG funds grew from 4153 at December 2020 to 5932 at December 2021. Morningstar reported that fees for asset managers which manage sustainable funds reached \$1.8 billion in 2021 at a global level.

To accompany the growing demand for sustainable investments there are a series of strategies that integrate ethical criteria into the investment process. Sustainable Investing (SI) consists in the integration of ESG factors into company analysis and investment decisions. The factors considered during the investment process, the way in which are integrated, and the outcome on portfolios are several and the inclusion of extra-financial considerations form the basis of any Sustainable Investment approach. Nevertheless, there are some differences that affect how the investment portfolio should be structured and which investments meet social and environmental goals.

Understanding the different approaches to sustainable investments allows us to learn how a portfolio is managed and which investment strategies best fit the investor's objectives. To understand the difference between these terms is useful to give some definitions. Such as what are ESG criteria? And what are SRI investments?

1.1.1) Definition of ESG factors

Nowadays, an increasingly number of investors and societies consider ESG criteria (acronym that states for: Environmental, Social and Governance criteria), a set of standards for a company's operations, during the phase of the investments valuation to screen potential investments. These criteria are used to evaluate an investment not only

from a purely economic point of view but considering even sustainable and ethical aspects. The inclusion of these criteria in the valuation, allows to measure the environmental, social and the governance impact of the companies and their capacity to comply with the standards set out by the institutions to pursue a sustainable and ethical development.

These criteria allow to stipulate a sort of classification of the companies that better comply with these three parameters through the disclosure of ESG ratings. The “sustainable rating” or “ESG rating” gives to the investors a synthetic valuation about the environmental, social and governance commitment of a company or an organization. The ESG rating does not substitute the traditional rating score for creditworthiness, but it is an important indicator that increases the information available, allowing the investors to improve their valuation and their choice about the risks and sustainability of their investments. These ratings are elaborated by expert agencies which collect and analyse data that involve environmental, social impact and governance characteristics of the company. This data can be collected through public information, ONG’s data, data provided by the authorities or companies’ documents. Therefore, the companies are not evaluated only by considering their capacity to make money but considering even their capacity to produce sustainable and ethical results, such as social inclusion and environmental protection.

In general, a company can be considered sustainable if it can have a competitive business position with stable returns over time and to create long-term shared value with the stakeholders, it analyses each impact that a business decision determines on the society and communicates those impacts of the decisions for each ESG factor, to comply with transparency requirements. The sustainable organization pays attention to these three factors:

E criterion

The environmental criterion is referred to the contribution of a company or a government to the climate change mitigation and adaptation, the parameters are focused on climate change impact of the company (or government), greenhouse gases emissions, natural resources preservation, food safety, energy consumption and waste production.

This criterion includes every initiative that have the objective to reduce the impact of the firm into the environment such as company’s energy use, waste it discharges,

natural resources conservation and pollution. It can also be used to evaluate any environmental risk that a company may face and how the company is managing those risks. For example, a company can be evaluated even through their compliance with government environmental regulations, their management of greenhouse gases emissions, or how their activities are impacting the land.

With the increased commitments around the world to challenge the climate change, emission reduction and decarbonization can have a positive impact on companies' valuation.

S criterion

The Social criterion examines how a company manages the decisions that have a social impact such as relationships with employees, suppliers, customers and more generally their approach to gender equality, human rights, health and safety, working conditions and every form of discrimination.

Besides these elements, the "social score" can increase in case of high investments in human capital and of firm's capacity to increase the wealth and well-being of their employees and the residents where the company is located; for example, if the company donates part of its profits to the local community, guarantees health and safety for its employees.

Social criteria are the most easily visible even for external member of the organization and their observation increase the positive image of the company.

G criterion

The last criterion is the one that includes the responsibility and the transparency of the Governance inside the company. It is important for external observers to evaluate the corporate identity and allows to define whether the operations and initiatives adopted are consistent with the sustainability objectives set by the institutions and if company's decisions meet the needs of external shareholders.

The Governance is referred to a set of rules or principles that define responsibilities, rights and expectations between stakeholders in the governance of the society. The G criterion depends on the meritocracy inside the organization, how the company avoids conflicts of interest, which measures are taken to prevent corruption, on internal control, executive compensation, transparency and disclosure, gender and ethnicity diversity of

the board of directors and if the company does not engage illegal practices. A well-established governance can align stakeholders' interests and is fundamental to sustain the long-term strategy of a company. The Governance can be referred even to national government standards.

1.1.2) Market overview of ESG factors

Investors have a different feeling about these three criteria. For example, climate change concerns are at the forefront of their minds, then investors focus more on the Environmental (E) element, which has seen an increase of asset allocation during the last year, from 44% in 2021 to 47% in 2022, according to the ESG Global study of Capital Group (2022). In the same research, they found that the Social criterion slightly increased of 1% (from 25% to 26%), while the Governance factor has seen a decrease in investors focus during the last year of about 4%, (from 31% to 27%).

Specifically, according to a European sustainable investment survey conducted by Mercer, the environmental element is the most important of the ESG factors when investors choose to invest. Second, the majority of participants chose the social factor over the governance factor as the second most important. The only exception is Ireland, which is the only country that ranks the governance factor as the most important, followed by the environmental and the social factors. While some countries like Germany, Austria, Norway and the UK give importance to each factor, without a clear dominance of one preference.

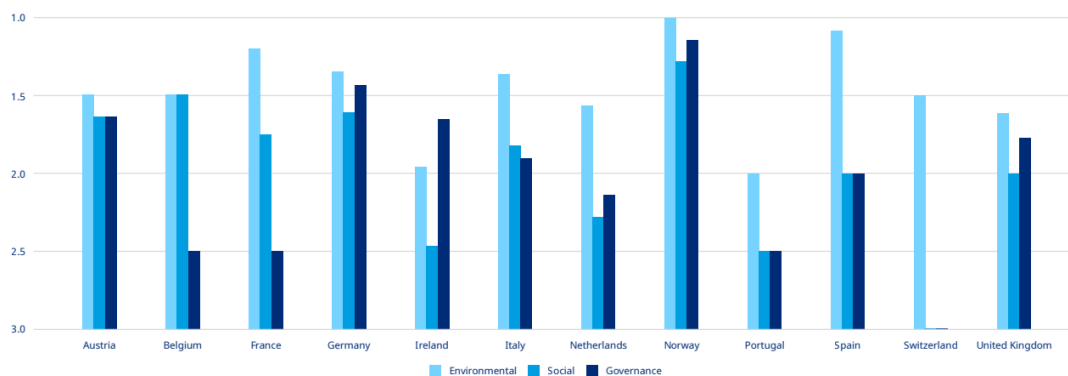


Figure 3, Ranking of the most important factors for European investors.

Source: Sustainable Investment Survey, Mercer.

These results at a global level seem confirmed by a report of Morgan Stanley (2022) where they reported the number of ESG-related material issues which they engaged during their meetings in 2021.



Figure 4. ESG Engagement statistics by topic in 2021 by Morgan Stanley.

Source: Emerging Markets ESG and sustainability. Report 2022, Morgan Stanley.

As we can see in figure 4, most of engagements were about Environmental topics (250 total engagements), mostly focused on greenhouse gas emissions, renewable energy and clean tech and energy usage and efficiency. Secondly, we find the social topics (243 engagements) mostly focused on employment practices, employment diversity and inclusion and customer privacy and data security. The less discussed topic was the Governance factor, focused more on transparency and governance sustainability, board structure and regulation, regulatory and board diversity.

1.2) Momentum drivers and Responsible Investment Approaches

Responsible investments are becoming a popular way for investors to support ethical causes that they believe in, with the intent to obtain positive financial returns.

Throughout the two-years period 2020/2021 ESG investments have seen a continued

momentum period, with more than a quarter of global investors which said to include ESG factors into their investment approach. European investors represent the highest percentage of ESG users (93%), before Asia-Pacific investors (88%) and North Americans (79%).

Such ESG Momentum is being fuelled by different factors, such as media influence that put external pressures, reputational concerns and the increasing clients demand for investments in renewable energies and investments targeting Sustainable Development Goals. Another factor that may have boosted ESG momentum is a general reduced concern about greenwashing, for example after the concrete commitment of European Institutions through green policies like the EU Taxonomy, giving investors more confidence toward sustainable investments.

Sustainable investing is aimed to improve the traditional financial analysis to evaluate potential investments, including, or excluding, investments based not only on their financial performance but even through ethical considerations like environmental, social and governance factors.

1.2.1) Active vs Passive investment strategies

Knowing that the Sustainable Development Goals of the UN concern are mainly about transition risks, then sustainability investments should focus on such risks. But, as argued before, existing metrics are not properly suitable to perform a companies' ESG analysis to check whether it is prepared for transition.

Then, investors and analysts should focus on material ESG factors (such as management of human capital and the environment) and assess their qualitative and quantitative impact on the company. This kind of analysis is impossible to perform with a passive investment approach and almost impossible with a quant approach (Schoenmaker D., Schramade W., 2018) due to a lack of universal indicators and the limitations presented by the ESG ratings. In this way investments tools based on the EMH do not suit for these new risks. Nowadays, there are limited data available but, in the future, the limited availability of data may diminish, in line with the efficiency of the adaptive market hypothesis and passive approaches may be possible to perform in the perspective of an improvement of such ratings.

On the other hand, an analysis to assess this risk can be performed with an active management approach, based on the concept of the AMH. In particular, long-term investors may want to allocate their investments to optimize financial, environmental and social value in the long-term, looking at whether the business model of a company is adaptable to the new green policies. To do that, investors should take a forward step from short-term metrics and go beyond traditional financial analysis. Moreover, a simple integration of ESG ratings does not allow to give a complete measure about the preparedness of a company to transition. Instead, analysts and investors need to look at data that really assess the transformational challenge, for instance by considering externalities, investigating governance and assessing the suitability of business model. Despite the better adaptability of the active approach toward preparedness analysis, only few investors and analysts do that (Cappucci, 2017), because of the fragmented framework of ESG ratings and investors' unpreparedness to investigate such risks by themselves. As reported by the ESG Global Study 2022, figure 5, about 63% of global investors prefer an active approach for their investments to influence the activities of investee companies, percentage that increases in Europe (68%) and North America (69%), where in turn 20% and 22% of investors prefer passive strategies while 12% and 8% a hybrid approach respectively. Active preference decreases in the Asia-Pacific to 52%, where 30% of investors still prefer a passive approach for their investments. Nevertheless, the lack of active management initiatives may be due to a long and inefficient investment chain; then to benefit from the ESG research a change of incentives along the investment chain is required.

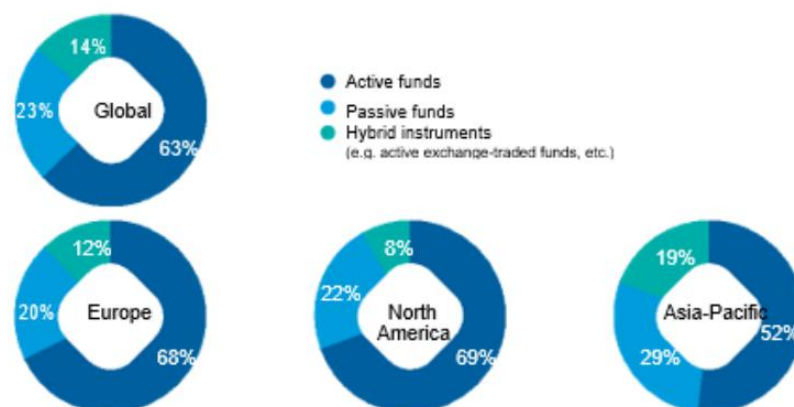


Figure 5, Preferred approach for green investments: Active vs Passive strategies.

Source: ESG global study 2022. Harvard law School.

1.2.2) The 7 strategies for sustainable investments.

According to the OECD, the CFA Institute and the Global Sustainable Investment Alliance there are several strategies to ESG investing that can be used by investors to perform an active investment approach and favour a better integration of social and environmental risks and reduce the volatility on portfolios. Such strategies are: negative screening, positive screening, ESG integration, active ownership, thematic investing, norms-based screening and impact investing.

Negative screening

The oldest approach of sustainable investments is the negative screening, or exclusionary screening. This method is used from the investors to exclude investments in companies that have a negative impact on the society or on the environment. Originally, socially responsible investors used negative screening to exclude ‘sin industries’, such as tobacco, gambling and alcohol. This process has evolved to focus on modern investors preferences and political goals, also excluding from the investment universe companies with high carbon emissions that use coal and fossil fuels to produce energy and do not comply with ESG standards. This strategy can be useful to divest from carbon intensive sectors that, in turn, leads to a lower market performance of those sectors¹.

Political goals are often referred to the 10 principles launched in the 2000 by the United Nations, organized under 4 categories: anticorruption, human rights, environment and labour standards².

Positive screening

¹ According to the Friedman’s doctrine with the negative screening approach the investment universe is reduced; then, investments in companies that belong to ‘sin industries’ and could lead to good performance are not taken into account, reducing the performance of the investment portfolios.

² To learn more about the 10 Principles visit: <https://unglobalcompact.org/%20what-is-gc/mission/principles>

This strategy, rather than simply eliminate companies from the investable universe as in the negative screening, is aimed to identify companies or governments that best contribute to positive social practices and environmentally sustainable activities which will be included in the fund or investment portfolio. Positive screening can be performed through two approaches. The “best-in-class” approach, where an ESG score is assigned to each company within a specific sector. The “best-in-universe” approach, where companies are ranked according to their ESG scores across sectors. One of the advantages of positive selection is that companies will be encouraged to compete with each other to increase their social and environmental impact and be selected by investors to receive financing. On the other hand, this strategy can become too exclusive, reducing the investments universe and the possibility for the investors to properly diversify their portfolios, increasing their risk.

ESG Integration

ESG integration is the most used approach for sustainable investments. It consists on including material ESG factors during the investment process, including not only the analysis of financial information, but even non-financial information such as ESG risks and opportunities, looking at Key performance Indicators (KPIs). Differently from negative and positive screenings that are structured to narrow the investible universe, the integration approach includes ESG criteria for asset selection and it can be applied to every potential investment, to improve returns and better manage risks. With this approach, investors pay more attention to ESG factors that have the potential to affect the company’s ability to create value for its stakeholders. This assumes a different mean for each company. For instance, technology companies are more likely to be impacted by security concerns and data privacy, while companies in the automotive industry are more likely to be impacted by greenhouse gas concerns.

Moreover, investors must decide how much weight to give at each ESG concern. For example, when an analyst evaluates an equity security may define that a company sustainability rating will probably be an essential indicator of increased risk or future success. Then, the analyst would adjust equity valuation according to the perceived ESG risk or benefit, to better position the stock (or asset) within the portfolio. This lack of standards, as we will see, is one of the major problems for ESG strategies adoption.

Active ownership

Active ownership consists of the right for shareholders to influence the activities and the decisions of investee companies about environmental, social or governance concerns to preserve long-term shareholders value and improve their returns. It can be used to improve poor quality engagement, poor informed proxy voting practices and the poor transparency of the companies' governance. It can be applied for each asset class. For instance, in listed equity, is used for *shareholder engagement*, where shareholders and the company's board discuss about the adoption of more sustainable practices to improve risks and returns and be more competitive in the long-term, and *voting activities*, done by proxy, or in person during the Assembly General Meeting (AGM) to influence company's decisions.

Thematic investing

A strategy characterized by a thematic focus, allowing investors to target on one or more of the Environmental, social or governance issues. This approach uses sustainable themes, allowing investors to focus on delivering one or more of the United Nations sustainable development goals, such as: water scarcity, climate change, gender inequality, data privacy & cyber security or human capital management. Once an investor has identified one or more themes to focus on, he can determine which are the sectors that most likely benefit from these trends and build a portfolio accordingly to this research. In this way, an attractive risk-return profile is combined with the intention to contribute to a specific social or environmental challenge.

Norms-based screening

Investments are screened according to their compliance with international standards and norms covering ESG factors such as the United Nations (UN) norms.

Impact investing

The United Nations (UN) defines impact investing as a way for the investors to allocate their capital with the objective to obtain a social and environmental impact, alongside a positive financial return. The positive impact of investments is of primary importance to reach specific goals that are beneficial for the society and/or the environment. The central point of impact investing is to quantify the impact of the investment not only on the performance but even on the society with appropriate measurement methods. These investments present some factors that allow to measure the impact that investments have on the society, their structure present three characteristics:

- Intention, the company must follow a social or environmental objective;
- Measurement, is the way to determine whether a company is generating the desired impact as a result of its operations;
- Financial performance, measures the amount of profit that the company is generating as a result of its social or environmental operations.

Impact investments include: microfinance, social business funds and community investing.

Figure F shows the strategies implemented both by institutional and wholesale investors around the world. As can be seen, ESG integration is the most used implementation strategy (used by 59% of the investors) especially by institutional investors (63% vs 55% of wholesale) even if it has seen a decrease in its use during the last year. This shows that investors prefer to take a holistic approach to fully include ESG into their investment process. The second and the third most popular strategies are respectively thematic investing (49%) and impact investing (47%), which gained ground during the last year at the expenses of positive and negative screening. This change in strategies preferences is given by the fact that investors are reviewing their approach as they move from basic screening methods (which are included in the first and second sustainable finance stages) to more sophisticated approaches (included in the third sustainable finance stage); shift that is seen mostly on institutional investors. Even though are still the less used approaches, the highest increase in the inclusion on investors' strategies can be seen in the use of active ownership (increased by 9% during the last year) and in the use of norms-based screening approaches as Net zero strategies and the UN SDGs portfolio benchmarking.

