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An analysis of the Green Finance and related risks: future expectations on green bond premium

Prof. Daniele Penza
Supervisor

Prof. Federico Merola
Assistant Supervisor

ID number 733091
Valeria Maiellare
Candidate

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INTRODUCTION

Green finance has a significant impact on environmentally sustainable development. Therefore, developing green finance has become an irreversible and unstoppable trend for the economic transition. Defining green finance may be challenging since there is no single, fixed, and agreed-on common definition. For this essay, green finance has to do "with any financial initiative, process, product, or service with the goal of protecting the external natural environment or managing how the environment affect finance and investment" (Marsh & McLennan companies/NACD, 2020) [1]. Green finance is a kind of financial activity to promote better development of the environment and to improve the typologies of resources used. It also deals with climate change. Its role is pivotal not only to develop the green features of the financial industry in its operations but also to change the investment orientation of enterprises and to accelerate the transformation of green consumption.

Many are the actors playing in the green financial market. Among them, governments across the world are undertaking actions for the transition toward low-carbon and more circular economies which entails the adoption of the passage of the Paris Agreement on climate change. An in-depth analysis of climate-related and environmental risks, whose drivers are two factors that is physical risk and the transition risk, is presented in the first chapter. Moreover, institutions are required to look at climate-related and environmental risks when they decide to set up their business strategy and governance and risk management frameworks. Companies are also required to make disclosures aiming at enhancing transparency into the financial markets and. However, all these requirements are having and will have impacts on both employees and companies' directors.

Moving deeper into the analysis of green finance, the second chapter seeks to provide an overview of the main social benefits, definitions, and categories of bonds' instruments, which respectively are: green bonds, social bonds, sustainability bonds, and transition bonds. The growth in sustainable investing skyrocketed during 2021. The green bond market reached just over half a trillion in 2021 according to the Climate Bonds Market Intelligence. This result is in line with the continued acceleration characterized the green bond issuance during the last years and the highest since 2007. It also highlights the trend of 10 consecutive years of green market growth. Data and information about the European green bond market are also provided in this chapter.

To ensure that green bonds fulfill the expected role within the environment, issuers should produce a green bond framework explained in the third chapter. However, the phenomenon of greenwashing is increasingly becoming widespread and dangerous for investors. For such a reason an external review is highly recommended for companies. Moreover, bonds are characterized by different shades of green depending on

[1] Definition by Marsh & McLennan Companies/NACD. Climate change: the implications for boards. Article Series 2020.

the possible environmental impact they may have on the external environment. This chapter also aims at investigating a cutting-edge topic: the green risk premium namely greenium. It can be stated that green bonds offer a greenium when they are issued at a higher price above the average price and therefore have a lower yield than outstanding bonds. This means that investors are willing to accept a lower remuneration for their investments, other things being equal, as long as investments made are linked to "green" economic activities. This implies that bonds can be priced at a lower level (thus, a lower interest rate) than the risk-paired traditional bonds. Evidence about the sign and the magnitude of the greenium will be provided.

In the last chapter, I will perform an analysis through which I will provide a snapshot of the evolution of the total issuance of green bonds until today. Taking into consideration fifteen years since the first green bond issued in 2007 by the European Investment Bank, I divide my analysis into two parts. In the first part, I will make, through extrapolation and consequently an interpolation, a forecast about the total green bond issuance in the next fifteen years, and precisely for 3 target years: 2025, 2030, and 2035. The second part of the analysis will concern 3 possible scenarios analysis through which I will understand if the greenium creates and will create benefit for the issuers in the next future. Eventually, a description of new forms of sustainable investments, specifically, sustainability-linked bonds and ESG funds, will be provided.

CHAPTER I

CLIMATE-RELATED AND ENVIRONMENTAL RISKS

Definitions, scope and applications

Governments all over the world are taking steps toward a low-carbon and more circular economies following the passage of the Paris Agreement related to climate change and the UN 2030 Agenda for Sustainable Development in 2015. On the European level, the European Green Deal's objective is to make Europe the first climate-neutral mainland by 2050. The European Green Deal is not a law, but it is the cornerstone of Europe's sustainable economic growth strategy, and the foundation on which almost all of its subsequent ESG and sustainability legislation is based. Launched on December 2019, it is an prominent section of the European Commission's strategy which entails the implementation of the UN's 2030 Agenda and the SDGs. Its goal is to make the EU a competitive and innovative economy where:

- There will be zero net emissions of greenhouse gases by 2050;
- A resource efficient approach will be managed; and
- Any person and country will be accompanied during this transition.

Its purpose is channeling private investment towards the journey to a climate-neutral economy. Thanks to the so called Just Transition Mechanism and in particular through a financing at least equal €100 billion over the period 2021-2027, it also provides financial and technical support to assist all those regions that are most affected by the "green" transition.

The centerpiece of the European Green Deal is the European Climate Law, which will transform its promises into legal obligations and write into law the goals set out in the deal, including a legally binding target of net zero greenhouse gas emissions by 2050 and an objective target of reducing emissions by 55% by 2030, with progress to be observed every five years from 2023 in line with the Paris Agreement's Global Stocktake. The Green Deal includes an investment pillar as a key initiative called European Green Deal Investment Plan, also called the Sustainable Europe Investment Plan. It highlights the importance of financial resources to meet its objectives, combining both legislative and non-legislative procedures to meet three objectives:

- Raising funds at least equal to €1 trillion from both the EU budget and other public and private entities over a period of 10 years;
- Making investments sustainability-based for all sectors; and
- Assisting public administrations and project leaders to define a set list of sustainable projects.

This Plan foster sustainable investment decisions, through a mix of initiatives.

As declared in the Commission action plan on funding sustainable growth, the financial sector is expected to cover a vital role in this regard following the guide of climate-related and environmental hazards [2]. For the general economy and financial institutions, the journey towards a greener economy reflects both threats and appealing chances. For instance, the actual economy and financial system can be damaged by climate change and environmental degradation, which represents a physical risk. The European Central Bank (ECB) talks about climate-related risks as a core risk in the Single Supervisory Mechanism (SSM) Risk Map for the euro area financial system for the second year in a row. According to the ECB, institutions should adopt a strategic, forward-looking, and comprehensive approach to manage the above-mentioned risks. The ECB is constantly paying attention to events that could have an impact on eurozone market. The Commission's action plan on financing sustainable growth intends to reroute funds toward sustainable investments. This should increase the level of sustainability decreasing the probability of environmental risk, and improve transparency in the long-term. The European Banking Authority (EBA) was granted numerous missions to the banking industry in order to investigate how environmental, social, and governance (ESG) risks may be handled and considered into the three pillars of prudential supervision that is: The Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the European Deposit Insurance Scheme (EDIS). To this end, the EBA issued a Sustainable Finance Action Plan as well as a Discussion Paper on the incorporation of ESG risks into binding frameworks made by authorities. The economic activity and, more in general, the financial system, are constantly under attack by structural changes due to climate and environmental degradation. The related impact can occur directly, in case, for instance, of a crease in value of assets, or indirectly, through macro-financial shocks.

Two are the main risk drivers concerning the climate-related and environmental risks:

- Physical risk derives from the financial consequences of climate change, such as repeated extreme weather shocks and gradual climate change, as well as environmental events that affect land, air, water, trees, and many other life-forms. This typology of risk can be “acute” when it is the consequences of extreme events, such as floods or storms, and “chronic” when it is due to ongoing shifts, such as increasing temperatures or resource scarcity. This can directly lead to a reduction in productivity or indirectly causes the disruption of supply chains.
- Transition risk derives from a financial loss suffered by an institution as a result of the transition, as the name suggest, to a lower-carbon and more environmentally friendly economy, either directly or

[2] ECB 2020. Guide on climate-related and environmental risks: Supervisory expectations relating to risk management and disclosure. Please see the following paragraphs for further detail.

indirectly. This can occur when, for instance, new forms of policies related to the climate and the environment are adopted or as a consequence of technology developments, or shifts in market mood and preferences, among other things.

These risks can also damage the robustness of an institution's business model under a medium-longer perspective and are particularly relevant in relation to institutions characterized by business models based on sectors and markets highly exposed to these typologies of risks. The above-mentioned risks can also trigger further losses in relation to credit, operational, market, and liquidity risks as well as non-Pillar 1 risks like migration, credit spread in the banking book, real estate, and strategic risk. These risks can affect many categories of risks which already exists. The level and timing of mitigation measures define the strength and distribution of physical and transition risks and whether the transition takes place in an orderly or disorderly fashion.

It is worth noting that other risks may affect the financial system. Moreover, the prominent interconnection between climate-related change and environmental risks is capable to generate even greater impacts. Climate change is expected to assume several shades across the world and is likely to be impacted and to impact different sectors and business activities in several different ways. To this end, a forward-looking perspective and a long-term horizon is a necessary action taken by institutions. This allows a fast respond from institutions in a timely manner in case the transition to a low-carbon economy speed up and transition risks materialize more rapidly than expected. Several assessments, such as surveys, have been performed by the ECB to keep track about the behavior of institutions in addressing climate-related and environmental risks [3]. Actions taken by institutions towards these key risks depends on the main features of institutions such as the size, business model, complexity, and geographic location. Evidence demonstrate that institutions are still lagging behind and have mainly approached the topic from the perspective of corporate social responsibility. In particular, they still lack and have to develop a robust risk management framework. A survey conducted jointly by the ECB and the EBA, reveals that the vast majority of the institutions have construct one or more sustainability policies while most of them are unable to estimate the impact of these risks on their balance-sheet having no tool at the disposal. Only part of the institutions has performed stress and reverse stress-testing scenario tests, scenario analysis, and capital adequacy tests in order to define their risk appetite in their risk management approach. In addition, institutions' practices may differ a lot among them, as shown by the analysis over some selected significant institutions (SI) contained in the ICAAP packages. Climate-related risk taxonomies are very heterogeneous and are often jointly combined with exiting risk categories, such as credit risk or operational risk. Still a lot of limitations reduce the practice's efficacy. For what concerns the level of disclosures, the larger the institution, the more exhaustive the disclosures. Only a small number of institutions

[3] Surveys institutions correspond to approximately 44% of total euro area banking assets.

are correctly specifying the definitions and methodologies used and only a tiny part of them makes disclosures in line with the suggestions provided by the TCFD. Nevertheless, the ECB pointed out that a considerable part of institutions is working on improvement initiatives regarding their disclosure procedures. If required, SI have to improve their procedures and practices in a faster and timely manner. According to the supervisory dialogue, SI are obliged by the Joint Supervisory Team, to supply information to the ECB of any existing discrepancies in their practices with respect the supervisory expectations and of any arrangements aimed at progressively addressing these expectations. In addition, any practices and methodologies used in the development will change over time in the future. Supervisory expectations have to be applied in proportion to the nature, scale, and complexity of the institutions' activities meaning that less significant institutions are highly encouraged to follow the above recommendations as well as other relevant publications by their NCAs.

Supervisory expectations

Several articles provided by the CRD (Capital Requirements Directive) and the CRR (Capital Requirements Regulation) define the general prudential framework applicable to institutions that are asked to have in place strategies and processes aimed at assessing the internal capital adequacy in order to cover the level of risks to which they are or might be exposed. Other requests, among others, include having robust governance arrangements; ensuring periodically reviews supplied by the management body about the strategies and policies set up; setting out specific legislative requirements in a timely manner.

In this respect, articles 73 and 74 of the CRD set out supervisory expectations relating to business models and strategy. Institutions are expected to comprehend the short, medium, and long-term impact of climate-related and environmental risks in order to make educated strategic and business decisions. This is possible through a comprehensive understanding of the key factors, trends, policies, and regulations of the business in which they operate since climate-related and environmental risks can possibly affect many areas such as economic growth, employment, or real estate prices. Moreover, when detecting their business model, institutions should highlight hazards linked to climate and environmental shocks across all the, geographic areas, and products and services they are in or are considering becoming active in. Institutions are also called to have a forward-looking view of their assessments. Once the typologies of climate-related and environmental risks affecting the business strategy have been pointed out, institutions are required to integrate their strategies along the relevant time horizon and to generate acceptable returns in line with their risk appetite. Since climate-related and environmental risks may have a direct influence on the robustness of an institution's current and next strategies, institutions should consider any important aspects relating to their long-term financial interests. Given the uncertainty surrounding the future course of climate change and society's response to it, the scenario analysis technique is particularly relevant in the context of climate-related and environmental concerns. These scenarios, as any other scenario analysis, rely on specific considerations which will possibly impact the

environment. These types of analysis are expected to be supported by forecasted information where available, and also to be relevant to an institution's particular exposure to environmental risk. These assumptions, being quantitative and/or qualitative in nature, are linked to different time horizons (up to or over 5 years) over which the correlated effects are expected to materialize. This analysis may also involve the presence of an expert judgment.

Both climate-related and environmental risks are reflected in the institution's business strategy for instance by setting, monitoring, and adjusting key performance indicators affecting the individual business lines and portfolios. Once strategic objectives are set out, institutions are expected to adjust and consider the risks related to their different lending and trading portfolios stemming from the transition to greener and more sustainable economy. Any strategic decisions including significant climate-related and environmental factors should be incorporated into the institution's policy.

Article 74 also relates to the institutions' governance and risk appetite. In particular, institutions should promptly assess, handle, follow and report the actual and possible future risks they might be exposed to through the construction of a robust governance. The latter together with a comprehensive reporting on climate-related and environmental risks addressed to the management body is essential to properly manage these risks. The management body, both as supervisory and management actor, is expected to manage the roles of its members and/or its sub-committed for climate-related and environmental risks through the definition of roles and responsibilities. The body, once it has ensured that each member holds a responsibility and the latter is clearly specified, following a proportionality approach, in line with the institution's profile, may establish committees other than those specifically referred to in the CRD. The committee can be either a new or an existing one, but it should ensure the proper expertise and experience of its members in the area for which they are working for. The management body should construct, follow, approve and monitor the business strategy process, and should take proper decisions supported by robust information. Each decision should be based on and supported by qualitative and quantitative information. To achieve a comprehensive approach to risk, from one hand, institutions' should consider long-term financial interest, from the other hand, the management body should adopt a forward-looking approach to the institution's response to the goals set out under international and well known agreements such as the Paris Agreement (2015), EU environmental-related policies such as the EU Green Deal, local and national policies, as well as the outcomes of well-founded climate-related and environmental assessments, such as those by the IPCC and IPBES. To be in line with the above-mentioned agreements, the management body is expected to carefully monitor the institutions' exposures and responses to climate-related and environmental risk by assessing and monitoring the role played by the management function and the attainment of its goals. This goal can be easier achieved by setting and overlooking KPIs and KRIs.

As stated above, a risk appetite framework (RAF) should be in place as well. This considers the institution's exposure to all the material risks under the view of a long-time horizon and in line with the business strategy set up by the institution. Collecting information about climate-related and environmental risks into the RAF improves institutions' resilience to such risks and their ability to handle with them, for instance, by allowing lending activities only to specific regional areas or economic sectors. In their risk inventory, institutions should produce a precise description of climate-related and environmental risks that feeds into their risk appetite statement (RAS). The risk inventory should be in line with the institution's internal risk taxonomy since it represents the result of the risk identification process. The RAS is the base of the internal taxonomy in which climate-related and environmental risks are anticipated to be properly identified within a categorization of distinct risk categories and causes. Key risk indicators and specific limits, tolerances, and thresholds should be put in place and regularly monitored to perfectly manage climate-related and environmental risks. Moreover, even when procedures are violated, a pre-specified process and a follow-up procedure should have been formally defined. Based on current data and forward-looking estimates, the ECB wants institutions to follow and disclose their exposure to climate-related and environmental risks through quantitative metrics and qualitative ones when the formers are still under development. The risk appetite indicators and limits should be defined by the institution's business model, depending on the level of risk that the institution is ready to accept according to their own characteristics and risk capacity. It is also important to regard on how long-term nature climate change may accentuate existing risks. Institutions should ensure that their remuneration policies and practices encourage behaviors compatible with their risk approach, by, for instance, implementing a variable remuneration component tied to the fulfillment of climate-related and environmental achievements. This could be a way to incentivize behavior compatible with the institutions' risk strategy approach, as well as the institution's ethic. Sometimes financial implications of climate-related and environmental risks are difficult to quantify. In such cases, the management body may consider including some qualitative factors in the remuneration policy.

In order to identify, assess and manage climate-related and environmental risks, an organizational structure is necessary. Institutions are required to assign responsibilities and authorities within their internal control framework across either existing structures or new ones. These responsibilities have to carefully reported in the relevant policies, procedures, and controls. According to the EBA Guidelines, the internal control functions must have the appropriate human and financial resources, as well as the effective powers to effectively best-perform their role. Institutions should ensure that the organizational structure complies with all climate-related and environmental policies, procedures, and limits. The roles of the first line of defense are the following: identity, quantify, and track any risks linked to the environment which disclose evidence about the creditworthiness and the scoring/rating of a client, and carry out due diligence processes.

Institutions also define the risk management function's responsibilities as identifying, quantifying, measuring, tracking, and reporting climate-related and environmental risks and the tasks attributable to the compliance function. The control and risk management framework should be reviewed by the internal audit function, which should at least consider possible developments linked to external shocks, changes in the risk profile, and changes in products and/or business lines. Furthermore, because the internal audit function's role is about understanding the level of compliance with the institution's internal policies and procedures as well as external standards, also policies and processes for climate-related and environmental risks fall under its review.

Making informed decisions is a challenging practice made by the management body and relevant sub-committees. In order to be compliant with their role, they consider reports on risk data made by institutions. For such a reason, information supplied by institutions has to be transparent, accurate, concise, specific, and clear. These reports should "share relevant information on the identification, measurement or assessment, monitoring and management of risks" as declared by the EBA Guidelines on internal governance. Although the fast development of metrics and tools makes data available in institutions unfinished, the ECB expects reporting of climate-related and environmental risks to be updated and integrated with new information over time. These data have to be reviewed and analyzed by institutions in order to inform their strategy-setting and risk management, to highlights gaps relative to present data, and to set up a recovery plan to overcome any possible lacks. Institutions are expected to incorporate these risks into the data reporting system to effectively put in place a follow up procedure. Institutions are expected to ensure that the climate-related and environmental risk data reporting framework works in tandem with the climate-related and environmental risk indicators defined in their existing RAS and risk management systems. The data reporting framework is able, if necessary, to support the KPIs set by the institutions to assess the performance in terms of climate-related and environmental risks and public disclosure.

The influence of climate-related and environmental risks on an institution's business model, strategy, and risk profile needs to be communicated in risk reports. These risk reports should be integrated in the institutions existing risk reporting framework always keeping in consideration the institution's operations and risk profile. Any developments arising from new policies or procedures at any levels should be promptly integrated in the reporting expectations by the management body. This is possible only if an is adaptable and flexible to any external shock. The requests can be linked to situation of stress/crises, during which the demand for climate-related and environmental risks reporting grows to meet supervisory queries.

Another aspect to take into consideration is about integrating these risks into credit, operational, market, liquidity risk or any other material risk management, as well as into the ICAAP overall, over a sufficiently long-term horizon. This is fundamental in order to monitor and maintain, on an ongoing basis, the amounts, types and distribution of internal capital. To cover the exposures to these risks the institutions are or might be

exposed to, an adequate level of capital must be ensured. Institutions should be able to quantify the impact of climate-related and environmental risks on existing risk categories facing part of the risk management framework. The risk management framework should include both on-balance-sheet and off-balance-sheet risks, with proper considerations of both financial and non-financial risks, both for present and future concerns. Institutions are expected to identify all material risks included in an internal inventory, through the implementation of a regular process. The ICAAP's normative and economic perspectives are included in the expectation. All the assessments made by institutions in relation to climate-related and environmental risks should be related to all the business areas both under the view of a short and medium-long term horizon, and across various scenarios. This analysis should be customized as much as possible in order to perfectly fit the typology of business model and risk profile characterizing to the institution. Institutions should accurately quantify the climate-related and environmental risks to which they are exposed even if data are not available or difficult to quantify. If this the case, institutions can make assumptions to develop proxies for the assessment. Stress testing and scenario analysis are relevant for this purpose as well. Following the business model strategy and risk appetite, institutions should project a strategic approach in order to manage and mitigate climate-related and environmental risks. Therefore, institutions should not only adjust their risk policies, but also to set up a relationship with authorities and counterparties, to stop implementing some economic sectors or business, and to borrow from dangerous lenders that affect their climate-risk appetite.

Institutions should conduct proper and regular climate-related and environmental due diligence processes at the beginning of each procedure. Due diligence processes allow the collection of data granting the correct functioning of the procedure. This is important because each client relationship creates potential impacts which should be forecasted by institutions in order to preserve the integrity of their business models. Due diligence is useful to limit reputational and liability risks. The level of “in-depth” through which the due diligence is conducted depends on the sector and geographic location in which the client is situated. It may be supported by an external expertise. Based on the findings from the due diligence, decisions affecting the client relationship are taken accordingly.

The economic perspective should encompass the normative one and they mutually affect each other when evaluating the effect of climate-related and environmental risks on their capital adequacy. Any risks, as well as any concentration within and between such risks that may result from shocks in their operating environment, need to be considered in the institutions' forward-looking capital adequacy assessments. The ECB wants institutions to incorporate risks deriving from the energy transition into the assessment from an economic value perspective. In their periodic and regular evaluations, institutions are expected to assess the adequacy of their climate-related and environmental risk identification, measurement and mitigation instruments as well as whether the outcomes arisen from them sound well and remain appropriate given current and future

developments. Given the limitation affecting the collection of data and the availability of tool for identifying and measuring risks and this fast-paced sector, institutions are expected to regularly conduct internal reviews to update, if necessary, the data sources and methods in place.

Following Article 79 of the CRD, institutions should integrate climate-related and environmental exposures into the credit-granting process in a comprehensive manner. Their role is also to monitor these risks in their portfolios. Therefore, following the EBA guidelines about granting a loan, institutions are expected to take into consideration risks linked to climate-related and environmental factors in their credit risk policies and procedures and how these risks could impact the borrower's default risk. These expectations are the result of proper remarks made by institutions. An example can be the overexploitation of natural resources which might lead to limitations on their use, resulting in production shocks and losses to institutions' counterparties.

According to the supervisory expectations made by the European Central Bank, institutions are expected to create acceptable general risk indicators or ratings for their counterparties that take climate-related and environmental risks into account. As part of risk classification procedures, institutions should identify borrowers who may be exposed to heightened climate-related and environmental hazards, either directly or indirectly. Critical exposures to such risks should be promptly identified and, where required, examined under multiple scenarios to ensure the ability to assess and implement relevant risk mitigation actions, such as pricing. Moreover, climate-related and environmental risks can may undermine the value of collateral. Institutions are required to pay attention to the physical locations and the energy efficiency of commercial and residential real estate in order to accurately establish the value of collateral. Institutions are supposed to keep track of how geographic and sectoral concentration is prone to climate-related and environmental risks. Institutions may track asset concentrations of assets with specific features that are likely to be targeted by transition policies, such as the distribution of energy efficiency labels across residential and commercial real estate portfolios in light of anticipated legislation. For larger counterparties, institutions may consider climate-related and environmental risks in the single-name concentration analysis and using exposure limits or deleveraging strategies.

The risk committee of an institution should examine whether the pricing of assets offered to clients fully reflect the institution's business model and risk strategy. The loan pricing fixes the level and origin of their future income because if an institution decides to reduce or limit exposures to sectors harmful for the environment or the climate, thus the pricing is expected be aligned with the chosen risk perspective and strategy. This could, for instance, entail setting the interest rate of an environmentally sustainable loan at a level consistent with a higher resilience towards such risks and the associated improved creditworthiness under otherwise unchanged conditions. For banks making sustainable lending, the adjustment of the interest rate can be related to the client's achievement of sustainability targets over a predetermined period of time during which climate-related

and environmental risks are reduced. Institutions should construct a pricing framework linked to the loan's features and the impact of climate-related and environmental risks may be evident in the value of the cost of capital, funding or credit risk. Institutions are also expected to incorporate any higher funding costs for assets that are particularly vulnerable to physical and transition risk in their pricing.

As set out in article 85 of the CRD and the EBA guidelines, institutions should also manage and evaluate operational risk across all business line and operations, and consequently determine how operational risk may materialize. Institutions should evaluate the impact deriving from physical risks on their operations in general and asses how well prepared are to quickly recover their capacity to continue supplying services. This is particularly valid in case of outsourced services and IT activities and even more if providers are located in areas that are vulnerable to major weather occurrences or other environmental threats. Institutions must determine whether the nature of the activities in which they participate raises the likelihood of a negative financial impact stemming from future reputational risk, liability and/or litigation. Reputational risk can arise quickly and can rapidly damage firms. In order to avoid controversy in connection with their products, such as investing in products that can negatively affect the environmental, institutions should evaluate the compliance of their investment products with international or EU best practices.

Article 83 of the CRD relates to the identification, measurement and management of the sources and impacts of market risk. Environmental and climate-related risks could cause possible displacement in supply and demand for financial instruments, products and services, thus leading to a change in their values. According to the normative perspective, institutions are exposed to risks arising from debt, equity and equity-related financial instruments in the regulatory trading book as well as foreign exchange positions and commodities risk positions related to both the trading and banking book. In accordance with the economic perspective, all instruments are supposed to be evaluated based on economic value considerations, regardless their accounting treatment. The management of market risk should also consider its sub-categories in the banking book both the credit spread risk stemming from positions evaluated at fair value and at cost and risk deriving from equity exposures. The former is relevant for instance in case of financial instruments supplied by companies belonging to sectors considered environmentally unsustainable and which do not follow a comprehensive sustainable management approach. As a consequence, their value might be negatively impacted. Institutions specialized in commodities trading are expected to pay close attention to potential hidden weaknesses, such as price or value increases in some commodities that are deemed to be less environmentally sustainable than others. It is also a good idea for institutions to keep an eye on how transition and physical risks influence the governments to which they're exposed through sovereign assets. The overall assessment of market risk management, under both the normative and economic perspectives, can be performed through stress testing.

The appropriateness of scenario analysis and stress testing should in turn be evaluate, in order to incorporate them into their baseline and adverse scenario. All major risks that could deplete internal capital or impair regulatory capital ratios should be included in the stress scenarios. Three are the aspects which are compulsory for conducting scenario analysis and stress testing:

- how physical risk and transition risk may affect the institution
- how climate-related and environmental risks can evolve in different scenarios, taking into mind that historical data may not fully reflect these risks
- depending on the scenarios analyzed, how climate-related and environmental problems might manifest in the short, medium, and long term.

Several scenarios based on several different combinations of assumptions, linked to the institutions' risk profile, are considered in order to assess the institution's capital adequacy. In performing adverse scenarios, the institution is supposed to assume exceptional but credible events with sufficient severity in terms of their impact on its regulatory capital ratios. The normative perspective should set and cover a time horizon at least equal to three years even though a longer time horizon is always preferred since climate-related and environmental risks are usually visible in the medium to long term. Longer temporal horizons, in particular, might be considered in stress testing from an economic standpoint. Climate related impacts are also taken into consideration in designing recovery planning processes: in such a case institution should consider a variety of severe macroeconomic and financial stress scenarios and evaluate recovery options against them.

