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HOW IS CREDIT RISK AFFECTED
BY ESG FACTORS?

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This paper is based on the work of a technical committee of AIFIRM (Italian Association of Financial Industry Risk Managers), coordinated by Paolo Di Biasi and Andrea Resti with the technical-organizational support of CRIF.

The original paper (in Italian) and the list of the committee members can be found at: https://www.aifirm.it/wp-content/uploads/2016/03/2021-Position-Paper-29-ESG-e-rischio-credito.pdf

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1. FOREWORD[1]

There is growing interest among banks in production systems compatible with environmental protection, greater social balance, and sound governance practices. Lenders are being encouraged to pursue similar objectives by increasingly widespread regulations and the growing awareness of investors and customers. Openness toward environmental, social, and corporate governance (ESG) requirements is all the more important in a trust-based business such as financial intermediation, and the ability to respond to changing public attitudes and sensibilities can become a powerful driver of success, as confirmed by the high growth rates seen by "sustainable" mutual funds and other forms of responsible investments.

While the banking system is aware of the strategic importance of ESG issues, their practical introduction into the lending processes (and in the monitoring tools that guide management actions) is still extremely heterogeneous and fragmented. This is also true of those aspects of the ESG paradigm, such as climate risk, where the pressure from supervisory authorities has become stronger and more focused in recent years. A recent report by the European Banking Authority (EBA)[2] highlighted the limited ability of banks to classify their borrowers based on their level of vulnerability to physical risk and to regulatory, technological, and market changes driven by the climate emergency. The methodologies used to quantify the effects of this vulnerability are still based on qualitative and subjective criteria, given the lack of a reference set of indicators, the absence of adequate historical empirical data, and the difficulty of constructing models capable of managing long-term forecasts with an acceptable confidence margin.

As a result, environmental and, to an even greater extent, social and governance risks are still recorded in a very imprecise and unclear way by individual banks. While this is true within lenders, it is even more striking for external parties – like policymakers or investors – which must observe the exposure of individual institutions to ESG factors through a frosted glass. Because of this lack of information, it becomes more difficult to subject intermediaries to an effective "market discipline", rewarding best practices and penalizing undesirable behaviors driven by the quest for short-term profit.

Indeed, the increasing attention paid by the public opinion to sustainable intermediation models may fall prey to flawed or opportunistic practices such as greenwashing. This can lead to behaviors that are geared mainly toward marketing purposes, in search of an effective "storytelling" for a customer base that is increasingly sensitive to ESG issues.

Against this background, our paper explores the relationship between ESG factors and credit risk. Is there a link between compliance with ESG values and the reliability of a borrower? Does the availability of collateral that is more in line with ESG criteria (e.g., buildings with energy certification, financial instruments issued by more "sustainable" companies) significantly reduce the Loss Given Default (LGD)? Some studies, although still preliminary, seem to point this kind of relationship.

Of course, such an outcome would be highly desirable. The ability to reduce risk, and therefore increase financial leverage and return on capital, would be a powerful driver to accelerate the banking system's transition toward "green" portfolios that also respect human rights and promote good governance practices. The shift toward sustainable investments could be "rewarded" with a discount on mandatory capital requirements, and banks could pass on some of the lower funding costs to ESG-compliant firms.

Are we sure, though, that these factors are not already indirectly present in risk measurement models? E.g., if an environmental certification increases the value of a property used as collateral, a correct appraisal should be enough to recalibrate the loan-to-value ratio and therefore the expected LGD… These objections are conceptually correct, but not always justified. Indeed, environmental certification may not only affect the current value of a property, but also its ability to maintain or increase its value in the future, an aspect that a traditional appraisal may not capture.

As one can see, this is a wide-ranging and highly relevant topic: for banks, which are rightly eager to improve credit risk management and extract value – including in terms of lower capital requirements - from the shift toward "sustainable" finance; and for supervisors, who are formally requested to investigate this subject[3].

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[3] E.g., article 501(c) of the amended Capital Requirements Regulation (CRR) asks the EBA to assess whether a specific prudential treatment of exposures related to assets associated with environmental and/or social objectives would be justified.