Implementing ESG

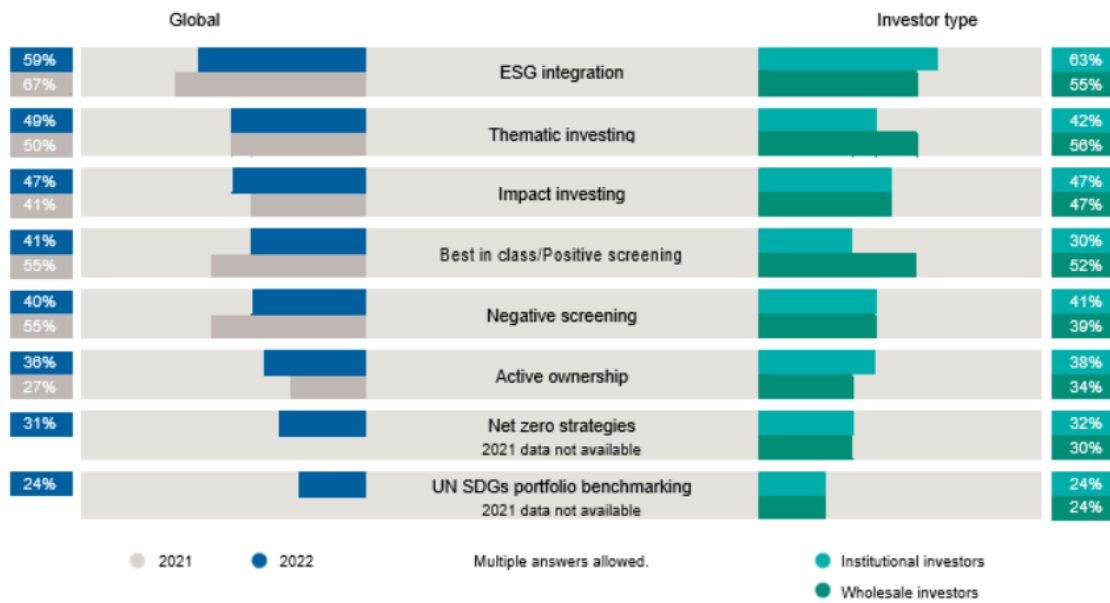


Figure 6. What ESG implementation strategies do investors use? (Multiple answers are allowed)

Source: ESG Global study 2022, Capital Group.

CHAPTER 2 – Debt financial market and Green bonds

2.1) Financial Instruments for the sustainable development

In this section I am going to explain what are the financial instruments that investors use to take a position in favour of ESG factors and to finance the sustainable development, how they are used, how their market is structured and what was their past development.

In sustainable finance, the two most used financial instruments are debt and equity instruments. During the early stages to finance a project, equity financing is preferred and investors receive shares to participate in the project's risks and returns up to a limit, given by the amount of capital that they have invested. During the later stages of a project, investors prefer debt instruments to finance their projects. Then, investors lend money to borrowers, money that will be repaid with interests.

Investing into green projects allows investors to manage their risk exposure toward physical and transmission risks. In this way, debtholders' investments are more likely to be repaid and shareholders' investments are less likely to fail.

2.1.2) Sustainable Debt instruments

Conventional debt instruments are the most used from companies to receive funds. But, in the reality, there are sustainability issuances that are not properly priced by normal debt instruments. Hanson and colleagues (2017) argued that debtholders are concerned about ESG exposures since ESG issues may affect the performance of debt instruments by generating tail risk. Investors integrate ESG factors to include financial materiality into investment performance and to meet client demands.

Up to now sustainability has been more focused on equity instruments than on fixed-income instruments. But, with an increasing sensitivity of investors about ESG issues and especially after the outbreak of COVID pandemic, sustainability has gained more consideration among fixed-income investors. After a trend of 10 consecutive years of green market expansion, during the 2021 this market has peaked a new record of over

\$1.6 trillion of debt issuance, increasing more than 50% compared to the previous year, due mostly to incentives provided during the pandemic. As represented in figure 7.

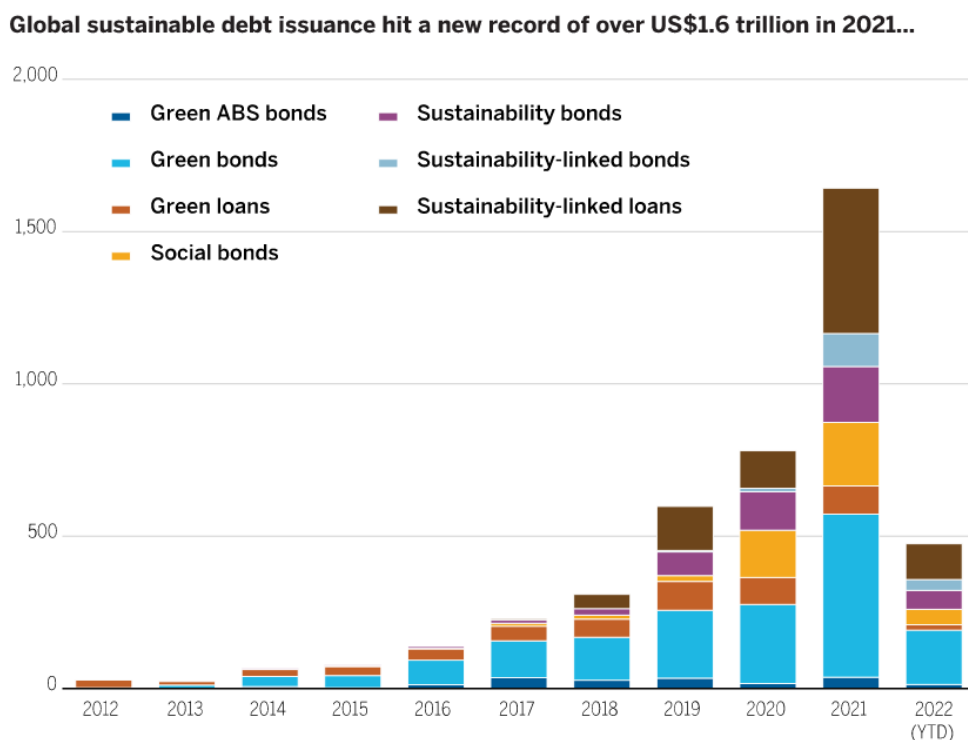


Figure 7, Global sustainable debt issuance during the last decade in US dollars.

Source: Bloomberg, BNEF. Chart data as of 23 May 2022.

Debt financing can be carried out through loans and bonds. A loan is a transfer of money from a bank to an individual or a company, while a bond is an agreement to transfer money from the market (constituted by investors) to the company that issues the bond. In other words, the issuer borrows funds from other investors and must repay those investors at a specified interest rate after a specified amount of time. Borrowers must return to the investors two types of payments: the coupons (interests paid) and face value (amount paid at the maturity).

The theoretical fair value of the bond is determined by calculating the present value of a bond's future payments (both coupons and face value) at a discount rate (or yield to maturity) and is useful for investors to determine which is the required rate of return for the bond investment. The formula to calculate the value is the following:

$$P = \frac{C}{(1+r) + (1+r)^2 + \dots + (1+r)^n} \quad (1)$$

Where:

P = fair value

C = coupon calculated through the face value time the coupon interest rate (100*i). It can be paid periodically (annually, semi-annually, etc.).

r = discount rate

n = maturity date

The current bond price depends on the level of the interest rate; therefore, the investor may purchase a bond below par, at par or above par. For instance, considering formula (1) if the interest rate increases, the value of a fixed coupon bond will decrease since the coupon rate will be lower than the interest rate in the economy, making the bond less attractive. When this happens, the bond will be traded at a discount, or below par. On the other hand, the bondholder will receive the full-face value of the bond at the maturity even if he purchased the bond for less than the par value. On the other side, if a bond is trading at a premium, it means that is offering a coupon (interest) rate higher than the interest rate offered for new-issued bonds, therefore investors are willing to pay more for the existing bond increasing its face value that becomes higher than the issuance price.

While, a Zero-coupon bond doesn't pay periodic coupons, then the value of a zero-coupon bond is simply the present value of the face value, as in formula (2):

$$P = \frac{F}{(1+r)^n} \quad (2)$$

Generally, during the evaluation of a bond investments the investor should assess whether the interest rate is adequate to the bond's relative default risk, the bond duration, expected inflation and price sensitivity in the yield curve. For this reason, anything that may potentially impact bond's cash flows should be evaluated relative to

other investment alternatives. In the context of green bonds, additional sources of risk like transition and physical risks should be included in the bond's valuation.

As shown above in figure 6, the most used instruments for sustainable debt financing are *Green Bonds*. They have reached about \$500 billion issuance in 2021.

As represented in figure 7, green bonds are no longer the only sustainable-debt instrument to raise money for sustainable projects. This market has seen a huge diversification over the past years with the introduction of additional instruments in response to the increasing market demand for sustainable financial products and to the rise of different needs of investors. Such instruments are sustainability bonds, green loans, sustainability-linked loans and social bonds.

The nearest alternative to Green Bonds are *Sustainability Bonds*, defined by the ICMA in its Sustainability Bond Guidelines (SBGs) as bonds whose proceeds are destined exclusively to finance projects with clear environmental and socio-economic benefits. A similar definition as the one of the Green Bonds, with similar guidelines to facilitate the emission of such instruments. This market is continuing growing during the first half of the 2022 at a 5.2% year over year growth rate, with more and more issuers that use this format to define their commitment to the transition pathways. Even though issuers can decide at which key performance indicators (KPIs) allocate their proceeds, like renewable energy, waste, sustainable finance, corporate social or ESG score, most of them choose GHG emission target (about 61% in the first half of 2022) to demonstrate their commitment towards net-zero goals. The 26.7% of such GHG targets, in the first half of 2022, covered all the three scopes of emissions, including Scope 1, 2 and 3. The degree of commitment depends on the industry (figure 8). For example, This commitment varies among industries with 61% of communications SLBs covering all three scopes, as well as 44.4% of real estate ones, 47.6% of financials, but worryingly, only 27.9% of oil and gas and 15.2% of gas utility SLBs. Climate Bonds urges SLB issuers of all sectors, including fossil fuel-reliant sectors such as oil and gas utilities to include Scope 3 emissions in their SLB targets, to clearly demonstrate to investors the ambition and credibility of their transition plans.

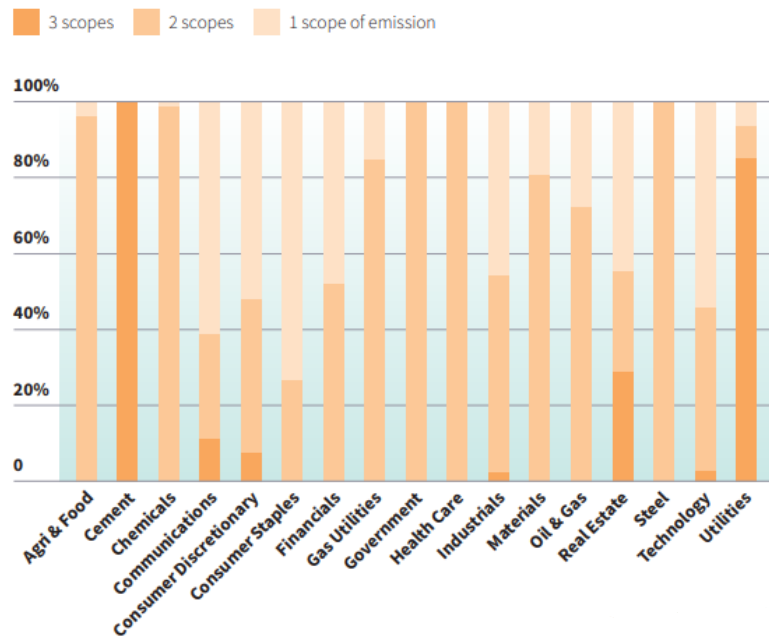


Figure 8, GHG emission scope coverage for sustainability-linked binds across industries (2022).

Source: Climate Bond Initiative (2022).

Social Bonds is the third most used debt-financing instrument, issued for the first time in the 2015, and peaked about \$220 billion issuance in 2021. The ICMA defines this category as, bonds whose proceeds are used exclusively to finance projects with clear socio-economic benefits. The use of this instrument as seen a huge increase especially during the COVID-19 pandemic in 2020 and 2021, due mostly to pandemic bonds, issued to revive the economy after the lockdown-induced recession; issuance that has seen a reduction during the 2022.

In 2016, the sustainable debt-financing market expanded to the loan market, as a consequence of the insufficient amount of green bonds issuance to the increasing demand of small- and medium-size investors who were not sufficient credit rating to raise money through the debt capital market. Unlike green bonds which are mostly exclusively publicly listed with detailed information, sustainable loans are private and the reporting level is less controlled with lower verifications than for bonds, this limits their diffusion.

Sustainable-linked Loans constitute, as we can see in figure 6, the principal loan instrument in the sustainable debt market and the second most used instrument after the green bonds. The terms of the loan are linked to the score of borrowers on ESG ratings

provided by companies like Sustainalytics or MSCI, to the characteristics of the borrower and to the sector in which operates. During the loan period, if the borrower achieves a higher ESG rating, he will receive an improvement in the loan terms, most of times it means a reduction of the interest rate. While, if the rating decreases the borrower will receive a worsening of the terms for the loan.

Just like green bonds, the proceeds gained through *Green Loans* are used for environmentally beneficial activities and the Green Loans Principles (GLPs) share the same four aspects of the GBPs. Despite their rapid growth during the last years, they constitute the smallest share of the sustainable debt market. Differently from the bond market, the sustainable loan market can be seen as a first step to induce small- and medium-size organizations to increase their sustainable performance. These instruments can be an important tool for the transition toward a cleaner economy because are mostly used by corporations.

As we can see in figure 6, during the 2021, a period of important economic stimulus for corporations where central banks kept low the interest rates and governments granted incentives to finance green projects, this market rocketed surpassing the social bonds and settling as the second most used sustainable financing instrument.

Nowadays, the Green Bonds market dominates the sustainable debt market because the regulatory framework (like the EU Taxonomy) is the most developed and the sustainable effects of green bonds are more easily to verify than other products. But, with more and more sustainable debt-financing products that are entering in the market, is likely that the green bonds market share will be reduced in the future, in favour of the new ones.

Nevertheless, up to now the total green debt issuance is not enough to reach net-zero by 2050. McKinsey suggested that to achieve this objective a total of \$9 trillion is needed each year, while intergovernmental organizations and research institutes reported that to achieve this objective, it will be necessary to invest about \$275 trillion in physical assets over the next 30 years. Most of these investments will likely come from the private sector. The provision of these point of reference, are important to compare current investment levels to a quantitative objective and, as we can notice, the limitations of green bonds provision for small- and medium- corporations will make it necessary the expansion of existent products and the introduction of others.

2.2) Green Bonds

2.2.1) Green and Conventional bonds: A credit risk perspective

Just like traditional bonds, green bonds are fixed-income debt instruments; they have the same seniority, ratings and recourse as a traditional bond issuer. The main difference between traditional and green bonds is that the proceed of the second ones are destined to support climate and environmental projects, such as clean energy, green buildings, energy efficiency investments, sustainable agriculture or water conservation.

An example of rapid pace with which green bonds caught on compared to traditional bonds, can be given by green corporate bonds which moved from about \$20 billion (less than one percent of total traditional bond market) in 2014, to more than \$350 billion (about six percent) in 2021, as shown in figure 9. During their climbing, green bonds has been criticised because of their high costs of issuance and their lack of standardization which can lead to the greenwashing practice or to green bonds that in the reality do not finance green projects.

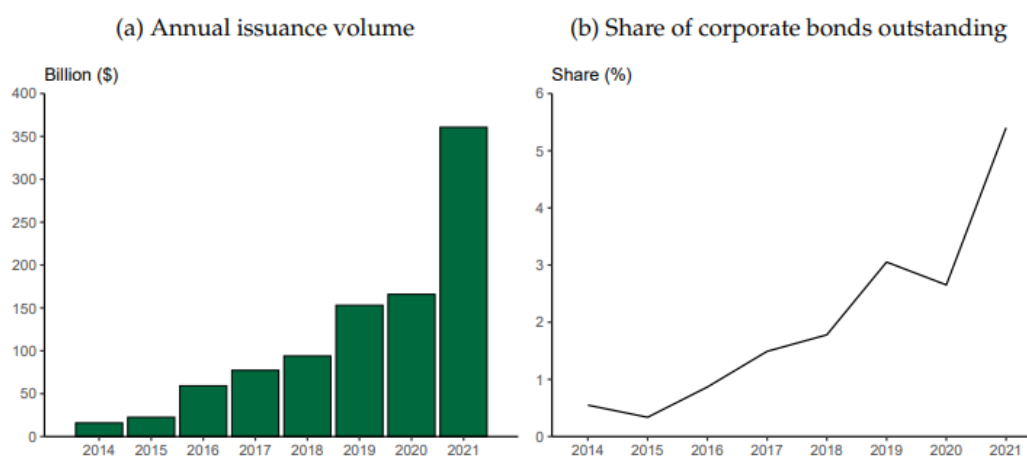


Figure 9, Growth of green corporate bonds, from 2014 to 2021.

Source: International finance discussion paper. Board of governors of the Federal Reserve System. 2022.

2.2.2) financial and non-financial performance

However, investor demand and the consequent price impact may be triggered by financial and non-financial investment motives.

About financial performance:

Some authors like Magnanelli and Izzo (2017) and Stellner, Klein, and Zwergel (2015) found that the corporate environmental and social performance is negatively correlated with the credit rating and the cost of capital, due mostly to the creation of intangible assets and to a lower idiosyncratic risk. Other authors like Oikonomou, Brooks, and Pavelin (2014) examined 3000 bonds of 742 different companies and observed an inverse relationship between corporate social performance and corporate bond spreads. Moreover, firms with a stronger corporate social performance benefit from lower yield spreads and consequently of a lower cost of debt. On the other side, companies that are engaged in environmental and social misconduct are penalized by the market with a higher yield spread, with a consequent increase of the risk premium that in turn increases the cost of debt.

Other authors like Bauer and Hann (2010), examined the environmental profile of 582 US public companies between 1995 and 2016, reporting that environmental concerns impose higher borrowing costs due to an increased likelihood of being exposed to legal, reputational, and regulatory liabilities (higher exposition to the transition risk).