Pursuant to article 86 of the CRD, institutions are required to maintain adequate liquidity buffers through setting an appropriate strategy and system for the identification, measurement, management and monitoring of liquidity risk over an appropriate set of time horizons. Impacts of climate-related and environmental risks on their liquidity position, either direct or indirect and both under the economic and the normative perspective, should be included in the ILAAP process. Such evaluations are required to be carried out under a forward-looking approach, considering both normal and stressed conditions, and, in particular, to evaluate severe but feasible scenarios that could occur in conjunction, with an emphasis on critical vulnerabilities. The goal of institutions is about determine if climate-related and environmental risks will have a significant impact on net cash outflows or liquidity buffers. As a consequence, institutions should incorporate this into their liquidity risk management and liquidity buffer calibration. For example, institutions could consider the possibility of a combined idiosyncratic and market stress situation occurring simultaneously with the materialization of climate-related or environmental risks. Institutions could also consider the impact of such risks on regional liquidity positions, such as in local currencies, as well as potential, operational and other impediments to providing liquidity to regions where climate-related or environmental risks occur. Furthermore, institutions are expected to integrate their business strategy to liquidity resource allocation. To this purpose, institutions

are encouraged to consider the specific marginal cost of funding of sustainable refinancing instruments in their internal pricing process, including, where applicable, the liquidity cost or benefit compared to regular refinancing instruments [4]. This topic will be further discussed in the next chapters.

Evidence from disclosure policies and procedures

Regulatory disclosures are essential for promoting transparency within financial institutions and making sure the correct functioning of financial markets. For this end, institutions should issue and inform the market by disclosing detailing and meaningful information and key metrics on climate-related and environmental risks that they deem to be material, but not proprietary or confidential. An information is material when its omission or misstatement may affect or change economic or political decisions, the estimated level of information relevance for users, as well as the relationship with recent changes in risks and disclosure requirements. In order to assess if an information is material or not, both qualitative and quantitative information are used. Since there are no agreed on common threshold for materiality, considering reputational and liability risks associated with the institution's impact on the climate and environment and arising from controversy in connection with its products and operations, might be useful. In case of materiality, methodologies, definitions and criteria related to them are disclosed by institutions. The presence of an immaterial information will lead the institution not to disclose information or a set of requirements. It is noticeable that quantitative and qualitative information are needed to justify this judgement about immateriality. This result makes participants aware about the institution's risk profile and consequently limit reputational and liability risks. Disclosures, including a complete review of the entity's overall impact, are highly recommended and expected by the ECB when institutions aim to promote climate-related and environmental goals. The ECB has declared that information currently disclosed is heterogeneous and partial and, in some cases, they do not grant enough transparency on thresholds utilized and portfolios covered. Institutions that aims to stop or limit financing to specific industries or activities for the reasons cited above, are obliged to report the definition of the typology of activity and associated targets in terms of data and outstanding volumes by geographic area. They should also disclose the internal monitoring governance, as well as the criteria used to identify counterparties covered by the financing policy and the scope of business relationships concerned. Similarly, when reporting on their contribution to environmental goals, institutions are obliged to examine all business lines and their exposures.

Disclosures within climate-related and environmental risk revolve around the following aspects: business model, policies and due diligence processes, outcomes, risks, and risk management, and KPIs. Moreover, institutions are expected to declare the total amount of money spent on Scope 3 GHG emissions137 for the whole group. Despite the fact that the ECB does not require the adoption of a specific measurement and/or

[4] See paragraphs 24 and 25 of the CEBS Guidelines on liquidity cost benefit allocation of 27 October 2010.

attribution methodology, institutions are encouraged to employ a granular approach to monitoring carbon emissions while staying compliant with the GHG Protocol as set forth in the European Commission's Supplement. For instance, a project-by-project approach to calculate the carbon intensity of big corporate portfolios and a property-by-property measurement of actual energy usage or energy efficiency classification for real estate portfolios might be used. Disclosures required [5]:

- the amount or percentage of carbon-related assets in each portfolio in millions of euros or as a percentage of the current portfolio value, as well as a forward-looking best estimate of this amount or percentage over the course of their planning horizon;
- the weighted average carbon intensity of each portfolio, where data are available or can be reasonably estimated and a forward-looking best estimate of such a measure as we stated above;
- the volume of counterparty exposures by sector and, to the extent possible, the best estimate of this amount in the future;
- credit risk exposures and collateral volumes by geography/country of activity or collateral, including a list of countries/geographies that are particularly vulnerable to physical risk.

All these metrics and related formulas and methodologies have to be carefully explained and disclosed. Institutions should report the key performance indicators (KPIs) and key risk indicators (KRIs) they use to create a strategy and manage risk, as well as relevant targets and the current performance of the institution against those targets. These metrics are necessary in order to show the short, medium, and long-term resilience of the institution's strategy under the view of different climate-related scenarios. Obviously, disclosures need to be updated and improved as fast as the evolution of the needs of market participants.

European Union law requires large companies to disclose certain information on the way they operate and how they manage social and environmental challenges. The non-financial reporting directive [6] states the rules on disclosures about, for instance, the policies implemented by large companies, including financial institutions. Institutions are required, according to the current prudential framework, to disclose their risk profile. As aforementioned stated, the EBA also clarifies the concept of material information and the subsequent rules applied. After the Paris Agreement in 2015, several international best practices were launched aiming at improving and harmonizing the disclosure process on climate-related and environmental risks. Among them, the TCFD (Task Force on nature-related Financial Disclosures) lays down a framework for assessing and reporting corporations' climate-related risk management strategies. This framework was based

[5] See Annex 1 of the European Commission Guidelines on non-financial reporting: Supplement on reporting climate-related information.
[6] Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and group.

on four thematic areas namely governance, strategy, risk management, and metrics and targets. These recommendations were implemented by the ECB which dispose disclosures for each of them. Therefore, recommended disclosures were required for: the business model; policies, and due diligence; the outcome of policies; principal risks and risk management; and key performance indicators.

In a constantly evolving world, also disclosure frameworks are evolving rapidly from being a mostly voluntary exercise to having to comply with specific requirements. The major reason for this shift derived from the inconsistency, incomparability, and unreliability of information gathered. The recently established Task Force on nature-related Financial Disclosures (TNFD) convened NGOs, governments, and private financial institutions and is expected to deliver a framework for nature-related financial disclosures by the end of 2022. The goal of the Task Force is to help the financial sector through "redirecting flows of finance to allow nature and people to flourish" [7].

The European Central Bank makes a report [8] in which it provides a snapshot of the level of disclosure of climate-related and environmental risks in the SSM countries. The assessment was performed in view of the supervisory expectations set out in the "ECB Guide on climate-related and environmental risks" [9]. The assessment covered 107 significant institutions (SIs) and 18 less significant institutions (LSIs) in 2019 as a reference year. The underlined assessment examined the existence of disclosures only and not their substantiation, in relation to the governance, strategy, risk management, and metrics and disclosures. The goal is to determine whether SI and a sample of LSI make disclosures about climate-related issues. However, also environmental disclosures were considered if considered relevant and sufficiently credible. The vast majority of institutions (86%) refer to climate-related risks in their public disclosures in some form (e.g. annual report), what differs is the comprehensiveness and depth of information reported. Nevertheless, the number of institutions that do make any disclosures with any reason behind, has reduced substantially from 35% in 2019 to 14% in 2020. Almost 60% of institutions incorporate the information in their annual report while others include the information either in their non-financial disclosures report, in their Pillar III report, in a dedicated (e.g. TCFD) report, or otherwise. Noticeably, one-third of the institutions spread the information across two or more reports. Although 86% of the institutions referred to climate-related risks in their disclosures, around half of them do not demonstrate that they have explicitly considered the potential strategic impact of these risks. Specifically, those institutions that do not make disclosures about their risk management processes

[7] ECB, 2020. ECB report on institutions' climate-related and environmental risk disclosures. Please see the following paragraphs for further detail.
[8] ECB, 2020. ECB report on institutions' climate-related and environmental risk disclosures. Please see the following paragraphs for further detail.
[9] ECB, European Central Bank (2020b, May). Guide on climate-related and environmental risks: Supervisory expectations relating to risk management and disclosure. See the following paragraphs for further detail.

(around 68%), have not disclosed any climate metric (70%), and have not in any way described the potential impact of transition risks (81%) or physical risks (83%) meaning that the stakeholders are not able to verify the immateriality of the risks. On the other hand, about 84% of institutions that have considered the impact of these risks, state that the risks have a strategic impact. Institutions that asses a risk as immaterial are expected to document this assessment through available qualitative and quantitative information. For the group of institutions stating that the risks have no material impact, the substantiation given for non-materiality in their disclosure generally seems to diverge from the supervisory expectations that have since been specified. As previously stated, the TCFD recommends institutions to disclose information on climate-related risks in their governance and risk management processes irrespective of their materiality. Anytime institutions do not follow this recommendation will impact the stakeholders' ability to evaluate whether institutions have appropriate processes in place that would enable them to observe the materialization of the risks and respond to them in a timely manner. It has been observed that only 12% of the assessed institutions provided complete references to the methodologies, definitions, and criteria associated with disclosed metrics, and 26% provided only partial references. The majority of institutions providing this type of information, at least partially, are globally systemically important banks and promotional lenders. However, less than a third of the retail lenders or asset managers did so. For stakeholders understanding the company's view of how climate change impacts its business model and strategy, and how its activities can affect the climate, over the short, medium and long term is really important.

Other observations gathered refer to institutions' decision to disclose or not whether climate-related risks, either transition risk or physical risk, have any kind of impact on their business strategy. It has been observed that a total of 49% of institutions do not disclose what was previously stated. Interestingly, this percentage includes both smaller and larger institutions. However, these are mostly smaller institutions. 12% of institutions disclose the impact of either a physical risk or transition risk on their business strategy, while 39% of institutions disclose both. It has been discovered that 54% of the institutions do not reveal the impact of transition risk on their business strategy. It is fascinating to consider the time horizon for assessing the impact for those that do. Some 30% of institutions disclose the impact of transition risk on the business strategy in the short and long term. The remaining 16% only reveals the impact across one-time dimensions, either the short term (10%) or the long term (6%). There exists a correlation between these numbers and the size of the respondents' balance sheet: the larger the balance sheet, the more likely that the bank discloses the impact both in the short and the long-term horizon. The 79% of institutions having balance sheets larger than € 500 billion disclose the impact of transition risk in the short and long term, while only the 8% of institutions with balance sheets smaller than € 30 billion. Once again, the larger the institutions' balance sheets the greater the information disclosed on the impact of physical risks on their business strategy. However, this percentage is lower for transition risk, with 54% of institutions with balance sheets larger than € 500 billion disclosing the

impact of transition risk in the short and long term, and 25% making some disclosures on the impact, either only in the short term or only in the long term. The trend in the availability of information in disclosures is less clear for banks with up to € 500 billion on their balance sheets. As previously indicated, climate-related risks have a strategic influence on nearly 9 out of 10 institutions that do such an analysis. This demonstrates that when reviewing and reflecting on the consequences of climate-related and environmental issues, institutions determine whether or not to integrate them into their operations based on their impact on their business strategy.

Only half of the institutions provide disclosures on the board's oversight of either climate-related risks or opportunities. While some institutions refer to the board's involvement in climate-related topics, the form taken by this involvement is not always described. A pattern was observed whereby larger institutions are disclosing such information, whereas smaller institutions do not. Approximately 47% of all institutions do not share any information about board oversight, whether directed, by individual members, or through committees. The existence of disclosures is strongly related to the size of the institution rather than its business model. Eventually, over half of the institutions do not provide information to stakeholders about how their board of directors or a designated committee manages climate-related risks. It may be difficult to assess how climate-related risk management is integrated into the governance system. This information is available to stakeholders in larger institutions, even if it sometimes takes a very basic form.

One out of two institutions have publicly described their processes for identifying, assessing, and managing climate-related risks, of which only a minority have done this comprehensively. Although many institutions state that work in these areas is underway, less than a quarter of institutions mention climate-related scenario analysis in their disclosures and even fewer mention stress testing. Institutions that have included climate-related risks into their credit risk management strategies often utilize a mix of sectoral approaches, ranging from the exclusion of specific sectors to increased involvement with clients in specific sectors.

For what concern metrics and targets, just over one-third of the institutions disclose both. Only few institutions disclose quantitative information about the carbon intensity of their portfolios. Reporting of greenhouse gas (GHG) emissions typically incorporates Scope 1 and 2 emissions, and more rarely downstream emissions (Scope 3) from portfolios. Targets are not always supported by the appropriate metrics, making demanding the evaluation performance of the institution against them. Institutions are also expected to disclose the KPIs and KRIs they used for their strategy-setting and risk management. They are also required to relate their current performance to the above cited metrics. It seems that 74% of institutions do not have such KPIs and KRIs in place, whereas 10% have them but do not make reports on their performance against them.

Employees engagement and potential impacts

The green transition will also affect people and, in particular, employees. This impact will vary and can be difficult to forecast its magnitude. The crucial point to show off is related to the transition inequality over the next years. This is not about how many jobs are created or lost, but the number of communities and people left behind. It is crucial for companies to understand this in order to positively impact society as a whole. Companies will want to consider how their carbonization plans are likely to be implemented in a sensitive and equitable manner without exacerbating existing skills shortages and talent pipeline difficulties. They may render some segments obsolete while driving growth in others. The transition is such an interesting topic and it is, for most of the industries, a huge step forward while for others the green transition is taking away jobs. Surveys [10] conducted have shown that decarbonization leads to some adverse impacts on the workforce. The transition to a low carbon organization anticipates some job redundancies or, even worst, a disruption of the labor market. Just a few respondents expect a positive impact on the workforce. This phenomenon is amplified by digitalization which contributes to positive societal outcomes as well as to the displacement of the workforce. Over the next years, executives will retrain and upskill employees for new jobs and responsibilities since most of them believe that the corporate decarbonization journey will impact employees. Since the energy transition is a long-term journey, sometimes expectations relate to the simple retirement of roles rather than transition to new ones. Notwithstanding, the consequences of climate change represent a real cost for an individual in the short term. Every employee has a role to play in the transition towards net zero since implementing a decarbonization plan implies necessary changes for him. However, employees' action is also driving the required change, with the war on talent, meaning that organizations are frequently being asked about their carbonization plans before a prospective employee decides if they are an organization they want to work with. This is a clear example of how employees can foster and show the positive impact that could come if organizations are able to further engage employees in driving decarbonization plans going forward. Given the potential impacts on the workforce and perceived levels of resistance; employees should be appropriately incentivized to support the transformation of a company to a low-carbon business model. An example of an incentive can be linking director remuneration to performance in decarbonization efforts. This can be seen as a strong message for the workforce. Surveys reveal that remuneration incentives are put in place for board directors to achieve decarbonization targets. Nevertheless, this does not happen for the rest of the workforce and just a few companies have established individual KPIs tied to decarbonization. This also relates to the fact that a large majority of these incentives are linked to the implementation of specific solutions, rather than to GHG reductions or specific net-zero targets and timelines. If those solutions are not directly relevant to those employees, it may be challenging to translate this link to individual and even team KPIs. Setting clear, credible,

[10] The latest survey report by Eversheds Sutherland and KPMG Climate Change and The People factor 2021. Please see the following paragraphs for further detail.

and measurable interim targets is a concept gaining popularity since, according to a report by the IPCC (Intergovernmental Panel on Climate Change), the global warming would likely increase to 1.5 degrees Celsius by 2030. Employees' engagement in fighting against climate change can be discouraged by the way the information is framed or due to a lack of information and certainty. For this reason, the ability to credibly and meaningfully convey climate change ambitions and behaviors to employees relies on the verification and reporting on both interim and principal targets. Transparency in reporting and a possible valuation made by an external third party is essential in order to convey a positive social message to the market as a whole using KPIs and measurement systems. Only half of the companies that have a decarbonization plan in place, have also a process to report progress to internal audiences and even less companies make reports to external stakeholders. Almost no companies have included default ESG - align funds for which employees would need to opt-out rather than as part of their pension schemes.

The growing importance of the service sector, as well as its reduced carbon intensity, can aid the EU's transition to a low-carbon future. The EU has been undergoing a structural shift to a service economy, with lower value added and employment shares of traditional 'brown' sectors and higher shares of employment in intrinsically 'green' sectors. Business sectors that are relatively low in carbon emissions and material inputs are characterized by a higher rate of employment and value generation. The majority of jobs in the EU are not in carbon-intensive industries [11] as showed by the chart (1) below. More than 70% of the workforce is employed in industries that account for less than 10% of total CO2 emissions. Construction, wholesale and retail trade, and other services sectors together create more than 70% of gross value added and employ more than 75% of the workforce, while producing less than 12% of all CO2 emissions. These sectors are also characterized by a high level of employment. Electricity production, transport [12], industry, agriculture, and mining, on the other hand, account for about 90% of all CO2 emissions in the EU, while contributing only 25% of GDP and employing less than 25% of the workforce.

[11] ESDE 2019 Chapter 5 "Towards a greener future: employment and social impacts of climate change policies".
[12] Not all sub-sectors contribute equally (e.g. rail transport is far less polluting than some other forms of transport).

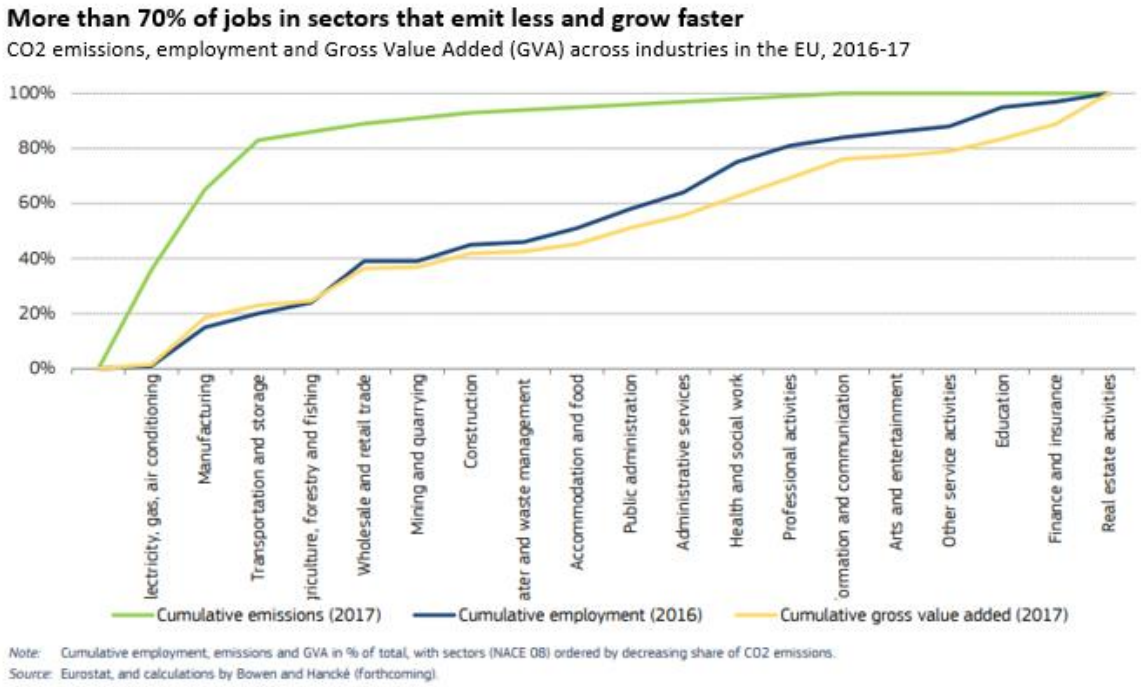


Chart (1) from ESDE (2019) Chapter 5 "Towards a greener future: employment and social impacts of climate change policies"

The transition to a climate-neutral economy, if well managed, can create jobs for people of all skill levels but progress is not automatic, and focused policies are required to accompany, lead, and accelerate the ongoing decarbonization process. Even though the growing share of services in the economy helps to reduce the carbon intensity of production, parallel actions are needed to decarbonize energy-intensive activities. Furthermore, some service sectors such as blockchain technologies or activities in the fintech world are energy-consuming. As long as electricity [13] is produced through carbon-rich methods, the increasing energy demands in these sectors remain problematic and hence shifts towards sustainable energy production are necessary. In this context "Greening the economy" does not only imply doing the same things with less CO2 emissions and material inputs, but also doing fundamentally different things, with consequent effects on incentives, salaries, and economic policymaking. The shift to a green economy is likely to intensify in the future, involving a major portion of the workforce. New forms of work such as smart working can have a positive impact on emissions. Furthermore, operations that make the economy more circular by making better use of raw materials contribute to increased total factor productivity and, as a result, to economic growth and employment creation. Surveys have shown that through technological changes it is possible to improve resource efficiency in five key sectors (food, motor vehicles, construction, electronics, and waste management). This can potentially create an

[13] See in particular International Energy Agency and OECD (2017), as well as Krause and Tolaymat (2018) and Vranken (2017). According to estimates, the annual energy consumption of Bitcoin could be at the 43rd place of country rankings, just after Switzerland and before Colombia, hence exceeding the total energy consumption levels of 159 countries in the world. Its consumption would be equivalent to e.g. 20% of the total energy consumption of Italy, or 45% of that of the Netherlands. For a critical discussion of these estimates, see e.g. Digiconomist (2018).

additional 700,000 jobs in the EU by 2030 in a business-as-usual scenario [14]. This can be mainly possible through job creation in the waste management sector and an overall shift from capital-intensive to more labor-intensive activities. Nevertheless, some of the emerging activities could be automated. For a better assessment of the potential impact on jobs of the transition towards the green economy, broader typologies of green(able) activities need to be considered. To this end, the EU technical expert group on sustainable finance [15] in its technical report made a focus on economic activities that can make a substantial contribution to climate change mitigation or adaptation, while avoiding significant harm to the other environmental objectives. These activities are:

- Activities that are already low carbon
- Activities that contribute to a transition to a net-zero emissions economy in 2050 but are not currently close to a net-zero carbon emissions level
- Activities that enable low-carbon performance or enable substantial emissions reductions, namely enabling activities

These are the activities that according to the Taxonomy are considered near-zero and transition activities.

Key issues for directors and senior management

Once having analyzed the potential impacts and issues related to employees, it is also essential to make a focus on the climate change approach taken by executives. Surveys [16] reveal that executives believe that their companies have the knowledge, resources, skills, and expertise to meet their goals and develop and deliver their future decarbonization plan within the next three years. However, this tough mismatch with the aforementioned statements since only less than half of the companies currently has a clear decarbonization plan in place. As companies become more aware of climate change strategy and shift their ambition into action, the process specifies and identifies, in a more granular way, the skills that will be required. At that point, the lack of internal resources appropriately skilled to meet corporate needs may become noticeable, particularly in the short term, given the timescale needed to hit net-zero targets. The survey also makes evidence of the large and complex business transformation faced by companies that will require change management expertise to help employees embrace new business models and responsibilities. Change management more than any other skill is fundamental to successfully developing and delivering a decarbonization strategy. Moreover, a high level of resistance to the above-mentioned changes can be forecasted. For sure, learning remains central in such a topic but the engagement and understanding should be accompanied by a specific strategy to achieve

[14] See European Commission (2018e)
[15] EU Technical Expert Group on Sustainable Finance (2019).
[16] The latest survey report by Eversheds Sutherland and KPMG Climate Change and The People factor 2021.

a successful transition. The best strategy is based on the early recognition of the skills gap, on an engagement with the workforce and collaboration with government bodies, plus education and training to support future and possible needs. Data shows that the majority of directors and senior management would look to upskill or retrain their current workforce and fewer would look to recruit new employees. To this purpose, it is essential to understand how companies are going to upskill and retrain employees. Multiple paths have been chosen by companies, making a mix between in-house learning and development programs and external resources, including coursework and contractors. The use of consultants like professional services firms is the most popular and used. One recent development is the emergence of training services specific to climate and decarbonization. A more flexible approach to training could be of particular benefit for those employees displaced by the upheaval, as well as to underpin climate upskilling on a broad scale and accelerated timeframe, including:

- Borderless learning — more competitive programs offered globally, sharing learnings from multiple jurisdictions;
- Shorter courses and degrees — with micro credentialing offered in a range of related courses such as circular economy;
- Experiential and lifelong learning — reliance on work-integrated learning, often with adult learners older than the typical graduate. Yet at the same time, climate risk should become business-as-usual for universities.

Climate change may impact each industry differently, and executives will likely face several hurdles on the road to net zero. Since the technology, media and telecoms industry strongly focuses on consumers, it is quite straightforward that executives in those sectors are heavily focused on the impact of their businesses on the environment and the communities in which they operate. The consequence is a huge ambition, for the TMT sector, to be an early adopter on issues of social concern but still less than half of the companies have a clearly defined decarbonization plan in place and even less have appointed a climate expert to their board. This situation is also reflected in the financial services companies where firms are mainly concerned about the impact of their operations on the environment and communities in which they operate than transitional risk or physical repercussions on their own operations. On the other hand, more firms in the energy and natural resources sector confirmed that they have a clearly defined decarbonization plan and have also appointed a climate change expert to their board, meaning that the companies need to add skills in order to develop a successful decarbonization strategy. Executives from the energy and natural resources sector (ENR) are almost equally focused on the physical impact to their businesses and transitional risks as they are on their company's environmental and community impact. Even more companies in the infrastructure and transport industry have a clearly defined decarbonization plan and have appointed a climate change expert to their board. Executives

are the most likely to include climate risk in their investment decisions, with the majority incorporating it in either due diligence or discounted cash flows.

Executive and non-executive directors can contribute to good climate governance in different ways. While non-executive directors are not responsible for the day-to-day operations of the company, they may have specialized knowledge or viewpoints on issues such as risks and opportunities of climate change. Executive directors, on the other hand, are operationally accountable and should have greater insight into how climate risks and opportunities are managed within the organization. Even when a board of directors has a sufficient number of directors with the necessary skills to address climate issues at the company, further actions should be taken to maintain and improve the board's command of the subject, to broaden perspectives and allow for more in-depth discussions and reviews of climate issues. The board may want to consider including climate-related targets and indicators in their executive incentive schemes in order to align the interests of executive directors to the long-term health and resilience of the company. The directors' duties, under some jurisdictions, are conceptually capable of being applied to corporate governance failures in the identification, assessment, oversight, and disclosure of climate risks.

One of the board's most important responsibilities is to oversee the management of risk, but an increasingly complex and fast-evolving risk landscape makes this task harder than ever since ESG issues are becoming more apparent. Climate change is accelerating and affecting people in a variety of ways, from more catastrophic weather to technological change, business model disruption, regulatory risk, and changes in customer behavior. Shareholders' action and litigation may be brought against boards that fail to appropriately handle climate concerns. The rules established by the US Securities and Exchange Commission (SEC), Public Company Accounting Oversight Board (PCAOB), and the stock exchanges provide a well-established framework for the board's oversight of financial statement disclosures. This task is not easy to complete since climate risk is a rapidly evolving concept with no standard way to evaluate a company's disclosure practices meaning that making decision about what constitutes useful disclosures and for boards overseeing and monitoring these disclosures is demanding. There are several, voluntary, climate-risk reporting frameworks. Among them, the most popular, include those from the Global Reporting Initiative, Carbon Disclosure Project, Climate Disclosure Standards Board, the Financial Stability Board's Taskforce on Climate-related Financial Disclosures (TCFD), and Sustainability Accounting Standards Board. It would be useful to harmonize this approach and align climate risk disclosures with the recommendations of the TCFD. The latter aims at setting up recommendations for voluntary climate-related financial disclosures that are "consistent, comparable, reliable, clear, and efficient, and provide decision-useful information to lenders, insurers, and investors." However, the SEC has not adopted mandatory, climate-related information in securities law disclosures.

Overseeing climate disclosure is a responsibility that may be taken by few committees [17], such as the risk, compensation and audit committees or by a specific committee appointed by the board that might assume and manage primary responsibility for all aspects concerning the topic. In reality, the majority of the boards choose something in between those two choices.