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This paper looks at the banks' risk management processes and, after defining ESG factors and how they interact with traditional banking risks, discusses how risk governance can be enhanced to incorporate ESG metrics, starting with those dealing with climate-related and environmental risks. It also focuses on loan origination and monitoring processes, showing how ESG factors can be incorporated into lending strategies, loan pricing, and collateral selection.

Finally, we examine the possible relationship between ESG variables and credit risk. One case study is presented concerning the introduction of ESG variables (mostly environmental) into bank rating processes. The results are incomplete and preliminary, but suggest that there is a potentially positive and statistically significant impact of ESG factors on the creditworthiness of bank borrowers.

2. THE EVOLUTION OF THE RISK GOVERNANCE FRAMEWORK IN LIGHT OF THE ESG FACTORS

ESG factors can have negative impacts (e.g., reputational damage, credit losses, etc.) but also positive ones (cost reductions and diversification benefits). For this reason, they should become part of a bank's risk governance and credit risk management infrastructure.

In this chapter, after defining ESG risks and how they interact with traditional banking risks, we look at how risk governance can be enhanced (from the choice of a business model to the risk appetite framework, ICAAP and ILAAP) to incorporate these types of factors, starting with climate-related and environmental risks. We finally focus on loan origination and monitoring processes, showing how ESG factors can be incorporated into lending strategies, loan pricing, and collateral selection.

2.1 DEFINING ESG RISKS AND THEIR INTERACTION WITH "TRADITIONAL" BANKING RISKS

ESG risk can be defined as the risk of a negative financial impact arising directly or indirectly from the effect that environmental ("E"), social ("S"), and corporate governance ("G") issues can have on the bank and its stakeholders, including customers, employees, savers, and suppliers. This can also happen indirectly, e.g. when ESG factors have a negative impact on the performance or solvency of a bank's counterparties (EBA, 2020, *Sustainable Finance: Market Practices*)[4]. More generally, ESG risks can be defined as "environmental, social or governance events or conditions, which if they occur have or may potentially have significant negative impacts on the assets, financial and earnings situation, or reputation of a supervised entity" (see BaFin, 2019, "Consultation - *Guidance Notice on Dealing with Sustainability Risks*").

ESG factors materialize through different transmission channels (see Table 1):

// **Physical risk -** this is the risk caused by the bank's interaction with counterparties that may suffer a negative physical impact linked to ESG factors;

// **Transition risk -** this refers to the uncertainty surrounding the time and speed of transition to a more sustainable economy, including:

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[4] In other words, the impact of ESG factors on banks is both direct (as for any other business) and indirect (through losses suffered by their borrowers).

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- changes to ESG policies (e.g., energy efficiency policies, taxes on fossil fuels leading to a price increase, environmental policies that encourage the use of environmentally sustainable resources, etc.);

- technological changes making old, polluting technologies obsolete ;

- behavioral changes (e.g., consumers and investors moving toward more sustainable products or assets);

// **Legal risk -** risks arising from losses or damage caused to natural persons or businesses due to ESG factors (e.g., damage due to non-compliance with ESG regulations).

	Physical risk	Transition risk	Legal risk
Environmental	X	X	X
Social		X	X
Governance			X

ESG risk can be seen as an extension of the risks already known by banks, supervisors and experts. Indeed, while ESG risks could be treated in a stand-alone way, it often becomes difficult to separate them from traditional credit, market, liquidity, and operational risks. ESG risks apply across all business processes, and therefore require an integrated risk governance.

While ESG risks materialize through already-known risk categories – such as credit, market, and operational risk – it is important for institutions and regulators to gain a holistic view of their overall relevance for financial performance. Their impact depends not only on the institution's business (e.g., types of assets, sector, size, geographical location, life-cycle stage, and types of liabilities), but also on governance and management strategies.

//

Having said that, let us discuss how ESG factors affect the main "traditional" bank risks.