In a similar way bond credit ratings are affected by corporate environmental practices. Then, the credit rating is likely to decrease when environmental concerns increase. Ge and Liu (2015) report that a solid corporate environmental and social performance positively impacts issuers' credit ratings and lowers their respective yields, thereby lowering the cost of capital for newly issued bonds. In addition, the same authors report lower indirect costs because of a lower number of covenants in the bond's legal documentation, for firms with a better corporate social performance.

In the paper "The Impact of Credit Rating and Greenness on the Green Bond Premium" published in the 2015, the authors find that bondholders tend to evaluate the issuer's creditworthiness based on its environmental performance when firms operate in environmentally sensitive industries, as oil and gas, pulp and paper, forestry, energy, utilities, chemicals and pharmaceuticals, mining and resources.

Another study conducted from Graham, Maher, and Northcut (2001) a bond rating prediction model populated is used for bonds issued between 1990 and 1992 and confirm a significant effect between a company's credit rating and its potential environmental liabilities.

An important point is the eligibility of green bonds from a credit risk perspective. Obviously, the concept of credit safety goes beyond credit ratings, but institutional investors impose rating requirements on their investments as a constrain to safeguard their credit quality and maintain their reserves. For instance, they could exclude bonds with ratings lower than BBB+ from their portfolio. As reported before, green and traditional bonds differ only on the “green promise” to finance sustainable projects, then green bonds are backed not only by cash flows related to sustainable projects but also by the entire balance sheet of the bond issuer. This allows a comparison between ratings in traditional and green bond markets.

In 2014, green bond ratings, including government and corporate bonds in the Us, Europe, Japan China and Great Britain, at the issuance, were more concentrated at lower grades, mostly between BBB+ and BBB-. By 2019, the trend has changed, with green bond ratings that converged to traditional bond ratings, where in both cases about 65% of new issued bonds were high graded with a rating higher than BBB+ (see figure 10).

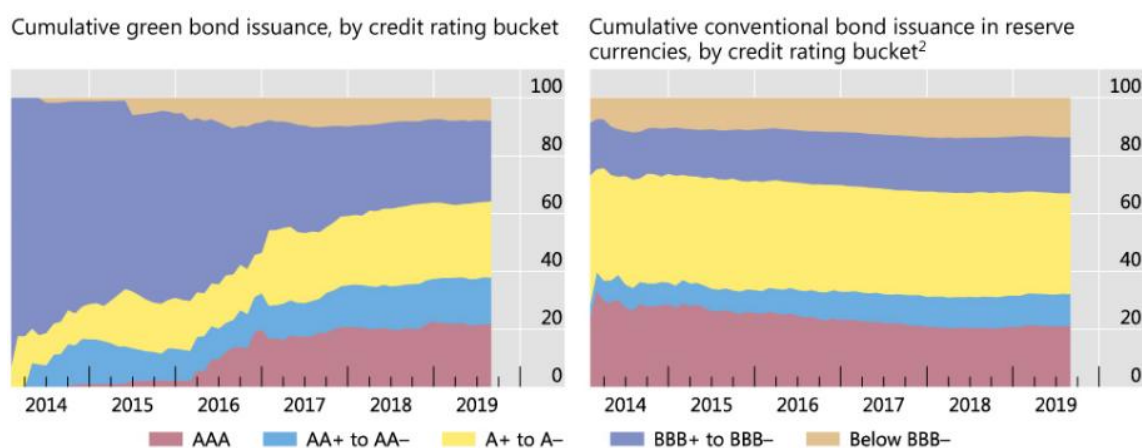


Figure 10, Credit Ratings at issuance: Green vs Conventional bonds.

Source: Bloomberg, author’s calculations.

More in depth, in 2019, credit quality was similar for green and traditional bonds for each type of issuer. The only exception were government bonds (mostly in the US but even in Europe) where green bonds quality was lower, in part due to a lower amount of issuance of sustainable debt instruments.

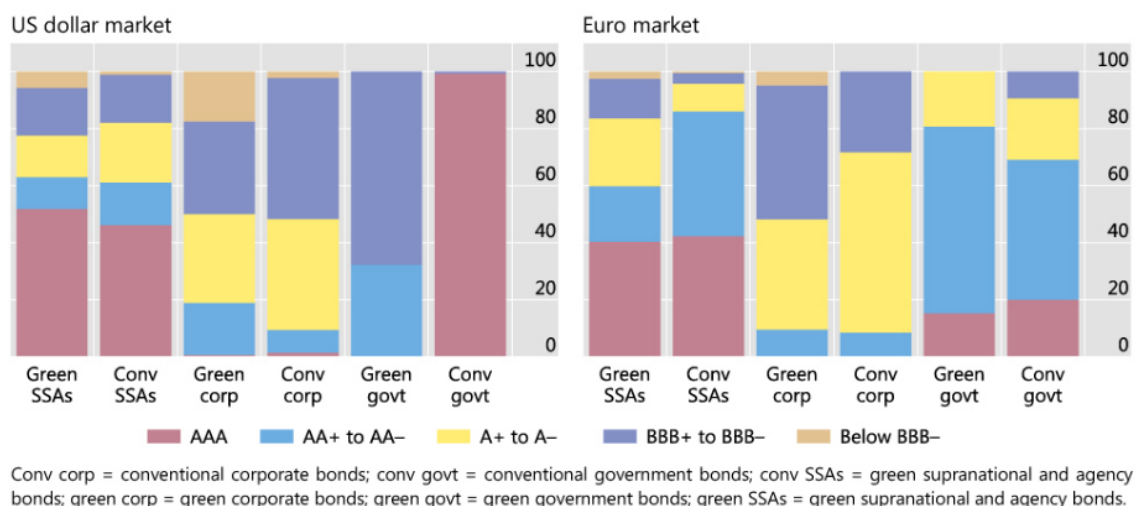


Figure 11, Green and Conventional bond credit rating distribution by type of issuer.

Source: Bloomberg, ICE BofAML indices, author's calculations.

About non-financial performance:

Other studies also observed which non-financial investment motives affect investor demand and, consequently, asset prices, which might cause a price difference between green and equivalent non-green bond instruments. In this respect, there are several papers that provide evidence against the underlying assumptions of Modern Portfolio Theory (Markowitz, 1959). As argued before, investors do not look only at their risk adjusted portfolio payoffs, but also at their taste toward certain type of asset as environmentally friendly assets. Based on this claim, Fama and French (2007) show that investors' taste for certain assets causes a shift in equilibrium prices that is not accurately reflected in the CAPM. For this reason, investments that are conformed to investors' tastes provide greater total utility compared to investments that do not match investors' tastes but have an equivalent risk-return profile. This effect is observed in the following studies.

In the paper: "The Impact of Credit Rating and Greenness on the Green Bond Premium When looking specifically at SRI practices", is observed that environmentally and socially responsible investors are willing to forgo potential investment returns in exchange for increased utility obtained by investing in projects which are in line with their social and environmental ideas.

Another study like the one conducted from Webley, Lewis, and Mackenzie (2001) show that ethical investors are largely committed to ethical investments and are willing accept an underperformance of their investment portfolio if includes sustainable environmental and social projects. Moreover, socially responsible investors are also willing to pay higher management fees when investing in SRI funds. Similarly, to the previous study, this evidence the fact that investors are willing to forgo financial rewards to align their investments decisions with their preferences toward sustainable assets.

2.2.3) A market overview of Green Bonds

In 2007, the Intergovernmental Panel for Climate Change (IPCC, 2007) published a report that explained the linkage between human activity and global warming.

The report, prompted, during the same year, a group of Swedish pension funds contacted the SEB (Scandinavian Enskilda Banken AB) to implement the inclusion of environmental material factors to put their savings on a safe place for their concerns about increasing risks due to natural disasters. Then, the SEB contacted the World Bank which had environment projects to finance and the competence to report the impacts of its projects. After one year, in 2008, the World Bank issued the first ever green bond, allowing the definition of criteria for green-bond-support eligible projects and contributing to the creation of the green bond market. Through this issuance, the World Bank demonstrated that investors could challenge climate issues by supporting climate solutions without giving up financial returns. Since then, the World Bank has raised about \$13 billion through 150 green bonds emissions in 20 different currencies all over the world. Besides, this instrument has become the most used sustainable debt issuance instrument, constituting almost a half of the market.

Companies and governments can signal their commitment to climate goals and to the Paris Agreement issuing green bonds. Exist different types of Green Bonds like Green Revenue Bonds, Green Project Bonds and Secured Green Bonds. All together reached a peak of almost a half (about \$550 billion over a total of \$1.6 trillion) of the global sustainable debt issuance during the 2021, according to Bloomberg; with 839 issuers (32% more compared to 2020) and 2089 number of instruments (19% more than the 2020), according to the climate bond initiative. Increasing from only \$31 billion in 2014, with a compound annual growth rate of almost 50% for the entire market. The

fast adoption of such financial instruments was fostered during the last years by subsidized interest payments, tax credits and tax-exempt status for such bonds. Making green bonds structurally attractive, in comparison with traditional bonds.

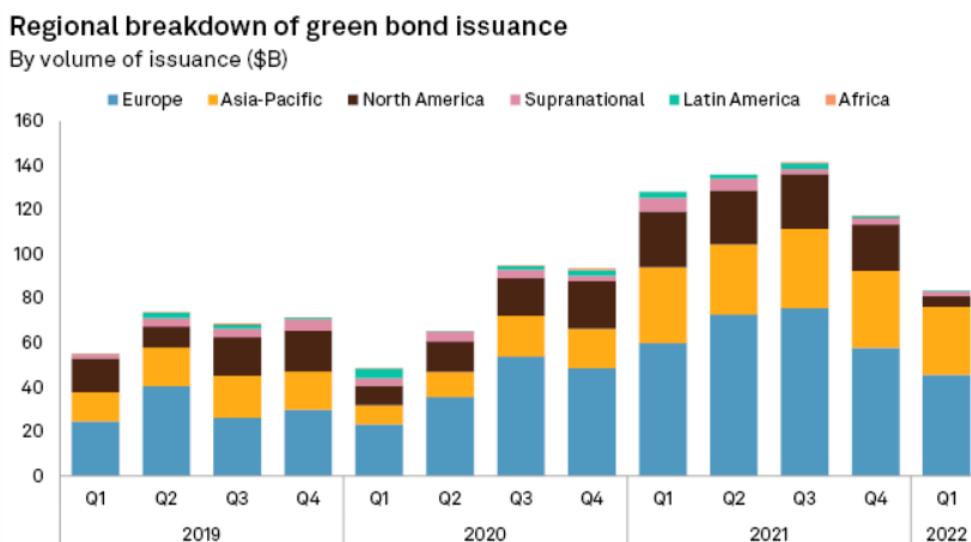


Figure 12, Regional breakdown of global green bonds issuance, by volume of issuance in billion dollars (\$).

Source: Climate Bonds Initiative. April 2022.

Green Bonds were issued in 58 countries around the world in 5 regions and, as we can see in figure 12, which reports the volume of green bonds issuance by region, the green bonds issuance has seen an up and down trend during the last three years, where European issuers have been the most active, followed by Chinese, US and finally supranational issuers. The trend has seen a contraction during the first quarter of the 2020, when COVID-19 pandemic broke out, and a rapid recovery during the second and third quarter of the same year, followed by a strong up-trend during the 2021 fostered by the post-COVID economic recovery and higher energy prices.

The economic recovery during the second part of the 2020 and the first part of the 2021 is due to strong stimulus that European and North American institutions gave to the economy to address some challenges like a higher bankruptcy risk of the companies. Such stimulus like the recovery plan where the European Commission lent money to the member countries to restart their economy, the low interest rates that the central bank

kept during this period and tax cuts and incentives to support the local economies or specific industries mostly hit by the pandemic like hospitality and travel sectors.

During 2021, low interest rates, governments incentives and increasing interest of investors toward clean projects have driven issuers choice to fund upcoming liabilities through these instruments. However, an inversion of the issuance trend started at the end of the 2021, when inflation rate increased, and worsened during the first quarter of the 2022 when Russian-Ukrainian conflict began, putting more uncertainty around the global economic outlook and affecting funding for energy transition projects.

The 2021 has seen the overtaking of Asia-Pacific issuers against North Americans as second most prolific region with a cumulative \$371.7 billion of issuances (versus \$343 billion in North America) at the end of the year, that mostly came from financial and non-financial corporates. The 70% of green bond emissions in Asia-Pacific came from China, Japan and Singapore (figure 16, next paragraph).

As most central banks, in particular the ones that operate in occidental countries like Europe and North America, were planning to raise interest rates to control inflationary pressures, financing costs for bond issuers have increased, creating uncertainty between investors. Consequently, as we can see in the figure above, most of issuance reduction happened in these two areas, when the European Central Bank (ECB) in Europe and the Federal Reserve (FED) in the North America at the end of the 2021 were planning to raise interest rates during the 2022. While, in the Asia-Pacific area, which has seen the fastest increase in green bonds during the last years, has seen the lowest reduction during the beginning of the 2022, falling from \$34.23 billion to \$30.63 billion, compared to the same period the last year, because inflation were not so high as in the other two areas and the People's Bank of China (PBC) did not consider to increase interest rates.

At the fourth place we find the Supranational green bonds with a total issuance of \$120.7 billion in 2021, value that doubled if compared to the previous year because even of the emission of a green bond from the EU of \$13.9 billion.

Less impressive are the numbers in South America and Africa, with only \$8.2 billion of emissions in South America and \$1.2 billion of sovereign issuance (entirely provided by Chile) and no sovereign green bonds emissions in Africa during the 2021, which reported a total market of \$4.4 billion.

According to the Climate Bond Initiative (CBI), the issuance of green bonds all over the world fell from the peak, of almost \$140 billion during the third quarter of 2021, by about 35% to \$83.8 billion. Only in Europe, the region that mostly contributes to green debt issues, the issuance (concentrated in Germany, France and Italy) fell from \$60.16 billion to \$45.8 billion during the last year. As green bonds issuance in this region started to decline, European issuers started to prefer sustainability-linked bonds, as shows the global trend for these instruments in figure 11. One factor that could have contributed to this change in preferences is that sustainability-linked bonds are more flexible for issuers, while green bonds are not constrained to specific environmental or social projects. The data reported in figure 7 above and figure 13 below are referred to green bonds that are aligned with the Climate Bonds Taxonomy until 14 April 2022 and do not include non-aligned bonds or bonds that do not have enough information to be categorized as aligned. The CBI reported that, during the first quarter of 2022, \$21.29 billion of green bonds issued globally were not aligned with their definitions and \$28.26 billion have not been yet categorized.

Looking at figure 13 below, the green bond global market is fragmented into different bond types. Most of green bonds are issued by corporations, both financial and non-financial, with government-backed entity issuance and sovereign issuance which have seen a huge decrease especially during the first quarter of the 2022.

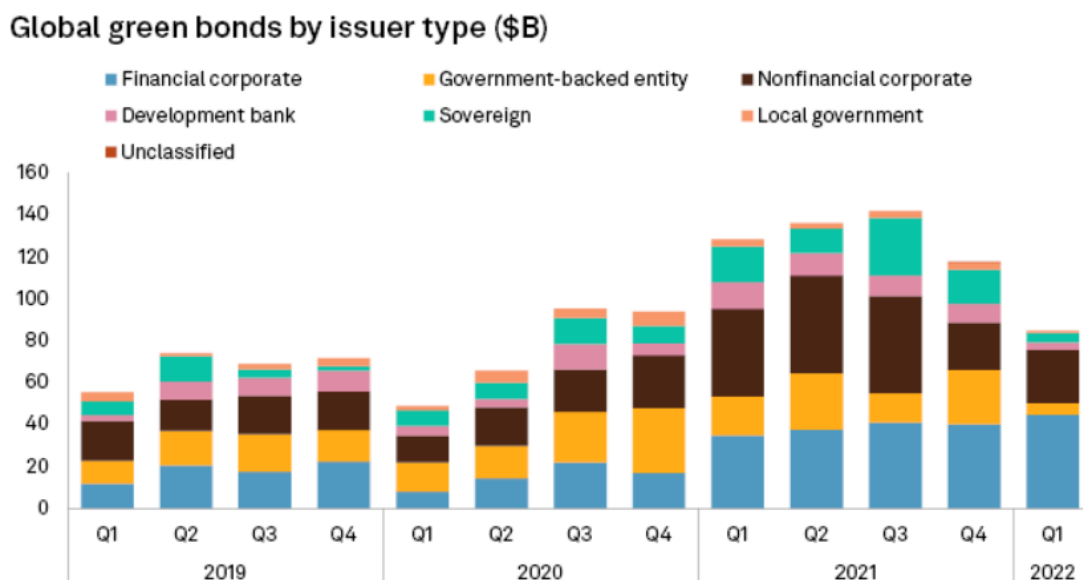


Figure 13, Global green bonds issuance by issuer type, by volume of issuance in billion dollars.

Corporate green bonds were mostly concentrated on financial companies, like banks that use green bonds proceed to extend loans at firms that need financial support for green projects. Other financial firms that issue green bonds are Real Estate Investment Trust (REITs) to finance the development of green buildings. Other sectors that issue green corporate bonds are electric utility sector, alternate energy, heavy industry and automobiles. All of which need to be requalified to overcome the challenges of transition risk and survive in the long-term. It is worth mentioning that the share of green bonds issued by fossil fuel companies is negligible.

It is interesting to observe how proceeds of green bond market has been used during the 2021, year of most issuance for this market.

2.2.4) Use of proceed for green bonds

Figure 14 reports the use of proceed derived from the green bonds' issuance from 2014 to 2021. As we can observe, the largest share of green investments has been committed to Energy (35%), Buildings (28%) and Transportation (18%) sectors, fostered by government incentives, which collectively received about 80% of the total proceeds. With non-financial corporates that supported more Energy and Transport, providing 40% and 27% of the total capital respectively, while financial corporates were the strongest supporters for buildings (37.5%). Industry has been the sector which increased more in the last year from \$1 billion of issuance in 2020 to \$9.1 billion in 2021, according to the Climate Bond Initiative.