Just few people in a company are real climate experts therefore training at all levels throughout an organization from people setting strategy to direction and top management is the key. Transitioning to a global, low-carbon economy is a challenging goal for both directors and senior management and employees. Many of them working in transitioning industries do not doubt the truth of climate change, but at the same time they are concerned about their future prospects in the transition to a net-zero society. Companies can only truly realize their net zero ambitions if targets are reached in an inclusive manner.

[17] See Marsh & McLennan Companies/NACD. Climate change: the implications for boards. Article Series 2020.

CHAPTER II

GREEN FINANCE

An analysis on green finance: importance gained and future developments

Defining green finance may be challenging since there are many possible definitions but for the purpose of this analysis, it can be defined as any financial initiative, process, product, or service that is either designed to protect the natural environment or to manage how the environment impacts finance and investment [18]. The term green finance is used to label activities interconnected to the environment, finance, and investment. Related terms to green finance include responsible investment, environmental, social, and governance (ESG), sustainable finance, and climate finance. Even though they are treated synonymously, there are differences in the scope of the terms, particularly in relation to whether they include social and governance issues. These issues usually relate to the definition of "sustainable finance" or "responsible investment", whereas those that only focus on environmental issues are more likely to be termed "green finance". If the only topic to be concerned with is about preventing or responding to climate change, the term "climate finance" may be used. It is a widely shared concept that it is not possible to knock off the environment from society. For this reason, the need to improve standards of living and to reduce inequality can't be separated from the need to protect our environment for both high-income and low-income countries. The United Nations Environment Program [19] defines a sustainable financial system as "one that creates, values, and transacts financial assets in ways that shape real wealth to serve the long-term needs of an inclusive, environmentally sustainable economy". Green finance also refers to products and services, managing current and future environmental risks; organizational strategies; organizations themselves; as well as investment sectors, industry initiatives, and policy instruments. Finance and investment can help or hurt environmental results, and the environment can influence the success of investments and finance activities in a favorable or negative way. This term can either refers to a specific product or service as well as to an industry sector or organizational approach. As mentioned earlier, green finance refers to a wide range of financial products and services that can be split into three categories: banking, investment, and insurance. Examples of these include green bonds, green-tagged loans, green investment funds, and climate risk insurance.

Once defined the green finance, it is essential to understand the concept of a "green" product. In many cases, the "green" aspect of the product relates to the asset – such as investments in clean energy projects or reforestation. In other cases, the features of the product are designed to encourage or reward environmentally-

[18] Definition by NACD. Climate change: the implications for boards. Article Series 2020.
[19] Chartered Banker Institute. The Green Qualifications Workbook – Chapter 1.

friendly activity – such as mortgages that are discounted in line with a property's energy efficiency, or investment that links the sustainable management of resources with funding limits or collateral requirements. Other products, even though are labeled as "green", may not be universally accepted as such. Examples are:

- Financial products (e.g. credit cards) which offer a donation to environmental protection work in reward for a certain level of spending
- Financial products, which respond to an environmental issue (such as flood insurance) but do not seek to address the causes of this issue (such as climate change)
- Financial products which minimize the environmental impacts of the provider's operations (such as using recycled paper) or which offset the customer's normal activities (such as the carbon emissions generated by air travel)

The inclusion or not may depend on the boundaries that define green finance. The same concept applies to sectors defined as "green". It is generally accepted saying that some sectors are more universally accepted as "green" than others. Green industry areas, for instance, are renewable energy production, distribution, and storage, energy efficiency in domestic and industrial buildings, green transport, recycling, pollution prevention, water conservation, and forestation. Instead, carbon capture and storage (CCS), nuclear energy and fossil fuel efficiency are more or infrequently cited as "green" areas. Finance may help these areas in a variety of ways, such as providing long-term financing for new renewable energy projects, green mortgages which tie repayments to household energy efficiency improvements or providing venture capital for innovative new storage technologies. Sometimes projects may have to compete with environmental and social impacts and this can often lead to controversial financing decisions.

Today, financing mitigation and adaptation to climate change and sustainability remains one of the primary challenges. To solve the problem, a significant quantity of money is required and, specifically, an investment of $53 trillion in energy-related investments by 2035 is necessary to maintain the Paris Agreement's 2°C temperature target. The Green Climate Fund (GCF) was set up in 2010 by 194 countries with the goal of providing financial assistance to developing countries in order to help them reducing greenhouse gas emissions and adapting to climate change. Since then, the term "green finance" has shown up in numerous studies of international organizations (for example, the IFC, 2017) and national governments. Academics have also been paying close attention to relevant debates. The mere definition of Green finance, on the other hand, is sometimes a blurred concept frequently confused with climate finance. For such a reason it is often difficult to distinguish between the two. According to International Finance Corporation (IFC 2017), green finance is defined as "financing of investments that provide environmental benefits", whereas climate finance is proposed and defined by the United Nations Framework Convention on Climate Change (UNFCCC) as "local, national or transnational financing-drawn from the public, private and alternative sources of financing-that

seeks to support mitigation and adaption actions that will address climate change" [20]. Even though the meaning can be slightly different, the core concept at the base of both definitions is the financing tools for coping with climate change and others for sustainability.

Bond instruments: Green bond, Social bond, Sustainability bond, and Transition bond

The releases of Green Bond Principles [21] (GBP) in 2014, based on a voluntary coalition of banks, issuers, and investors named ICMA (International Capital market association), developed guidelines and issued non-perspective recommendations for the best practices in the market. The GBP is accompanied by the Social Bond Principles [22] (SBP), the Sustainability Bond Guidelines [23] (SBG), and the Sustainability-Linked Bond Principles (SLBP). The distinction between labelled and unlabeled bonds, sponsored by the GBP, boosted the growth of green bonds issuance. Following the release of the GBP, there was a huge surge in green bond issuances of $36.6 billion USD in 2014, nearly tripling the amount issued in 2013. Since then, government and private institutions entered in the market and played a critical role. The principles are a set of voluntary frameworks with the declared aim and vision of enhancing the role of global debt capital markets in financing progress towards environmental and social sustainability. The principles highlight the best procedures for issuing bonds with social and/or environmental goals, aligned with global rules and recommendations that enhance transparency and disclosure in order to preserve market integrity. The principles also improve the knowledge of financial market players about the relevance of environmental and social issues, with the purpose of attracting more capital to support sustainable development. The principles seek to support issuers in financing environmentally sound and sustainable projects that foster a net-zero emissions economy and protect the environment. Moreover, the GBP promotes a step change in transparency that facilitates the tracking of funds for environmental projects, while simultaneously it aims to improve insight into their estimated impact. Investors, banks, underwriters, arrangers, placement agents, and others can use the GBP's recommendations about the methodology and disclosures used by issuers, to understand the features of each green bond. The GBP stresses the importance of information that can be considered transparent, accurate, and integrate and which will be disclosed and reported by issuers to stakeholders through core components and key recommendations. The four key core components for alignment with the GBP are:

- Use of Proceeds
- Process for Project Evaluation and Selection
- Management of Proceeds

[20] A bibliometric analysis on green finance: current status, development, and future directions.
[21] Green bond Principles: voluntary process Guidelines for Issuing Green Bonds.
[22] Social bond Principles: voluntary process Guidelines for Issuing Green Bonds.
[23] Sustainable bond Principles: voluntary process Guidelines for Issuing Sustainable Bonds.

- Reporting

The key recommendations for heightened transparency are the green bond frameworks and external reviews. A green bond can be defined as such if the proceeds of the bond are used for an eligible green project, which should be appropriately defined in the legal documentation of the security. All green projects that have been certified as eligible, should produce evident environmental benefits that will be examined and, when possible, quantified by the issuer. In case part of the proceeds are or may be used for refinancing, the issuers should disclose an estimate of the share of financing vs. re-financing, and if necessary, also explain which investments or project portfolios may be refinanced, and, to the extent relevant, the expected look-back period for refinanced eligible green projects. Even not exhaustive, the following list [24] of project categories reflects the most common types of projects supported or expected to be supported by the green bond market:

- Terrestrial and aquatic biodiversity conservation (including the protection of coastal, marine and watershed environments);
- Clean transportation (such as electric, hybrid, public, rail, non-motorized, multi-modal transportation, infrastructure for clean energy vehicles and reduction of harmful emissions);
- Sustainable water and wastewater management (including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flooding mitigation);
- Climate change adaptation (including efforts to make infrastructure more resilient to impacts of climate change, as well as information support systems, such as climate observation and early warning systems);
- Circular economy adapted products, production technologies and processes (such as the design and introduction of reusable, recyclable and refurbished materials, components and products; circular tools and services); and/or certified eco-efficient products;
- Green buildings that meet regional, national or internationally recognized standards or certifications for environmental performance.

It is worth noting that definitions of green and green projects may also vary depending on sector and geography and that there exist many institutions that supply independent analysis, advices, and guidance on the quality of different green solutions and environmental practices.

The expression green bond is generally referred to a fixed-asset class, which is similar in the financial structure to conventional corporate and government bonds (e.g. similar in pricing, mechanism, rating, etc.) and that

[24] See Green bond Principles: voluntary process Guidelines for Issuing Green Bonds.

differ in the use of their proceeds earmarked by the issuer in projects with environmental benefits. The 2007 was a crucial year since the European Investment Bank issued the first green bond, the new fixed-income instrument labelled as the Climate Awareness Bond, which raises around 0.9 USD billion funds to allocate in eligible green projects. Initially, from the 2007 to the 2013, the green bond market was substantially driven by supranational issuers, such as multilateral development banks i.e., EIB and World Bank. Moreover, during the early stages, this emergent instrument probably lacked a world agreed definition and a common ground of settings. According to the Green Bond Principles, 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. Therefore, unlike "vanilla" bonds that finance the general working capital of the issuers, green bonds should be used only in relation to green projects, investments, expenditures, or assets helping to address climate and environmental issues. At the same time, the buyer of a green bond will usually recourse to the issuer's entire balance sheet, meaning that the investor is not exposed directly to the financial risks of the specific projects financed by the green bond [25]. The first green bond was issued by the World Bank in cooperation with the Swedish bank SEB in 2008. Since then the global green bond market has grown from 11 billion USD issued in 2013 and 36 billion USD issued in 2014 (OECD 2016) to 167 billion USD issued in 2018 (Climate Bonds Initiative 2019). Cumulative issuances up to 2018 are 521 billion USD (Climate Bonds Initiative 2019).

Some eligible green projects may have social co-benefits and so the classification of the use of proceeds bond as a green bond should be determined by the issuer based on its primary objectives for the underlying projects. It is essential to remember that green bonds should not be considered fungible with bonds that do not follow the GBP's four key components. The issuer of a green bond should disclose information about:

- the green project's objective;
- the process by which the issuer determines how the projects fit within the eligible green projects' categories;
- the process by which the issuer identifies and manages perceived social and environmental risks associated with the relevant project(s).

Other practices are encouraged to be done: place the information described above in the context of the issuer's larger environmental sustainability objectives, strategy, policy, and/or processes; provide information, if relevant, on the alignment of projects with official or market-based taxonomies, related eligibility criteria, including if applicable, exclusion criteria; and also disclose any green standards or certifications referenced in project selection. Further, the GBP establishes a methodology for identifying mitigants to known material risks

[25] From Climate Bonds Initiative.

of negative social and/or environmental effects from the relevant project(s). Clear and relevant trade-off analysis and monitoring are examples of such mitigants if the issuer considers the possible risks to be significant.

Issuers should promptly disclose information on the use of proceeds to be renewed annually until full allocation. The annual report should comprehend a list of the projects to which green bond proceeds have been allocated, as well as a brief description of the projects, the amounts allocated, and their expected impact. When the amount of details that can be made available is limited by confidentiality agreements, competitive considerations, or a large number of underlying projects, the GBP suggests presenting information in generic terms or on an aggregated portfolio basis (e.g. percentage allocated to certain project categories). The GBP also suggests the use of qualitative and, when possible, quantitative performance indicators in order to respect the transparency principle.

Social bonds are defined [26], according to the principles, as any type of bond instrument where the proceeds, or an equivalent amount, will be exclusively applied to finance or re-finance in part or full new and/or existing eligible social projects and which are aligned with the four core components of the SBP. The social bonds principles, including the four major components and key recommendations for heightened transparency, are the same applying to green bonds. The list [19] of social projects categories this time includes:

- Affordable basic infrastructure (e.g. clean drinking water, sewers, sanitation, transport, energy)
- Access to essential services (e.g. health, education and vocational training, healthcare, financing and financial services)
- Affordable housing
- Employment generation, and programs designed to prevent and/or alleviate unemployment stemming from socioeconomic crises, including through the potential effect of SME financing and microfinance
- Food security and sustainable food systems (e.g. physical, social, and economic access to safe, nutritious, and sufficient food that meets dietary needs and requirements; resilient agricultural practices; reduction of food loss and waste; and improved productivity of small-scale producers)
- Socioeconomic advancement and empowerment (e.g. equitable access to and control over assets, services, resources, and opportunities; equitable participation and integration into the market and society, including reduction of income inequality)

The target population can include poor people, excluded and/or marginalized communities, people with disabilities, migrants, displaced persons, undereducated, underserved owing to a lack of quality access to

[26] Social bond Principles: voluntary process Guidelines for Issuing Green Bonds.

essential goods and services, unemployed, women and/or sexual and gender minorities, aging populations and vulnerable youth and other groups.

The principles also explain the definition of a Sustainable bond [27] as any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance a combination of both green and social Projects. Both sustainable and social bonds are aligned with the four core components of both the GBP and SBP. The issuer of a social or sustainable bond should communicate to investors the same objectives and set of information stated above. In the market there are different types of green/social bonds, precisely four:

- Standard Green/Social Use of Proceeds Bond: a standard recourse-to-the-issuer debt obligation aligned with the GBP;
- Green/Social Revenue Bond: a non-recourse-to-the-issuer debt obligation aligned with the GBP in which the credit exposure in the bond is to the pledged cash flows of the revenue streams, fees, taxes etc., and whose use of proceeds go to related or unrelated Green Project(s);
- Green/Social Project Bond: a project bond for a single or multiple Green Project(s) for which the investor has direct exposure to the risk of the project(s) with or without potential recourse to the issuer, and that is aligned with the GBP;
- Green/Social Securitized and covered Bond: a bond collateralized by one or more specific Green Project(s), including but not limited to covered bonds, ABS, MBS, and other structures; and aligned with the GBP. The first source of repayment is generally the cash flows of the assets. Project revenue is used to repay the bond, and recourse is limited to the collateralized asset.

Another important definition to be considered related to transition finance [28] which refers to instruments financing activities that are not low- or zero-emission (i.e., not green), but have a short- or long-term role to play in decarbonizing an activity or assisting an issuer in its transition to Paris Agreement. The transition label includes a broader range of industries and activities. Generally, and until now, transition bonds originate from highly polluting, and hard to-abate industries. They are not considered green bonds since they are a critical component of a transition to net zero. Example sectors include extra actives such as mining; materials such as steel and iron, chemicals, and cement; and industrials including aviation and shipping.

The new category of Transition bonds is expected to reduce carbon emissions and play a vital role in global financial markets in 2021 [29]. However, data from BloombergNEF reveals that until May 2021 only six

[27] Sustainable bond Principles: voluntary process Guidelines for Issuing Sustainable Bonds.
[28] Caroline Harrison and Lea Muething. Sustainable debt global state of the market.
[29] Oxford Business Group. Transition bonds: a new tool to fund the shift towards climate sustainability?

transition bonds had been issued and a total of 11 were issued during 2020 according to analysis performed by the non-profit organization Climate Bonds Initiative (CBI). Even though 2021 does not show a huge increase in transition bonds issued, some facts suggest that they will play a more pivotal role moving forwards. In February 2021, the London Stock Exchange announced the establishment of a transition bond segment on its sustainable bond market, while there have been calls for Japan's Ministry of Economy, Trade, and Industry to introduce a goal of selling 30 transition bonds by 2023. Another important decision came from the Asian Development Bank (ADB) announcing that it would no longer fund coal mining or oil and natural gas production and exploration. Although this announcement made companies dealing with fossil fuel production worry, it also represents a clear sign of future transition bonds in emerging markets, as the bank noted that it would continue to provide financial support for plants transitioning to cleaner solutions. Transition bonds are likely to gain most from broader global trends toward sustainable or green financing in the future. Analysis from the Climate Bonds Initiatives organization released in April 2021, has found that, despite the severe economic impact of Covid-19, a record $700bn in green, social and sustainable finance was issued last year, almost double the $358bn witnessed in 2019. Indeed, in March Standard & Poor's Global predicted that transition finance could account for $1trn of the estimated $3trn in annual funding needed to meet long-term climate goals. One of the earliest examples of a transition bond was issued in 2019 by a Brazilian beef producer, Marfrig who had previously tried unsuccessfully to issue a green bond in an attempt to clean up its supply chain by using funds to buy only from suppliers that had committed to not destroying the rainforest. According to Mark Carney [30] "If we are concerned about this whole economy transition and we are concerned about mainstreaming sustainable finance then you need that whole transition bucket in the middle rather than just 'green' and 'brown' finance." The potential investments that would be covered by the transition bond's definition are much broader than the green bond's definition meaning that there would be a much bigger audience and probably a pricing advantage [31] . One common critique is that many of these transition bonds are overly ambitious, with the lack of defined international norms raising concerns about "transition-washing" by corporations. For this purpose, the Switzerland-based industry trade group International Capital Market Association published the "Climate Transition Finance Handbook" in December 2020 which seeks to provide clear guidance and common expectations to capital markets participants on the practices, actions, and disclosures to be made available when raising funds in debt markets for climate transition-related purposes. Also, the London Stock Exchange welcomes the publication of ICMA's Climate Transition Finance Handbook. The Climate Transition Finance Handbook acts as an additional guidance for issuers seeking to utilize green bonds, sustainability bonds, or sustainability-linked bonds with the aim of constructing and then achieving their climate transition strategy. According to the London stock exchange [32] transition bonds belong

[30] March 2020 statement from Mark Carney speaking before the UK's House of Lords EU Financial Affairs Sub-Committee.
[31] Michael Ferguson, who works on sustainable finance at S&P, who noted in a 2019 interview.
[32] London Stock Exchange, Transition bond segment.

to the category of sustainable debt finance instrument in which the issuer uses debt markets to raise funds for climate and/or transition-related goals. They can take the following forms:

- Use of Proceeds instruments, defined as those aligned to the Green and Social Bond Principles or Sustainability Bond Guidelines; or
- General Corporate Purpose instruments aligned to the Sustainability-Linked Bond Principles.

Issuers displaying transition bonds on the segment will need to meet the following criteria:

- Publish a transition framework prepared in accordance with the ICMA Climate Transition Finance Handbook;
- Disclose in line with the principles outlined by the Task Force on Climate-related Financial Disclosures or another global recognized standard, or commit to do so within a reasonable timeframe;
- Confirm its commitment to the goals of the Paris Agreement, including approved targets to achieve net-zero emissions by 2050; and
- Commit to report annually on its transition performance

The financial sector is becoming increasingly important in fostering the transition to sustainability and carbon neutrality. One reason is the need to raise huge sums of private capital in order to meet the investments required for reaching the climate targets of the Paris Agreement and the UN Sustainable Development Goals. This is not the only reason. Another important point is about the efficient way through which the finance sector makes capital allocation. As a result, the financial industry is the main area for influencing what happens in economies around the world. All this is possible through several pathways such as fiscal and monetary policy, investor concerns about unsustainable business practices leading to stranded assets [33] , investor concerns about climate policy and climate impact risks [34], better transparency on who is financing unsustainable economic activity [35]and better understanding of how the so called environmental social and governance (ESG) dimensions impact the financial performance of assets. Two are the key elements at the base of fostering sustainable transition: the development of a taxonomy of sustainable economic activity and the establishment of standards for sustainable financial products including a new voluntary EU green bonds standard based on the taxonomy as declared by the European Commission. According to a survey conducted by the "Journal of Sustainable Finance & Investment" [36] the three major incentives to issue green bonds are: broadening the investor base, lower capital costs, and meeting investor demand for sustainable investment products. Although the financial

[33] McGlade and Ekins 2015; Material Economics and SEI 2018).
[34] Bloomberg et al. 2017.
[35] Global Canopy Programme 2016; Galaz et al. 2018; Folke et al. 2019; Gardner et al. 2019.
[36] Aaron Maltais & Björn Nykvist (2020): Understanding the role of green bonds in advancing sustainability, Journal of Sustainable Finance & Investment, DOI: 10.1080/20430795.2020.1724864.

incentives are more prominent amongst issuers compared to investors since it is the issuer that benefit financially from the high demand for green bonds and the lower interest rates they can secure, the financial drivers of a green investment are still considered weak among issuers. Despite the fact that nearly all of the responding issuers state the rebate they receive for issuing green bonds more than covers the additional cost of green certification and reporting, the cost of capital benefits appears to be too small. Securing access to capital was actually the most often cited financial benefit among issuers. The large majority of respondents believe that the access to financing will be more and more dependent on the sustainability of borrowers. Issuing a green bond is also a way to share and transmit a message to the community by a company. It can also be perceived as a stamp of quality for the organization which seeks to secure customer demand and loyalty by demonstrating the integration of sustainability into their business practices. These are branding incentives. However, the target of this branding is not clearly directed toward the customers of issuers. For example, a real estate company may sell its rental spaces to clients as environmentally friendly, but the fact that the building was financed (or, more likely, refinanced) with a green bond does not appear to be information that the renter cares about. Rather, the real estate company's consumers can relate to green building grading and certification systems. Once the project is finished, green finance is put on, and this labeling or branding satisfies the interests of the company's lenders (i.e. institutional investors or banks).

The growth of sustainable investing

The European Commission in 2018 in its Action Plan defined sustainable finance as “the process of taking due account of environmental and social considerations in investment decision-making, leading to increased investments in long-term and sustainable activities. More specifically, environmental considerations refer to climate change mitigation and adaptation, as well as the environment more broadly and related risks (e.g. natural disasters). Social considerations may refer to issues of inequality, inclusiveness, labor relations, investment in human capital and communities. Environmental and social considerations are often intertwined, especially as climate change can exacerbate existing systems of inequality. The governance of public and private institutions, including management structures, employee relations and executive remuneration, plays a fundamental role in ensuring the inclusion of social and environmental considerations in the decision-making process.”

Sustainable investing enables retail and professional investors to select their investments based on their individual values and priorities without sacrificing financial returns. The focus on sustainable investing has skyrocketed during 2021. In May 2021, Fitch Ratings noted that green bond fund assets under management (AUM) had increased by 80% year-on-year to reach EUR22bn (USD26bn) at the end of Q1 2021. The broader market has seen bond fund AUM increase by 4% over the same period. Such funds would likely be restricted to buying bonds bearing the green label. Not only green funds, but also funds with softer mandates bearing

labels such as Sustainable, ESG, SDG, Paris Aligned and so on which often include a preference for green bonds where available, are subject to demand.

In a year characterized by uncertainty the report on Sustainable Debt Global State of the Market published in 2020 [37] shows that green issuance rebounded in the second half of 2020 to reach a record-breaking USD290.1bn by the end of December, compared to the prior record of USD266.8bn set in 2019. This was possible thanks to the government support packages which led issuers to cautiously returned to the market. Many public sector issuers turned to social and/or sustainability-themed bonds to help alleviate the severe economic shock caused by the pandemic. By September, confidence had returned, and businesses that had delayed green bond issuance earlier in the year were ready, resulting in the most active third quarter in green bond history. October and November remained active prior to the US election when issuance slow down as the year progressed.

The number of external reviews highlights how much emphasis investors are putting on the integrity of the green label. The number of Certified Climate Bonds (CCB) also increased and reached a cumulative total of USD150bn – or 15% of the market – in October 2020.

Four-fifths of the overall green volume originated from developed markets (DM) in 2020, compared to 73% in 2019. Emerging markets (EM) accounted for 16% versus 22% the prior year, while the contribution of supranational entities (SNAT) was 4% against 5% in 2019. Chinese issued a lot of social bond, affecting the overall emerging markets number. The volume of bonds issued has increased in Europe in 2020, accounting for a large portion of green debt in 2020, specifically it is responsible for USD156bn or 48% of the total. European issuance was pulled by government backed entities and non-financial corporates, each contributing 25%. The support of government and the existence of policies are creating more opportunities for private sector like the automotive sector which issued debit green bonds in 2020. North America remained broadly flat on the number of issued bonds (about USD60bn). The Latin America & Caribbean region exhibited close to 65% growth compared to the prior year, reaching USD7.9bn in 2020. More than half of the total originated from Chile, including four sovereign bonds worth a total of USD3.8bn. Africa had its strongest year yet, with USD1.2bn in green debt originating from.

The COVID-19 negatively affect Asia-Pacific and SNAT which register a drop in the bonds issued. Bonds were issued to sustain healthcare, medical supplies and other immediate needs arising from the pandemic. Most of the green bonds have originated in the US with a total of USD52.1bn (18%), issued between August and November. Even though the US market had the largest number of individual issuers with 144, its private sector green bond market is still underdeveloped and continues to lack large, benchmark-sized green bonds

[37] Prepared by Climate Bonds Initiatives.

with adequate transparency. The market is dominated by municipal issuers. The second and third largest source of green debt were respectively Germany and France.

Broadly speaking, 2020 was characterized by growth in public sector issuer types while private sector volumes either remained static or shrunk. Since public sector issuers typically make long term investment, they result less vulnerable to market dynamics. An exception are banks, as many turned their attention to issuing bonds under the social label to address the impacts of COVID-19. Moreover, the most significant growth was experienced by Government-backed entities. More than 62% of the 2020 green bond volume had a maturity of up to 10 years, with almost 40% having a 5-10-year maturity, which was the largest individual bracket. Among the 5-10-year bonds, half of the amount originated from financial and non-financial corporates. Energy, building and transport were the three largest use of proceeds categories in 2020 contributing for 85% to the total. Moreover, energy, transport and land use categories have expanded in 2020. Investments in renewable energy increased by 19% compared to 2019. About half of such investments came from financial and non-financial corporates, including energy companies. While the building category remained more or less the same, the land use reported a growth of 59% in 2020 even if it still remains one of the smaller categories, contributing 5% overall.

Green bonds with external reviews accounted for 89% of qualifying instruments in 2020, 7% more compared to 2019. Climate Bonds actively encouraged greater market transparency through disclosure and celebrates this development. As above-mentioned, the increasing number of external reviews highlights how much investors care about the integrity of the green label accompanied with a greater awareness of the risks of greenwashing. On the other hand, issuers are keen to avoid liabilities associated with 'getting it wrong'. The volume of Certified Climate Bonds grew by 14% in 2020. The most used external review is the second party opinions which volumes increased by 17% year-on-year. Interestingly, the number of bonds in that category declined by 2% over the period, which suggests that SPOs are being sought for larger individual bonds. Some issuers sought external reviews from multiple sources and for this reason the sum of external review volumes is greater than the total amount of green bonds issued in 2020.

Sustainable bond issuance has skyrocketed in 2020, having almost reached 2019 levels in the first half of the year. In 2020, sustainability bond issuance increased by 131% compared to 2019. Development banks generate 68% of sustainability bond issuance. Europe was responsible for a solid growth of 43%, accounting for a 20% of total 2020 issuance. Almost half of the volume came from local governments. North America was among the regions showing the most impressive development and the USA placed second in the country ranking with USD9.9bn. Issuance grew by 164% year-on-year from USD3.9bn to USD10.4bn mainly due to several benchmark sized deals from non-financial corporates issued in the second half of the year. Issuance from Asia-Pacific remained almost static. Over 80% of the bonds issued in 2020 had an original maturity of up to 10

years. The 0-5 year bracket was the largest, with 43% of the issuance volume. The longest dated bond came from the World Bank, with a 50-year maturity.