First, with regard to **credit and counterparty risk**, ESG risks are challenging at all stages of the loan origination and monitoring process. The EBA guidelines (EBA/GL/2020/06, 2020) explain the role of environmental factors in the loan origination and monitoring process, providing a guide to assess ESG risks. In particular, the EBA suggests that banks include ESG factors – as well as all risks and opportunities associated with them – in their risk management policies, particularly for credit risk, and in their procedures.

The impact of ESG factors on the customers' creditworthiness is currently being studied by the banking system at an international level and will be further discussed in §4. Harmful environmental events are increasingly causing financial damage to corporate borrowers, leading to the need to reconsider their probability of default. When assessing the customers' creditworthiness, banks increasingly need to supplement the overall internal rating with scoring/ratings that also explicitly take into account environmental compliance.

The impact of ESG risks on credit risk parameters can be measured as follows:

// Probability of Default (PD) may change, for example, due to new regulations in the area of sustainability (which could reduce demand for some products and cause a fall in turnover), adverse climatic conditions (such as floods that could cause a crisis in some sectors, such as agriculture), and exposures to corporates that violate human rights;

// Exposure At Default (EAD) could be adversely affected by unforeseen shocks to the borrower caused by environmental disasters;

// Loss Given Default (LGD) could be negatively impacted by a drop in the value of assets used to secure loans, leading to losses when non-performing exposures are collected.

With regard to **market risk**, ESG factors can affect the fair value of a portfolio of financial instruments in several ways:

// accentuating the left tail of the distribution of market risk returns, given the presence of financial instruments issued by companies that do not meet environmental and social sustainability criteria;

// an increase in the volatility of the returns on financial instruments issued by companies in sectors perceived as unsustainable; the price of these instruments may be more significantly influenced by a tighter ESG regulations. The same holds for the value of portfolios that only include a low share percentage of ESG-compliant instruments.

The inclusion of ESG risks in market risk management is not enough. In fact, an organizational framework must be adopted that defines the responsibilities for decision-making, implementation, monitoring, and reporting of the impact of ESG risks on the bank's securities portfolio.

ESG factors also affect **operational risk**, mainly through the reputational/legal risks that may arise from the activities of the bank and its counterparties. For example, the financing of companies extracting fossil fuels could be the subject of public controversy with a negative impact on the reputation of the financing bank; exposures to companies that do not adopt appropriate standards in relation to workers' rights (or more generally, human rights) may also increase future compliance costs, with potential negative impacts on the financial position, and/or reputational risks, leading to a loss of customers. In addition, climate-related physical risks can cause a direct negative impact on the bank due to material damage caused by adverse climate events.

ESG factors may also have an effect on a bank's **liquidity and refinancing risk,** affecting its ability to refinance on the market and on the degree of liquidity of its financial assets. From this perspective, the banking system is called upon to include ESG factors in the liquidity and refinancing risk management process, taking into account normal and stressed market conditions. Namely, on the assets side, ESG factors can influence the value of financial assets by increasing their illiquidity. Liquidity risk may also ensue from bank runs caused by unforeseen environmental shocks and/or social unrest. On the liabilities side, ESG factors may affect the availability and/or stability of funding sources due, for example, to higher costs of market access and/or higher funding uncertainty due to shifts in the savers' preferences. Conversely, greater attention to ESG factors can lead to easier access to liquidity and the capital market, as evidenced by the widespread success enjoyed in recent years by "sustainable" investment vehicles, which captured a significant share of the new savings[5].

2.2 ESG RISK MEASUREMENT: POTENTIAL DIFFICULTIES AND APPROACHES

The analysis of ESG factors and the assessment of ESG risks[6] should translate into a bank's whole risk governance process and, as requested by the EBA, into the loan origination/monitoring policies and creditworthiness assessment tools. As many banks still in the early stages of this effort, a number of challenges emerge:

Uncertainty: the impact of environmental risks is very uncertain in terms of timing, as well as of the impact of the various policies and regulatory actions aimed at reducing emissions. For each measure adopted, various scenarios should be envisaged, each with different economic and social implications;

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[5] In December 2020, ESG open-ended funds in Europe (including ETFs) accounted for around 11% of the total and managed resources of more than €1,100 billion (with annual growth of 52%, compared to a market average of 3%). There were around 500 new funds of this type in 2020 (42 of which were specifically related to climate change), while a further 253 funds were "repurposed", changing their name and investment policy in order to intercept the growing demand for sustainable investment. Source: Morningstar. "European Sustainable Funds Landscape: 2020 in Review - A Year of Broken Records Heralding a New Era for Sustainable Investing in Europe", Morningstar Manager Research. Chicago, 2021.