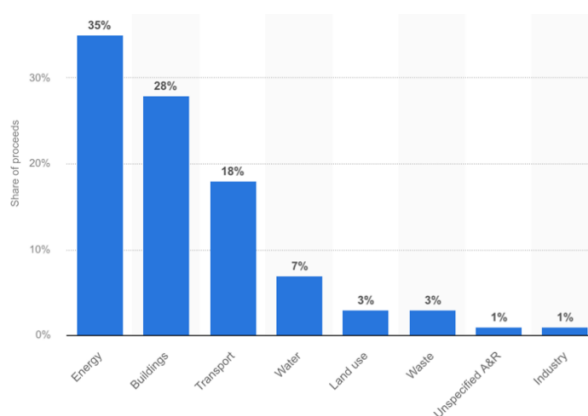


Figure 14, Use of proceed from green bonds worldwide by sector (2014 - 2021).

Source: Statista.com, March 2022.

A report of the World Bank confirms the allocation of the procedure on these sectors, specifically on energy efficiency, clean transportation and land use sectors (37%, 25% and 14% respectively in 2021). But the World Bank is committed even on the public administration sector (15%). World Bank's commitments are set to reflect individual countries' challenges, resources and demands to develop the most useful and effective projects.

2.2.5) Currencies

Green bonds were issued in 33 different currencies during the 2021, with three currencies that participated at about 80% of total issuance. Top three currencies in 2021 were Euro (EUR) with 44% of issuance, Dollar (USD) with 26% and the Chinese Yuan (RMB) with 11% of the issuances. Being the European bond market the most developed both in terms of amount of issuance and of advanced policy measures is not surprising to see that the majority of issuances were being in EUR, with 64% of issuances coming from issuers using EUR as official currency and the remaining part from international issuers that may look for diversification benefits, such as US 24% and Asia-Pacific EUR-denominated green bond issuers. However, the higher number of issuers come from US, with 96% of bonds issued domestically.

In general, the share of currencies for bonds issuance is concentrated on top ten currencies at 97%. From 2020 to 2021 the highest increase has been by 686% to, an equivalent of, \$35 billion in GBP, moving to the fourth place of most used currencies for green bonds issuance. About the other continents, Benin was the African country with most green bonds issued (\$693 million) and Indonesia which issued all deals in Dollars.

Sovereign issuance of green bonds was almost totally denominated in hard currencies (98% of shares), with 63% of sovereign issuance that was USD-denominated and 29% denominated in EUR. The only local currency worth to mention is from Uzbekistan (UZS) with 25 of the total volume.

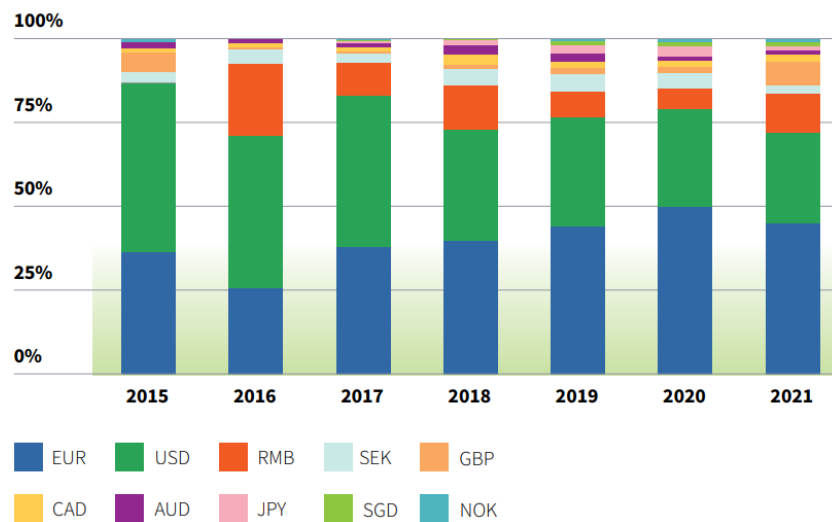


Figure 14, Green bond issuance worldwide by currencies (2015 – 2021).

Source: Climate Bond Initiative, 2021.

2.2.6) Green Bond issuance: Comparison between 2021 and 2022.

In this paragraph I am going to dig deeper at the emission of green bonds, looking at which countries contributed more to the emission in each region and comparing the results between the first half of the 2021 with the results of the first half of the 2022 to look at what changed (in terms of emissions) in the green bond market in a period of economic growth fostered by institutions (2021) and a period characterized by increasing inflation and the invasion of Russia in Ukraine (2022).

Figure 16 reports the amount and the number of green bonds issued during the first half of the 2021 for the most relevant countries over 47 excluding sovereign issuances. As we can see, the USA issued the highest number of green bonds (495) for a total amount of \$37.6 billion (17% share of total volume). The US market has been characterized by a large number of issuers bringing small deals and only 23 benchmark size issuers, with an average size of \$750 million. This trend of large-liquid bonds helps to attract new investments. The second place goes to Germany with 102 green bonds issued for an amount of \$28.5 billion (12% share of total volume), with Deutsche Bank that priced 48 green bonds and the German government that doubled its commitment by issuing \$11.5 billion of new bonds. Then, there are France and China with 20 and 92 green bonds

issued and similar volumes, \$22.8 billion and \$22 billion respectively (about 10% of total issuance volume each), with a huge comeback for China that issued only \$23.8 billion during the entire 2020. In the top five we can find even Spain with 34 deals and an amount of \$11.7 billion (5%).

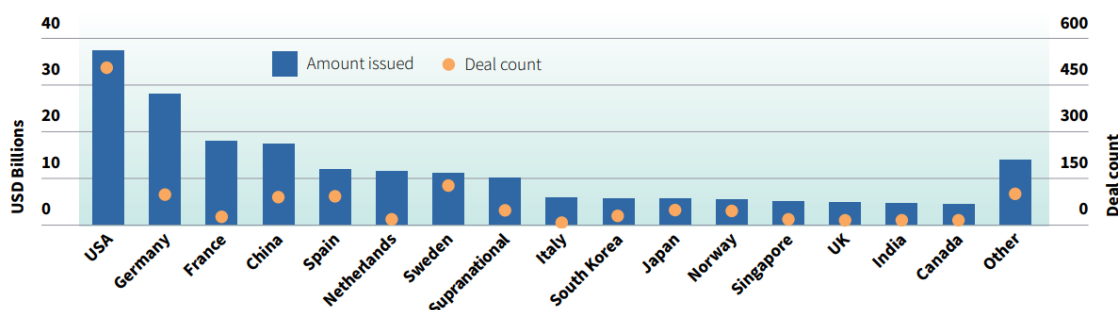


Figure 16, Global green bonds issuance by country (H1 2021), volume of issuance in billion dollars (\$).

Source: Climate Bonds Initiative. 2021.

Due to post-COVID inflation concerns and the market volatility that followed the Russia-Ukrainian war conflict was not surprising a drop of 21% in green bond market issuance between 2021 and 2022, from \$277.5 billion in 2021 to \$218.1 billion in 2022. Especially the first quarter of the 2022 (due to the beginning of Russia-Ukrainian war) saw the lowest volume since the end of 2020 but these poor results were in part offset during the second quarter of the same year, with an increase of 25%, bringing the green labelled issuance at \$1.9 trillion, closer to the \$2 trillion threshold.

By looking at figure 17 we can see that volumes in Europe declined of 31% compared to the first half of 2021, especially in Spain and Sweden. On the other hand, Emerging Markets increased their share of green bond issuance from 20% in 2021 to 29% in 2022, because mostly of the increase in the Chinese market with 116 issuers for a \$48.2 billion volume. The most impressive increase in issuance comes from supranational which increased about 75% from the first half of 2021 at \$19.6 billion (10% of total volume). Similar market share (9%) comes from the US, which decreased their market share from the 17% of the year before.

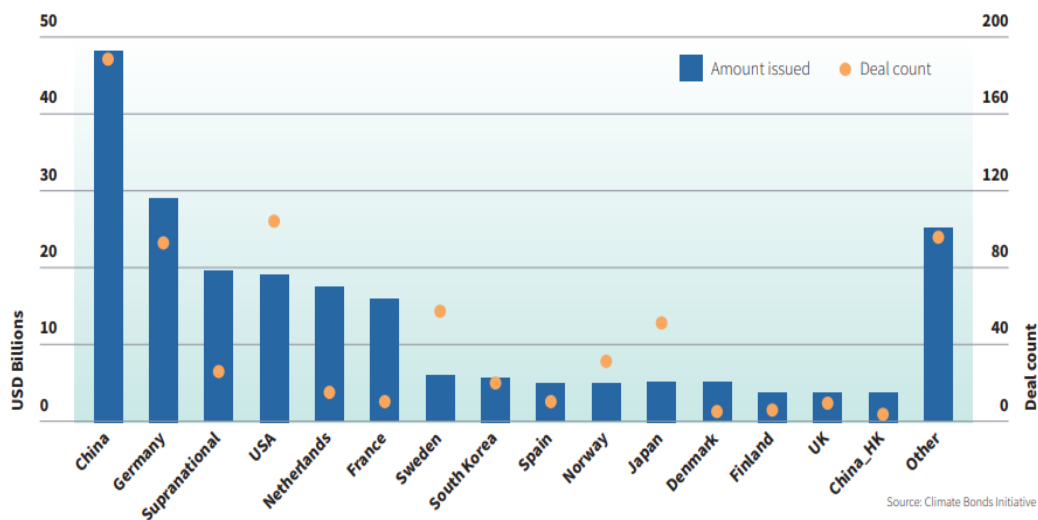


Figure 17, global green bonds issuance by country (H1 2022), volume of issuance in billion dollars (\$).

Source: Climate Bonds Initiative. 2022.

As a matter of fact, sovereigns are maintaining momentum in the first half of this year. the largest contribution comes from Germany with \$7.8 billion, reopening its 2030, 2031 and 2050 deals for a total of \$36.3 billion from the 2020 to the end of the first half of 2022. The German government is one of the most active to issue new federal bonds to give investors worldwide access to the green benchmark bonds, establishing a green yield curve. In Europe France, with its new inflation linked-deals, and Denmark, with its green bon debut with maturity 2031, are keeping the pace with Germany. In Asia, Hong-Kong returned on the market and South Korea gained shares of bond issued.

2.3) The concept of Greenium

Over the past years, the use of thematic bond issuances with the focus to address the use of proceeds to one of the Sustainable Investment Goals (SDGs), defined by the UN, is increased all over the world, as reported in the previous paragraph. There are multiple reasons that cause this proliferation.

From the investors' side, their interest toward environmental, social and governance products like green bonds is increasing, moved principally from the perceived risk reduction associated to green investments (like climate-related risks that lead to

stranded assets) and other ethical reasons which have a positive impact on the risk-adjusted financial returns (because consider the environmental risk in the evaluation process of the instrument) and on the society. Other explanations for why investors would accept a lower yield on green bonds than a similar traditional bond is that they are willing to give up immediate financial returns in exchange of future environmental benefits. This choice may be taken because investors seem to assign a positive value to the “green promise” (that, as described in the previous paragraph, seems to distinguish green from traditional bonds); therefore, they are willing to pay a higher price for the bond at the issuance, accepting a lower investment return to finance green projects (Tang, D.Y. & Zhang T., 2020). Another reason for which investors may be willing to pay an extra price for a bond with a positive sustainable impact can be due to the fact that the greenium is part of the discount factor to calculate the required rate of return for investors’ investments and the issuance of a thematic bond is perceived to improve sustainability which, in turn, results in a lower risk of the issuer, both linked to the transition to a greener economy and to the physical risk, guaranteeing a lower yield (higher price) compared to the normal yield curve. In this way, green bonds tend to show less volatility than their conventional peers, making them more attractive for risk-adverse investors

From the issuers side, the key motivation for primary issues is that not only thematic bonds provide long-term value creation allowing the issuer to comply with sustainability requirements set by institutions to face physical and transition risk, but also may attract new investors and increase the demand for the bond.

Therefore, the greater demand for green bonds than the total green bonds issuance causes their prices to rise. Then, the additional demand may directly lower the interest rate (the so-called yield) paid on the bond, and green bond’s yield will be lower than the yield of a comparable traditional bond. This yield difference is called “Greenium” (or Green Premium).

From a global perspective, developing countries and growing corporations are facing many challenges like the climate change, COVID impacts and unsustainable debt burdens. Then, according to an UNDP analysis the most vulnerable countries are going to face high economic and development costs because of larger debts and costs of financing. For such vulnerable countries, the probability to come out from such crisis

depends on liquidity risk in the short term and on their ability to make quality investments in physical and human capital. For all countries these solutions will require a stable and low cost of financing. To do that it becomes important for each country (or company) to identify sustainable and appropriate debt solutions depending on their fiscal situation and risk exposure, attaining to the Sustainable Development Goals of the UN.

The existence of a greenium may further incentivize issuance from governments and corporations of green bonds in the primary market, given that they will pay less to fund their projects as green bond yield is lower. Also, if the greenium remains even after the issuance, investors may benefit from the sales of green bonds in the secondary market (David C, Nihar C. & Mark S., 2021), this may be a further incentive for investors to buy green bonds. On the other hand, if the greenium is not present or does not remain after the issuance, the market could collapse. For this reason, the continued existence of a green premium may depend on an objective measure of “greenness”.

According to CBI data, the greenium is materialized only in 14% of US green bond issuance and in 22% of European issuance between 2016-2019, while during the 2020, in particular after the COVID-19 outbreak, more than 70% of European green bonds showed a larger spread compared to their conventional equivalents.

But, verifying in a first moment that green bonds are in the fact green, in addition to the process of certification, issuance, monitoring and reporting over the lifetime of the bond, may take long time and may be expensive, especially for small or first-time issuers and for complex green projects. Additional costs may include additional due diligence to select projects and define the use of funds and acquire third-party certification to consider their bonds as green; where, green bond certifications are based on the guidelines provided by the ICMA and the CBI. Other additional costs may come from monitoring bond’s performance, providing internal and external reporting to ensure a re-certification, as stipulated during the first issuance. The presence of a green certification is important to qualify the bond as green, avoiding penalties at the end of the bond’s life and more importantly to avoid a market collapse caused by the inexistence of a greenium.

Although green bonds offer a greenium, they may still be more expensive than issuing a comparable traditional bond. Then, to reach a cost advantage during the phase of raising

money and, at least, break-even the gain of that premium with issuance costs, some issuers may take a very large greenium for the borrowing or may take several green bond issues. In other words, providing that green bonds are sufficiently green is one of the major challenges for this instrument and is not without a cost. Cost that may reduce the transactions in the second market and the supply of issuance of such instrument.

Empirical evidence shows that the greeniums not always exist, and even when it exists its value might differ from a few basis points to more significant values. To increase the bonds' demand, an issuer may signal a strong sustainable use of the proceed for a great risk-reduction and a long-term positive impact to improve their operations, while a less fascinating story may have the opposite effect.

Moreover, the lack of consistency and objectivity in green standards jeopardizes the market growth. For example, green bonds are self-labelled by issuers that, as argued in the first chapter, can choose from a variety of external reviewers; therefore, companies with a low ESG rating and that do not have projects with immediate environmental effects have had problems to convince investors to accept green ratings on projects with future benefits and focused to reduce transition risk. In addition, small firms must sustain high monitoring costs to prove their compliance to investors. The adoption of consistent standards may lower these costs, offering to the governments the opportunity to stimulate sustainable debt instruments through monetary, fiscal and regulatory policies.

To sum up, issuers may benefit from the greenium existence for lower borrowing costs on sustainable debt, but investors are questioning the logic behind the green premium, arguing that it is not the most efficient way to incentivise issuers to boost their spending on sustainable products. For instance, sustainability-linked bonds reward (or penalize) the issuer by requiring lower (or higher) interest payments to investors in the case that sustainable KPIs are met.

2.4) Green Halo effect

Green bonds provide not only the direct benefit of the greenium, as discussed above. But provide additional indirect effects for the issuers. For example, green bonds may offer a marketing benefit that can lower the company's cost of capital by increasing

business performance, attracting new customers or by attracting new investors. These potential indirect effects are called “green halo”.

Some research pointed out that green halo benefits are typically of short-term, like the decrease in issuers’ secondary market bond yields after the first green bond issue, but there is no evidence on long-term improvements to the cost of capital of the company (Tang, D.Y. & Zhang T., 2020).

A good point has been argued by Maltais and Nykvist in their paper: “Understanding the role of green bonds in advancing sustainability”, 2020. When they talked about the existence of asymmetric information between companies and investors about companies’ environmental plans (such as how they are planning to reduce emissions). If such information is not communicated effectively to investors with a preference for sustainable instruments, the company may not be able to allocate efficiently their issue, selling their debt to investors that are not willing to pay for a green premium, then the company will raise less capital than how much would have raised by issuing and selling debt instruments to investors with a preference for sustainable instruments. For this reason, green halo is a factor that companies should consider when issue debt instruments.

Differently to the greenium, the green debt halo effect provides a wide price shift of outstanding bonds, meaning that this effect would not be observable as a difference between green and vanilla bonds yield (greenium), but as a yield shift in time (Forfot J. & Fosse H., 2021). Then, the advantage of the green debt halo effect would come in addition to the greenium (which affects the green bond price), affecting the entire portfolio of debt. In figure 18 (a) below are illustrated the cumulative average abnormal returns (CAAR) for all green and vanilla bonds for each of the ten days before and after the announcement date. As we can see, especially green bonds with external review (figure 18 (b)) show a higher CAAR than their traditional peers and green bonds without external view. It is worth to note that the largest change in CAAR come between -1 and 0, the day before the issue announcement.