The social bond market exploded in 2020, recording a more than 10-fold increase (1017%) year-on-year, the sharpest annual growth in any theme since the inception of the GSS debt market, reaching USD249bn in issuance. The number of issuers using social labels grew by a similarly astonishing number and encompassed a broader range of countries and currencies than ever before. The rapid increase can be linked in a large part to the COVID-19 pandemic's consequences, as well as to the bond issuers' growing desire to address health and other social concerns in a more strategic manner. Pandemic bonds contributed significantly to the rise, accounting for 34% of all social bond issuance in 2020. Climate Bonds' definition of a pandemic bond is a use of proceeds instrument financing COVID-19 response measures under a label specifically related to this. Almost all regions were characterized by high level of bonds issuance in 2020, apart from Africa. Non-financial corporates saw the most impressive increase, from USD2.4bn to USD50.5bn, which translates into almost 2000% (20x) growth. This is significant because it demonstrates that the private sector was increasingly valuing labelled instruments and channeling funds directly to social projects. Non-financials accounted for 20% of the overall issuance volume in 2020, with Chinese issuers primarily bringing pandemic bonds to market. Financial corporates more than quadrupled their volume, with Citigroup and Bank of America issuing the largest deals. Deals' size was similar to the sustainability bond space. Social bonds are typically short-term bonds with a tenor of up to 5 years. Volumes had decreased toward longer-dated bonds and so the 5-10-year bracket makes up 24%, and tenors beyond 20-years only 6%.

The speed at which the sustainable finance landscape is currently evolving is surprisingly. An interesting aspect of the green finance is the above-mentioned transition finance. Despite the fact that the green bond market is rapidly expanding and providing a natural answer for issuers who can already identify acceptable assets, projects, and activities that meet current green standards; the universe remains small. By the end of 2020, 11 bonds had been issued with the transition label, including bonds from energy company SNAM, as well as a recent deal from the Bank of China. There are lots of rumors and debates around the transition bonds. Main issues concern the relevance, reliability, and availability of transition pathways – and thus the appropriate uses of transition bond proceeds – for specific sectors.

The EU is a global leader in the fight against climate change, with the goal of becoming the world's first climate-neutral economic union by 2050. Further, the EU is committed to the UN 2030 agenda for sustainable development with the stated intention to embed the Sustainable Development Goals (SDGs) into all policies and encourage all member states to do the same. Further, the EU is committed to the UN 2030 agenda for sustainable development with the stated intention to embed the Sustainable Development Goals (SDGs) into all policies and encourage all member states to do the same. In Europe, the climate agenda is more significant

than in any other region. The EU has been a pioneer in setting policies, rules and targets aimed at assisting the transition to a carbon-neutral, climate-resilient economy. Among them, it is worth mentioning the efforts to build the Green, Social, and Sustainability (GSS) bond market as an efficient funding mechanism for the public and private sectors to accommodate the necessary borrowing for the transition. European leadership in the form of institutional and policy support is contributing to the growth of the GSS bond market through four paths:

- climate and economic policy;
- a climate-resilient, sustainable growth plan;
- regulation and standardization of frameworks, taxonomies, data and disclosure;
- the ECB include such bonds in its quantitative easing buying program, and its operational expenditure is linked to sustainability. The European Central Bank's Banking Supervision department has also asked to banks to develop a climate risk assessment and climate action plans for evaluation in 2021. Climate stress testing at the bank level will begin in 2022.

The European green bond market

Since the European Investment Bank inaugurated the green bond market in 2007 with its Climate Awareness Bond, the market has grown very fast, although it still accounts for just about 3 to 3.5 percent of total bond issuance. As stated above, the Commission's proposal [38] aims to establish an official EU standard for green bonds aligned with the EU taxonomy for sustainable activities, based on a registration system and supervisory framework for external reviewers of European green bonds. This proposal, named EU green bond standard (EU GBS), is currently under examination by the co-legislators. The proposal is based on the EU taxonomy for sustainable activities, and complements a series of other measures included in the action plan on sustainable finance (2018) and, more recently, in the new strategy on sustainable finance (2021). Within the European Parliament, the file has been assigned to the Economic and Monetary Affairs (ECON) committee. In the Council, the working party on financial services is meeting to discuss the dossier. The objective pursued, according to the Paris Agreement, requires significant investment. Green bonds are increasingly becoming popular and in fact the related market at EU level, grew an average of 50% per year in the period 2015-2020. Nevertheless, it represented only 3 to 3.5% of overall bond issuance in 2020. Despite projections, made by the European Parliamentary Research Service, predict that the market will reach US$1 trillion of yearly global issuance in 2023 (see Figure 1), there is a need for more fast expansion and rapid growth of a high-quality green bond market to fulfill the targets in the Paris Agreement.

[38] See European Parliamentary Research Service (EPRS), 2022. European green bonds: A standard for Europe, open to the world.

Figure 1 – Green bonds issued by year (globally)

Figure (1) from Climate Bonds Initiative (2021)

Figure 2 – Share of global green bonds issued in €

Figure (1) from Climate Bonds Initiative (2021)

Figure 2 shows that the EU is a global leader in green bonds, with 48 % of global issuances in 2020 being denominated in euros and 51 % of the global volume of green bonds being issued in the EU. In terms of volume, in 2020 the US was the top country of issuance, followed by Germany, France, China and the Netherlands; Sweden and Spain were also among the top 10 countries worldwide. Europe has pioneered the green bond market, thanks to the world's first green bond issued by the EIB in 2007 as a Climate Awareness Bond (CAB). Today, the EIB is the largest supranational issuer and is spearheading application of the EU taxonomy and EU GBS, championing EU standards globally. In its Climate Bank Roadmap 2021-2025, the EIB committed to gradually aligning CABs and Sustainability Awareness Bonds (SABs) with the proposed EU GBS. It was the first issuer to do so, describing the transition to the new EU regulatory framework in its 2020 CAB Framework and 2020 SAB Framework. The EIB has helped to develop the EU taxonomy and EU GBS in the Commission working groups, and published the White Paper on the Need for a Common Language in Green Finance in 2017.

Of course, nothing is simple as it may appear. For this reason, many obstacles impact and prevent the development of the green bond market such as issues for issuers and investors, and problems in the external review market, among others. Possible future consequences are market disruption from greenwashing, a lack

of supply of green bonds, and limited impact. More in detailed, the EU Commission identified three main barriers [(2)] that hinder the expansion of the green bond market:

- lack of agreement on a common definition of green projects and green bonds;
- often complex review procedures for green bonds;
- lack of investable projects and assets.

The Commission identified problems both for investors (costly/difficult to identify high-quality green bonds) and issuers (additional costs of issuing a green bond due to market fragmentation, uncertainty around green assets, and potential reputational risks). For the external review market, the Commission identified possible issues in its heterogeneity and lack of transparency, and possible conflicts of interest. The possible consequences are:

- potential future market disruption from greenwashing;
- not enough high-quality green bonds being issued compared to market demand;
- the risk that not enough investment will be channeled towards projects with a substantial impact.

Moreover, taking into consideration the expected growth of the green bond market, also these issues are likely to expand and grow leading to an increase of the risk of high-impact/visible greenwashing incidents which can lead to serious reputational problems. The Green Bond Principles of the International Capital Market Association (ICMA) and the Climate Bonds Standard developed by the Climate Bonds Initiative (CBI) are the two market standards. Due to less stringent criteria, the former dominates the market. This voluntary standard, initially based on best practice guidelines established in 2014 by a consortium of investment banks, has been developed and monitored by an independent secretariat hosted by the International Capital Market Association (ICMA). The guidelines, de facto considered global standard, were updated in 2018 and June 2021. The Next Generation EU green bonds are also aligned with the GBPs. While the standard defines a clear process for project selection and allocation of funds, it lacks a clear definition of green economic activities and only recommends a third-party external review. These two elements are the most important differences with the EU GBS. The climate bonds standard put in place stricter requirements and therefore it entails fewer users. In addition to the ICMA standard's core standards, the CBI standard contains a taxonomy with screening criteria to determine green economic activities, as well as the requirement that green bonds be certified by recognized external reviewers. Around a quarter of all green bonds will be issued under the CBI standard by 2020. In 2015, the People’s Bank of China (PBOC) issued the first guidelines defining criteria and categories for green bond projects, and a taxonomy in the form of a Green Bond Endorsed Project Catalogue. In April 2021, the PBOC issued a new catalogue of projects that are eligible for green bond issuance, which came into effect on 1 July 2021. On 29 May 2018, the Parliament, in its resolution on sustainable finance, ascertained the need to

regulate green bonds and that the EU lacks a unified standard for green bonds, which should build on a sustainable taxonomy. It also declared that periodic report on the environmental impact on the underlying assets together with a supervision by public authorities should be put in place. Green bonds, according to Parliament, should include a reverse environmental impact and support a reduction in the use of fossil fuel assets, as well as exclude certain sectors – particularly those that have a significant negative impact on climate – and not violate core social and human rights standards. Parliament called on the Commission to regularly assess the impact, effectiveness and supervision of green bonds. The Commission is also required to consider mechanisms to enable SMEs to bundle projects, thereby allowing them to access the green bond market also through the use of digitalization process and green FinTech. Parliament underlined the need for an EU GBS, and supported the Commission's pledge to explore enabling frameworks such as green bond standards to promote sustainable public investment. Parliament deemed that a significant share of the EU bonds to be issued in the context of the Recovery plan for Europe should be based on the EU GBS. The proposed regulation would create a voluntary 'gold standard' for green bonds, the 'European green bond standard' introducing uniform requirements for issuers of bonds that named their bonds "European green bond" (EuGB). It would also set up a registration system and supervisory framework for external reviewers of European green bonds. Both EU and non-EU issuers, can make use of the standard. The main requirement would be alignment with the EU taxonomy, as issuers should allocate 100 % of the proceeds of the bond to finance taxonomy-aligned economic activities, before maturity of the bond. The new standard would allow the funding of long-term projects (up to 10 years) for economic activities aligned with the EU taxonomy, and it would help issuers to finance their green transition. There is broad support for the proposal, but also different views on the more controversial provisions: voluntary standard (vs mandatory), 100 % taxonomy alignment (vs more flexibility), partial grandfathering (vs full or no grandfathering). Various comments concern the necessity to include activities and sectors currently not covered by the EU taxonomy, and to facilitate access to the instrument for transitional activities and for SMEs. Some suggest a sustainability standard including social and governance factors.

It can be interesting to see the ranking in 2018 [39] of the major economies in Europe. France issued its first green bonds in 2012 with three French deals coming from local government. In 2018 France boasts the largest green bond market in Europe and the third largest globally. The 60% of allocations since 2014 went to top two sectors that are energy and buildings. However, transport sector allocations also rising due to strong issuance by state-owned rail company SNCF Réseau while allocations to other sectors remain very limited. Moreover, France issuance have an excellent track record in using best recommended practices such as the use of external reviews. A high level of transparency and an increasingly use of certification under the Climate Bonds

[39] From the Green Bond Market in Europe 2018.

Standard define the French green bond reporting. All these practices are signals of the French commitment to financing projects or assets compliant with the Paris Agreement.

The German green bonds market follows a steady grow since 2013 reaching the 4th global position in 2017 during which green bond issuance nearly doubled from 2016. With a large vanilla bond market, a strong policy backdrop and a wide base of banks and potential issuers, Germany has huge potential for further green financial growth. German investors can lead on fund deployment, banks – on growing the green covered bond market, Deutsche Börse – on providing essential market infrastructure and services. Also there, the 96% of issuance benefits from an external review or certification under the climate bonds standard. This creates a strong international investor confidence in the green credentials of the market and sets a strong benchmark for German entities looking to join the green bond market. France and Germany account for the highest number of Certified Climate Bonds in Europe. In 2017 68% of green bonds issued are denominated in EUR. Until 2017 renewables energy are by far the most popular investment followed by buildings and water.

In Italy the outstanding debt volumes of green, social and sustainable bond issued by Italian entities and listed on the Italian stock exchange at the end of July 2021 amounted to EUR44.8bn [40] : 60% of those volumes are labeled as 'Green', 8.5% as 'Social' and 31.5% as 'Sustainable' or 'Sustainability-linked' bonds. The Italian green bond market is largely dominated by utilities and infrastructure companies: the most frequent eligible project categories cited within the use of proceeds' description are Renewable Energy (26%), Energy Efficiency (18%), Pollution Prevention and Control (12%) and Clean Transportation (11%), while the Green Buildings category is cited only in 7% of the cases.

In terms of volumes issued only EUR2.6bn of the Green Bond issuances was allocated to the Green Building category that is equivalent to 10% of "Green" labeled bonds, and 5.9% of total GSS bonds volume issued**.** According to the ICMA, green buildings are defines as those buildings that meet regional, national or internationally recognized standards or certifications for environmental performance. Furthermore, after the project category has been determined, the issuer must agree to precise and measurable energy, water, and waste management efficiency and savings goals, and report their success on an annual basis until the bond proceeds have been fully allocated. The building construction ecosystem, which includes construction materials and building management, is responsible for 36% of total global GHG emissions; as a result, energy efficiency in new asset developments and decarbonization of existing buildings, along with oil & gas sector financing, are the main areas of focus for banks, investors, and operators.

In 2017, Intesa Sanpaolo became the first Italian bank to enter the market with a EUR500m green bond earmarked for renewable energy and green building loans. The first public sector deal came with railway

[40] Data from Sustain Advisory 2021.

company Ferrovie dello Stato Italiane's EUR600m bond, which could well be the first of many, given the EUR94bn in investment identified in the firm's 2017-2026 industrial plan. Renewable energy leads use of proceeds with 70% of cumulative allocations. In 2017, transport's share reached 20%. The remaining proceeds are distributed between buildings, water and waste. In Italy the 'Green Building' category has been used in the allocation of green bonds issued by financial institutions (Unicredit, Banca Intesa, Banca Popolare di Sondrio, Mediobanca) and insurance companies (Generali and Unipol). Generali, Unicredit and Banca Intesa are also signatories of the Net-Zero pledge through the industries-led Net Zero Alliances of Insurance and Banking respectively. Insurance companies with direct real estate asset management exposure tend to allocate bonds' proceeds exclusively to acquisitions of green buildings or to upgrading (retrofitting/renovating) existing assets in portfolio; this is the case for Generali Real Estate, a subsidiary of the Generali group, that has policies for green buildings and green leases, aiming to improve the environmental performance of the company's real estate assets, which has resulted in an increased number of certified green buildings. Generali group is the largest issuer of green bonds allocated to the 'Green Building' category with a total of EUR1.2bn of allocated proceeds from bonds issued in 2019 and 2020.

In the case of financial institutions, proceeds of the bonds are allocated not only to the acquisition, financing or refinancing of real estate assets, but also to the funding of loans / mortgages to retail customers and, most recently, to monetize tax credits linked to public subsidies for energy efficiency works (known as *Superbonus, Ecobonus*), or earthquake risk reduction on existing buildings (*Sismic bonus*) of private individuals (not businesses) and apartment blocks. Intesa San Paolo is the second largest issuer of green bonds allocated to "Green Buildings" with EUR940m of allocated proceeds from a bond issued in March 2021. The issuer of a green bond in the Green Building category must contribute to specific and measurable impacts indicators of energy, carbon, water, and waste performance, or to internationally recognized standards or certifications for environmental performance, according to the ICMA's Green Bond Principles. The majority of Italian issuers rely on certifications. LEED, BREEAM, and EPC are the most popular. However, in terms of performance thresholds and labeling systems, certifications are not necessarily similar; additionally, national standards in European Union member nations are produced through separate processes and may not represent the same level of efficiency aspiration. The European Green Bonds Standards, which are endorsed by the EU Taxonomy, will make indications more homogeneous and comparable. The Taxonomy's current wording proposes a system in which absolute thresholds (for operational primary energy as well as operational and embodied GHG emissions metrics) should be set, at a minimum, at the level of performance corresponding to the top 15% of the local building stock in the case of acquisition and ownership of the buildings, while in the case of building renovation thresholds should result in a primary energy demand reduction of at least 30%. The Italian real estate and building construction sector is showing signs of growth, fueled not only by the country's projected GDP growth, but also by a growing understanding of the new market paradigm:

decarbonization of the real estate economy is a risk-reduction strategy that banks and insurance companies will increasingly need to address, as well as one of the most significant business opportunities of the next decade. Innovative capital market solutions and alternative insurance schemes, as well as government policy support, can help reshape the Italian real estate business.

CHAPTER III

GREEN BOND AND THE GREEN RISK PREMIUM

Green bond pricing and the shades of green

A report from the Climate Bonds Initiative discloses evidence about how green bonds issued in the first half of 2021 perform in the primary markets. Bonds considered are USD and EUR green bonds with a minimum original issue size of USD500m. Therefore, these bonds are the most liquid ones. Developed market, emerging market, and supranational issuers are included. During this period, USD226.1bn of green bonds were added to the Climate Bonds Green Bonds Database, the most in any half-year, and equivalent to 76% of the 2020 full-year issuance (USD298.9bn). This paper includes 34% of that amount that met the above requirements (USD75.9bn), split between 75 green bonds from 62 issuers. EUR is the dominant currency with 56 bonds totaling EUR51bn (USD61.2bn), while 19 USD denominated bonds have a combined issue size of USD14.1bn. During the post-covid period, inflation rises and investors were afraid about overpaying for assets that could be hurt by rising interest rates. However, rates did remain low in H1 2021, and bonds prices rose thanks to the accounting support from central banks and the impacts of the pandemic support, which contributed to rising bond prices. Against this backdrop, green bonds amounting to USD226.1bn were added to the Climate Bonds Green Bond Database during this period, with record issuance each month. EUR (USD105.5bn) and USD (USD63bn) denominated bonds together contributed three-quarters to the total amount.

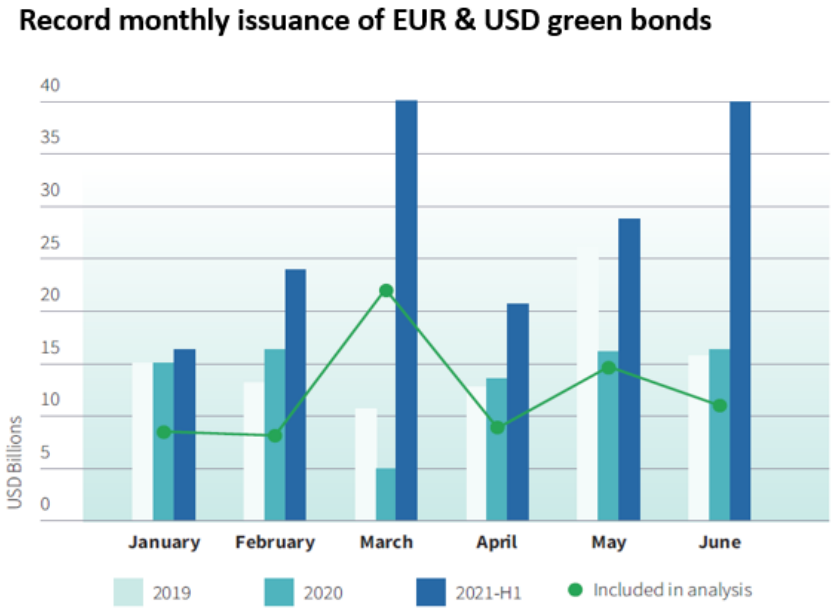


Figure from Climate Bonds Initiative (2021)

Green bonds resulted to be oversubscribed (average oversubscription was 2.9x for EUR green bonds and 4.7x for USD green bonds) compared to vanilla equivalents in 2021. They also experience a spread compression greater compared to vanilla equivalents (average of 20.4 bps for EUR green bonds and 19.6 bps for vanilla bonds vs 29.9 bps for USD green bonds and 24.8 bps for vanilla bonds). The comparison with carefully selected vanilla equivalents helps determine whether investors attach any value to the green label.

Individually, just 40% of EUR green bonds achieved larger oversubscription than vanilla equivalents (compared with 70% in H2 2020). In the sample of bonds considered, specifically 54 green bonds, two achieved the same oversubscription as vanilla counterparts (Intesa SP 2028 (SP), and de Volksbank 2026 (SNP)), nineteen attracted larger book covers than equivalents, 21 attracted lower book cover than equivalents, and four were excluded from the analysis. Just under half (48%) of EUR green bonds experienced larger spread compression compared to vanilla equivalents. Two out of 54 achieved the same amount of spread compression as equivalents (Vonovia 2031, and Sparebank 1 SMN 2028 (SP)), 25 tightened more, and 27 tightened less.

The H1 2021 USD green bond sample achieved the largest recorded average book cover of 4.8x, beating the previous high of 4.1x observed in H1 2019. 14 USD bonds have spread compression data, and again, a new peak of 29.9bps was recorded beating the 25bps seen in H2 2020. Sumitomo MTB 2026 matched the spread compression of its vanilla pair, nine green bonds tightened more than their pairs, while the remaining four did not. The 58 non-sovereign issuers included in this analysis were contacted and asked to reveal what percentage of their offer was allocated to green or socially responsible investors (green investors). The following are the outcomes of this survey:

- 34 issuers representing 40 bonds shared the data
- Seven issuers representing seven bonds replied but were unable to disclose the data
- Nineteen issuers representing 22 bonds did not reply

According to the data gathered, the average allocation to investors describing themselves as green was 66% (+18% compared to H2 2020).

As stated earlier, the focus on sustainable investing has skyrocketed in the last 12 months showing an increase of green bond fund assets under management of 80% year-on-year. On the other hand, the broader market has seen fund AUM increase by 4% over the same period. Such funds would likely be restricted to buying bonds bearing the green label. Not only green funds are sources of increasing demand, but also:

- Funds with softer mandates bearing labels such as Sustainable, ESG, SDG, Paris Aligned and so on which often include a preference for green bonds where available;
- The ECB remains the largest buyer of EUR denominated bonds including those labelled green;

- Broad market investors: benchmark sized (EUR500m+) green bonds, which are increasing in number, attract attention from all types of investors, since they will qualify for inclusion in broad market fixed income indices. Broad market indices do not actively exclude green bonds;
- The growth of green labelled ETFs and such products provide a broad range of investors access to green bonds via the secondary market.

The EU Taxonomy allows the improvement of data standardization. Including the EU Taxonomy in the green bonds' frameworks had helped numerous issuers, such as de Volksbank, Deutsche Kreditbank, and Ferrovie Dello Stato, in attracting a pool of committed dark green investors. The European Union is strongly committed to standardizing the concept of a green investor. From 1 January 2022, European investment businesses that label their products as green or socially responsible will be forced to declare the percentage of their investments that comply with the EU taxonomy, i.e., are consistent with a net-zero economy by 2050. This would provide green bond issuers with a clear benchmark to measure the relevant credentials of bidders and offer to asset owners more transparency in the manager selection process. However, not even an issuer has started to see any ramifications of this. Deutsche Bank was the only USD issuer to disclose data.

The new issue premium attached to bonds is the additional yield received by buyers and paid by sellers for a new bond as compared to where seasoned bonds from the same issuer are trading in the secondary market at the time of issuance. A new issue premium is a standard feature of the bond market. When compared to outstanding debt, a bond may be issued with a higher price and hence have a lower yield. The bond will be priced within its yield curve. This is known as a new issue concession and, when present in relation to a green bond, it has been termed “Greenium”. This is a great result for any issuer because it suggests that their green bond will cost less to fund than their traditional/vanilla debt. Even if a bond is priced on its yield curve, there is still no new issue premium, which is good for the issuer's cost of funding. There is no reason why a bond being green should impact its price since green bonds' ranks are comparable to bonds with the same payment rank and issuer. There is no credit enhancement to explain pricing differences and issuers of green bonds often incur costs such as Second Party Opinions and Certification, although these are typically negligible. Green bonds and vanilla equivalents are subject to the same market dynamics such as supply, rate expectations, geopolitical issues, and the fall-out from global pandemics.

Since the European Investment Bank issued the first green bond in 2007, the green bond market has experienced almost an exponential growth which will be described in more detail in the last chapter. Data from the Climate Bonds Initiative shows that the worldwide annual issue volume has grown from less than 37 billion USD in 2014 to over 160 billion USD in 2018 and 267 billion USD in 2019 worldwide reaching USD 290 billion in 2020. The growth of the green bond market over the last ten years indicates the enormous need for climate adaptation and mitigation funds. Therefore, academic studies show that both institutional and retail

investors with a focus on sustainable investment have a desire to invest in green bonds. Green bonds also represent an ideal financing source for green projects and may also enjoy lower costs of capital in the primary market. Green bond profits were originally intended to be used for green projects such as renewable energy and energy efficiency. As more and more issuers from various sectors entered the market, concerns arose around the idea that green bonds could be misused to finance greenwashing projects. This issue can threaten the survival of green bonds, since, according to an investor survey conducted by CBI, green labels and issuer transparency are the most crucial and significant factors for green bond investors in making investment decisions. It is worth noting that the green bond market is generally not subject to government regulation and there are only a few voluntary rules to prevent the possibility of greenwashing. As stated above, to ensure that green bonds make the expected contribution to the environment, issuers can disclose an overall green bond framework that has the four core components: i) the use of proceeds; ii) proceeds for project evaluation and selection; iii) managing of the proceeds; iv) reporting. However, the issuer both labels his bonds as green bonds and make a green bond framework on their own. Indeed, an external and independent review to examine the alignment with the GBPs and the greenness of the bonds is highly recommended by the GBPs. According to the GBPs, there are generally four types of the external review report, namely:

- second-party opinion;
- verification;
- certification;
- green rating.

Issuers can use one or more external reviews for their bonds. External reviewers are usually represented by independent research institutions whose activity is focus on environmental research. Independent research institutions specializing in environmental study, such as the Center for International Climate Research (CICERO) and ISS-Oekom, are common external reviewers. They look at whether green bonds are aligned with GBPs or they assess the bond's greenness using their standards and methodology. These external reviewers are meant to help communicate between investors and issuers, thus constructing a transparent dialogue and a consequently healthier and more profitable green bond market.

Second-party opinions (SPO) are the most popular external reviews for green bonds. They are issued by independent research institutions such as CICERO, II-Oekom, and Sustainalytics. The analysis provided by SPOs is generally accurate since they cover the four components of the GBPs and other related issues. An SPO released by CICERO includes the following elements: a description and an assessment of the issuer's green bond framework, rule, and procedure for climate-related activities. The assessment, part of the report, comprises the strengths, weaknesses, and pitfalls of the green bond framework. Also, an estimation of the greenness of the bonds can be provided. For instance, CICERO's SPOs are graded into several shades:

- Dark green
- Medium green
- Light green

These shades are linked to the possible environmental impact of the green bond and the robustness of the issuer's governance structure that supports the framework. "Dark green" is only given to green initiatives and solutions that, according to CICERO's criteria, offer the greatest method to accomplish the long-term vision of low carbon and climate-resilient future. Moreover, the shades can vary over the years. For instance, the 2015 green bond framework of the German state-owned development bank KfW has been classified as a "dark green" shade from CICERO, because of its clear and exclusive focus on renewable energy and robust procedure for project screening. However, in 2019 the same bank received the "medium green" for the green bond framework since the framework cannot fully guarantee the exclusion of fossil fuels and thus it was considered less green compared to 2015 one. Medium green is allocated to projects and solutions that represent steps towards the long-term vision but are not quite there yet. Another example of dark green and medium green is, respectively, a wind energy project with a governance structure that integrated environmental concerns and plug-in hybrid busses [41]. Light green is allocated to projects and solutions that are environmentally friendly but do not by themselves represent or contribute to the long-term vision. An example is an efficiency in fossil fuel infrastructure that decrease cumulative emissions [42]. The GBPs represent voluntary guidance for green bonds, but do not take a position on the quality of green solutions. This is where CICERO Shades of Green intervene. Its goal is to connect climate change science with the financial markets. It also assesses the environmental soundness of green projects: mitigation projects for their potential to reduce or abate emissions, and adaptation projects for their potential to help society adapt to concrete efforts of climate change. Governance and transparency considerations also factor in as they indicate the capabilities of the issuer to implement the climate and environmental ambitions of the investment framework. CICERO's methodology also comprises an assessment of the governance structure of the issuer, graded Excellent, Good or, Fair. Their SPOs are desk reviews, based on documentation provided by the issuer and information gathered during meetings, teleconferences, and e-mail correspondence with the issuer. CICERO Shades of Green provides an ex-ante assessment based on the knowledge that is available at the time of issuance. The second opinion process is structured as follows:

- An initial assessment based on the issuer's input such as green bond framework, sustainability strategy and reports, and other relevant documentation;

[41] Example provided by CICERO Shades of Green factsheet 2021.
[42] Example provided by CICERO Shades of Green factsheet 2021.