[6] From this point, reference will be made mainly to the lending business.

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// *Lack of data:* data on ESG factors may not be meaningful, or may be unreliable and difficult to use. Even when information is available (such as for carbon dioxide emissions), is may be difficult to translate it into forecasts of the counterparties' financial performance;

// *Methodological constraints*, the risk management models used by banks are based on historical information, which is then used to estimate current and future risks. However, when it comes to environmental factors, such models are likely to be inadequate. It can therefore be very difficult to include ESG risks in the calculation of standard risk parameters such as PD or LGD;

// *Timescale mismatch:* while the strategic planning of intermediaries typically looks at "short" periods, ESG factors can materialize over decades.

In other words, the integration of ESG factors into risk management processes (including the management of credit risk) is hampered by the lack of data on the counterparties' ESG characteristics and by methodological issues: e.g., when assessing the financial risks associated with climate change, traditional retrospective analysis cannot be relied on and longer time windows are needed than those usually adopted.

However, data availability on ESG aspects will benefit from a number of initiatives. Indeed, as part of the EU's "action plan on sustainable finance", several activities related to ESG disclosure have been entrusted to the EBA and other bodies, as summarized in Figure 1.
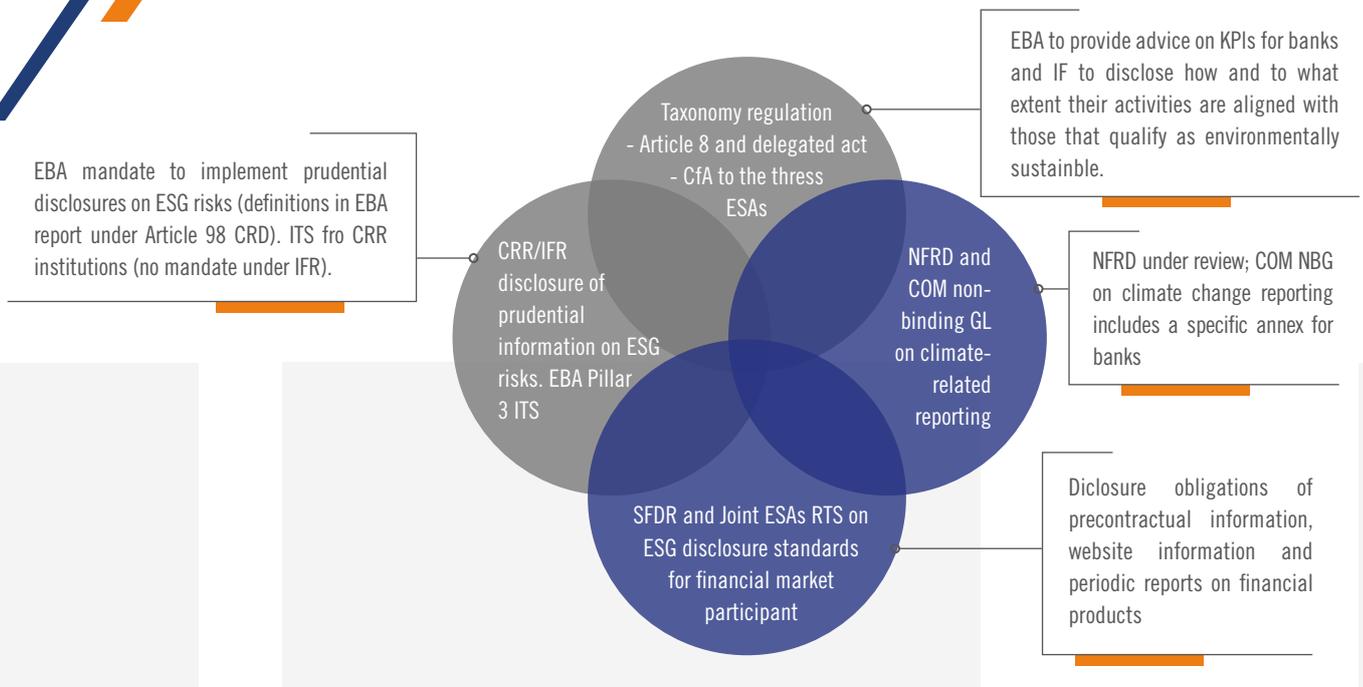
EBA mandate to implement prudential disclosures on ESG risks (definitions in EBA report under Article 98 CRD). ITS fro CRR institutions (no mandate under IFR).