(a)

(b)

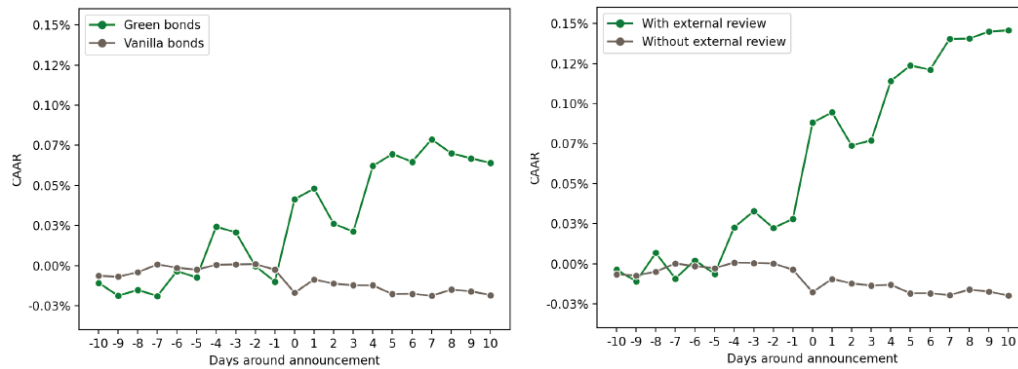


Figure 18, difference in cumulative average abnormal returns between green and vanilla bonds.

Source: The Norwegian University of science and technology.

2.5) Climate related risk-drivers for debt instruments

The United Nations refers to the climate change as “a long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle, or anthropogenic, due to human activities”.

The climate in the earth has always changed, but the current changes are occurring particularly rapidly and in an alarming way. From a mean temperature of 13.6°C in the 1850, during the pre-industrial Revolution period, the observed global mean surface temperature of the earth increased to 14.8°C in the 21st century, according to the American institute of Physics; temperature increase that is due to a higher level of Green House Gases (GHG) in the atmosphere, from about 290 ppm (parts per million) in 1850 to about 418 ppm in 2021. The second IPCC assessment report, published in the 1995, has argued that the primary reason for the increase of GHG in the atmosphere and the related global warming is attributed to GHG emissions of human activities, argument that has been confirmed by stronger evidence reported with the following IPCC assessment report in 2000, 2007 and 2015. The sixth IPCC assessment report, published in the 2021, concludes that “Scientific evidence for warming of the climate system is unequivocal” and further warming will be caused by the continue anthropogenic emissions, bringing to an increase of extreme temperatures around the mean. The effects of climate change are intensifying in the form of extreme weather

events, warming and acidification of the oceans, melting ice, rising temperatures, reduced snow cover, rising sea levels, declining biodiversity, water scarcity and desertification. Moreover, these physical hazards would further develop over time and the global warming caused by human activity is going to persist for centuries if no action is taken to reduce it. All these effects can be translated into financial risks that are affecting the economy and will affect it even more heavily in the future.

For this reason, scientists all over the world recommend taking decisions and act to mitigate global warming and to decrease GHG emissions by transitioning to a low carbon economy, reducing the severity of future impacts of climate change; however, the changes in regulations, technology developments and market and consumer sentiment may lead to potential disruptions and shocks for many sectors of the economy, particularly if this transition has not been planned in advance.

To understand better how the climate-related changes impact the economies can be introduced two categories of climate risk drivers: Physical and Transition risks.

2.5.1) Physical and Transition risk drivers

Physical risk drivers

Physical risk drivers are changes in weather and climate events that directly impact our society and affect the economy and affect physical risk. These drivers may occur with different frequency and severity, leading to different level of risk which becomes increasingly difficult to predict. The exposure to physical climate risks is affected by humans' activities and decisions, while timing, location and magnitude of specific events cannot be controlled. Physical risk drivers can be of two types:

Acute physical risk drivers are associated to extreme weather events, such as: floods, storms, wildfires and other extreme precipitation. The increase in the concentration and severity over short periods of acute climate events is expected to rise physical damages to infrastructure, and properties. While concentrated rainfalls are expected to result in periods of floodings, followed by periods of severe drought. These events are generating repeating and significant financial losses.

Chronic physical risk drivers are associated with gradual shifts in climate related events, such as: rising average temperatures, rising sea levels, ocean acidification and desertification. For instance, higher physical damages can be due to an increase in temperatures that lead to ice melting and raising sea levels which generate inundations and submersion of coastal cities. Then, physical risks do not affect the economies homogeneously, but depend on geographical location since each region exhibit different levels of development and climate patterns.

Transition risk drivers

Transition risks arise when we move from the current economy toward a low-carbon economy. It means that some sectors are going to face a big shift in asset values or higher costs of doing business. They can arise because of:

Innovation and changes in the affordable technologies related to energy-saving and to increase the use of non-fossil fuels technologies with the aim to reduce the GHG emissions to meet United Nations' objectives or other policy goals. The main problem for corporations is the existence of business models based on technologies which are going to become obsolete, and the use of energy sources are going to become more and more expensive because of policy measures. A too late adaptation may cause high costs for the corporations which should adapt to new technologies to minimise the climate-policy impact to remain competitive.

Changes in public sector policies to take measures to reduce GHG emissions encouraging energy transition policies and attributing public subsidies (to encourage the use of electric vehicles or energy efficiency buildings and discouraging fossil fuel usage) to increase energy efficiency standards to promote a transition towards an economy where activities produce less GHG emissions.

Change in sentiment towards a green economy is required for a transition to a low carbon economy. In banking sector, retail clients and institutional investors have already requested to direct their savings and investments toward institutions with projects and policies with a positive environmental impact. Investors are incorporating climate risk into their investment approach and decision-making (such as asset managers) with the result of a reassessment and a possible change in risk profile and valuation in debt and equity investments exposed to climate change. For this reason, corporations and banks are incentivized to adjust their investment strategies to comply with regulatory and

supervisory approaches. On the other hand, the expectation on climate policies, changes in technologies or physical hazards may lead consumers and investors to change their preferences about where they put their money with consequent impacts on the assets value. In other words, investors and consumers sentiment can impact climate risk drivers.

The main problem is that a delayed and uncoordinated transition to a green economy will affect certain sectors and the financial stability of some areas. Even if risk drivers are of specific nature and vary by economy, differently from physical risk drivers which depend on geographic areas, transition risk drivers are global. Another difference between the two risk drivers is that the transition risks are a relatively new category and firms and investors are reducing investments into some sectors (like coal, gas and oil) to manage these transition risks. A solution to help investors to make more informed decisions is to induce companies to disclose more information related to climate change. Moreover, political events (or transition events) do not carry direct costs that affect a company's cash flows, differently from physical events like natural disasters. Then, to understand the effects of transition events it becomes useful to look at indices' history. In their research paper, Antoniuk Y. and Leirvik T. (2022) selected some events like the Paris agreement, the US presidential elections of 2016, the US exit from the Paris agreement and the COVID-19 pandemic and observed the changes in returns of green and conventional municipal and corporate bonds of the US. As we can see in figure 18, green and conventional indices are correlated, but both municipal and corporate green bonds overperform their conventional peers (purple line) for most of the time.

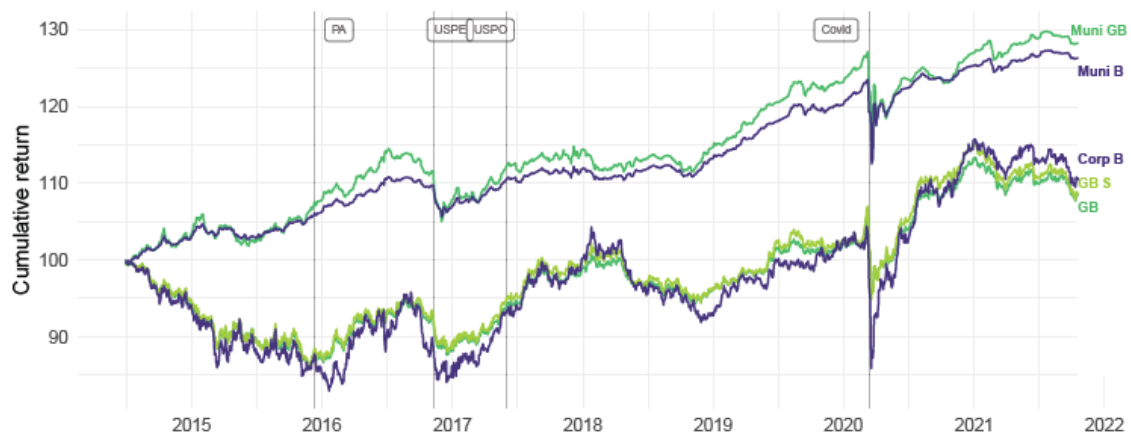


Figure 19, Historical prices comparison between green bonds and conventional bonds market. From 2014 to 2022.

Source:

Differently from municipal bonds, corporate bonds seem more affected by such events. Particularly, positive stimulus was given by the Paris agreement where green corporate bonds positively reacted to the global commitment to fight against climate change, showing a low correlation with crude oil index. While the unexpected US presidential election results put more volatility to bonds' prices. The US exit from the Paris agreement caused a negative return shock in municipal bonds, but not corporate bonds even if the event brought uncertainty about the future US climate policy. After the COVID-19, that was not a climate regulatory risk, but nevertheless was a source of market uncertainty which increased the volatility of bond market, corporate green bonds continued to outperform their conventional peers, where corporate green bond shock returns were lower than the shock in conventional corporate bond returns, until late 2020 when the trend reversed and conventional corporate bonds outperformed green corporates. Moreover, during 2020-2021 the relationship between green bonds and other asset classes became statistically significant (Bouri et al., 2021). Naeem et al. (2021) argued that the recent better risk-reward of conventional corporate bonds may be subject to market inefficiency. Transition events may have both short- and long-term effects on green bond performance, indicating that not only physical but even political risks should be accounted for in a financial instrument valuation. Then, a portfolio adjustment after changes of regulatory risk is necessary to obtain diversification benefits.

2.5.2) Transmission channels for credit risk

Through transmission channels, climate risk drivers can translate into traditional financial risk categories faced by the banking sector. Then, climate risk not always represents new a new type of risk. Transmission channels can be split into two categories to better allow banks to analyse direct or indirect microeconomic (like climate impact on asset value and banks' counterparties) and macroeconomic effects.

Microeconomic transmission channels

Microeconomic transmission channels impact banks' financial risks either directly or indirectly through the impaired value of financial assets or their counterparties. Banks' risks depend mainly on credit risk, market risk, liquidity risk, operational and reputational risk.

Credit risk

The banks' credit risk can be impacted by both physical and transition risk drivers which have a negative effect on borrowers' ability to repay debt or on banks' ability to fully recover the value of a loan when an event of default occurs.

Physical risk drivers: they indirectly impact banks' credit risk through their counterparties (such as households, corporates, sovereigns). These physical damages may negatively impact cash flows of an entity as damages in physical capital will generate less income, reducing the assets value and consequently a counterparty's wealth. For instance:

- Households: Households are typically impacted by damages to real estate generated by chronic or acute physical events. Since the climate change will increase the frequency, severity and magnitude of adverse events the risk is translated into an increase of predicted default probability, especially in properties that are in coastal areas, leading to large devaluations of real estate which affect home prices. Banks could face an increase on credit risk if have properties in impacted regions as mortgage collaterals. As exposed by a Zillow's research (2019), costs in real estate due to chronic and acute events can increase up to \$1.75 trillion by 2100.
- Corporates: Acute physical risks may affect corporate profitability, which can affect their suppliers, decreasing corporate sales in the short-term, resulting in a reduction of corporates' equity value which potentially increase the credit risk for lenders. The globalized supply chain increases the physical risks for banks' counterparties, especially in developed countries that have a long supply chain. It results difficult to quantify this impact across countries due to the complexity of the global economic system. Corporates credit portfolios will be impacted

even by chronic physical risks since lots of banks are showing through scenario analysis that incremental climate change (as rising temperatures, rising sea levels and droughts) may impair the financial health of borrowers whose reduced profitability could affect their creditworthiness. These impacts vary by sector and geography.

- Sovereigns: A little different is the case of sovereigns, where the income effects that arise from physical risk impact taxes and government expenditures. A reduction in income output resulting from impaired corporates will result in lower tax revenues for the governments. In addition, governments are expected to sustain higher expenditures with the purpose to cover adaptation costs and to address negative economic impacts. Consequently, more vulnerable countries will face higher borrowing costs and higher sovereign bond yields and spreads compared with less vulnerable countries, increasing the risk of default and subsequently the loss-given-default, resulting in a heightened credit risk.

Transition risk drivers: in response to the path of carbon emissions which will be determined, losses may materialize in the future. To determine the range of these path-dependent economic effects, researchers and supervisors rely upon Scenario analysis by considering expected future government policies, expected technological change, consumers and investors sentiment.

- Government policy: Corporates profitability may be affected by policies adopted in the transition towards a low-carbon economy. For instance, if a tax on GHG emissions is introduced corporates in certain sectors will face higher operating expenses which will reduce their earnings and their ability to repay outstanding debts to banks. As a result of the transition to a low-carbon economy, companies that rely on fossil fuel reserves may become unable to generate a positive economic return. These reserves are even called “stranded assets” (which can be defined as << assets that have suffered from unanticipated or premature write-downs, devaluation or conversion to liabilities>>, according to Lloyd’s in 2020) and companies which have large amounts of these assets in their balance sheet are more vulnerable to transition risks and consequently to default probability. Furthermore, if stranded assets are provided as collateral for loans their devaluation may result in a higher credit risk, eliminating the benefits which are generally provided by the use of collaterals.

- Technological change: Technological innovation is expected to be facilitated by the effort to manage climate change. In this way, existing carbon-intensive technologies will be relatively more expensive than new technologies if carbon taxes or low-carbon subsidies are introduced. As a consequence, corporations which base their production on carbon-intensive technologies will be less competitive if they do not adopt new technologies. Banks which are more exposed to corporates that are not adapting to a low-carbon economy may face higher credit losses.
- Sentiment: Consumer sentiment towards a low-carbon economy may be triggered by a rising perception of harmful future climate events. A higher awareness may lead consumers to act in a way to reduce the impact of climate change, for example buying cars with low GHG emissions. A change in consumers behaviour and awareness may induce corporates onto low carbon investment and production models. Institutional investors are induced to divest from firms with environmental concerns because of higher costs due to climate regulation changes, leading to the impairment of the firm's profitability that will no longer be able to meet its debt payments, deteriorating its credit quality (which leads to a higher cost of debt) and increasing banks' credit risks. Therefore, current and future expectations on corporate profitability subsequently affect creditworthiness.

Market risk

Physical and transition risks can detect new information about assets value and future economic conditions, resulting in a different value of the assets due to changes in price and volatility in the market. In addition, climate risk could also lead to a breakdown in correlation between assets with the effect of reducing the efficacy of hedges, making harder an active risk management. On the other side, unexpected price movements may be reduced if climate risk is already priced in the asset value.

Physical risk: The uncertainty created by the intensity, location and timing of future adverse climate events and consumption shocks which follows from natural disasters may lead to a higher price volatility in the financial markets (higher stock or commodities price volatility). But there are little researches on the impact of physical risks on the other aspects of the capital market.

Transition risk: Transition risk related to changes in sector policies, technological development and investor sentiment may lead to a repricing of financial assets. Where investors may increase for example the risk premia that they demand from carbon-intensive borrowers, due to the higher climate-related risk that these last subjects will face. In general, banks tend to hold financial assets for a shorter period compared to the longer horizon over which transition risks are expected to concretise, affecting the impact of climate risk on the assets' market valuation.

However, market price may be less sensitive to future shifts in price if climate-related events are already priced in the asset value. Evidence show that prices have already begun to incorporate transition risk, but due to a lack of standard metrics and comparable disclosures around climate risk market price would not reflect the risk in the same way. Furthermore, is unclear to what extent markets price in climate risk and how banks' market risk is affected by this pricing into asset value because of a lack of information.

Some evidence shows that price in transition risks may already be included in cost of options (to protect against downside tail risks, which is larger for firms with a carbon-intensive business) and real estate valuations with the pricing of possible physical damages for properties in areas exposed to climate events. A study conducted from Bolton and Kacperczyk (2020) show that after controlling for several climate-related factors equities earn a higher return. Suggesting that investors would already be asking for compensation for their exposure to carbon-intensive companies.

Liquidity risk

Banks' liquidity risk may be impacted by climate risk drivers both directly, through their capacity to sell assets and raise funds, or indirectly through customers' demands for liquidity. While for transition risk drivers there are limited analysis, is stated that physical risk drivers for liquidity risk may impact banks through their counterparties. For instance, if corporates and households are affected by physical risk, they will need liquidity to finance their losses, then they may withdraw their deposits or credit lines, putting pressure on banks' liquidity.

Operational and reputational risk: On one side, operational risk defined in the Basel capital framework as *<<the risk of loss which results from inadequate internal processes, systems and people or from external events.>>*, can affect directly the banks

reducing its operational ability, for example by disrupting their telecommunication structure or transportation facilities; but can affect even corporates as banks, which are exposed to an increasing regulatory compliance risk, such as liability costs associated with low-carbon investments. A quantification of operational risk is difficult because data are rarely made public. On the other side, reputational risk may indirectly impact banks that provide financing to corporates high-carbon-emissions-related activities.

Macroeconomic transmission channels

Macroeconomics transmission channels are climate-related risk drivers that affect macroeconomic factors which, in turn, indirectly impact banks through the economy.

Credit risk

Physical risk drivers: Increases in human mortality and decreases in labour productivity derived from climate change may result in a global output reduction in hotter and poorer countries. Moreover, economic growth may slow down due to socioeconomics changes (such as, spread of violent conflicts or mass immigration as a consequence of extreme weather events and resources depletion) that can impact borrowers' creditworthiness and drive changes in economic growth. These events result into a higher risk and borrowing costs for governments which indirectly impact banks if hold government bonds in their balance sheet.