- Draft a second opinion that takes into consideration all the four GBP pillars. It usually takes between 1 and 2 weeks;
- Clarifications with the issuer as needed in the following 3 weeks after the draft;
- The final second opinion is issued;
- Finally, the second opinion report is drawn.

CICERO's greenness evaluation is just one among many others as shown in the Table (1). For such a reason, it can be useful to make a unique standard green scale represented by the shades in the Table (1) below: "dark green", "medium green", "brown", and "no shade". A green bond is defined as "dark green", if it exhibits an above-average positive evaluation, while the shade of "medium green" indicates a level of greenness that SPO providers consider being standard in the green bond market. Following this criterion, "brown bonds" are those bonds showing below-average or negative evaluation results. When an SPO does not explicitly disclose a shade of green, the bond is awarded as having "no shade "and it is up to the investor to draw his own judgement, based on positive and negative signals implicitly delivered by SPO providers.

Table 1 Different shade of green schemes

Shade	CICERO	Vigeo	ISS-Oekom	Sustainalytics
Dark green	Dark green	Reasonable	Excellent	Leader
			Good	Outperformer
Medium green	Medium green	Moderate	Medium	Average performer
	Light green			
Brown	Brown	Weak	Poor	Underperformer
				Laggard
No shade	No clear shade	No clear shade	No clear shade	No clear shade

Table (1) from "*The Pricing of green bonds: external reviews and the shades of green*" (2021)

Verification reports are generally less lengthy and detailed and are issued by auditing companies. In this case, the role of reviewers responds to predefined tasks such as examining whether the use of proceeds is aligned with the GBPs or other related regulatory rules. They also judge whether the issuer has violated any requirements defined by the GBPs or by the issuer. Therefore, it can be stated that verification reviewers evaluate green bonds more objectively, while SPO reviewers deliver subjective and comprehensive opinions on green bonds, according to their standards.

CBI certification issues a certification scheme that is based on scientific criteria ensuring consistency with the 2-degree Celsius warming of the Paris Agreement. When a CBI certification is assigned, the greenness of a

green bond is judged by the CBI. Traditional credit rating firms such as Moody's and S&P produce green rating reports. For instance, Moody assigns five grades of green ratings to green bonds, ranging from 'excellent' to 'poor'. At first glance, green ratings are similar to SPOs with a shade of green, since they both provide a greenness assessment. However, green rating reports from credit rating agencies are regarded as a different type of external review, as they are more quantitative and focus on issuers' environmental performance data. Furthermore, they are significantly less common in the green bond market than SPO reports.

Several studies analyze the green bond premium and its determinant. However, not all these studies agree on the fact that green bonds enjoy a significant premium since different samples, selection, and observation periods can lead to different results. To find the bond premium, a comparison of the yield between green and conventional bonds could be conducted in the primary market or the secondary market by indirectly examining the impact of the green label by regressing the bond yield on a green label indicator. Some studies have found the major determinants of green bond premiums such as credit rating, issuer type, liquidity, and green credentials which are important for the cost of green bonds. In particular, Baker et al. (2019) investigate the pricing of 2083 U.S. municipal and 19 corporate green bonds and find that green bonds with a CBI certification have yields 26 BP lower than ordinary bonds with similar characteristics. Bachelet et al. (2019) focus on 89 matched green bonds and find that those green bonds issued by private firms with external reviews show a small premium (1 BP). Kapraun and Scheins (2019) analyze 641 green bonds and observe that certified green bonds have yields 2 BP lower than green bonds without a certification and green bonds traded on green exchanges show lower yields (7 BP) because they are required to meet some standards set by green exchanges. In contrast, Larcker and Watts (2020) examine a matched sample of 640 municipal green bonds and find that the CBI certification makes no significant difference in the pricing of municipal green bonds. Nevertheless, these earlier studies have several drawbacks: they do not apply a strict matching process to gain more observations and thus may be subjected to estimation biases; some of them focus only on a sub-sector of the green bond market such as US municipal bonds; neither of these studies provides an estimation of the impact of the four indifferent categories of external reviews previously discussed. Furthermore, the shades of green methodology in SPOs is completely ignored by these studies. However, their importance cannot be neglected considering their increasing popularity in recent years.

Based on the paper [43], a green bond premium can be defined as the difference between the yield of a green bond and a comparable conventional bond [44]. The framework relies on the investors' taste argument i.e.

[43] Dorfleitner, G., Utz, S. & Zhang, R. (2021). *The pricing of green bonds: external reviews and the shades of green.* See the following paragraphs for further detail about methodology and results.

[44] Main green bond database for this report is Environmental Finance which lists self-labeled green bonds and contains information on bond issuance and related documents such as external review reports. A complete list of straights green bonds has been extracted since the inception of the green bond market in 2007 until April 2020. In the end, the analysis is built on a dataset of 1248 straight green bonds with adequate data.

investors appreciate non-financial aspects of an investment [45]. In this respect, some investors are willing to sacrifice a certain proportion of the return in order to achieve a non-financial utility from the investment. Moreover, Höchstädter and Scheck (2015) reveal that investors aiming at environmental (or social) impact accept some curtailment of the achievable financial return. Following this framework, a bond B is defined with the functional

$$r_B + \alpha g_B$$

were the parameter α represents preferences for the (expected) greenness g_B of the bond with a yield r_B. Accordingly, an equation (1) showing an investor's preferences regarding a green bond (GB) and a comparable conventional bond has been derived. If a green bond has a yield r_{GB} and an expected greenness g_{GB}, while the conventional bond has a yield r_{CB} and no greenness, then an α* exists such that at a given point in time

$$r_{GB} + \alpha^* g_{GB} = r_{CB} \qquad (1)$$

Different investors may yield different values for α >= 0, depending on their financial preferences. If specific investors have a higher appreciation of greenness than the market-related α*, they will prefer the green bond. Therefore, they are willing to buy the bond at the current yield level. Aggregated over all investors, this effect yields a positive value of α* and thus explains a positive green bond premium:

$$r_{CB} - r_{GB} = \alpha^* * g_{GB}$$

if there is a sufficiently large share of investors with positive values for α. An α* different from zero in this framework indicates the existence of a price impact of bond greenness. Based on these theoretical considerations, we deduce 3 hypotheses on the link between investor preferences and the green bond premium. The majority of bond issuers in the green bond market report on the use of proceeds, usually releasing their green bond framework or social impact reports based on the GBPs. Non-financial disclosure reduces information asymmetry regarding the implemented sustainability practices. Given that non-financial disclosure on environmental activities increases the green bond transparency, thus reducing uncertainty and idiosyncratic risk, investors are willing to receive lower risk compensation, leading to a reduction in the cost of debt of green bonds. Indeed, if the label "green bonds" largely increases the transparency of green bonds for a sufficiently large proportion of green investors who imply a positive greenness g_{GB} from the voluntary disclosure of the green bond issuer, then a positive α* and thus also a positive premium r_{CB} - r_{GB} can emerge.

[45] Note that there is mixed evidence on whether sustainable and especially environmental-friendly (stock) investments yield a financial under- or out-performance (Orlitzky et al. 2003). However, this question is not relevant in our context, as the green bond premium.

Therefore, the first hypothesis is as follows:

Green bonds are priced at a premium in the secondary market, compared to conventional bonds with similar characteristics.

Even though, as mentioned earlier, non-financial disclosure reduces information asymmetry, some of them cannot be eliminated. The validity of the released information is pivotal in this analysis and external reviews are considered fundamental for investors. The report's analysis makes another assumption: the greenness can be either G > 0 or zero according to a probability p which reflects the probability of the uncertainty in objectifying the real facts. That is:

$$g_{GB} = p \cdot G\,(1-p) \cdot 0 = G \cdot p$$

It follows that, having 2 bonds, one (GB1) supported by an external review regarding its greenness, while the second (GB2) with no such information, the external review would in most cases increase the probability of p. In case the review comes to a positive conclusion and investors trust the assessment of the external reviewer more than their assessment of the voluntary disclosure, then the probability p increases [46]. This reasoning is consistent with the theory of informational transaction costs. Without a review, investors who are potentially interested in a specific bond have to invest some information costs to verify whether or not the greenness is there. These research-related costs can be avoided if an external review is provided. Such information costs are generally priced in bond markets. In our case, investors will subtract the necessary transaction costs from the decision functional (1) $r_{GB} + \alpha^* g_{GB}$ when considering their effective net value, and thus demand a higher yield for GB2 than for GB1. This implies a lower bonds premium for GB2. All these results lead to the second hypothesis.

Therefore, the second hypothesis is as follows:

Green bonds with a statement from an external reviewer on their true greenness enjoy a higher green bond premium in the secondary market.

Another hypothesis is implied by the informational transaction cost argument. If a green bond has been traded on the market for some time without an external assessment, more and more potentially interested investors may have already spent their research-related transaction expenses, which are intrinsically fixed costs. Therefore, following this reasoning, one can expect to observe an increasing green bond premium for those

[46] Indeed, in our sample employed in the empirical part, there are no bonds with external reviews claiming that the corresponding issuer is prone to greenwashing. However, theoretically, this is possible and would lead to a lower probability p.

green bonds that do not have an external review, as these costs only accrue at each investor's first dealing with the specific bond. We subsume this consideration into another hypothesis.

Therefore, the third hypothesis is as follows:

The premium of green bonds without a statement from an external reviewer on their true greenness is positively related to the duration for which the green bond has been traded on the secondary market.

Finally, the sample has been restricted to green bonds with external reviews, i.e., bonds having the same (high) value of p. However, different levels of greenness exist (see Table 1). Therefore, we substitute G in Eq. (4) with one of the values G_1, G_2, and G_3 (with $G_1 > G_2 > G_3$). If one green bond (GB1) has a darker shade of green, say G_1, than another (GB2), say G_2, then $g_{GB1} > g_{GB2}$ for equal values of p. Accordingly, a specific investor with a fixed α would, therefore, be willing to accept a higher premium for GB1 than for GB2. This discussion leads us directly to the fourth hypothesis.

Therefore, the fourth hypothesis is as follows:

Green bonds with a higher level of greenness confirmed by external parties enjoy a higher premium in the secondary market.

To isolate the impact of the green label on the bond yield, i.e., the green bond premium, the ideal setting would comprise one bond that exists in both treatments, i.e., as a green bond and a conventional bond at the same time. This is not possible to be observed by market data, for such a reason each green bond has been matched, through the report, with a comparable conventional bond. Indeed, each green bond is linked to a list of conventional bonds with similar bond characteristics. However, a perfect match is quite impossible, since only a few parties issue such a bond pair but a reliable estimation of the green bonds' premium was possible. After having conducted the matching process, the final sample can be defined. Specifically, this contains 250 green bonds matched with 500 conventional ones and more than 92.772 daily observations from 2011 to 2020. Then, a two-step regression procedure based on a hybrid model to elicit the green bond premium and its determinants were performed. One important result achieved is that, on average, the expected green bond premium is positive and statistically significant. However, some green bonds are priced higher than their counterparts. In particular, green bonds with an SPO or a verification enjoy a higher green bond premium. This association suggests that credible and assured non-financial disclosure is beneficial to investors. Moreover, green bonds supported by SPOs are traded at prices that increase with the level of greenness evaluation of the green bond, i.e., a darker shade of green is more likely to have a higher premium. Another crucial finding is the relevance of external reviews and shade of green methodology in green bond pricing. It has been revealed that investors are sensitive to information asymmetry in the green asset market. If more public information on the greenness

of green bonds becomes available, the investor base for green assets may grow as investors gain trust in green assets, and the risk of greenwashing decreases. As a result, reducing knowledge asymmetry is critical to the growth of climate finance. To increase communication among market participants, easier access to third-party reports and evaluations should be fostered. Government initiatives that assist green bond issuers in achieving uniform, inexpensive, and impartial greenness assessments could help the climate financing industry thrive. However, the need for greater theoretical and empirical research on green finance elements is also highlighted by these observations on financial markets.

The Greenium: a green risk premium

A milestone in the literature exploration of the green and non-green bond pricing differential is marked by the study of Preclaw and Bakshi (2015) [47]. The authors detected that investors were paying a premium to acquire green bonds. Some possible explanations were presented and explained by the two using an OLS regression model:

- The price premium could be a mechanical supply and demand mismatch for green issues relative to their non-green equivalents. This suggests that "Greenium" could be a short-term phenomenon, unsustainable in the long term as issuers tend towards cheaper funding. This approach recognizes green funding as an inherent funding arbitrage;
- The green bond market should, according to some market participants, trade at tighter spreads to reflect its externalities. This concept is frequently criticized because green bondholders are not the residual claimants of environmental benefits; the good impact of green bonds on the environment or the issuer should theoretically benefit both green and conventional bondholders.
- Tighter green bond spreads could reflect an investor preference, where investors derive sufficient benefits to offset the lower cash flow. Examples of these benefits can be 'psychological benefits', brand value, influence with regulators, and other non-financial gains;
- Green bonds may be less risky or volatile by nature compared to conventional bonds, resulting in tighter spreads that reflect their risk-adjusted return.

HIS Markit has conducted a study in August 2020 48 aims at detecting the notion of "Greenium" in the senior, investment-grade Euro-denominated corporate bond tranche of the index. This study wants to explore a potential variation in results arising from a cross-universe study that is an approach that includes securities

[47] Preclaw, R. and Bakshi, A., 2015. The Cost of Being Green. Report, Barclays Credit Research.
[48] Meyer, S. & Henide, K. (2020). Searching for "Greenium

from across the debt capital structure, issuer types, and currency denominations. The Greenium is defined as the differential between the Z-spread (zero-volatility spread) of a green bond and the Z-spread of an implied theoretical non-green bond, controlling for seniority and optionality, where a negative (tighter) spread indicates a premium. The Zero-volatility spread (Z-spread) is the constant spread that makes the price of a security equal to the present value of its cash flows when added to the yield at each point on the spot rate Treasury curve where cash flow is received. In other words, each cash flow is discounted at the appropriate Treasury spot rate plus the Z-spread. The Zero-volatility spread helps analysts discover if there is a discrepancy in a bond's price. Because the Z-spread measures the spread that an investor will receive over the entirety of the Treasury yield curve, it gives analysts a more realistic valuation of security instead of a single-point metric, such as a bond's maturity date. The Z-spread is used to remove curvature effects and the implied curve is constructed using linear interpolation for simplification. The Z-spread is a measure of the spread the investor would realize over the entire benchmark zero-coupon curve if the bond is held to maturity.

The study [49] comprises 26 eligible issuers in which HIS Markit deconstructed data from the iBoxx Global Green, Social & Sustainability Bond. Results achieved are the following:

- A market value-weighted Greenium of -1.84 bps
- An incrementally tighter spread in the aggregate versus notional non-green bonds of a comparable time to maturity
- The greatest evidence of Greenium was found amongst sectors that typically have a greater intensity of greenhouse gas (GHC) emissions

Limiting the study to the iBoxx EUR Global Green, Social & Sustainability Bond index which is a sub-index of the broader iBoxx Global Green Bonds index, composed exclusively of securities from the Climate Bonds Initiative Green Bond Database, whose taxonomy is aligned with the Paris Agreement 2050 climate neutrality (i.e. keeping the increase in global average temperature below 2oC above pre-industrial levels and in pursuit of limiting the increase to 1.5oC to mitigate climate risks) lead to different results. In particular, the pricing premium is more pronounced at a value of -2.70 bps.

All the evidence above stated relates to and reveals the presence of a Greenium in secondary markets. Another important finding can be extrapolated from the following data: the characteristics of Greenium indicate a mechanical demand & supply mismatch, with the highest Greenium and perceived investor demand being shared by the highest emitting sectors (-9.5, -3.4, and -2.5 bps of Greenium respectively for the Oil & Gas, Utilities and Industrials sectors, respectively). These findings support further discussion of the importance of

[49] Meyer, S. & Henide, K. (2020). Searching for "Greenium": evidence of a green pricing premium in the secondary Euro-denominated investment grade corporate bond market

third-party due diligence and certification as explained in the previous chapter. However generally, it can be stated that Greenium is not static over time.

The Greenium or "green bond premium" implies that bonds can be priced at a lower level (thus, a lower interest rate) than the risk-paired traditional bonds. This creates an issuer's incentive to obtain fresh financial resources, which lowers his debt cost. Furthermore, it is essential to demonstrate that investors are willing to renounce certain risk-adjusted returns to invest in long-term sustainable financial instruments. Many authors detected the existence of the green bond premium at the issuance of green bonds (primary market) and on an ongoing daily negotiation (secondary market). However, as shown in Table (5) [50], within academics, there is no consensus on this phenomenon.

Table 5. Green premium empirical literature by the type of sample, methodology, and main results.

Author(s) (Year)	Characteristics of the Sample				Methodology		Main Results		
	Time Span	Geographical Scope	Sample Size	Market Segment	Methods	Size-Effect Type	Greenium Evidence	Premium Dimension	Level of Statistical Significance
Febi et al. (2018)	2013–2016	UK e Lux	64	Secondary market	Fixed effect panel regression model	Credit spread (difference between green bond yield and government bond yield)	Controversial	−69.2 bps in 2016	10% in 2016 no significance other years
Hachenberg and Schiereck (2018)	2015–2016	World	63	Secondary market	Matching method, yield curve, Wilcoxon test, Panel regression model	Spread between green bonds and similar conventional bonds	Controversial	−1.18 bps (entire sample)	no significance
Karpf and Mandel (2018)	2010–2016	US	1880	Secondary market	Yield curve, Mixed regression model, Oaxaca—Blinder decomposition	Yield to call (yield to maturity priced out the value of this option attached)	Yes	−7.8 bps (part of premium explained by green purpose)	n.a.
Bachelet et al. (2019)	2013–2017	World	89	Secondary market	Matching method, Regression model (OLS, FE)	Spread between green bond ask yield and matched conventional bond ask yields	Controversial	+5 bps (entire sample) −4 bps (subsample government/institution issuers)	1%
Gianfrate and Peri (2019)	2013–2017	EU	121	Primary and secondary market	Propensity score matching	Secondary market yield bond spread	Yes	between −5 and −13 bps (on average depending on temporal windows of the study)	different significance levels
Nanayakkara and Colombage (2019)	2016–2017	World	82	Secondary market	Panel data regression with hybrid model	Daily option adjusted spread (OAS)	Yes	−63 bps	1%
Zerbib (2019)	2013–2017	World	110	Secondary market	Matching method, Fixed effect panel regression	Daily ask yield between green bonds and synthetic conventional bonds	Yes	−2 bps (in the entire sample)	1%
Hyun et al. (2020)	2010–2017	World	60	Secondary market	Matching method, OLS, and fixed effects generalized least squares (FEGLS) regression model	Liquidity-adjusted ask yield spread between green bonds and paired conventional bonds	Controversial	−6 bps (in case of third party verification) −15 bps (in case of CBI certification)	1%
Kanamura (2020)	2014–2018	World	n.a.	Secondary market	Risk-Expected return model	Market indexes	Yes	n.a.	n.a.

[50] Cortellini, G. & Panetta, I. C. (2021). Green Bond: A Systematic Literature Review for Future Research Agendas. Journal of Risk and Financial Management 14: 589. https://doi.org/10.3390/jrfm14120589. Please see the following paragraphs for further detail.

Table 5. *Cont.*

Author(s) (Year)	Characteristics of the Sample				Methodology		Main Results		
	Time Span	Geographical Scope	Sample Size	Market Segment	Methods	Size-Effect Type	Greenium Evidence	Premium Dimension	Level of Statistical Significance
Larcker and Watts (2020)	2013—2018	US	640	Primary market	Matching method, kernel density estimator, Nearest neighbors matching, Wilcoxon test	Initial offering credit spread	no	+0.5 bps (but in 85% of the cases yield spread is null)	1%
Partridge and Medda (2020)	2013–2018	US	453	Primary market	Matching method, Yield curve, Panel regression model	Initial yields at issue	Controversial	−0.1 bps (in 2018)	no significance
				Secondary market		Daily traded market yields	Yes	−4 bps (entire sample)	1%
Tang and Zhang (2020)	2007–2017	World	1510	Primary market	Matching method, Regression model, Diff-in-diff analysis	Yield spread at the issuance	Controversial	−6.94 bps (entire sample) no pricing difference when issuer's characteristics are considered	5%
Wang et al. (2020)	2016–2019	China	159	Primary market	Matching method, univariate and multivariate analysis	Credit spread (spread between the "at-issue green bond yield" and the yield on a treasury security of comparable maturity)	Yes	−34 bps	1%
Immel et al. (2021)	2007–2019	World	466	Secondary market	OLS regression	Secondary market yield bond spread	Yes	between −8 and −14 bps	1%

Note: Papers are displayed by year and in alphabetical order.

Table (5) from "Green Bond: A Systematic Literature Review for Future Research Agendas. Journal of Risk and Financial Management" (2021)

From the table above, Nanayakkara and Colombage (2019) analyze a sample of global 82 corporate green bonds. Here, they find that green bonds are traded with a tighter credit spread (Greenium) of 63 bps compared to similar corporate bond issues. Similarly, Wang et al. (2020) documented that corporate green bonds have a lower yield (credit) spread of 34 bps than the corresponding conventional bonds. The authors demonstrate that Greenium tends to increase in the case of green bonds certified by CBI, firms with high CSR scores, less concentrated ownership structure, and green bonds held by long-term institutional investors. These results are in line with the above from the Climate Bonds Initiative and the previously mentioned hypothesis. Meanwhile, using a sample of 110 GBP-compliant green bonds issued worldwide and paired with identical conventional bonds, Zerbib (2019) discovered a minor negative premium of roughly 2 basis points (green bonds priced tighter than conventional bonds). This is related to the pro-environmental investor's preferences. The premium is higher for financial firms and low-rate bonds, according to the author. Karpf and Mandel (2018) looked over 1880 US municipal green bonds and found that the green bond return is 23 basis points lower than traditional municipal bonds. In contrast to Zerbib (2019), the authors believe that the issuer's features mainly explain the pricing spread rather than the green nature of green bonds (greenium explained by green characteristics is around 7.8 bps). Partridge and Medda (2020) discovered considerable evidence of greenium in the US municipal green bond secondary markets (4 bps), but not a clear evidence of discounted pricing for municipal green bonds in the primary markets when compared to comparable non-green bonds. Immel et al. (2021) focused their effort in understanding the existence and magnitude of greenium according to the green bond's degree of greenness (measured by the level of ESG rating) on a global sample of 466 green issuances. The authors found that the green bonds issued by ESG rated the issuer's experience as a higher negative premium (between -9 and -19 bps) compared with the un-rated green bond issuances (between -8 and -14 bps).

Furthermore, the authors pointed out that a greater ESG rating is associated with a higher negative green bond premium. Surprisingly, the G-score (issuer governance characteristics) is the key driver of green bond premium inside the ESG rating. Using a propensity score matching approach, Gianfrate and Peri (2019) discovered evidence of a green bond premium when looking into both primary and secondary EU green bond markets. Greenium was detected in both market segments, with a larger presence in the primary market.

Contrary to what was previously stated, other authors had controversial results when conducting studies about the greenium phenomenon in the secondary market. Hachenberg and Schiereck (2018) found that green bonds, on average, are priced tighter than conventional bonds by about 1 bp, by studying a sample of 63 global investment-grade green bonds. Nevertheless, the results found by the authors depend on the rating classes (AAA-rated are priced wider than their similar non-labeled bonds, whereas AA-BBB-rated green bonds show a greenium) and issuer industry (government trade is marginally wider, whereas corporate and financial issuer green bonds trade are tighter than the non-green bonds). Likewise, Hyun et al. (2020) discovered no robust and significant yield premium/discount on average, by comparing the liquidity-adjusted yield premiums of green bonds versus conventional synthetic bonds. However, once again, a greenium was found in correspondence to green bonds which are certified by an external reviewer (6 bps) when they are certified by CBI (15 bps).

Bachelet et al. (2019) indicated that green bonds have a higher yield and are less risky than the comparable "brown" bonds. However, the authors' findings are controversial, in their sample, a greenium is detected when considering pubic-related green bonds and third-party verified green bonds.

Another interesting result was found by Febi et al. (2018). They highlighted a greater negative yield differential (greenium) between a green bond and a non-green bond in 2016 equal to 69.2 bps compared to a non-significant yield difference in the 2013-2015 period. These results are based on a sample of 64 green bonds listed on the UK and London stock exchanges from the period 2013-to 2016.

Tang and Zhang (2020), focusing on the primary market, analyzed a sample of 1510 global corporate green bonds' issuance from 2007-to 2017. The authors found that, on average, green bonds have a lower yield of about 7 bps compared with the similar conventional bonds, but considering a yield spread comparison between the same issuers in the same year, they did not find any evidence of greenium.

Furthermore, also a few shreds of evidence of the opposite phenomenon, that is positive yield spread between green and non-green bonds, was found. For this purpose, Larcker and Watts (2020) decided to analyze a sample of 640 US municipal green bonds and found that a small positive premium (0.5 bps) determined that green bonds are slightly more expensive than non-green bonds for the issuer. The authors further added that there is

no pricing differential between green and non-green bonds, since, in 85% of cases, the differential yield is zero.

For all those scholars who found evidence of green bond premium, the reasons are several:

- From the investor-side perspective, according to Zerbib 2019, the explanation is that investors are willing to pay "to go green". This means that pro-environmental and social preferences are strong enough to push an investor to accept a lower risk-adjusted return for a green bond than the conventional one;
- From the investor-side perspective, according to Bachelet et al., the presence of a Greenium can be explained by investor preferences or lower stakeholder risks, but only if correlated to an established issuer reputation (or conversely a green certification) to reduce asymmetric investor information and the greenwashing risk;
- From the issuer-side perspective, Karpf and Mandel (2018) gave their opinion and relative explanation to greenium. According to them, the higher green bond pricing relied on the green bond issuer characteristics, assuming that these issuers have more creditworthiness and more robust economic fundamentals. In this case, it would lead investors into requiring a lower yield on green bonds compared to conventional ones.
- Another point of view is the one from Partridge and Medda (2020) who justified the greenium existence in the secondary market rather than the primary market with the capacity of bond traders to resell green bonds for higher prices, due to the relative shortage of this instrument.