EBA to provide advice on KPIs for banks and IF to disclose how and to what extent their activities are aligned with those that qualify as environmentally sustainble.

Taxonomy regulation - Article 8 and delegated act - CfA to the thress ESAs

CRR/IFR disclosure of prudential information on ESG risks. EBA Pillar 3 ITS

NFRD and COM non-binding GL on climate-related reporting

NFRD under review; COM NBG on climate change reporting includes a specific annex for banks

SFDR and Joint ESAs RTS on ESG disclosure standards for financial market participant

Diclosure obligations of precontractual information, website information and periodic reports on financial products

Figure 1 - ESG Disclosure: initiatives by European authorities

In any case, ESG indicators will play a key role in both the lending and the investment process, with a significant impact on the banks' operating functions. Credit institutions will have to implement a structured approach to data collection as well as a well-defined operational workflow within their organization. In this regard:

// the departments responsible for products should typically be responsible for data collection, preliminary information analysis and the assessment of ESG trends, identifying potential problems and strengths by industry and geographical area, or even by individual counterparty. Data should be acquired either directly from the customer or, hopefully to increasing extent, indirectly, from databases focused on ESG data[7];

// based on this new information, the Risk Management department should incorporate ESG factors into the bank's Risk Appetite Framework ("RAF"), as well as into the setting of risk limits and other risk governance tools.

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[7] With regard to public databases, work is under way to define the European Single Access Point (ESAP) promoted by the European Commission, which will contain both financial and "non-financial" data (or rather, sustainability or "pre-financial" information, using the two terms now considered more appropriate). Therefore, the ESAP should contain ESG data both on counterparties within the scope of the Non-Financial Reporting Directive ("NFRD"), and on smaller counterparties not subject to these regulations (an ESG Template is being developed for SMEs, excluding those of very small size).

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In this context, the implementation of structured automated processes that enable timely data collection and proactive data analysis will also prove expensive from an IT perspective. On the one hand, data collection requires the development of specialized software to preserve data integrity; on the other hand, the standardization of formats is necessary to allow precise cataloging and an initial assessment of the ESG factor metrics. Without an adequate IT structure and highly automated processes, the data received would be hard to manage. In a number of Commission consultations (NFRD, new sustainable finance strategy, ESAP), the European Banking Federation (EBF) has stressed the importance of some form of centralized information hub at an EU level, collecting ESG data in a standardized and potentially machine-readable format.

It seems likely that the actual assessment of ESG risks will have to be preceded by a so-called "tagging" according to the EU Taxonomy (as well as other ESG taxonomies used by individual banks). "Tagging" means checking (and monitoring) whether a given economic activity fits the screening criteria provided for by a given classification (e.g., those provided by the EU Taxonomy according to a science-based approach that includes the so-called "do no significantly harm" principle).

For EU banks at least, such tagging may also be necessary for prudential reporting purposes (especially if the EBA confirms the introduction of the so-called Green Asset Ratio, a ratio indicating the incidence of ESG investments on the total investments financed by a bank), as well as for non-financial reporting (assuming that the indicators presented in the Guidance issued by the Commission in June 2019, which refers to the Taxonomy, will translate into the new NFRD).