Transition risk drivers: As a result of a shift away from fossil fuels, many countries may face several losses during the transition to a low-carbon economy, leading to lower revenues and higher expenditures for countries that rely more on fossil-fuel based production. For instance, higher carbon-emission taxes increase prices in carbon-emission supply chains, increasing production costs, reducing the profitability and the related investments in those sectors which results in a lower equity price. Firms face higher costs and may raise prices, lowering consumptions. Lower investments and consumption result in a lower GDP and, in turn, in a higher unemployment rate, lowering households' income. A deteriorated households' wealth may lead to a reduced ability to repay their debt, increasing banks' credit risk.

CHAPTER 3 - Policies and procedures for green bonds Issues.

3.1) Green Bond Principles

During the last years, the market of sustainable financial instruments and especially the one of the green bond instruments is gaining market share. On one hand, the adoption of such instruments is positive because can prevent companies and investors to lose money due to physical risk (direct impact of the climate change, as drought floods, desertification, etc.) and transition risk (indirect impact of the climate change, as green policies that promote higher taxes for non-sustainable projects and high incentives for green projects). On the other hand, the increasing adoption of such instruments can lead to some problems like greenwashing that is one of the main preoccupations for governments and investors. To prevent this problem the ICMA (International Capital Market Association) published, in the 2014, the Green Bond Principles with the aim to standardize the green bond market, allowing investors to make a more informed choice about such instruments and companies to comply with governments standards preventing them to lose money and wellness.

As explained in the previous chapter, the green bonds are an instrument that allow companies to finance sustainable projects. Specifically, the Green Bond Principles give the following definition: *“Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects and which are aligned with the four core components of the GBP.”*

In other words, green bonds are instruments whose proceeds are designed to finance, or re-finance, eligible climate and environmental-friendly projects to promote a net-zero economy. GBPs together with the Sustainability Bond Guidelines (SBG), the Sustainability-linked Bonds Principles (SLBP) and the Social Bond Principles (SBP) are published under the governance of the principles coordinated by the ICMA, the International Capital Market Association. These Principles are a set of non-binding guidelines and recommendations with the goal of promoting an environmentally and

socially sustainable progress of the debt capital market. In other words, a set of relevant criteria are defined and all market participants can develop its own practice to comply with those criteria. The GBPs are also aimed to attract more capital in support of the sustainable development and to promote transparency and disclosure. These Principles are updated as required to reflect the sustainable debt market development.

Therefore, these Principles have not law-making power and are provided to green bond issuers as guidelines for the selection, management, evaluation and disclosure of projects financed through green bonds, so they can report in the most reliable way the use of Green Bonds proceed to promote more transparency in the company's disclosures and facilitate the tracking of funds toward environmental projects, improving the assessment of their estimated impact in the environment, giving to investors the possibility to invest in a more informed way and to comply with investors' preferences.

But, given that the alignment with these principles is voluntary, the proceed of green bonds may not be destined to green projects, fostering the global trends of greenwashing, in the sustainable finance industry. Moreover, the GBPs recommend looking for third-party certification to assure that green bonds proceed is effectively destined to green investments. In other words, green bonds are conventional bonds with a "green promise" (Levine, 2019).

The four components of the GBPs are: 1) Use of Proceeds, 2) Process for Project Evaluation and Selection, 3) Management of Proceeds, 4) Reporting.

More in details, the use of proceeds of the bond for eligible green projects should be described in the legal documentation of the instrument and all the eligible green projects should provide environmental benefits which will be quantified and assessed by the issuer.

During the evaluation and selection process the green bond issuer must clearly communicate to the investors: the sustainable environmental objectives, the process with which the issuer determines how the projects fit with the eligible green projects categories and all the information about how the issuer manages and identifies social and environmental risks associated with that project.

About the management of the proceed, the Green Bond Principles encourage a high level of transparency, recommending that the management of the proceed should be supplemented by the consultation of an external auditor, or other third parties, to track the allocation of funds gathered through the green bond proceeds.

Finally, the issuers should keep readily available up to date information about the use of proceeds to be renewed quickly in case of material developments. The information should be reported annually, including a list of the projects at which the green bond proceeds have been allocated with a brief description of the projects (for instance, the percentage allocated to certain project categories).

Based on such principles, American and European institutions have established some policies to facilitate and incentivize the transition to a more sustainable economy.

3.2) EU Taxonomy

In 2020, the EU commission instituted the EU Taxonomy as part of the European green deal to support the EU economy passage to the carbon neutral economy target set by the Paris Agreement in 2015. This program is supported by the ECB to promote a higher transparency in green bonds to promote a better harmonization of practices, helping external reviewers to define what is “green”, ensuring credibility between sustainable investors and strengthen the role of the EU as a world leader of this market. First of all, the Commission identified the three main barriers that may affect the development of the green bond market, as: the lack of a common definition of green bonds and green projects, too complex review procedures for green bond issuance and revision, and lack of qualitative sustainable projects and assets to invest.

The EU Taxonomy is a classification system for economic activities with the purpose to provide more clarity to companies, policy makers and capital markets about which investments and economic activities are environmentally sustainable in the context of the European green deal. The final goal is to make greener the European economy and, as a screening tool, prevent greenwashing inducing investors to identify and invest into sustainable activities with more confidence.

Through rules and definitions, the EU Taxonomy determines which economic activities are environmentally sustainable. The definition of economic activity is based on two criteria and must “*contribute to at least one of six environmental objectives listed in the Taxonomy and do no significant harm to any of the other objectives, while respecting basic human rights and labour standards*”. (Taxonomy Regulation, 2020).

The six environmental objectives cited above are: 1) Climate change mitigation, 2) climate change adaptation, 3) sustainable use and protection of water and marine resources, 4) transition to a circular economy, 5) pollution prevention and control, and 6) protection and restoration of biodiversity and ecosystems.

Specific requirements and thresholds, for an activity to be considered as sustainable, are defined in the Technical Screening Criteria (TSC), elaborated in secondary legislation called Delegated Acts (DAs).

Such activities can be classified into two categories, enabling activities and transitional activities. The first category allows other activities to give a contribution to one or more of the six objectives set by the Taxonomy and their environmental impact must go over the activity’s lifecycle. The second category must contribute to climate mitigation and to sign a pathway to keep global warming in line with the 2° objective, set by the Paris Agreement.

The Taxonomy is not only a classification tool but has even other functions, such as requiring to certain entities to disclose information about their alignment with the Taxonomy Regulation. Such disclosure requirements are:

- Non-Financial Reporting Directives (NFRD), also known as Article 8, where subjects that undertake such disclosure requirement need to disclose the proportion of turnover which is derived from the Taxonomy activities, and the proportion of their capital and operating expenditures associated to Taxonomy activities.
- Sustainable Finance Disclosure Regulation (SFDR), also known as article 5 and 6 Taxonomy disclosure, it covers products with sustainable investments as objective (*Art. 9 SFDR products*), and for products with social or environmental

characteristics (*Art.8 SFDR products*). This disclosure covers to what extent an investment in economic activities is qualified as environmentally sustainable.

The weakness of such program is that even though the Taxonomy requires progress in the alignment plans to be updated and reported yearly, it lacks to effectively sanctions over non-compliance over time. In particular, in an opinion of November 2021 the ECB has remarked the absence of a procedure to issue a labelled green bond and distinguishing it from a bond that does not comply with the taxonomy requirements. Moreover, the lack of a common definition for the underlying projects and lack of standardization may reduce the attractiveness of such instruments, increasing the transaction costs compared to their conventional peers. For this reason, the ECB allows ESMA to supervise external reviewers of European green bonds at the European level. To mitigate a sudden divestment from non-taxonomy-aligned bonds, the ECB suggests to supervise and assess over time the attractiveness of the EU GBS compared to market standards. Moreover, it recognises a timeline for when the new European green bonds should become mandatory, suggesting three to five years for the new issuances to comply with the standards. On the other hand, the ECB recognizes the difficulty to set a concrete time period for the standards to become mandatory.

By improving ESG disclosure requirements, investors can improve their decision making and a new category to help investors to compare the carbon footprint of their investments can be created.

3.3) European Green Bond Standards

Inside the wider context of the European Green Deal, in 2020, the European Green Deal investment plan published the EU green bond standard (EUGBS). About the preparation of such proposal, after the report of the High-Level Expert group (HLEG, 2018), the commission set up a Technical Expert Group (TEG, 2019-2020) to receive assistance during the development of future regulations on sustainable finance, given that green bonds are increasingly becoming an important instrument for the low-carbon transition, and given the lack of standards for such instruments.

The TEG's assessment, published in March 2020, proposes the introduction of standards to improve the transparency, comparability, credibility and effectiveness of

the green bond market and to encourage the issuance and investments in EU green bonds through a “usability guide for the EU green bond standards”. This guide reports a guidance on the use of the standard and a registration scheme for external verifiers. The Commission and the TEG, contemporaneously with the guide, published a joint document to respond at the frequently asked shareholders’ questions. During the same year the European Commission assessed the possibility of a legislative initiative for the EU green bond standards, but after two consultations during the 2020, the Commission decided to propose the regulation of the EU green bond standards, based on the outcome of those consultations.

The proposed regulation of the EU GBS, differently from the ICMA standards which are focused on the emission process, is a voluntary standard focused on which projects can be considered eligible to be financed through green bonds, improving instrument quality and supporting public authorities, companies and even issuers outside the EU to select the best projects while meeting sustainability requirements. Such standards will be useful to protect both issuers and investors. For instance, issuers may demonstrate that they are financing green projects aligned with the EU Taxonomy, while investors can more easily assess how the green bonds proceed will be used, reducing the risk of greenwashing. The key requirements under the proposed framework are:

- Taxonomy alignment, the proceeds should be allocated to projects that are aligned with the EU Taxonomy.
- Transparency, it is required a full transparency about the allocation of bond proceeds through detailed reporting requirements.
- External review, to ensure the compliance with the regulation and the Taxonomy alignment of the financed projects, all European green bonds must be verified by an external reviewer.
- Supervision by the European Securities Market Authority (ESMA) of reviewers, external reviewers must be registered with and supervised by the ESMA authority, to guarantee a higher quality and reliability of their reviews and to protect investors and market integrity.

3.4) Green Bond Labelling: External review and Certification process

The first green bond was issued from the European Investment Bank (EIB) in 2007, followed by the World Bank. Since then, the market has grown rapidly but still represents only around 3.5% of the overall bond issuance, therefore a quicker growth is required to achieve the targets of the Paris Agreement. In 2014, the first corporate green bond issued under the new Green Bond Principles signed a turning point. And more recently, the EUGBS were set to comply with the EU Taxonomy goals. The history is telling us that certification and standards has been identified as the key to improve the transparency and the confidence toward green instruments. On the other side, if standard and independent verification are not used (or not properly used), then green bond labelling may lose its impact. For example, the absence of a global consensus on how to classify green projects may add confusion to investors, as issuers develop their own methodologies to classify such projects. Then, investors seek assurance through third-party certification (external review), that typically includes an assessment of the issuer's integrity and its capability to select projects that are consistent with those standards. Such certification involves both a pre-issuance report (on the alignment with the chosen standards of the intended use of proceeds and an assessment of the integrity and capability of the issuer to select projects that are consistent with those standards) and a post-issuance report (to verify and assess the allocation of the proceed and the environmental impact of the project).

The commission identified potential issues for the external review market, mainly in its lack of transparency, possible conflict of interests and heterogeneity. These issues may lead to some consequences like. low quality in the green bond issued, low amount of investments channelled into sustainable projects and a market disruption due to greenwashing.

There are several types of providers that can process a bond in order to classify it as a green bond. They are broadly grouped into pre-issuance reviews and post-issuance reviews.

The types of reviews are the following:

- 1) Second Party opinion, is an independent institution with sustainability expertise which advise for sustainability-linked frameworks, assessing the issuer's green bond framework and analysing the greenness of the project or the asset. The

importance of independence is crucial and any conflict of interest between the institution and the bond provider should be disclosed to investors. External reviewers should also assess: the environmental features of the project financed with the use of proceed, the environmental benefits and impact of the green financed project and the material risk associated with such project. Some providers can also provide a sustainability rating to classify the different aspects of the proceeds' allocation and giving a qualitative indication of the aspects of issuer's framework (as Sustainalytics, CICERO, etc.). The SPO can provide both pre- and post-issuance review.

- 2) Verification, an issuer can obtain an independent verification against a set of criteria, that typically are sustainability targets and KPI performance.
- 3) Certification according to the Climate Bond standards, may be provided for a pre-issuance review, where bond sustainability, use of proceed or KPIs are verified against a recognised external green standard or label which defines the specific criteria and alignment that the bond must respect to be qualified as green (e.g. the use of proceed adhere to a sector specific criteria of the Climate Bonds Standards, like low carbon transport). But either for a post-issuance review, as an assurance against climate bond standards. The reports can be performed by advisory companies as EY or KPMG.
- 4) Green Bond Rating, an issuer can ask an assessment to rating agencies, which evaluate the use of proceed, the compliance with green bond principles (or other benchmarks as a 2-degrees climate change scenario) or sustainability KPI's according to an established sustainable rating methodology. GBR focuses on a pre-insurance review and is provided by agencies like Moody's GBR or S&P's Green evaluation.

3.5) Green Bonds regulation in North America

In the past decades, assets have quadrupled with an increase in the incorporation of ESG factors of 68% between 2014 and 2019. Bloomberg estimated sustainability financial market to be worth more than \$53 trillion by 2025. This stimulus, led the FED in the US to ensure robust, appropriate disclosure and investors protection. As stated in the previous chapters, an improvement on material sustainability metrics is related to better companies performance while disclosure of immaterial information is not informative (Khan, Serafeim and Yoon, 2015).

Many companies, banks and non-governments organizations (NGOs) are adopting their sustainability disclosure. As a result, across the sustainability reporting field exists a variety of frameworks with different metrics and definitions to measure the degree of sustainability. Typically, issuers disclose historical data, while the market also consider a variety of future performance forecasts. More clarity on issuer-disclosed data can increase the robustness of such data and provide companies a clear list of requirements rather than a wide range of information to disclose. Moreover, for Long-term investors giving information that allow to consider factors that affect the long-term value is critical to fulfil their fiduciary duty. The introduction of disclosure standards that provide them comparable data allow them to make a more informed investment decision. A clear regulatory guidance can provide common standards to focus disclosure to relevant metrics.

The Security and Exchange commission (SEC) is inviting public input on guidance as: they apply to climate change disclosures, how and whether they should be modified and potential new disclosure frameworks that the Commission may adopt in its disclosure rules.

In addition to the measures already taken by the SEC, the Focusing Capital on Long Term Global mission (FCLT Global) suggests the SEC of:

- Engage with the global community on this issue, including the G7 work on their decisions.
- Converge more with the IFRS Sustainability Standards Board, focusing on building standards based on existing frameworks as, Task Force on Climate-Related Financial Disclosures (TCFD) and the value reporting Foundation (SASB, IIRC).
- Recognize that investors and companies are global and is critical that long- and short-term metrics must be consistent at a global level.

Especially the last point is of great significance because US companies and investors are strongly affected by the European rules and requirements. Therefore, having global standards dramatically simplify companies' reports and improve the comparability between companies.

CHAPTER 4 – Analysis of the yield difference between Green and Conventional bonds

4.1) Literature review

As reported by different scientific studies and as we can see on our everyday life, the global warming is becoming more and more visible, causing many damages at different levels from flooding to droughts all over the world. While governments are implementing strategies to decrease the negative impacts of the climate change on the financial system at an aggregate level to reduce the systemic risk, investors are looking for financial instruments to hedge their financial exposure not only against physical risk but even against transition risk like political decisions that may impact companies' costs and earnings (transition risk). In this way, companies are reviewing their objectives and investment plans, shifting their financial focus over sustainable projects, decreasing their financial risk, increasing their ratings and finally reducing their cost of capital for higher profits.

In this sense, green bonds are gaining attention from different types of investors, from the investors that want a positive impact to the environment from their investments to the investors that are looking for new financial instruments to diversify their portfolios, by anticipating the risks that are awaiting us.

Due to this high interest, Green Bonds demand often outweigh the offer even if there are several shadows over the reliability of their "greenness", as we have seen previously with the Greenwashing issue; and even if it is not so clear how Green Bonds behave compared to similar "Vanilla" bonds (traditional bonds).

Some research assumed that Greens' and Vanillas' yields (considering that both have the same characteristics) are the same; while, other experts, believe that Green Bonds have a lower yield than their conventional peers, which is offset with the positive impact on the environment.

As I am going to report in the following pages, the existing literature of Green Bonds is varied but still limited and does not provide a unanimous scientific consent about the

drivers that lead investors to choose sustainable financial instruments. However, different research, with different methodologies obtain different results. The principal studies are analysed below.

The principal paper, at which many other studies are inspired, was written by Oliver David Zerbib. During the 2018, when he published the paper “The effect of pro-environmental preferences on bond prices: Evidence from green bonds” on the Journal of Banking and Finance.

In this paper, he examined whether investments in assets, with a low environmental impact, are driven by financial motivations, such as lower risk or better expected financial performance drivers. In particular, he exploited the bond market to look at the impact of sustainable preferences on prices, wondering if the positive impacts on the environment are reflected on the bond performance and, if so, this happens uniformly in the entire green bond market.

To do so, he looked at the green bond market, comparing the yield of each green bond of the sample with a similar conventional bond of the same company to isolate sustainable preferences on bond price for instruments with the same financial risk. The analysis to look at the existence of a green bond premium (as the difference between the yield of a green bond and its conventional peer) has been performed on a sample of 110 green bonds of the secondary market in Europe and US, between July 2013 and December 2017, using the matching method.

Such method consists of matching a pair of securities (finding a conventional bond for each green bond) with similar characteristics except the one property at which we are interested to study. The selected conventional bonds must have the same issuer, currency, credit rating, bond structure, collateral and coupon type of the green bond in addition to a limited difference in maturity date (conventional bond with a maturity of two years neither shorter nor longer than the green bond’s maturity) and issue date (at most six years earlier or later than the green bond’s issuance). The non-similar property is the liquidity. Therefore, the difference between the green and the conventional bonds yield is the effect of the green bond premium and the liquidity differential.