Concluding, these studies give no clear evidence regarding greenium. Moreover, there is no academic consensus regarding the potential mispricing between green bonds and conventional/non-green bonds in primary and secondary markets. In the primary market, the previous authors detected greenium in 40% of the studies, but the quote of controversial and contrary evidence is respectively 40% and 20% of the surveys. In the secondary market, the evidence of greenium is quite majoritarian (around 63% of the cases), and no contrarian evidence is detected within the sample of studies. These results should be interpreted, considering that secondary market studies are slightly double the size of the primary market ones. It is worth noting that these studies do not focus (or very little) on the geographical scope, time frame, and methodology. For instance, across the US-based research, the authors exclusively studied the green bond US municipal markets (both in primary and secondary markets). Even then, there is still space remaining to investigate the US corporate green bond market. Another issue is represented by the time coverage. Particularly, across the EU-based studies, the most updated one (Gianfrate and Peri's study in 2019) presents data updated to 2017. Furthermore, the large majority of the papers on the greenium within the sample are global-referred, and they do not consider the phenomenon on a regional/country base.

It can be said that more in-depth research might be addressed to better investigate global primary markets of green bonds, as well as update the period of the analysis. Considering the phenomenon of the Greenium in a more conclusive way may lead to more consistent and reliable results.

Given the great timeliness of the topic, it is hard to find reliable studies that provide reliable information. Despite this, every year new information is supplied and therefore data from 2018 or 2019 can be very far from current findings.

The Greenium in the stock market: the role of greenhouse gas and environmental disclosures

Climate change is a fact, but we do not know which the effective economic costs associated with this change will be. On the other hand, we also do not know what the economic benefits of doing something "to be green" would be. Answers cannot be found looking at the present value of activities directed to reach environmental objectives, since it would be hard to pin down such analysis. Likewise, the consequences of a transition to a low-carbon, resource-efficient and circular economy are also largely uncertain. Hence, these issues have to be addressed as aspects of long-run risk. The authors [51] in question try to measure the added value of greener economic activities in terms of market excess returns.

They start to show the European market prices climate risk through a standard asset pricing model. Here they found that not only environmental performance matter, but a combination of greenness and environmental transparency are important too. Then they also estimate the greenium associate to more environmentally friendly and transparent firms.

In order to identify the market price of climate risk or environmental risk more generally, one should also consider other factors other than actual environmental performance. In fact, investors are really interested in the existence of a company climate strategy as well as in the green bond issuers' trustworthiness. So, in short, market price of climate risk is based on a prices factor which considers both environmental performance and environmental transparency. More precisely, they first set up portfolios characterized by a different shade of green and a different degree of environmental transparency. The level of greenness depends on the firm-level information on greenhouse gas (GHG) or CO2 emission, combined with a measure of the completeness of firms' environmental disclosures, to yield a synesthetic greenness and transparency index for each stock. A clear example of greener companies would be those with a large share of their turnover in green economic sectors like renewable energy. Conversely, all those firms that lack of disclosures on their environmental performance are labeled as non-transparent. Examples are companies active in carbon-intensive sectors of

[51] Alessi, L., Ossola, E. & Panzica, R. (2021). What greenium matters in the stock market? The role of greenhouse gas emissions and environmental disclosures.

course. The green and transparency factor is constructed based on 942 companies listed on the STOXX Europe Total Market Index.

The authors also make a short but interesting focus on the issues concerning the greenwashing, which can be seen as the reason why it is so hard to price the green factor. Looking across the actual composition of the portfolios of publicly traded investment funds which defined themselves as "green" or "sustainable", it seems that many funds are not so green as they would appear. An example can be a fund limit its exposure to carbon-intensive sectors, but at the same time it mainly invests in financial stocks. For instance, banks and insurers are admittedly directly responsible for a very small fraction of GHG emissions, but they are not at the forefront of efforts to reduce emissions. Moreover, several companies only disclose partial information about themselves which results to be misleading in the investors' eyes.

Likewise, one should be careful not to consider extreme views and definitions of "green" stocks. For such a reason, portfolio diversification is pivotal for asset managers, and concentrating the exposure on a small set of pure green players is not a viable option. This topic is clear for all to see: most regulatory interventions could be introduced in a piecemeal way otherwise the green transition would be a systematic shock affecting all companies. A gradual approach is essential for all companies, also those with the highest level of energy efficiency and the lowest CO2 emissions. This means that the assessment of firms' sustainability has to be done relative to their peers. Indeed, an energy company that reduces its reliance on fossil fuels – though not having an entirely renewable energy mix – is greener than one that is not reducing its carbon footprint.

The authors, in the context of a standard asset pricing model, show that the portfolios are associated with a statistically significant intercept, suggesting the existence of an omitted factor. This factor is the greenness and transparency factor, which is constructed based on a long-short strategy involving the greener and more transparent portfolio and the brown portfolio. The greenium associated with this factor is negative and highly statistically significant. This means that investors accept a lower remuneration for their investments, ceteris paribus, if these investments are linked to greener and more transparent firms. Therefore, this is the evidence of climate risk being viewed as significant, with the market seeing value in investing in greener assets as a hedging strategy towards worse environmental outcomes. This gives a boost to environmentally friendly activities which are likely to be supported by political action through incentives, either fiscal or of other nature. At the same time, this also decreases the demand for some assets that would become stranded.

All the earlier stated evidence about the existence of a greenium has clear financial stability implications. The authors show that the European market as a whole does price climate risk. Therefore, if an investor does not factor in climate risk in the construction of her portfolio, he is pricing her holding based on a mis specified model, where the greenness and environmental transparency factor is omitted. Moreover, if this mispricing effect the assets held by systematically important financial institutions (SIFIs) such as large banks, insurers,

and pension funds, there could be consequences in terms of systemic risk. In particular, assets' returns could be affected through 2 main channels:

1) From a long-term perspective, frequent and severe natural catastrophes derived from climate change could negatively result in an impact on assets linked to particularly vulnerable economic activities. These risks are named physical risks which are not considered in this paper;
2) From a medium-term perspective, the implementation of sustainable finance policies will entail higher costs for firms with higher emissions, hampering the firms' possibilities of distributing dividends to their shareholders. Moreover, carbon intensive assets will increasingly become "outdated". This risk is called transition risk which is considered in this paper.

These two channels characterize a climate risk factor that investors should price. The model performed by Alessi, Ossola and Panzica reveals that in an extreme but plausible scenario where greener and more transparent companies outperform brown companies, all institutional sectors at the global level, including governments, non-financial institutions, and financial corporations, as well as European SIFIs, would be hit by losses. The direct losses could amount to 1.5% of the global equity exposure, and USD 7 bn for European SIFIs overall. Investors might mitigate the loss by decreasing their exposure to carbon-intensive sectors and reallocating their investments to greener assets. However, they could only avoid losing money if they redirected their investments to companies that are greener and more transparent. The implied message is that all companies are in trouble when it comes to climate risk since brown asset mispricing is a widespread phenomenon. Moreover, this analysis only refers to equity holding. Consequently, in a stressed scenario, losses are likely to be recorded also on the bond portfolio and notably, on banks' loan exposure. Losses are computed by the authors using a simple model based on the marginal expected shortfall. The marginal expected shortfall measures a firm's expected equity loss when the market falls below a certain threshold over a given horizon. This approach does not factor in losses resulting from second-round effects, like fire sales, which could magnify first-round losses. Therefore, climate or climate-policy shock could affect financial stability, particularly if coupled with shocks of other nature. For such a reason, conducting a climate stress test is warranted for SIFIs to monitor their reliance to climate change. The greenness and transparency factor could be utilized by investors to hedge against climate risk, as well as by regulators to assess SIFIs' risk exposure. It is worth noting that, in the future, we can only expect increased regulatory pressure to reduce carbon emissions and move toward a more sustainable growth path.

It is interesting to understand more in-depth the greenness and transparency indicators. Different indicators are available to assess a company's commitment to the environment. However, identifying synthetic proxies for firms' environmental performance is difficult. As stated above, the main source of information is firms' environmental disclosures which are generally published by companies in their annual reports, or in separate Corporate Social Responsibility or Sustainability reports, as well as in dedicated ESG releases or Corporate

Governance reports. These types of reports are essential to understand if a company is doing green business or not, or if it is transparent. More than one indicator may be necessary to carefully assess a company's environmental performance. Indeed, the authors explore two factors:

- Environmental transparency, related to the quality of firms' environmental disclosures;
- GHG emissions.

As a proxy for the environmental transparency of a company, they decide to use the Bloomberg Environmental disclosure score, namely in this case as E score. This is an index quantifying the completeness of a firm's disclosure of its impact on the environment. The E score considers several aspects: the level of a firm's transparency compared to its carbon emissions, air and water pollution, its commitment to the protection of biodiversity, and its waste management, among others. The weighted E score goes from zero for companies that do not disclose environmental data to 100 for those which disclose detailed information for each pillar. The score also depends on the type of industry sector and each component is weighted based on its importance. Particularly, GHG emission disclosure is attached the highest weight. The E score is also used to judge the level of transparency of a firm concerning its environmental sustainability commitment i.e. the higher the commitment the greater the firm's transparency. Hence, the authors decide to make the first selection among firms that are transparent and firms that are not. Firms that do not disclose information are deemed to be non-green, as their environmental commitment appears weaker compared to firms that do disclose (quantitative) information on this pillar. However, this does not mean that those firms are necessarily ecologically destructive. To set up a comprehensive index of a company's environmental performance, the transparency measure and the quantitative disclosure on emission are combined as follow:

$$G_{i,y} = yK_{i,y} + (1-y)E_{i,y} \quad with\, y \in [0,1]$$

where $K_{i,y}$ is the inverse of the ranking of firm i in term of emission intensity (i.e. the total amount on GHG emissions normalized by revenues or, if not available, it would correspond to the total carbon dioxide CO2 emitted weighted by revenues), and $E_{i,y}$ is the ranking of firm i in term of E score. $G_{i,y}$ is the synthetic greenness and transparency indicator of a company i at year y. The parameter γ controls for the relative importance of the two components of the index. The benchmark case is set with y = 0.2. It follows that, the higher the company's level of transparency the larger the value of $G_{i,y}$. Firms that attain a lower emission intensity, for a given level of transparency, are also associated with larger values of $G_{i,y}$. As shown in the table below, the number of companies reporting on their environmental performance has exhibited an upward trend in the last ten years, reaching around 700 EUROSTOCC companies in 2017, which is more than half of the sample.

Figure 1 – Total number of companies for which E score (yellow bar) and emission intensity (gray bar) are available

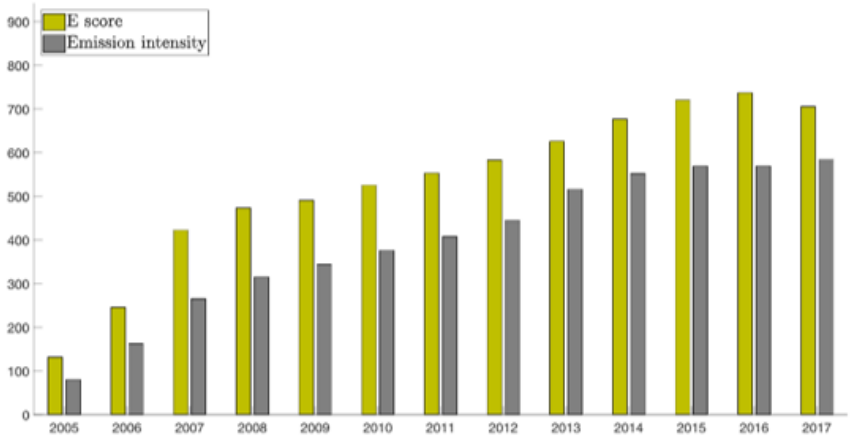


Figure (1) from Journal of Financial Stability (2021)

Some limitations characterized the synthetic greenness and transparency indicator are:

- The mismatch of data reported i.e. some analysis includes data from 2005, while the Bloomberg ESG application was launched in 2009. In other words, market participants could start using Bloomberg E score in 2009, but the index used in this report is based on information already available in the market;
- Firms label themselves as green. However, they may actually be less green than they claim since the EU Non-Financial Reporting Directive (NFRD) only requires auditors to verify the publication of non-financial disclosures by relevant firms, but there are no assessment and verification requirements on the content of non-financial disclosures. However, the asset pricing analysis should not be affected by this problem, insofar as investors base their decisions only on publicly available information as we do;
- Related to the previous issue of self-reporting is that one of self-selection, due to the fact that unless firms are subject to the NFRD, it is up to them to choose whether and in particular which environmental information disclose. Self-selection can lead to a bias in the analysis. However, in this paper, the self-selection should work well since greener firms should have a natural incentive to disclose more as they have less to hide. At the same time, also more environmentally damaging firms may also have an incentive to do voluntary disclosure, as they are subject to greater external pressure;
- ESG ratings can differ across different data providers, as demonstrate by the literature. In fact, the authors use the E score which consider both environmental ratings and quantitative data on carbon emissions. Moreover, the authors show that considering only one of the two factors does not yield meaningful results.

Finally, among non-transparent firms, they further selected “brown” firms that are companies mainly related and active in sectors with a high level of carbon emissions. Information is taken from the Eurostat database and includes sectoral emissions in Europe.

They also construct a linear factor model where they assume an approximate factor structure for excess returns combined with the absence of arbitrage opportunities to obtain asset pricing restrictions. They opt for a time-invariant model, which assumes that the exposition of an asset *i* to each observable factor does not evolve over time. Even though a time-variant model would have been the best choice, a time-invariant model is the only available option as the greenness and transparency indicator defined above is only available for a relatively short sample. A time-varying model for the excess return could only be estimated on a much longer time series and a much larger cross-section.

Based on the linear factor model, the three authors decide to make a comparison between the greener and more transparent portfolio and the brown. Then, they propose an observable greenness and transparency factor defined as the difference between the returns on the greener and more transparent portfolio and those on the brown portfolio. Finally, they estimate the greenium which is the risk premium associated with the greenness and transparency factor, using a set of European individual stocks. The sample considers all the individual stocks from January 2006 to August 2018, included in the STOXX Europe Total Market Index (TMI) in August 2018. Almost 95% of the free-float market capitalization across 17 European countries is covered by the STOXX Europe TMI. The reliability of this study depends on the quality of environmental disclosures of European firms, not on the quantity of information. Financial firms (i.e. companies classified in sectors with NACE code K or L) are excluded from the sample. Summing up, the final dataset comprises $n = 942$ stocks. The provider collects data on stock returns and market capitalization is Bloomberg. The panel is unbalanced, which means that asset returns for all enterprises are not available at all times. To accommodate for publication lags, they use environmental disclosures from the prior reference year each year. Hence, the passages followed by the authors are the following:

- They split the transparent companies from the non-transparent ones;
- They define, at each month, the returns on the transparent and non-transparent portfolios and the market capitalization of the stock in a given month;
- Focusing on transparent firms, they study the returns on different portfolios characterized by different shades of green and degrees of transparency;
- Focusing on non-transparent firms, they build the brown portfolios;

It follows that the number of portfolios and relative returns analyzed by the authors and shown in Table 1 below are respectively: the portfolio including all transparent firms, the greener, and more transparent portfolio, the portfolio including all non-transparent firms, and the brown portfolio. Looking at the mean

return, the non-transparent portfolio has outperformed the others, followed by the brown and the transparent. It is also interesting to look at the Sharpe ratio, which is used to help investors understand the return of an investment compared to its risk. The ratio relates the mean performance to the standard deviation of the returns on a portfolio. Shreds of evidence demonstrate that the non-transparent portfolio still outperforms the others, which have a similarly better performance than the market. The average return decreases as the level of the greenness and transparency indicator increases. Neither the mean return nor the Sharpe ratio is monotone in greenness and transparency, which is explained by the fact that the environmental characterization of a portfolio is only one of the determinants of its performance. Finally, the distribution of returns for all the portfolios is characterized by excess kurtosis and negative skewness.

Portfolio	Mean	Std	Kurt	Skew	Sharpe	*t*-stat
Transparent	1.102	0.497	3.744	-0.391	0.204	2.522
Greener and more transparent	0.943	0.502	4.097	-0.593	0.188	2.315
Non-transparent	1.732	0.586	5.210	-0.632	0.296	3.643
Brown	1.425	0.638	6.985	-0.909	0.224	2.754

Table (1) from "*What greenium matters in the stock market? The role of greenhouse gas emissions and environmental disclosures*" (2021)

Another important finding is that both transparent and greener and more transparent portfolios have a lower exposition to the market factor than non-transparent meaning that the first ones tend to be less correlated with the market compared to more opaque and browner firms. The performance achieved by the different portfolios can also be explained by the difference loadings on the other factors. For instance, the exposition with respect to the size factor is negative for the transparent and greener and more transparent portfolios and positive for non-transparent and brown portfolios. This result lead to another important conclusion: greener and transparent firms correlate more with bigger firms, while, on the other hand, non-transparent firms and brown firms correlate more with smaller firms. Moreover, the adjusted R-squared is lower for the brown portfolio based on all the models.

Finally, the intercept is positive and significant for all portfolios and models, suggesting the existence of an omitted factor.

They also investigate whether investors accept lower (higher) compensation for holding environmentally friendly stocks by searching for a negative (positive) risk premium. The estimated greenium found is negative and significant at the 1% level in all cases. This means that investors are willing to accept lower compensation, ceteris paribus, to hold assets that correlate positively with the greenness and transparency factor i.e. greener and more environmentally transparent assets. This happens because investors are only interested in their

portfolios' future payoffs. Hence, if they accept a lower remuneration, this is because by doing so they are hedging some risks, particularly the climate risk, in this case. Fama and French also suggest that investors' decisions, in a more general context, may be driven by some "taste for assets" or "taste of green", unrelated to expected return. Another main result is that the greenium is negative and significant at the 1% confidence level also for $y = 0.2$ and $y = 0.8$, demonstrating that the above stated results are not dependent on giving the same weight to the two components of the greenness and transparency factor. Even though giving more weight to emissions than to transparency, or the other way around is not important, both components are essential. Hence, he greenium is not significantly different from zero when y assumes extreme value. This suggests that only the combination of emission intensity and disclosure quality is systematically priced by the market. For instance, if $y = 1$, that is the indicator is based only on emission, this will result in a risk premium not significantly different from zero, suggesting that investors do not look at emissions only. The same theory applies in the case of $y = 0$ where investors should care only about the completeness of environmental disclosures. In this case, the greenium is still negative and significant, but only at the 10% confidence level.

The authors also carry out a climate stress test on actual investors' equity holdings. They consider both institutional sectors at the global level, as well as European SIFIs in particular. The goal of this analysis is to measure the exposure of investors to climate risk, in a scenario where more stringent sustainability-oriented policies are progressively implemented. This would lead to greater pressure on carbon-intensive firms and sectors. In this scenario two opposite and correlated things happened: on one hand the expected returns on greener stocks increase, as more sustainable firms can distribute higher dividends, and subsequently, on the other hand, the price of brows stocks drops for the same reason. It is quite straightforward that policy pressure will primarily affect the environmental disclosures. Of course, all those companies that have already implemented suitable procedures will be better off once disclosure regulation becomes more stringent. This will lead to an increase in the expected return on stocks of more environmentally sustainable and transparent firms. This implies that the return on the greenness and transparency factor, which is positively correlated with returns on greener and more transparent stocks, increases.

CHAPTER IV

THE GREENIUM ANALYSIS: FUTURE EXPECTATIONS ON GREEN BOND PREMIUMS

Analysis introduction

The greenium has been defined as the extra yield, compared to the yield characterized by a conventional bond with the same maturity, that investors grant to companies issuing green bonds. According to several people, including Agathe Foussard e Nelson Ribeirinho, portfolio manager of Mirova, the greenium could be the result of a mechanical supply and demand mismatch. Even though it has shrunk across the years, it still plays a key role. According to some industry specialists, the main drivers of the greenium in 2022 [52] are:

- The positive interest rate;
- the European taxonomy for sustainable activities;
- the development of sustainability-linked bond;
- the updated rating for the indices and the bonds' world as a whole.

Data gathered from the Italian monthly ADVISOR on financial advisory, suggest that the greenium (or credit spread) is around 2.64 basis points in 2022. According to them, the greenium during 2022 will be attested around 2 basis points for senior debt, and more precisely 5 basis points for senior corporate debt (excluding financials) and 6 basis points excluding utilities, government, and financials [53].

As stated above, the growth of the green bonds market is going faster every month, and data gathered during the last years are astonishing. For such a reason, this phenomenon cannot be neglected. Therefore, I would like to analyze the green bonds market and try to understand the market's trend during the next fifteen years. Furthermore, I will investigate the greenium's behavior concerning the green bond market until now and the possible greenium's existence in the next future. Finally, I will end up with some interesting conclusions about the green bond premium based on the previous achievements completed.

Data selection and empirical methodology

For the purpose of this analysis, I first gather data about the number of total green bonds issuance from 2007 to 2021 in USD billion from the annual report made by the Climate Bonds Initiative. Data gathered are the following:

[52] ESG news (2022). "Greenium, i nuovi driver per il 2022".
[53] Data from Il sole 24 ore. Minnena, M. (2022). Debito verde dopo il boom: le sfide per il 2022.

- 2007 = 0.9 USD billion
- 2008 = 0.5 USD billion
- 2009 = 1.0 USD billion
- 2010 = 3.7 USD billion
- 2011 = 1.0 USD billion
- 2012 = 2.0 USD billion
- 2013 = 11.0 USD billion
- 2014 = 36.6 USD billion
- 2015 = 41.8 USD billion
- 2016 = 92.0 USD billion
- 2017 = 155.5 USD billion
- 2018 = 167.3 USD billion
- 2019 = 266.5 USD billion
- 2020 = 290.1 USD billion
- 2021 = 517.1 USD billion

I take into consideration the fifteen year since the European Investment Bank issued the first green bond in 2007. This means that I collect 15 observations, namely x_1 , x_2, x_3 until x_{15}. The annual figure in 2021 is the highest since market inception and maintains the trend of 10 consecutive years of green market expansion. 2021 represent the last reference year that I take into consideration for my analysis. All the data considered from now on are in USD billion (hereinafter also "bn" or "B"). It is worth noting that, the green bond market has experienced a large, or better, astonishing increase, almost exponential, growing on average of 50% per year in the period from 2015 to 2020.

I conduct the first part of the analysis using the programming language Python. First of all, given n = 15 observations (i.e. x_1 , x_2, x_3 … x_{15}) , I want to plot these observations (i.e. points in time) related to the above data along a curve. Specifically, I want a function that passes through all the points. Since data are assumed to be approximate, I do not expect the resulting curve to pass exactly through them, merely to get as close as possible on average. For doing this, I run 3 different interpolations to find the one that best-fit:

1) An interpolation considering a 4th order polynomial function
2) An interpolation considering a 2nd order polynomial function
3) An interpolation considering an exponential function

The 3 mentioned functions seem to pass on average through all the points. For this reason, I proceed to perform the so-called chi-squared test or χ^2 test, a hypothesis testing method. Specifically, I perform the Pearson's Chi-square goodness of fit test to determine how well the model fits the observations. The Chi-square goodness of

fit test checks whether my theoretical sample data is likely to be from a specific theoretical distribution. The test provides a way to decide if the data values have a "good enough" fit to justify my hypothesis. The test compares the values that I will expect to collect with the collected values, through this formula:

$$c^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

where O is the observed value, E is the expected value and "i" is the "ith" position in the contingency table.

Once having defined the best-fit function, I proceed with plotting the function *f*.

Then, through an extrapolation, I predict the volume of total green bonds issuance in the next fifteen years, and precisely for 3 target years: 2025, 2030, and 2035.

The first part of the analysis is now concluded.

Proceeding with the second part of the analysis, the core part of this study, I first want to analyze the greenium's behavior during the past years. Due to a lack of information about this new and challenging topic, I managed to collect all the possible and reliable data related to the greenium during the last four years:

- In 2018, according to the S&P Dow Jones Indices researchers of December 2021, academic researches during that period observed a greenium between 15 and 30 bps. Making an average between the two values, I consider a greenium around 23 bps;
- In 2019, according to the same source, the value of greenium was around 4 bps;
- In 2020, according to the Associazione per i Mercati Finanziari in Europe, the greenium's value was about 9 bps;
- In 2021, according to an article made by Generali Group in April 2022, the generic outcomes for the 3 main sectors are the following:
    - Average greenium in TMT = 2.1 bps
    - Average greenium in utilities = 2.8 bps
    - Average greenium in industrial = 4.4 bps

  Therefore, I decide to make an average between them and consider a greenium's value of about 3 bps in 2021;

- In 2022, according to the Italian monthly ADVISOR on financial advisory, the greenium (or credit spread) is around 3 bps. According to them, the greenium during 2022 will be attested around 2 basis points for senior debt, and more precisely 5 basis points for senior corporate debt (excluding financials) and 6 basis points excluding utilities, government, and financials. However, I consider 2022 in my analysis only to show that the greenium still exists and its value is still equal to 3 bps.

Starting from this data I perform 3 different scenarios analysis about the greenium's behavior in the next years:

1) Worst scenario case in which I assume that the greenium will decrease about 2 bps, reaching a value of 1 bps which remains equal until 2035;
2) Basic scenario case in which I assume that the greenium will remains flat, that is equal to the value of 2021 (or 2022) of 3 bps until 2035;
3) Best scenario case in which I assume that the greenium will increase about 2 bps, reaching a value of 5 bps which remains equal until 2035.

Results and shreds of evidence found will be described in the next section.

Results and discussion

Once having defined the key passages and methodologies used to perform the analysis, it is now time to show evidence of the results achieved. The first analysis' purpose is about understanding which of the 3 interpolations performed show the best fit since the functions' graphs are not enough to certify the model's robustness. The Chi-squared test gives the following results:

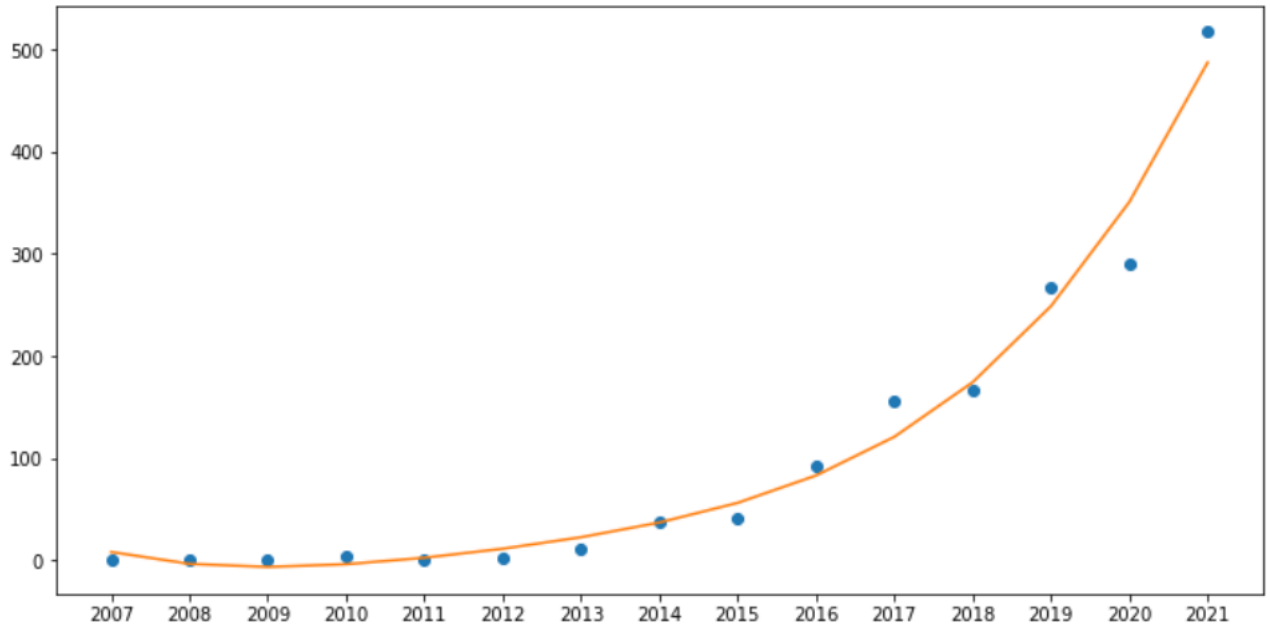
1) For the 4^{th} order polynomial's function the Chi-squared value = 20.21
2) For the 2^{nd} order polynomial's function the Chi-squared value = 35.13
3) For the exponential function the Chi-squared value = 34.90

Then I set a significance level, α, equal to 0,05 (or, equivalently, 95% confidence interval), the most common one, and I also find the degrees of freedom of my test which are equal to the number of observations minus one, i.e. in this case 15-1=14. The Chi-squared value with α = 0,05 and 14 degrees of freedom is 23,68. I compare the values of my test statistic (i.e. 20.21; 35.13 and 34,90) to the Chi-squared value and I can conclude that since the only number lower than 23,68 is 20.21 (i.e. 20.21 < 23.68), the only function showing a good fit and that is statistically significant is the 4^{th} order polynomial function. This means that I do not reject my 4^{th} order polynomial model at 5% significance level.

Then, as previously stated, I proceed with plotting the 4th order polynomial function f, specifically:

$$f = a*(x^4) + b*(x^3) + c*(x^2) + (d*x) + e$$

based on the number of total green bonds issuance from 2007 to 2021 in USD B to get an idea about the curve's shape.



As shown by the graph, even though the resulting curve do not intersect exactly each point, it gets as close as possible on average.

The subsequent extrapolation shows the following results:

- Total green bonds issuance for year 2025 = 1561.58 USD bn
- Total green bonds issuance for year 2030 = 4954.00 USD bn
- Total green bonds issuance for year 2035 = 12378.40 USD bn

These forecasts give us an idea at which rate the green bond market is increasing and how will continue to. Even though I have preferred to be more prudential in making forecasts, the growth rate highlighted by the above results is pretty in line with that one assumed by the CBI. The latter assumes a total issuance of green bonds equal to 5 trillion in 2025 since it expects the market to doubled from 2024 to 2025. I preferred to be more prudential since the evolution of the market will essentially be determined by supply and demand, and we do not know how the future will be.

Once having defined the number of green bonds issued in the three target years, I perform 3 possible scenario analyses in which 3 different and possible values of greenium are considered. Since the greenium is still visible, there are no reasons why it should not exist in the future as well. Here, I multiply the number of bonds by the greenium in order to see if the companies are currently benefit from any economic incentive and if this economic incentive will increase in the future as long as the green bond market increases.

Note that the “actual greenium’s value” refers to 2021 value. However, as previously said, the greenium value in 2022 is equal to that one in 2021. The scenarios are illustrated below:

1) Worst scenario case where the greenium is set equal to 1 bps for the 3 target years 2025, 2030 and 2035

Worst scenario

Greenium = 1 bps

Values in USD billion	2018	2019	2020	2021	2025	2030	2035
# Bonds' issued (USD billion)	167,30	266,50	290,10	517,40	1.561,58	4.954,00	12.378,40
Grenium (bps)	23	4	9	3	1	1	1
# Bonds' issued x Greenium (USD billion)	0,04	0,11	0,26	0,16	0,16	0,50	1,24

2) Basic scenario where the greenium is set equal to 3 bps for the 3 target years 2025, 2030 and 2035

Basic scenario

Greenium = 3 bps

Values in USD billion	2018	2019	2020	2021	2025	2030	2035
# Bond emessi (USD billion)	167,30	266,50	290,10	517,40	1.561,58	4.954,00	12.378,40
Grenium (bps)	23	4	9	3	3	3	3
# Bonds' issued x Greenium (USD billion)	0,38	0,11	0,26	0,16	0,47	1,49	3,71

1) Best scenario where the greenium is set equal to 5 bps for the 3 target years 2025, 2030 and 2035

Best scenario

Greenium = 5 bps

Values in USD billion	2018	2019	2020	2021	2025	2030	2035
# Bonds' issued (USD billion)	167,30	266,50	290,10	517,40	1.561,58	4.954,00	12.378,40
Grenium (bps)	23	4	9	3	5	5	5
# Bonds' issued x Greenium (USD billion)	0,38	0,11	0,26	0,16	0,78	2,48	6,19

The number of bonds issued in 2025, 2030, and 2035 are the ones found above through the extrapolation.

The scenarios above show the greenium's behavior during the last 4 years (i.e. 2018, 2019, 2020, and 2021). These are the findings arising from the research:

- Academic research during 2018, observed a greenium of 15-30 bps, which results in a significant benefit for issuers at the cost of market participants pursuing ESG investments;
- The greenium started decreasing in mid-2019, probably because the huge increase in bonds issued (+59%) has temporarily shrunk the mismatch between supply and demand;
- In 2020, a year marked by a large bond issuers' growing desire to address health and other social concerns in a more strategic manner because of the COVID-19 pandemic's consequences, the

greenium, according to the Associazione per i Mercati Finanziari in Europe, increased on average from 4 to 9 bps;

- In 2021, the greenium return to decrease, probably for the same reason explained concerning 2019. This time the green bond market experienced an increase of 78%.

This evidence suggests that the greenium's behavior did not follow a linear and precise trend, for such a reason it is difficult to forecast its future performance. It is worth noting that results depend on, and vary accordingly, the geographical scope, time frame, and methodology. Furthermore, given the limited availability of information and the fair degree of heterogeneity, it is challenging to collect homogeneous information and consequently make a reliable forecast. For such a reason making scenario analysis and looking at what might happen should be the most plausible choice under these conditions.

Each scenario suggests that, the greenium, related to the total issuance of bonds per year, contributes to a significant level of savings for companies, since investors are willing to accept a lower remuneration for their investments, other things being equal, and therefore the bonds can be issued at a higher-priced (and subsequently a lower yield). In this way, companies will pay less interest resulting in a saving for them. The greenium represents a great result for issuers as it means they pay less to finance their green bonds compared to vanilla equivalents. Of course, a higher premium will lead to higher savings. Nevertheless, due to the explosion of the green bond market, even a greenium of 1 bps will be transformed in 1.5 bn of saving in 2035 for companies. Of course, if the greenium will increase for some reason, the benefit for the companies, in terms of savings, will increase as well. Moreover, my analysis is more prudential than the actual forecast made by CBI meaning that the savings could be even greater if the volume of bonds issued will be larger.

Other benefits for issuers can be:

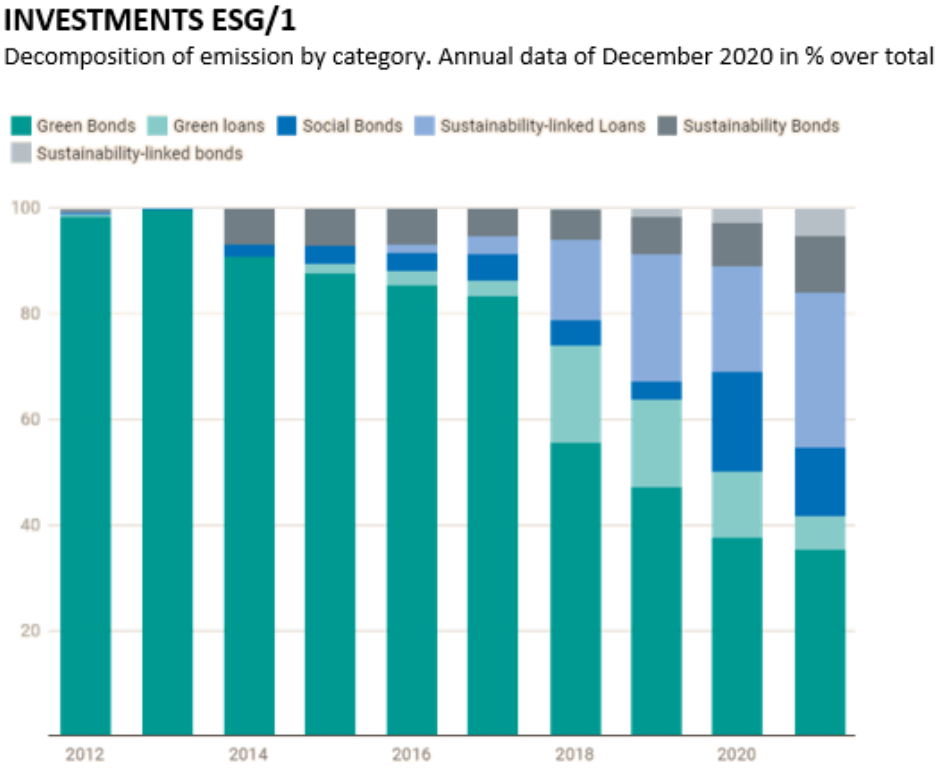
- Improve investor diversification;
- Enhance issuer reputation, since issuing green bonds is also a way, for companies, to share and transmit a message to the community;
- Provide an additional source of sustainable financing and an access into the sustainable financial market;
- Increase alignment regarding the durability of instruments and the project lifecycle;
- Attract strong investor demand for sustainable investment products, which can lead to high oversubscription and pricing benefits.

Therefore, I can state that, based on the data gathered and the actual available information, the greenium still exist and will continue to exist during the next years, thus creating a benefit and an economic incentive for issuers.

Obviously, this analysis is only a today forecast about something that will might be in the future. It is hard to predict the evolution of the market in the medium-long term. Therefore, the evolution of risk premiums and consequently of the greenium will essentially be determined by supply and demand of the bond market.

New forms of sustainable investments today

The label sustainable (or ESG) entails a wide range of investments: among them, green bonds are the most widespread. The "classic" green bonds are structured around a global certification standard, which is coordinated by the global consortium of the Climate Bonds Initiative (CBI), an offshoot of ICMA, precisely, the International Capital Market Association. The latter is a self-regulatory organization and trade association for participants in the capital markets. ICMA stated aims are to promote high standards of market practice, appropriate regulation, trade support, education, and communication. During the pandemic crisis, also social bonds have taken ground. However, from 2018 onwards, the most significant growth has been experienced by new categories of instruments yet cited above: sustainability-linked bonds/loans which have come to represent 34% of the entire ESG investment market. Even though the global market for classic green bonds has experienced and is still experiencing an abnormal growth, its weight is reduced and now represents "only" 35% of total issuance. The boom of the sustainability-linked bonds/loans is visible in the following graphs [54]:



[54] Data from Il sole 24 ore. Minnena, M. (2022). Debito verde dopo il boom: le sfide per il 2022.

Figure (1) from Bloomberg NEF

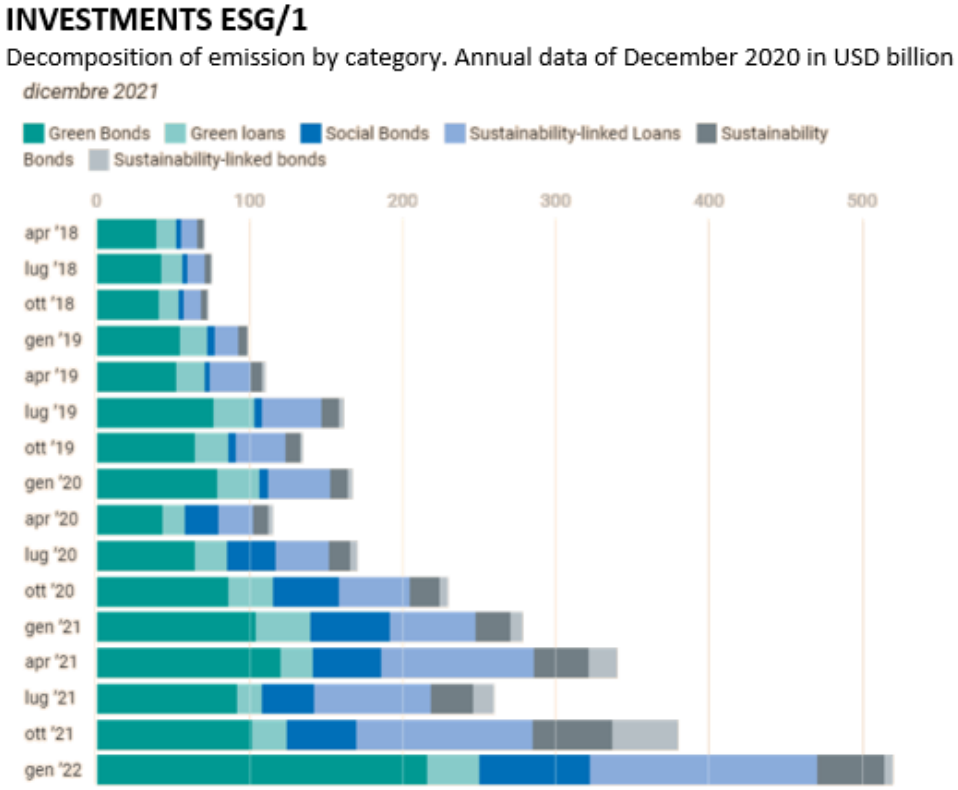


Figure (1) from Bloomberg NEF

Sustainability-Linked Bonds (SLBs) are bonds with financial and structural characteristics that vary according to the achievement of predefined objectives relating to the issuer's sustainability performance. Unlike green, social and sustainable bonds, whose proceeds are intended to finance environmental and social projects, the financial resources raised with the SLBs are not intended for specific purposes. The use of these instruments allows operators characterized by high intensity of carbon dioxide emissions to explicitly associate their commitments towards sustainability with specific indicators, thus benefiting from a better reputation.

It follows that the boom characterizing these bonds is justified by the greater flexibility offered. The sustainability linked bonds/loans incorporate greater flexibility in the collection and use of proceeds, to allow companies operating in non-green sectors, such as the chemical or hydrocarbon industry, to access the sustainable finance market. This allows small companies that are unable to comply with the transparency and monitoring requirements characterizing green, social, and sustainable tools, to become actors in the sustainable market.

Green, social and partially sustainability bonds share very specific properties:

- the connection with an explicit project to be financed;

- the definition of a specific intended use of the proceeds; and
- the contractual commitment to a periodic publication of a report about the related environmental impact.

This is a rather restrictive framework that in the past has worked well in reducing the phenomenon of the so-called greenwashing, but it has also reduced the potential audience of issuing companies. The performance of these new instruments is anchored on key performance indicators (KPIs). In other terms, the bond (or loan) has coupons that are linked to the achievement of target levels related to some key indicators such as the amount of CO2 emitted or the minimization of toxic production waste. If the company misses these objectives, the coupons automatically grow according to a step-up mechanism, increasing the cost of the loan by an amount equal to the theoretical estimation of the damage produced by the negligent behavior. In theory, this mechanism offers a great incentive for the company in achieving the sustainability objective: while with green bonds the responsibility of the company is only reputational, in this case, there would be a tangible economic effect. Furthermore, bondholders would be more protected in their standard green investments, since they will be able to count on a potential bonus in the event of failure to achieve environmental objectives. At this stage, there is no unambiguous and standardized definition for the KPIs that can allow to carry out an external control on the achievement of performance and a clear comparison between products. Moreover, enterprises issuing those types of instruments are currently setting up the bar of objectives very close to the current levels already achieved, in order to be sure of hitting them without too much effort and keeping the disbursements at the minimum level. Transition and Sustainability-Linked Bonds are an intermediate category between green bonds and traditional bonds still aiming at reducing environmental damage.

However, it is necessary to deal with the current perspectives and foster standardization of KPIs: according to the most recent estimates by the Barclays bank [55], the market for sustainability linked bonds/loans should grow by 50% - 70% in 2022, and in 2023 nearly all sustainable debt issuance could occur within this category.

European institutions are also adapting to the fast-paced market: from September 2020 the European Central Bank has accepted this type of instrument (albeit with various caveats) as collateral for standard bank refinancing operations while the European Investment Bank has granted various loans through these contractual schemes.

Also, the climate investment segment is in rapidly evolving. Investors eager to invest in strategies to counteract climate change have access to a wide range of possibilities. Data from Morningstar estimate the existence of 400 funds and ETF funds all over the world, of which 282 Europe based. The European market is by far the richest and most diversified market. The universe encompasses many approaches, which pursue different

[55] Data from Il sole 24 ore. Minnena, M. (2022). Debito verde dopo il boom: le sfide per il 2022.

sustainability objectives. Some are focused on the "decarbonization" of the portfolio; others on investments in green solutions. There are equity funds, but also balanced and alternative funds.

It is interesting to see more in-depth the most common funds [56].

Low carbon funds invest in companies characterized by low carbon insensitive. The low carbon funds support projects that help to reduce greenhouse gas emissions, generate clean growth, build resilient communities, and create good jobs.

Climate-conscious funds select companies that include climate change into their business strategy since they are more prepared for a low carbon transition. It is a hybrid group composed of both low-carbon instruments and those focused on climate solutions. An example is Lyxor S&P Europe Paris-Aligned Climate Etf. These ETFs are designed to meet and exceed the EU Paris-Aligned benchmarks' minimum requirements.

Green bond funds invest in bonds issued to finance the transition to the green economy. The GBP provides a reference of which type of projects are included.

The growing interest in ESG topics, accelerated by the pandemic situation, will likely drive demand for sustainable funds in Europe during the next years.

2020 was an outstanding year for ESG funds. Driven by a growing interest in environmental, social, and governance issues, European sustainable tools have broken new records in terms of flows, assets and product development.

In 2020, sustainable funds attracted net flows of 233 billion euros - almost double compared to 2019. In the fourth quarter, sustainable funds raised almost 100 billion, attracting 45% of total flows directed to European funds.

[56] Data and info from Morningstar (2021). I record dei fondi sostenibili europei nel 2020.

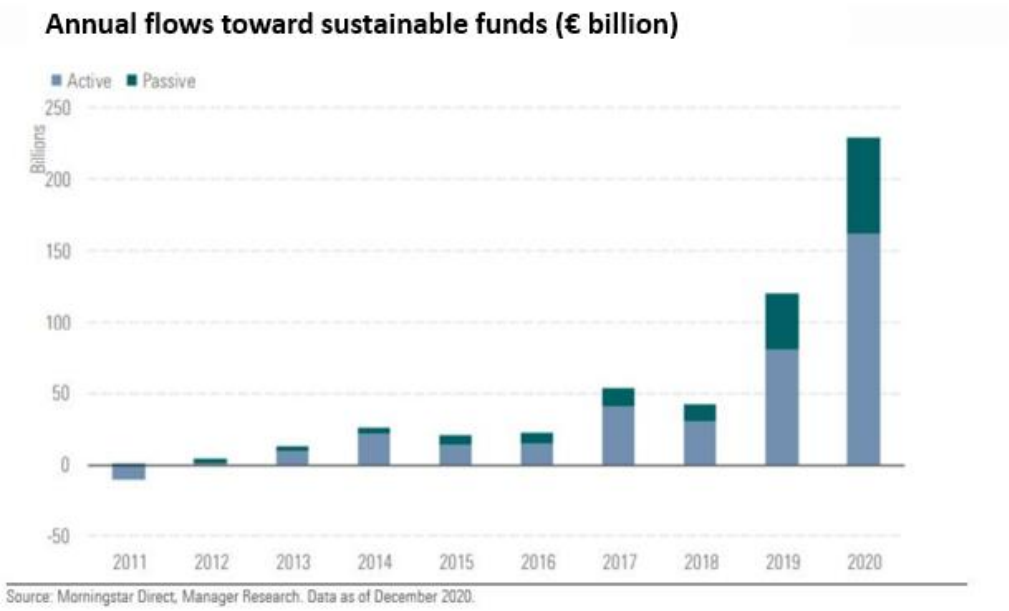


Figure from Morningstar Direct, Manager Research, Data as of December 2020

Investors have also realized that ESG funds offer comparable or even better performance than traditional funds in some cases. The pandemic has also accelerated investor interest in sustainability issues and, in particular, climate change.

Greater awareness of risks and opportunities resulting from the climate transaction is shown by the fact that climate-related funds were among the best-selling in 2020. In the fourth quarter, seven climate-oriented funds were ranked in the top 10 in terms of annual flows. Among them, energy funds are the winners in terms of performance. The best funds have grown, in terms of returns, by 100% and 200%, driven by expectations about higher long-term demand for alternative energy systems.

Forbes advisor conducts a survey in 2022 [57] looking at approximately 80 ETFs and mutual funds focus on ESG investing. They select the Best ESG Funds of May 2022 based on the following criteria: they exclude funds that did not have at least three years of performance data and whose performance fell significantly below the benchmark S&P 500 index or other ESG funds. Beyond performance, they considered the costs associated with each fund. The index funds on their list are the least expensive, and tend to perform best over longer periods. Finally, they considered how each fund selects ESG companies and debt. The best ESG funds highlighted are:

- The Vanguard FTSE Social Index Fund (VFTAX)

[57] Rob Berger (2022). The Best ESG Funds Of May 2022. Forbes ADVISOR.

- iShares MSCI USA ESG Select ETF (SUSA)
- Parnassus Core Equity Investor (PRBLX)
- iShares Global Clean Energy ETF (ICLN)
- Shelton Green Alpha Fund (NEXTX)
- 1919 Socially Responsive Balanced Fund (SSIAX)
- AllianceBernstein Sustainable Global Thematic Fund (ATEYX)

For what concern Italy, it is worth noting to say that, the 2022 Budget Act established the Italian climate fund managed by Cassa Depositi e Prestiti [58], with an endowment of 840 million euros for each of the years from 2022 to 2026 and 40 million starting from 2027. The fund will finance interventions, including non-repayable, in favor of private and public entities to contribute to the achievement of the objectives joined by Italy and established in the international agreements on climate and environmental protection.

Starting from this year, another 150 million will be allocated to the new Fund to support industrial transition and to facilitate the adaptation of the production system to European policies in the fight against climate change. Therefore, concessions may be granted to companies, particularly for those operating in energy-intensive sectors, for the realization of investments for energy efficiency, for the recycle of raw materials, as well as for the carbon capture, sequestration and storage.

Another important fund offering the opportunity to invest in the global green bond market and which has grown significantly over the last few years benefiting from a renewed sensitivity for environmental topics is the Eurizon Fund – Absolute Green Bonds [59]. The sector is based on an analysis of macroeconomic themes and on a careful screening within the universe of "green emissions". The result has been a diversified and flexible fund that aims to obtain a positive absolute return in the medium term while maintaining moderate volatility. On the occasion of the 2022 ESG Investing Awards, the fund has been awarded as the best fund in the category Best ESG Investment Fund: Climate / Green Bonds.

The ESG Investing Awards rewards annually global excellence in ESG (Environmental, Social and Governance) in terms of research, ratings, investment solutions and initiatives that help generating a positive impact on the integrity, growth and success of ESG investments as a whole.

Eurizon stood out among 345 American, British and European companies. It was also one of the finalists in other five categories: Fixed Income, Specialist Fixed Income, Emerging Markets Debt, Global Thematic and Social Bonds.

[58] Data from Il sole 24 ore. Scozzari, C. (2022). "Chi e come gestirà i 4,7 miliardi stanziati dalla manovra per clima e inquinamento".
[59] Info from Eurizon Asset Management official website: see the following paragraphs for frther detail.

The 2022 ESG Investing Awards are the only awards dedicated to evaluate the best companies involved in all the ESG investment areas at a global level. They are designed exclusively for banks, investment managers, research houses, rating agencies, index and ETF providers and exchanges. Eurizon Fund - Absolute Green Bonds was recently also awarded to MainStreet Partners “ESG Champions” 2022.

CONCLUSION

Sustainable finance has grown rapidly, as evidenced by the explosive growth of green bonds and the development of innovative SDG-related financial instruments, and many financial jurisdictions are now taking explicit steps to green their financial systems. However, progress seems still to be insufficient and too slow. Sustainable finance is still only a small fraction of overall financial activity in private markets, as it is only now beginning to be mainstreamed into the business models of the financial industry. Therefore, private finance is an essential component of the financing of the 2030 Agenda.

It is also true that new forms of sustainable investments such as climate conscious funds, green bonds fund, carbon funds as well as sustainable instruments as sustainability-linked bonds and transition bonds are rapidly taking place. The growth of the green bonds market is growing faster every month and data gathered during the last years are astonishing. For such a reason, this phenomenon is the core topic of this essay. A continued acceleration of green issuance, according to my prudential analysis, will drove the green bond market to just over one and half a trillion (1561,6 USD bn) in 2025 and to 12 trillion in 2035.

The green bond market topic is strictly related to the greenium existence. This green risk premium exists today and its value is around 3 bps in 2022. Given the limited availability of information and the fair degree of heterogeneity, it is challenging to collect homogeneous information and consequently make reliable forecasts. Therefore, performing scenario analysis represent the best way to examine and evaluate possible scenarios that could take place in the future and predicting the various feasible results or possible outcomes. I believe that the greenium will continue to exist at least during the next 15 years since the supply and demand mismatch will not disappear. This statement is supported by the fact that, as previously stated, the growth of sustainable finance is still insufficient and too slow. However, the value of the greenium could eventually drop to 1 bps or increase to 5 bps. Outcomes arising from both best-case scenario as well as worst-case scenario, find out that, as long as the greenium will not fall under the 1 bps, investors will benefit from an economic incentive. Even a greenium equal to 1 bps will be transform in 1.5 bn of saving in 2035 for companies since the volume of bonds issued is very huge. Moreover, the higher the greenium, the greater the benefit for companies, in terms of savings. A negative premium is regarded favorably by issuers because it can lower their funding costs, while investors will receive a slightly lower yield compared to existing similar bonds. This means that investors accept a lower remuneration for their investments, ceteris paribus, in so far as these investments are linked to greener economic activities. This can be interpreted this as evidence of climate risk being viewed as significant, with the market seeing value in investing in green assets as a hedging strategy towards worse environmental outcomes. In other word, some investors are willing to give up a certain proportion of their return as long as a non-financial utility from the investment is achieved.

Therefore, according to my analysis based on the data gathered and the actual available information, the greenium still exist and will continue to exist during the next years, thus creating a benefit and an economic incentive for issuers.

Finally, it should be noted at this point that the above analysis is only a snapshot. The evolution of risk premiums and consequently of the greenium will essentially be determined by supply and demand on the bond market.

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EXECUTIVE SUMMURY

Green finance has a significant impact on environmentally sustainable development. Therefore, developing green finance has become an irreversible and unstoppable trend for the economic transition. Defining green finance may be challenging since there is no single, fixed, and agreed-on common definition. For this essay, green finance has to do with any financial initiative, process, product, or service that is either designed to protect the natural environment or to manage how the environment impacts finance and investment, as specified by the Marsh & McLennan companies/NACD [60]. Green finance is a kind of financial activity to promote better development of the environment and to improve the typologies of resources used. It also deals with climate change. Its role is pivotal not only to develop the green features of the financial industry in its operations but also to change the investment orientation of enterprises and to accelerate the transformation of green consumption.

Many are the actors playing in the green financial market. Among them, governments across the world are undertaking actions for the transition toward low-carbon and more circular economies which entails the adoption of the passage of the Paris Agreement on climate change. An analysis of climate-related and environmental risks, whose drivers are the physical risk and the transition risk, is presented in the first chapter. Moreover, institutions are required to consider climate-related and environmental risks when formulating and implementing their business strategy and governance and risk management frameworks. Companies are also required to make disclosures aiming at enhancing transparency within financial institutions and granting the correct functioning of financial markets. However, all these requirements are having and will have impacts on both employees and companies' directors.