In the second stage, he controlled the effect of the difference in liquidity between each couple of similar bonds to extract a green premium by performing a panel regression between matched pairs of bonds with similar characteristics except for the green feature.

First of all, the green bond premium is defined as the non-observed effect of the regression of the yield difference ($\Delta\tilde{y}_{i,t}$) over the liquidity difference ($\Delta\text{Liquidity}_{i,t}$).

$$\Delta\tilde{y}_{i,t} = p_i + \beta \Delta\text{Liquidity}_{i,t} + \epsilon_{i,t} \quad (1)$$

Where:

- p_i = green bond premium
- β = exposure to the difference in liquidity
- $\epsilon_{i,t}$ = error term

Then, he calculated the difference between the yield for each couple of bonds, as:

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

Where:

- $y_{i,t}^{GB}$ is the yield of the Green Bond “i” at time “t”
- $y_{i,t}^{CB}$ is the yield of the Conventional Bond “i” at time “t”

And the liquidity is defined as:

$$\Delta\text{Liquidity}_{i,t} = \text{Liquidity}_{i,t}^{GB} - \text{Liquidity}_{i,t}^{CB} \quad (3)$$

Where:

- $\text{Liquidity}_{i,t}^{GB}$ is the liquidity of the Green Bond “i” at time “t”
- $\text{Liquidity}_{i,t}^{CB}$ is the liquidity of the Conventional Bond “i” at time “t”

As a proxy for the liquidity, he used the percent of the quote bid-ask spread.

After the calculation of the green premium, he did an additional regression to study the effect of the ratings, currencies and other characteristics on this premium.

$$\begin{aligned} \hat{p}_i = & \alpha_0 + \sum_{j=1}^{N_{\text{rating}}-1} \alpha_{1,\text{rating}_j} 1_{\text{rating}_j} + \sum_{j=1}^{N_{\text{sector}}-1} \alpha_{2,\text{sector}_j} 1_{\text{sector}_j} \\ & + \sum_{j=1}^{N_{\text{currency}}-1} \alpha_{3,\text{currency}_j} 1_{\text{currency}_j} \\ & + \alpha_4 \text{Maturity} + \alpha_5 \log(\text{Issue Amount}) + \eta_i \end{aligned}$$

With this methodology a negative green bond premium of -2 basis points has been found (bps), meaning that investors are willing to pay a higher price to buy green bonds. Moreover, he found that the sector and the rating are significant drivers of the premium, reporting that financial and low-rating bonds have a greater negative premium than the others. In addition, the low green premium suggests that a lower cost of debt of companies with good environmental performances should be less related to non-pecuniary motives and more related to a lower level of risk.

Evidence was found for investors in the secondary market, which pay a small negative yield premium to buy green bonds. Difference which is, in magnitude, comparable to that of the on-the-run liquidity premium on US Treasury bonds.

About the currency, was found that they may have a significant impact in the green premium and in less mature financial markets.

About the credit ratings, evidence show that at green bonds with low ratings is associated a lower green premium, especially for AA and A bonds.

A similar study was conducted by Maria Bachelet, Leonardo Becchetti and Stefano Manfredonia (2019). They used an econometric model to compare bonds that are as similar as possible except for their greenness. The comparison has been made to look at if investors are willing to pay a higher price for environmental factors of green bonds or they choose green bonds to diversify their portfolio introducing instruments that are less exposed to idiosyncratic risk, bankruptcy risk, etc.

They also included other considerations that may affect the existence and the amount of a green premium, like the difference in liquidity or the presence of a green certificate to reduce the risk of greenwashing.

As in the paper of Zerbib, the comparison between green and conventional bonds has been made through the matching method with same currency, issuer, rating, coupon type and other similar characteristics, as described in the table 1 below.

Bond Characteristic	Matching Criterion
Amount issued	±400%
Coupon rate	±0.25%
Maturity date	±2 years
Currency	Same
Issuer	Same
Rating	Same
Coupon type	Same (fixed rate)

Table 1, Criterion for matching method.

Source: The Green Bonds Premium Puzzle: The Role of Issuer Characteristics and Third-Party Verification.

Green bonds are here selected between the ones listed in the Climate Bond s Initiative website, which meet the CBI requirements ad have been certified by third parties.

Based on such thresholds they found 89 bond couples, studying their performance between January 2013 and December 2017. The sample was constructed to have the same bond characteristics, credit risk and to be exposed at the same market shocks.

They used formula (5) to analyse the different performance between green and brown bonds:

$$\Delta y_{i,t} = \alpha_0 + \alpha_1 \Delta Liq_{i,t} + \alpha_2 \Delta ZTD_{i,t} + \alpha_3 \Delta \sigma_{i,t} + \sum_j \beta_j \Delta B_{ji} + \eta_i + \varepsilon_{i,t} \quad (5)$$

Where $\Delta y_{i,t}$ is the daily yield spread for the i th bond couple; $\Delta Liq_{i,t}$ is the daily difference in liquidity (approximated with the bid-ask spread); $\Delta ZTD_{i,t}$ is the difference in no trading days; $\Delta \sigma_{i,t}$ is the difference in bond yield variance; $\Delta B_{i,t}$ are bond characteristics not exactly matched and $\Delta \varepsilon_{i,t}$ are the error terms.

With the regression they found that the green bond yield was slightly higher than the brown bond (2,03 against 2,02) with brown bonds more volatile and green bonds generally 5 bps more liquid respect to their matched peers. Such results outline a puzzle because green bonds have higher yields and simultaneously are more liquid and less volatile. The authors interpreted such findings by referring to the reputation of the issuer and to the presence of a green certificate. Again, non-verified green bonds issued from private issuers have a higher risk of greenwashing and identified a higher yield, even higher for unlabelled bonds for private issuers, while for institutional issuers such risk is lower, for this reason they found lower yields in this category.

A similar work, but with a focus on the sovereign issuance is the one published by Doronzo Raffaele, Siracusa Vittorio and Antonelli Stefano (2021) for Banca d'Italia.

Their research paper is based on the fact that Sovereigns are exposed to environmental risks (green policies and incentives) and opportunities. The main issue for institutions is to develop sustainable financial instruments to handle the transition towards a more sustainable economy, given the insufficient contribution of “carbon pricing” and “emission trading system” methods. Then, carbon pricing in addition to sovereign green bonds may be more effective to finance the transition to a low carbon economy.

Moreover, according to the same authors, sovereign green bonds are issued for long-term financing purposes, therefore green bonds can increase the average maturity of the debt instruments, lowering the risk of refinancing, beyond the previously mentioned reputational benefit.

On the other hand, there are some limits given by the costs to track, monitor and report the use of proceed for green bonds, costs that are greater if compared to those of a conventional bond.

The authors also discussed the financial performance of green and conventional bonds, implying that the different pricing may not be due to credit risk (if the issuer is the same); then, green bonds performance may be supported by green oriented investors and by long-term oriented investors, making green bonds less volatile than conventional bonds.

More specifically, their work is structured to answer at the following questions: “Is there a price advantage for sovereign issuers in issuing green bonds? Do sovereign green bonds outperform their conventional peers? Are green bonds more resilient in periods of financial stress?”.

To answer at the first question, have been included 38 bonds issued between 2016 and 2020 from 10 different countries, including only Euro and US dollar denominated bonds. To evaluate the existence of a yield difference in the primary market has been compared the yield at issuance of the green bond with its conventional peer's yield curve. The average difference between the two yields is 3.8 bps and is statistically significant, with green bonds slightly more expensive than the conventional. Moreover,

in the analysis also indicates that the lower performance of green bonds may be a sign of the lower liquidity in such market. The authors also pointed out that their research was conducted on a limited number of observations.

Similar results have been obtained for the secondary market. With a lower liquidity of green bond compared to their conventional peers. But in this case a more sophisticated method has been used. They used the Z-spread adjusted for the residual maturity, building a synthetic conventional bond interpolating the two conventional bonds with the closest maturity from the same issuer, as follows:

$$DZS_{i,t} = ZS_GB_{i,t} - ZS_CB_{i,t} \quad (6)$$

If $DZS_{i,t} < 0$, it means that the spread is negative and a green premium exists.

They found that the $DZS_{i,t}$ is -0.5 on average.

In a second step, the empirical analysis is focused on liquidity, considering the huge difference between the two markets, by doing the following regression:

$$DZS_{i,t} = p_i + \beta Liquidity_{i,t} + \varepsilon_{i,t} \quad (7)$$

Where, p is the residual yield difference between the green and conventional bonds, the *Liquidity* is calculated with the bid-ask spread and ε is the error term. Even with this method a -0.5 green premium has been found, finding that the liquidity differential has a significant explanatory power. In conclusion, on average green bonds slightly overperform their conventional peers in distress periods.

The research study that analyses the over-/under- performance of green bonds compared to their conventional peers including the highest amount of information is the technical report “Green bonds as a tool against climate change?”, written for the European Commission by Roberto Panzica and Serena Fatica, that studies the difference between green and conventional bonds yield, was published in the 2020.

In a previous paper, published in the 2019, they found that, among corporate issuers, a green premium is present only for non-financial issuers and the lack of such premium for financial institutions is because of, considering the nature of their business, the signalling of the bond’s greenness is difficult.

The research for this paper is structured to find an explanation to the concern for Greenwashing, motivated by the lack of legal measures. Their concern was focused on the fact that if greenwashing prevails, then green bonds will not have a real beneficial impact on the environment. On the other hand, if green bonds are issued to finance sustainable projects, we can observe an improvement in environmental performance of the companies that raise funds through green financial instruments. This technical paper assumes importance because illuminates a world with data limitations. Because of this problem they considered the relevant events that may affect companies' environmental performance.

Between the element considered, they firstly focused on total and direct (scope 1) emissions; secondly, they distinguished green bonds that are not issued to refinance existent projects. With the second distinction, they observed a strong reduction in emissions excluding green bonds issued for refinancing purposes.

The sample is built by selecting non-financial green corporate bonds issued worldwide between the 2007 and 2019, using Dealogic DCM as data source to download data on profits, total assets, debt, revenues and market capitalization. Environmental data, as ESG ratings, were downloaded from DataStream Asset 4. Following Flammer (2019), they used the following model:

$$y_{it} = \alpha_i + \alpha_{jt} + \alpha_{ct} + \beta * Green\ Issuer_{it} + \gamma * x_{it} + \varepsilon_{it} \quad (8)$$

Where:

α_i are company fixed effects, α_{jt} and α_{ct} are industry- and country-year fixed effects, β is a dummy variable for $Green\ Issuer_{it}$, equal to one if it is a green bond and zero otherwise, x_{it} is a control variable at company level and ε_{it} is the error term.

It is explicated in the paper that the major challenge is to evaluate the environmental performance of green bond issuers, given the presence of factors that may affect the emissions and the choice to borrow in the green bond market. To compare the performance of green bonds with their brown peers they used the matching method, slightly different from the one used in the previous paper. In this case, for each green bond issuer have been selected companies with at least one conventional bond in the same country, industry and time period; excluding conventional issuers that have borrowed also on the green market. To reduce the sample size of conventional issuers

and compare their performance for total emissions, have been selected green bond issuers with similar economic and financial characteristics to minimize biased statistical inferences and model dependence (King and Nielsen, 2019).

Besides the comparison for total emissions, they built a subsample to control for the difference in direct emissions. In both cases, a negative and statistically significant coefficient has been found for the green bond dummy, implying that the issue of green bonds is associated with a CO₂ emission reduction. Moreover, excluding green bonds with refinance purpose, the CO₂ emission reduction doubles (from 4% to almost 9%).

Another evidence for the signal about the environmental commitment of the green issuer is the adoption of external reviews. Because complying with Green Bond Standards and reducing the information asymmetries make green bonds more appealing to green-oriented investors than self-labelled green bonds.

A different approach has been used by Dragon Yongjun Tang and Yupu Zhang (2020), for the *Journal of Corporate Finance*.

In this work, not only the research is focused on looking at if costs for third party certifications affect green bond yield but even at the effect that additional information provided for green bonds affect the stock price of the issuer. According to their theory, investors associate companies that issue green bonds to finance sustainable projects to a lower cost of loans, lower cost of capital, then a better credit rating and a superior financial performance. Such performance is then reflected in the market value of the company.

Green bond dataset is here built including Bloomberg labelled worldwide green bonds to the green bonds labelled worldwide by the Climate Bond Initiative (CBI), covering the period from 2007 to 2017. While, for the matching sample data, they used Datastream and Worldscope to categorize different types of institutional investors.

To analyse the financial performance of the companies only corporate bonds have been considered, excluding asset-backed bonds, with a focus on the first-time issuance that attract more investors, while according to the same authors the effects on the secondary issuance no longer exists because the firms have already been disclosed to the public.

About the stock reaction to bond issuance the Capital Asset Pricing Model (CAPM) has been used to estimate abnormal returns.

The results show that the stock market reacts positively from 5 days before to 10 days after the announcement date with a +1.39% in stock price. Such positive effect is demonstrated to be triggered by green label effect, where green projects are certified to have a positive environmental impact, in addition to an expected lower cost of capital; thus, investors remunerate the company with a higher company value.

About the difference between green and conventional bond yield at issuance, the comparison is made between companies with similar size, market and liquidity. The regression of the yield spread at the issuance controls bond and firm characteristics as follows:

$$\begin{aligned} Yield\ Sprd_{i,t} = & \beta_0 + \beta_1 * Green_{i,t} + \beta_2 * Equity\ Volatility_{i,t} + \beta_3 * Bond\ Rating_{i,t} + \beta_4 * \\ & Maturity_{i,t} + \beta_5 * Issue\ Size_{i,t} + Firm\ Controls_{i,t} + Issuer\ FE + Issuer\ Year\ FE + \varepsilon_{i,t} \end{aligned}$$

(9)

Assigning a value of 1 to the dummy variable $Green_{i,t}$ if the bond is green and 0 otherwise. The resulting premium is 6.9 bps, including only country fixed effects, that is a huge benefit for the issuer, indicating that green bonds have pricing benefits. On the other hand, when firm fixed effects are included, which only examines bond yield spread issued by the same issuer, the resulting spread is no longer significant, meaning that financing cost channels do not seem the driving force of the positive announcement returns.

4.2) Description of the working methodology and matching method

The purpose of this elaborate is to study the spread between green and conventional bonds in the European and North American markets to see if the investors have an advantage, disadvantage or are indifferent to purchase this kind of instruments. In particular, the existence of the Greenium has already been studied by other research but my intention is to focus on the yield difference between green and brown bonds during the period between 2020 and 2022 and see how some events like the COVID-19

pandemic and the Russian-Ukrainian war affected the preference of the investors in such markets and consequently the yield of such instruments.

The dataset of Bloomberg has been used to download the data. Bloomberg uses the Green Bond Principles as a framework to label the bonds as green. On the other side, Bloomberg considers the use of proceeds from the green bond issuance and does not consider the process for the evaluation and selection of the projects, the management of the proceed, the reporting mechanism like inclusion and exclusion criteria for the green bond labelling scheme. More specifically, Bloomberg labels bonds as green if satisfies one or both of the following criteria: 1) The issuing institution self-labels the bond as green, and 2) Bloomberg identifies the bond as green if official public communication documents provide sufficient information about the proceed of such bond issued and that the projects financed are aligned with the Green Bond Principles.

First of all, to select the data from the Bloomberg dataset composed by 308119 bonds, I screened the green bonds for a total sample of 4847 instruments. The initial sample has been restricted by selecting the bonds issued in Europe and in North America because are the most mature markets for sustainable instruments and excluding sovereigns bonds (because my research is focused on the study of corporate bonds that better allow to study the preference of investors due to the effect produced on the profitability of such companies), bonds with a default rating (has been excluded bonds with a D rating for Standard & Poor's and a C rating for Moody's classified bonds) and all the bonds without the data useful to conduct this research as coupon rate, rating, amount issued, issue date, maturity and price at issue I founded 186 eligible green bonds at the date of 04/10/2022.

4.2.1) Matching method

To compare the yield of the green and conventional bonds has been used the matching method that consists of matching a pair of securities with the same properties except for the one property that we are interested to study, in order to avoid bias during the comparison in the yield between the two bonds. This method is the same used by Zerbib in the paper previously reported but given the difficulty to find two bonds with the same characteristics I faced a trade-off between the accuracy of the matching and the number of matched bonds, then the methodology used by Bachelet et al. in their research has

been adopted. For each green bond in the dataset, I searched for a brown bond that is the nearest neighbour to its characteristics. In particular, the couple of bonds must be issued by the same company, with the same currency, the same rating and same coupon type to eliminate both market risk and companies' specific risk. While, about the other characteristics: for the maturity date I chose a threshold of two years as a maximum period for the difference in the maturity, for the coupon rate a threshold of 0.30% as a maximum difference (a little bit higher than the 0.25% threshold set by paper considered due to the difficult to find data) and for the amount issued a maximum difference of 50% to control for effects of the size of the emissions (lower than the amount set by the paper considered because of the good quality of the data and without the necessity to set a higher amount).

Based on these criteria I identified 96 bond couples with the same credit risk, bond characteristics and exposed to the same market shocks. Therefore, their yields do not differ due to market risk, credit risk and taxes.

Table 2. Descriptive Statistics, Using the observations 1 – 7231.

Variable	Mean	Median	Standard deviation	N of observations
Yield difference	0,23505	0,06	0,62	7231
Liquidity difference	0,048577	0,026	0,35	7231
Amount issued	711583746,16	671198250	/	7231
Coupon	1,923	1,86	1,26	7231
Maturity (Months)	5,86	5,2	2,41	7231
Ask price	86,014	87,289	9,04	7231
Bid price	85,53	87,051	9,18	7231

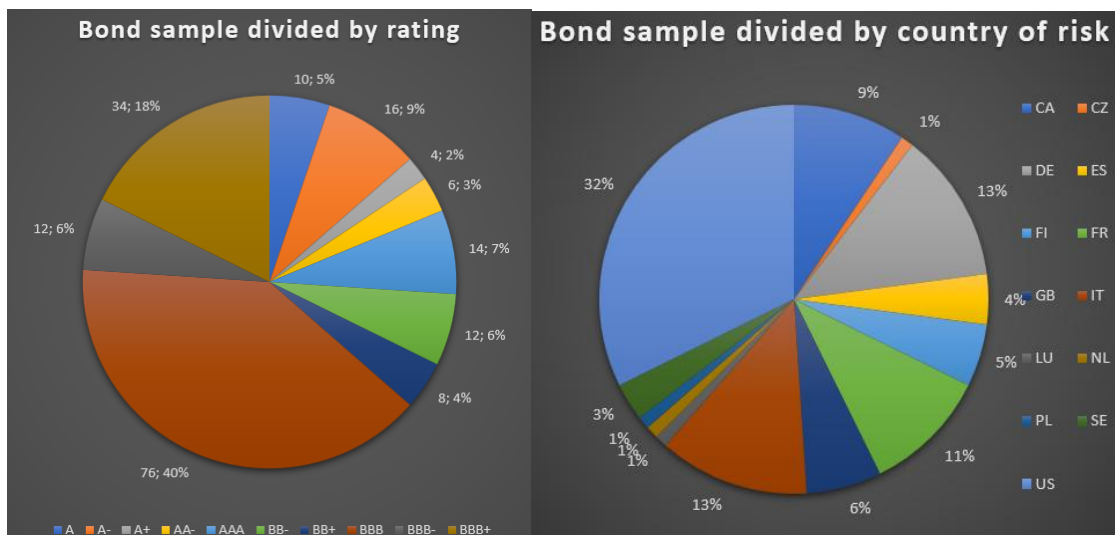
Variable	Minimum	1st quartile	3rd quartile	Maximum
Yield difference	-2,586	0,06	0,62	4,102
Liquidity difference	-2,957	0,026	0,35	3,621
Amount issued	10000000	500000000	879136875	1660434681,78
Coupon	0	0,95	2,77	4,75
Maturity (Months)	2,74	3,2	9,51	30,956
Ask price	60,037	79,329	93,35	103,405

Bid price	59,122	78,847	92,63	103,058
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Source: Personal elaboration.

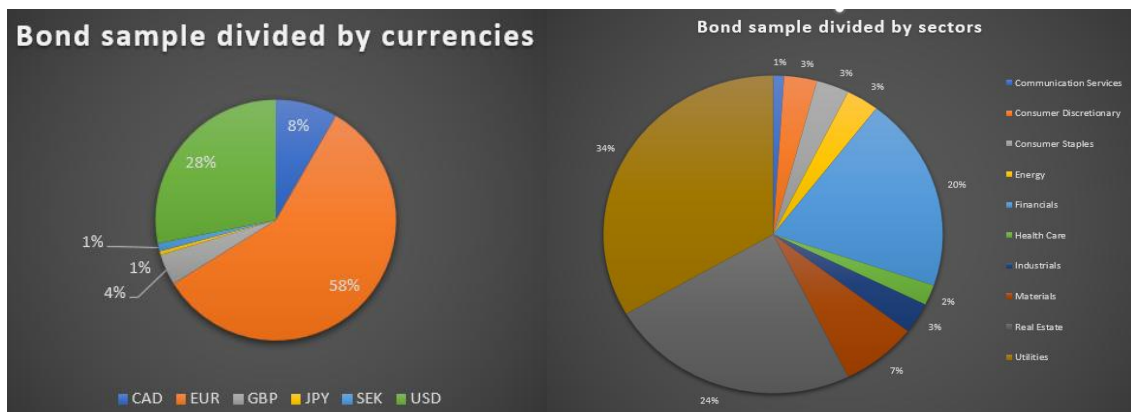
The descriptive statistics are reported in Table 2. We can see that the average Yield difference between green and brown bonds is 0,23%. It means that the green bonds had a higher performance of 23 basis points compared to their comparable conventional bonds. The maturity of green bonds is on average higher than the maturity of the comparable ones by 5,86 months. Moreover, it seems that green bonds are more liquid than their peers of about 0,04%.

Figure 20: Bond sample divided by rating and country of risk.



Source: Personal elaboration.

Figure 21: Bond sample divided by currencies and sectors.



Source: Personal elaboration.

Looking at the figures above, the bonds in the sample have been issued mainly in Euros (58% EUR) and American dollar (28% USD). The US has been the country with most issuances with 32% of the sample, it follows Germany and Italy with 13% and France with 11% of issuances. Looking at the sectors, the utilities is the most present with 34% of the issuance, the second is the Real Estate sector (24%) and then the Financials (20%).

While, about the ratings, the most prevalent are the bonds with a BBB rating, meaning that, even if the credit rating for green bonds is improved during the last years (as reported in Chapter 2) the rating level is still too low for making institutional investors confident to invest heavily in these instruments.

4.2.2) Green premium calculation

As far as concerned the methodology used to calculate the green premium and the characteristics that affect this difference, is similar to the one used by Zerbib in his paper. The procedure adopted the following:

First of all, I calculated the difference between bid and ask price as an estimate for the difference in liquidity, consistently with Fong et al. (2017), for each period between January 2020 to September 2022, finding a dependent variable for the regression called Delta Liquidity. To do that I downloaded the historical weekly data from Bloomberg. I chose weekly data because monthly data simplify too much the behaviour of the instruments, in this way I got more informative content to study the behaviour of green and conventional bonds.

Secondly, I created a second independent variable where I associated an ID number to the company that issued a bond for a total of 67 different companies. In this way I have been able to associate the Delta Yield and the Delta Liquidity to each company for each period during the regression.

At this point I calculated the Delta Yield that is the difference between the yield of the green bond and the yield of the comparative conventional bond for each period as the dependent variable in the regression. Similarly, to the regression method used by Zerbib. Then, I calculated the green bond premium as the unobserved effect in the

fixed-effect panel regression of the Yield difference on liquidity. The following formula has been used:

$$\Delta\tilde{y}_{i,t} = p_i + \beta\Delta\text{Liquidity}_{i,t} + B\text{CompaniesID} + \epsilon_{i,t} \quad (1)$$

Where:

- $\Delta\tilde{y}_{i,t} = y_{i,t}^{GB} - y_{i,t}^{CB}$ is the yield difference between green and conventional bonds for each period.
- $\Delta\text{Liquidity}_{i,t} = \text{GBLiquidity}_{i,t} - \text{CBLiquidity}_{i,t}$ is the difference in the liquidity between green and conventional bonds for each period.
- p_i = green bond premium
- B = It is the dummy variable assigned to the CompaniesID
- $\epsilon_{i,t}$ = error term

The regression is aimed to estimate the green bond premium, looking at the sign, magnitude and the significance of the independent variables that may explain the results of the greenium. As showed in the regression panel below in Table 3, the green premium founded in the sample considered is equal to 0,23. It means that, during the period considered, the green bonds overperformed their comparable brown bonds by 23 basis points

The result is consistent with the green premium founded by the research considered during this study. On the other hand, the result does not give an answer to the initial considerations, then the green premium is not changed considerably during the last two years of uncertainty due to COVID-19 and the Russian-Ukrainian conflict, showing results similar to the previous paper that considered data that precede this period.

Table 3: Regression panel, OLS Model, using observations 1-7231
Dependent variable: Delta_Yield

	<i>Coefficient</i>	Standard error	<i>t-student</i>	<i>p-value</i>	
Constant	-0,521507	0,0269201	-19,37	<0,0001	***
Delta_Liquidity	0,0605168	0,0115375	5,245	<0,0001	***
DCompanies_1	0,834200	0,0430310	19,39	<0,0001	***
DCompanies_2	0,975732	0,0402314	24,25	<0,0001	***
DCompanies_3	0,359279	0,0402027	8,937	<0,0001	***
DCompanies_4	1,21031	0,0327117	37,00	<0,0001	***
DCompanies_5	0,278506	0,0362188	7,690	<0,0001	***

DCompanies_6	0,638221	0,0428437	14,90	<0,0001	***
DCompanies_7	0,381907	0,0367407	10,39	<0,0001	***
DCompanies_8	0,605206	0,0917780	6,594	<0,0001	***
DCompanies_9	0,653871	0,0302654	21,60	<0,0001	***
DCompanies_10	2,47620	0,0322077	76,88	<0,0001	***
DCompanies_11	2,33344	0,0331179	70,46	<0,0001	***
DCompanies_12	0,645732	0,0368681	17,51	<0,0001	***
DCompanies_13	0,545706	0,0368407	14,81	<0,0001	***
DCompanies_14	0,543746	0,0508653	10,69	<0,0001	***
DCompanies_15	0,362391	0,0393445	9,211	<0,0001	***
DCompanies_16	0,665019	0,127001	5,236	<0,0001	***
DCompanies_17	0,424736	0,0315222	13,47	<0,0001	***
DCompanies_18	0,479779	0,0297131	16,15	<0,0001	***
DCompanies_19	0,676600	0,0542789	12,47	<0,0001	***
DCompanies_20	0,329470	0,0347567	9,479	<0,0001	***
DCompanies_21	0,898296	0,0328456	27,35	<0,0001	***
DCompanies_22	0,411699	0,0752558	5,471	<0,0001	***
DCompanies_23	0,657854	0,0329994	19,94	<0,0001	***
DCompanies_24	0,634115	0,0484715	13,08	<0,0001	***
DCompanies_25	0,952111	0,0418997	22,72	<0,0001	***
DCompanies_26	0,576607	0,0537751	10,72	<0,0001	***
DCompanies_27	2,10373	0,0397895	52,87	<0,0001	***
DCompanies_28	0,771232	0,0659998	11,69	<0,0001	***
DCompanies_29	1,21160	0,0462003	26,23	<0,0001	***
DCompanies_30	0,816784	0,0395939	20,63	<0,0001	***
DCompanies_31	0,538676	0,0402799	13,37	<0,0001	***
DCompanies_32	0,617292	0,0514706	11,99	<0,0001	***
DCompanies_33	0,408672	0,0390854	10,46	<0,0001	***
DCompanies_34	0,613007	0,0502442	12,20	<0,0001	***
DCompanies_35	0,540605	0,0455179	11,88	<0,0001	***
DCompanies_36	0,759885	0,0361153	21,04	<0,0001	***
DCompanies_37	1,02618	0,0334499	30,68	<0,0001	***
DCompanies_38	0,540058	0,0614901	8,783	<0,0001	***
DCompanies_39	0,726764	0,0347875	20,89	<0,0001	***
DCompanies_40	0,490576	0,0471367	10,41	<0,0001	***
DCompanies_41	-0,220048	0,0453039	-4,857	<0,0001	***
DCompanies_42	1,62129	0,0352673	45,97	<0,0001	***
DCompanies_43	0,764402	0,0314753	24,29	<0,0001	***
DCompanies_44	0,562387	0,0475436	11,83	<0,0001	***
DCompanies_45	0,202686	0,0511600	3,962	<0,0001	***
DCompanies_46	0,373882	0,0327011	11,43	<0,0001	***
DCompanies_47	0,664853	0,0408728	16,27	<0,0001	***
DCompanies_48	0,391552	0,0403520	9,703	<0,0001	***
DCompanies_49	0,621987	0,0548873	11,33	<0,0001	***
DCompanies_50	0,940929	0,0393327	23,92	<0,0001	***
DCompanies_51	0,567449	0,0528776	10,73	<0,0001	***
DCompanies_52	0,741695	0,0642700	11,54	<0,0001	***
DCompanies_53	0,611671	0,0450785	13,57	<0,0001	***

DCompanies_54	1,39728	0,0401667	34,79	<0,0001	***
DCompanies_55	-1,27289	0,0406896	-31,28	<0,0001	***
DCompanies_56	0,534219	0,0335083	15,94	<0,0001	***
DCompanies_57	0,659635	0,0355192	18,57	<0,0001	***
DCompanies_58	0,447896	0,0337599	13,27	<0,0001	***
DCompanies_59	0,453018	0,0336374	13,47	<0,0001	***
DCompanies_60	0,541427	0,0360206	15,03	<0,0001	***
DCompanies_61	0,799132	0,0281779	28,36	<0,0001	***
DCompanies_62	0,561664	0,0293462	19,14	<0,0001	***
DCompanies_63	0,538282	0,0359985	14,95	<0,0001	***
DCompanies_64	0,427966	0,0350478	12,21	<0,0001	***
DCompanies_65	0,578513	0,0386182	14,98	<0,0001	***
DCompanies_66	0,893941	0,0275161	32,49	<0,0001	***

Mean dependent var.	0,235049	SQM dependent var.	0,620000
Sum residuals sqrd	1487,557	E.S. of the regression	0,328761
R-squared	0,720187	R-squared corrected	0,718825
F(67, 13763)	528,7070	P-value(F)	0,000000
Log-verosimiglianza	-4205,314	Akaike criterion	8546,627
Schwarz criterion	9058,985	Hannan-Quinn	8717,299

Source: Personal elaboration.

Table 3 shows the results of the regression, in particular the mean of the independent variable (Delta-Yield) is equal to 0,23%. In addition, this result is well explained by the regressors because all the elements show a low p-value (lower than 0,0001) both for the companies and for Delta liquidity, meaning that the results are statistically significant.

The R-squared is relatively high (0,72), meaning that the explanatory power of the independent variables is high, therefore they explain the variability of the Delta_Yield around its mean.

Conclusion

In the last decades, problems such as pollution and global warming are becoming more and more serious, for this reason the financial world responded positively to this challenge, starting to take preventive actions to try to improve the current situation. To face these problems have been used different kind of instruments but Green Bonds are particularly suitable to encourage investments that will have a positive environmental impact. Then has been considered interesting to study if it is convenient for companies and investors to use or not this kind of instruments.

As we have seen in the previous chapters the green bond market, and in general the entire sustainable financial market, is growing up assuming a more and more important role within the sustainable debt financing methods, both for a higher interest of the investors toward this kind of instruments and for the necessity for companies to comply with the policies like the ones implemented by the European Commission or by the SEC in the US. Policies that are aimed to incentivise the use of sustainable debt financing instruments to better face the direct effect of the climate change in the economy, the so call physical risk and the indirect effect that is the transition risk.

The green bond market not only grew up in the number of issuances and amount issued but even in the quality if we think about the rating improvement during the last years. This market is even spreading worldwide with more countries that are using these instruments, therefore more currencies have been used for these instruments.

I founded 96 eligible couples to study the green bond premium. This research that focused on the yield difference between green and brown bonds showed a green premium of 23 basis with on average a higher liquidity of green over the brown bonds.

On one side, the investors are willing to give up a small part of the return on traditional securities because they are rewarded by the positive environmental impact. On the other side, the issuers can exploit a slightly lower cost of debt provided they finance projects with specific objectives.

However, the presence of a premium requires for sure the established reputation of the issuer or a green certification in order to guarantee more transparency, lowering asymmetric information and to safeguard investors from Greenwashing risk.

Appendix A – Articles of the EU commission’s proposal

Articles – analysis

Article 3 specifies that the designation EUGB shall only be used for bonds that comply with the requirements until their maturity.

Article 4 defines the use of proceeds of European green bonds. They should be exclusively allocated to: financing, where eligible; fixed assets (including those of households) that are not financial assets; capital expenditure (including that of households); operating expenditure incurred more recently than 3 years prior to the issuance of the bond; and financial assets as referred to in Article 5. Operating expenditure may relate to research and development, education and training, building renovation measures, and other direct expenditure necessary to ensure the continued and effective functioning of fixed tangible or intangible property assets. Sovereign issuers may allocate the proceeds to certain public expenditure programmes, such as funding or subsidy programmes and tax relief schemes.

Article 6 sets an important condition for using the proceeds of European green bonds. It requires that their use should relate to economic activities that meet the taxonomy requirements, or that they will meet these requirements within a defined period. In the latter case, a taxonomy alignment plan should describe the related actions and expenditure, and should not exceed 5 years from the bond’s issuance, or 10 years if duly justified.

Article 7 specifies how the taxonomy requirements should apply. Bond issuers should refer to the delegated acts of the taxonomy regulation applicable at the time of issuing the bond. If the delegated acts are amended afterwards, the issuer should apply the amended requirements within 5 years of the entry into application of the new delegated acts (‘partial grandfathering’).

Article 15 contains provisions on applying for registration as an external reviewer, the requirements, and how ESMA should process the application and the subsequent registration.

Article 25 deals with cases of external reviewers outsourcing their assessment activities to third-party service providers. It sets out the limits, responsibilities, notification obligations and organisational measures with which external reviewers should comply.

Articles 31 to 35 address the provision of services by third-country external reviewers. ESMA can record them in the register of third-country external reviewers, provided that the Commission has adopted a decision on the equivalence of that third country's legal and supervisory arrangements for external reviewers. Subsequently, ESMA would establish cooperation agreements with the competent authorities of third countries, and would reserve the right to withdraw the registration of a third-country external reviewer under specific conditions.

Articles 36 to 45 define the power of national competent authorities to supervise bond issuers, to suspend an offer of European green bonds, and to carry out on-site inspections or investigations. National competent authorities should publish any decision imposing administrative sanctions or taking other administrative measures, and should send an annual report on them to ESMA.

Articles 46 to 59 define the power of ESMA to request information, to carry out general investigations and on-site inspections, and to take supervisory measures such as withdrawing the registration of an external reviewer or temporarily prohibiting their activities under this regulation.

Articles 62 to 64 introduce a transitional period of 30 months following the entry into force of the regulation. During the transitional period, any external reviewer (including third-country external reviewers) that intends to provide a service under this Regulation should notify ESMA and provide the information according to Article 15. After the transitional period, ESMA should examine whether external reviewers and the services provided during the transitional period comply with the regulation.

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