Moving deeper into the analysis of green finance, the second chapter seeks to provide an overview of the main social benefits, definitions, and categories of bonds' instruments, which respectively are: green bond, social bond, sustainability bond, and transition bond. The growth in sustainable investing skyrocketed during 2021. The continued acceleration of green issuance drove the green bond market to just over half a trillion in 2021 according to the Climate Bonds Market Intelligence. The annual figure is the highest since the market inception and maintains the trend of 10 consecutive years of green market expansion. Data and information about the European green bond market are also provided in this chapter.

To ensure that green bonds make the expected contribution to the environment, issuers should disclose a green bond framework explained in the third chapter. However, the phenomenon of greenwashing is increasingly becoming widespread and dangerous for investors. For such a reason an external review is highly recommended for companies. Moreover, bonds are characterized by different shades of green depending on

[60] Definition by Marsh & McLennan Companies/NACD. Climate change: the implications for boards. Article Series 2020.

the possible environmental impact they may have on the external environment. This chapter also aims at investigating a cutting-edge topic: the green risk premium namely greenium. It can be stated that green bonds offer a greenium when they are issued at a higher price and therefore have a lower yield than outstanding bonds. This means that investors are willing to accept a lower remuneration for their investments, other things being equal, as long as investments made are linked to "green" economic activities. This implies that bonds can be priced at a lower level (thus, a lower interest rate) than the risk-paired traditional bonds. Evidence about the sign and the magnitude of the greenium will be provided.

In the last chapter, I will perform an analysis through which I will provide a snapshot of the evolution of the total issuance of green bonds until today. As stated above, the growth of the green bonds market is going faster every month, and data gathered during the last years are astonishing. For such a reason, this phenomenon cannot be neglected. For the purpose of this analysis, I first gather data about the number of total green bonds issuance from 2007 to 2021 in USD billion from the annual report made by the Climate Bonds Initiative. I take into consideration the fifteen year since the European Investment Bank issued the first green bond in 2007. This means that I collect 15 observations, namely x_1 , x_2, x_3 until x_{15}. The annual figure in 2021 is the highest since market inception and maintains the trend of 10 consecutive years of green market expansion. 2021 represent the last reference year that I take into consideration for my analysis. All the data considered are in USD billion (hereinafter also "bn" or "B").

I conduct the first part of the analysis using the programming language Python. First of all, given n = 15 observations (i.e. x_1 , x_2, x_3 … x_{15}) , I plot these observations (i.e. points in time) along a curve. Specifically, I want a function that passes through all the points. Since data are assumed to be approximate, I do not expect the resulting curve to pass exactly through them, merely to get as close as possible on average. For doing this, I run 3 different interpolations to find the one that best-fit:

4) An interpolation considering a 4th order polynomial function
5) An interpolation considering a 2nd order polynomial function
6) An interpolation considering an exponential function

The 3 mentioned functions seem to pass on average through all the points. For this reason, I proceed to perform the so-called chi-squared test or χ^2 test, a hypothesis testing method. Specifically, I perform the Pearson's Chi-square goodness of fit test to determine how well the model fits the observations. The Chi-square goodness of fit test checks whether my theoretical sample data is likely to be from a specific theoretical distribution. The test provides a way to decide if the data values have a "good enough" fit to justify my hypothesis. The test compares the values that I will expect to collect with the collected values, through this formula:

$$c^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

where O is the observed value, E is the expected value and "i" is the "ith" position in the contingency table.

The Chi-squared test gives the following results:

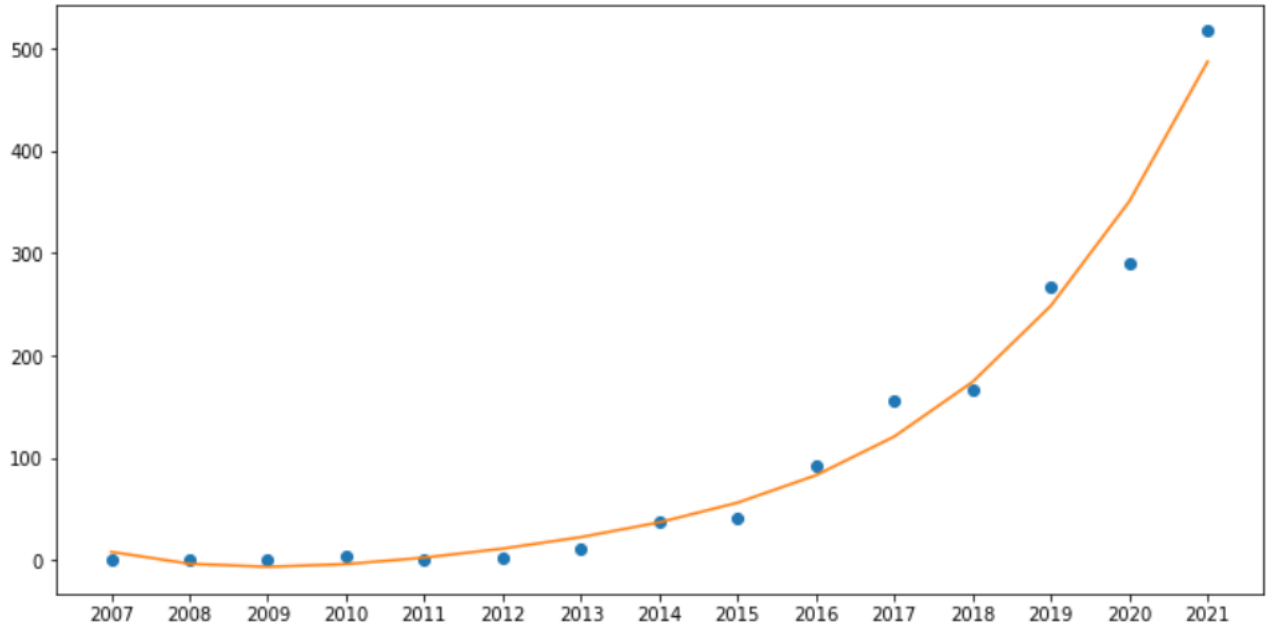
4) For the 4th order polynomial's function the Chi-squared value = 20.21
5) For the 2nd order polynomial's function the Chi-squared value = 35.13
6) For the exponential function the Chi-squared value = 34.90

Then I set a significance level, α, equal to 0,05 (or, equivalently, 95% confidence interval), the most common one, and I also find the degrees of freedom of my test which are equal to the number of observations minus one, i.e. in this case 15-1=14. The Chi-squared value with α = 0,05 and 14 degrees of freedom is 23,68. I compare the values of my test statistic (i.e. 20.21; 35.13 and 34,90) to the Chi-squared value and I can conclude that since the only number lower than 23,68 is 20.21 (i.e. 20.21 < 23.68), the only function showing a good fit and that is statistically significant is the 4th order polynomial function. This means that I do not reject my 4th order polynomial model at 5% significance level.

Then, as previously stated, I proceed with plotting the 4th order polynomial function *f*, specifically:

$$f = a*(x^4) + b*(x^3) + c*(x^2) + (d*x) + e$$

based on the number of total green bonds issuance from 2007 to 2021 in USD B to get an idea about the curve's shape.



As shown by the graph, even though the resulting curve do not intersect exactly each point, it gets as close as possible on average.

Then, through an extrapolation, I predict the volume of total green bonds issuance in the next fifteen years, and precisely for 3 target years: 2025, 2030, and 2035. The extrapolation shows the following results:

- Total green bonds issuance for year 2025 = 1561.58 USD bn
- Total green bonds issuance for year 2030 = 4954.00 USD bn
- Total green bonds issuance for year 2035 = 12378.40 USD bn

These forecasts give us an idea at which rate the green bond market is increasing and how will continue to. Even though I have preferred to be more prudential in making forecasts, the growth rate highlighted by the above results is pretty in line with that one assumed by the CBI. The latter assumes a total issuance of green bonds equal to 5 trillion in 2025 since it expects the market to double from 2024 to 2025. I preferred to be more prudential since the evolution of the market will essentially be determined by supply and demand, and we do not know how the future will be.

Once having defined the number of green bonds issued in the three target years, I perform 3 possible scenario analyses in which 3 different and possible values of greenium are considered. Since the greenium is still visible, there are no reasons why it should not exist in the future as well. Here, I multiply the number of bonds by the greenium in order to see if the companies are currently benefit from any economic incentive and if this economic incentive will increase in the future as long as the green bond market increases.

Note that the "actual greenium's value" refers to 2021 value. However, as previously said, the greenium value in 2022 is equal to that one in 2021. The scenarios are illustrated below:

3) Worst scenario case where the greenium is set equal to 1 bps for the 3 target years 2025, 2030 and 2035

Worst scenario

Greenium = 1 bps

Values in USD billion	2018	2019	2020	2021	2025	2030	2035
# Bonds' issued (USD billion)	167,30	266,50	290,10	517,40	1.561,58	4.954,00	12.378,40
Grenium (bps)	23	4	9	3	1	1	1
# Bonds' issued x Greenium (USD billion)	0,04	0,11	0,26	0,16	0,16	0,50	1,24

4) Basic scenario where the greenium is set equal to 3 bps for the 3 target years 2025, 2030 and 2035

Basic scenario

Greenium = 3 bps

Values in USD billion	2018	2019	2020	2021	2025	2030	2035
# Bond emessi (USD billion)	167,30	266,50	290,10	517,40	1.561,58	4.954,00	12.378,40
Grenium (bps)	23	4	9	3	3	3	3
# Bonds' issued x Greenium (USD billion)	0,38	0,11	0,26	0,16	0,47	1,49	3,71

5) Best scenario where the greenium is set equal to 5 bps for the 3 target years 2025, 2030 and 2035

Best scenario

Greenium = 5 bps

Values in USD billion	2018	2019	2020	2021	2025	2030	2035
# Bonds' issued (USD billion)	167,30	266,50	290,10	517,40	1.561,58	4.954,00	12.378,40
Grenium (bps)	23	4	9	3	5	5	5
# Bonds' issued x Greenium (USD billion)	0,38	0,11	0,26	0,16	0,78	2,48	6,19

The number of bonds issued in 2025, 2030, and 2035 are the ones found above through the extrapolation.

The scenarios above show the greenium's behavior during the last 4 years (i.e. 2018, 2019, 2020, and 2021). These are the findings arising from the research:

- Academic research during 2018, observed a greenium of 15-30 bps, which results in a significant benefit for issuers at the cost of market participants pursuing ESG investments;
- The greenium started decreasing in mid-2019, probably because the huge increase in bonds issued (+59%) has temporarily shrunk the mismatch between supply and demand;
- In 2020, a year marked by a large bond issuers' growing desire to address health and other social concerns in a more strategic manner because of the COVID-19 pandemic's consequences, the greenium, according to the Associazione per i Mercati Finanziari in Europe, increased on average from 4 to 9 bps;
- In 2021, the greenium return to decrease, probably for the same reason explained concerning 2019. This time the green bond market experienced an increase of 78%.

This evidence suggests that the greenium's behavior does not follow a linear and precise trend, for such a reason it is difficult to forecast its future performance. It is worth noting that results depend on, and vary accordingly, the geographical scope, time frame, and methodology. Furthermore, given the limited availability of information and the fair degree of heterogeneity, it is challenging to collect homogeneous information and consequently make a reliable forecast. For such a reason making scenario analysis and looking at what might happen should be the most plausible choice under these conditions.

Each scenario suggests that, the greenium, related to the total issuance of bonds per year, contributes to a significant level of savings for companies, since investors are willing to accept a lower remuneration for their investments, other things being equal, and therefore the bonds can be issued at a higher-priced (and subsequently a lower yield). In this way, companies will pay less interest resulting in a saving for them. The greenium represents a great result for issuers as it means they pay less to finance their green bonds compared to vanilla equivalents. Of course, a higher premium will lead to higher savings. Nevertheless, due to the explosion of the green bond market, even a greenium of 1 bps will be transformed in 1.5 bn of saving in 2035 for companies. Of course, if the greenium will increase for some reason, the benefit for the companies, in terms of savings, will increase as well. Moreover, my analysis is more prudential than the actual forecast made by CBI meaning that the savings could be even greater if the volume of bonds issued will be larger.

Other benefits for issuers can be:

- Improve investor diversification;
- Enhance issuer reputation, since issuing green bonds is also a way, for companies, to share and transmit a message to the community;
- Provide an additional source of sustainable financing and an access into the sustainable financial market;
- Increase alignment regarding the durability of instruments and the project lifecycle;
- Attract strong investor demand for sustainable investment products, which can lead to high oversubscription and pricing benefits.

Therefore, I can state that, based on the data gathered and the actual available information, the greenium still exist and will continue to exist during the next years, thus creating a benefit and an economic incentive for issuers. The willingness of investors accepting a lower renumeration gives evidence of climate risk being viewed as significant, with the market seeing value in investing in green assets as a hedging strategy towards worse environmental outcomes. In other word, some investors are willing to give up a certain proportion of their return as long as a non-financial utility from the investment is achieved.

Obviously, this analysis is only a today forecast about something that will might be in the future. Given the limited availability of information and the fair degree of heterogeneity, it is challenging to collect homogeneous information and consequently make reliable forecasts. Subsequently, it is hard to predict the evolution of the market in the medium-long term. Therefore, the evolution of risk premiums and consequently of the greenium will essentially be determined by supply and demand of the bond market thus performing scenario analysis represent the best way to examine and evaluate possible scenarios that could take place in the future and predicting the various feasible results or possible outcomes.

The label sustainable (or ESG) entails a wide range of investments: among them, green bonds are the most widespread. For such a reason, green bond phenomenon is the core topic of this essay. The "classic" green bonds are structured around a global certification standard, which is coordinated by the global consortium of the Climate Bonds Initiative (CBI), an offshoot of ICMA, precisely, the International Capital Market Association. The latter is a self-regulatory organization and trade association for participants in the capital markets. ICMA stated aims are to promote high standards of market practice, appropriate regulation, trade support, education, and communication. During the pandemic crisis, also social bonds have taken ground. However, from 2018 onwards, the most significant growth has been experienced by new categories of instruments yet cited above: sustainability-linked bonds/loans which have come to represent 34% of the entire ESG investment market. Even though the global market for classic green bonds has experienced and is still experiencing an abnormal growth, its weight is reduced and now represents "only" 35% of total issuance. The boom of the sustainability-linked bonds/loans is visible in the following graphs [61]:

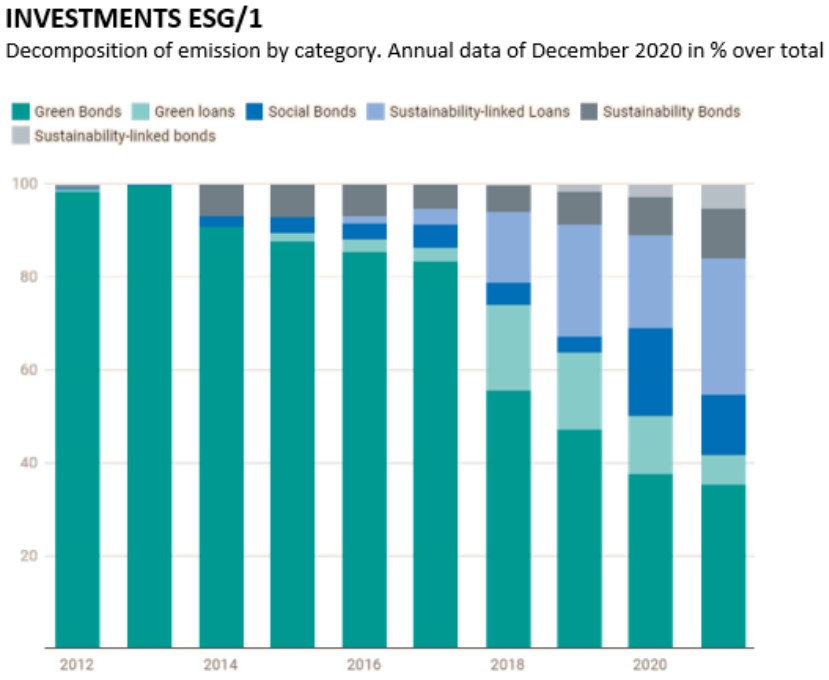


Figure (1) from Bloomberg NEF

[61] Data from Il sole 24 ore. Minnena, M. (2022). Debito verde dopo il boom: le sfide per il 2022.

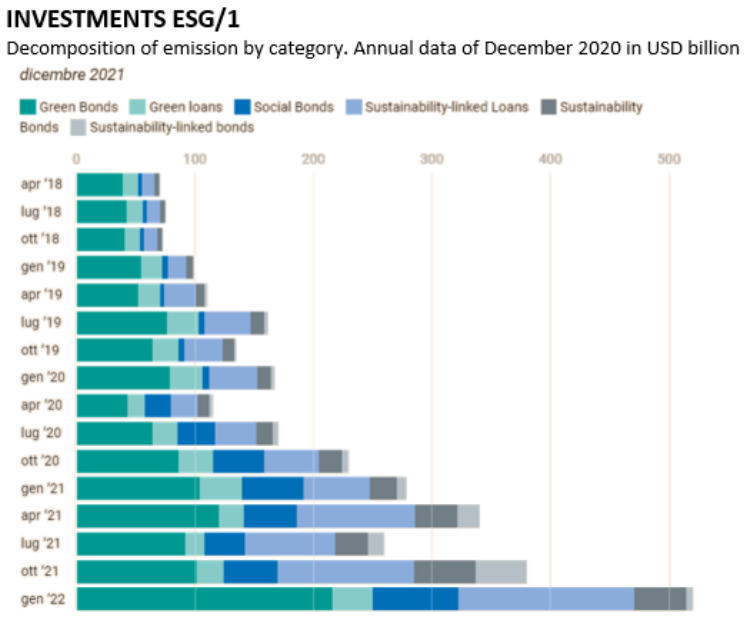


Figure (1) from Bloomberg NEF

Sustainability-Linked Bonds (SLBs) are bonds with financial and structural characteristics that vary according to the achievement of predefined objectives relating to the issuer's sustainability performance. Unlike green, social and sustainable bonds, whose proceeds are intended to finance environmental and social projects, the financial resources raised with the SLBs are not intended for specific purposes. The use of these instruments allows operators characterized by high intensity of carbon dioxide emissions to explicitly associate their commitments towards sustainability with specific indicators, thus benefiting from a better reputation.

It follows that the boom characterizing these bonds is justified by the greater flexibility offered. The sustainability linked bonds/loans incorporate greater flexibility in the collection and use of proceeds, to allow companies operating in non-green sectors, such as the chemical or hydrocarbon industry, to access the sustainable finance market. This allows small companies that are unable to comply with the transparency and monitoring requirements characterizing green, social, and sustainable tools, to become actors in the sustainable market.

Green, social and partially sustainability bonds share very specific properties:

- the connection with an explicit project to be financed;
- the definition of a specific intended use of the proceeds; and
- the contractual commitment to a periodic publication of a report about the related environmental impact.

This is a rather restrictive framework that in the past has worked well in reducing the phenomenon of the so-called greenwashing, but it has also reduced the potential audience of issuing companies. The performance of

these new instruments is anchored on key performance indicators (KPIs). In other terms, the bond (or loan) has coupons that are linked to the achievement of target levels related to some key indicators such as the amount of CO2 emitted or the minimization of toxic production waste. If the company misses these objectives, the coupons automatically grow according to a step-up mechanism, increasing the cost of the loan by an amount equal to the theoretical estimation of the damage produced by the negligent behavior. In theory, this mechanism offers a great incentive for the company in achieving the sustainability objective: while with green bonds the responsibility of the company is only reputational, in this case, there would be a tangible economic effect. Furthermore, bondholders would be more protected in their standard green investments, since they will be able to count on a potential bonus in the event of failure to achieve environmental objectives. At this stage, there is no unambiguous and standardized definition for the KPIs that can allow to carry out an external control on the achievement of performance and a clear comparison between products. Moreover, enterprises issuing those types of instruments are currently setting up the bar of objectives very close to the current levels already achieved, in order to be sure of hitting them without too much effort and keeping the disbursements at the minimum level. Transition and Sustainability-Linked Bonds are an intermediate category between green bonds and traditional bonds still aiming at reducing environmental damage.

However, it is necessary to deal with the current perspectives and foster standardization of KPIs: according to the most recent estimates by the Barclays bank [62], the market for sustainability linked bonds/loans should grow by 50% - 70% in 2022, and in 2023 nearly all sustainable debt issuance could occur within this category.

European institutions are also adapting to the fast-paced market: from September 2020 the European Central Bank has accepted this type of instrument (albeit with various caveats) as collateral for standard bank refinancing operations while the European Investment Bank has granted various loans through these contractual schemes.

Also, the climate investment segment is in rapidly evolving. Investors eager to invest in strategies to counteract climate change have access to a wide range of possibilities. Data from Morningstar estimate the existence of 400 funds and ETF funds all over the world, of which 282 Europe based. The European market is by far the richest and most diversified market. The universe encompasses many approaches, which pursue different sustainability objectives. Some are focused on the “decarbonization” of the portfolio; others on investments in green solutions. There are equity funds, but also balanced and alternative funds.

It is interesting to see more in-depth the most common funds [63].

[62] Data from Il sole 24 ore. Minnena, M. (2022). Debito verde dopo il boom: le sfide per il 2022.
[63] Data and info from Morningstar (2021). I record dei fondi sostenibili europei nel 2020.

Low carbon funds invest in companies characterized by low carbon insensitive. The low carbon funds support projects that help to reduce greenhouse gas emissions, generate clean growth, build resilient communities, and create good jobs.

Climate-conscious funds select companies that include climate change into their business strategy since they are more prepared for a low carbon transition. It is a hybrid group composed of both low-carbon instruments and those focused on climate solutions. An example is Lyxor S&P Europe Paris-Aligned Climate Etf. These ETFs are designed to meet and exceed the EU Paris-Aligned benchmarks' minimum requirements.

Green bond funds invest in bonds issued to finance the transition to the green economy. The GBP provides a reference of which type of projects are included.

The growing interest in ESG topics, accelerated by the pandemic situation, will likely drive demand for sustainable funds in Europe during the next years.

2020 was an outstanding year for ESG funds. Driven by a growing interest in environmental, social, and governance issues, European sustainable tools have broken new records in terms of flows, assets and product development.

In 2020, sustainable funds attracted net flows of 233 billion euros - almost double compared to 2019. In the fourth quarter, sustainable funds raised almost 100 billion, attracting 45% of total flows directed to European funds.

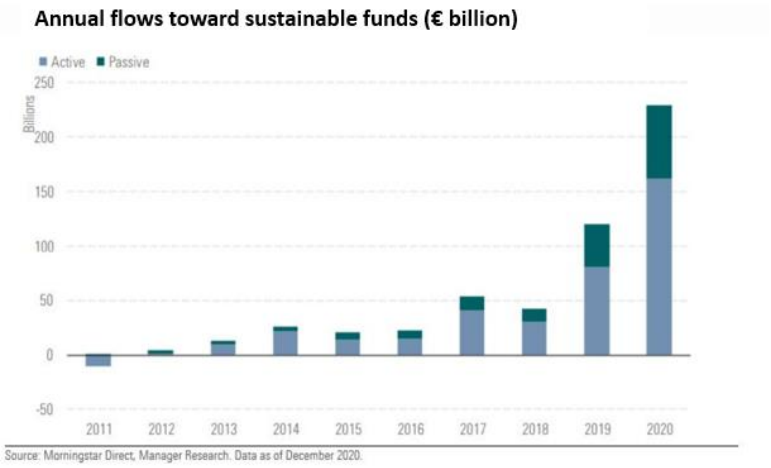


Figure from Morningstar Direct, Manager Research, Data as of December 2020

Investors have also realized that ESG funds offer comparable or even better performance than traditional funds in some cases. The pandemic has also accelerated investor interest in sustainability issues and, in particular, climate change.

Greater awareness of risks and opportunities resulting from the climate transaction is shown by the fact that climate-related funds were among the best-selling in 2020. In the fourth quarter, seven climate-oriented funds were ranked in the top 10 in terms of annual flows. Among them, energy funds are the winners in terms of performance. The best funds have grown, in terms of returns, by 100% and 200%, driven by expectations about higher long-term demand for alternative energy systems.

Forbes advisor conducts a survey in 2022 [64] looking at approximately 80 ETFs and mutual funds focus on ESG investing. They select the Best ESG Funds of May 2022 based on the following criteria: they exclude funds that did not have at least three years of performance data and whose performance fell significantly below the benchmark S&P 500 index or other ESG funds. Beyond performance, they considered the costs associated with each fund. The index funds on their list are the least expensive, and tend to perform best over longer periods. Finally, they considered how each fund selects ESG companies and debt. The best ESG funds highlighted are:

- The Vanguard FTSE Social Index Fund (VFTAX)
- iShares MSCI USA ESG Select ETF (SUSA)
- Parnassus Core Equity Investor (PRBLX)
- iShares Global Clean Energy ETF (ICLN)
- Shelton Green Alpha Fund (NEXTX)
- 1919 Socially Responsive Balanced Fund (SSIAX)
- AllianceBernstein Sustainable Global Thematic Fund (ATEYX)

For what concern Italy, it is worth noting to say that, the 2022 Budget Act established the Italian climate fund managed by Cassa Depositi e Prestiti [65], with an endowment of 840 million euros for each of the years from 2022 to 2026 and 40 million starting from 2027. The fund will finance interventions, including non-repayable, in favor of private and public entities to contribute to the achievement of the objectives joined by Italy and established in the international agreements on climate and environmental protection.

Starting from this year, another 150 million will be allocated to the new Fund to support industrial transition and to facilitate the adaptation of the production system to European policies in the fight against climate change. Therefore, concessions may be granted to companies, particularly for those operating in energy-intensive sectors, for the realization of investments for energy efficiency, for the recycle of raw materials, as well as for the carbon capture, sequestration and storage.

[64] Rob Berger (2022). The Best ESG Funds Of May 2022. Forbes ADVISOR.
[65] Data from Il sole 24 ore. Scozzari, C. (2022). “Chi e come gestirà i 4,7 miliardi stanziati dalla manovra per clima e inquinamento”.

Another important fund offering the opportunity to invest in the global green bond market and which has grown significantly over the last few years benefiting from a renewed sensitivity for environmental topics is the Eurizon Fund – Absolute Green Bonds [66]. The sector is based on an analysis of macroeconomic themes and on a careful screening within the universe of "green emissions". The result has been a diversified and flexible fund that aims to obtain a positive absolute return in the medium term while maintaining moderate volatility. On the occasion of the 2022 ESG Investing Awards, the fund has been awarded as the best fund in the category Best ESG Investment Fund: Climate / Green Bonds.

The ESG Investing Awards rewards annually global excellence in ESG (Environmental, Social and Governance) in terms of research, ratings, investment solutions and initiatives that help generating a positive impact on the integrity, growth and success of ESG investments as a whole. Eurizon stood out among 345 American, British and European companies. It was also one of the finalists in other five categories: Fixed Income, Specialist Fixed Income, Emerging Markets Debt, Global Thematic and Social Bonds. The 2022 ESG Investing Awards are the only awards dedicated to evaluate the best companies involved in all the ESG investment areas at a global level. They are designed exclusively for banks, investment managers, research houses, rating agencies, index and ETF providers and exchanges. Eurizon Fund - Absolute Green Bonds was recently also awarded to MainStreet Partners "ESG Champions" 2022.

[66] Info from Eurizon Asset Management official website: see the following paragraphs for frther detail.