Tagging counterparties on the basis of the EU Taxonomy may not be enough to evaluate ESG-related financial risks, and in particular credit risk. According to the evidence available today, not all economic activities[8] aligned with the EU Taxonomy (e.g., relating to climate change mitigation) also lead to a reduction in credit risk[9].

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[8] For example, green mortgages, products related to the development of the circular economy, and some forms of project financing.

[9] The economic activities with these characteristics are those defined as eligible for a specific form of prudential treatment which would be recognized by virtue of their reduced risk.

As a result, one of the main challenges for risk managers is to identify the additional information, besides tagging, required to assess the financial risks associated with ESG factors[10]. As noted by several rating agencies, defining ESG risks is essential to fully assess the creditworthiness of a counterparty, but is a complex process that involves a forward-looking perspective, especially for long-term factors. A typical example of forward-looking studies are scenario analyses and stress tests for climate-related risks, such as those that the ECB will conduct in 2022.

As noted above, data availability plays a major role, given the lack of transparency and the difficulty of obtaining relevant, reliable, and comparable information. One example are ESG ratings, whose production – by specialized agencies – follows different approaches and leads to results that are difficult to reconcile with each other (to the extent that ESMA has suggested that ESG ratings be subjected to forms of supervision and regulation similar to those already in place for credit ratings).

Another key aspect of ESG risks is the time horizon on which they must be assessed. Historical indicators must be available for each sector, but should always be accompanied by suitable forward-looking metrics. For example, measuring a company's CO_2 emissions today does not take into account the benefits expected from energy saving projects that are planned for the future. For this reason, the Taxonomy Expert Group (TEG) suggests[11] that a forward-looking assessment should be obtained by analyzing investments in sustainability or other ventures, to estimate the alignment of activities with performance improvement programs (as already identified for some macro sectors[12]). While quantitative indicators are certainly beneficial to forward-looking assessments, a number of subjective appraisals are required to understand in detail the dynamics of a sector, including how different counterparties are preparing to deal with the risks and opportunities, and what their specific points of vulnerability and strength are.

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[10] In the medium to long term, considering the transition risk, it still seems plausible to assume, once tagging is complete, that there will be a greater risk for a portfolio that is heavily unbalanced toward activities tagged as environmentally non-sustainable according to the EU Taxonomy. In that sense, tagging may also result in some "high-level" considerations in terms of financial risk.

[11] https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-taxonomy_en.pdf

[12] https://2degrees-investing.org/wp-content/uploads/2020/09/Katowice-Banks-2020-Credit-Portfolio-Alignment.pdf

2.3. INTEGRATION OF ESG FACTORS INTO THE RISK GOVERNANCE PROCESS

2.3.1 STRATEGIC PLANNING AND DISCLOSURE

Due to the special nature of ESG risks, a preliminary analysis should be conducted aimed at identifying factors, topics, and criteria that each bank considers relevant to its profile, business model, size, and reference market (with regard to geographical areas and sectors served).

As suggested by the relevant international standards (such as those drawn up by the Global Reporting Initiative[13]), a materiality analysis should be performed to identify the most significant sustainability issues, to which one or more ESG risk categories are associated. Examples of such risks are waste and pollution management, climate change, respect for human rights, the workers' employment and health and safety conditions, and anti-bribery and anti-corruption practices.

Each bank should then assess the impact that these risks could have with respect to three different levels:

// general, considering the negative effects that might ensue if they are not properly monitored;

// specific, based on the impact they could have on traditional risk categories, in particular on reputational risk;

// focused on emerging risks.

Climate change and environmental risks ("CER") are currently considered a priority in terms of the correct assessment and integration into risk management and strategic planning models. In 2020, the scientific community, governmental institutions and national regulatory bodies focused on mitigating these risks, including through initiatives such as the European Green Deal and the Taxonomy Regulation.

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[13] See note "*Global Reporting Initiative, The global standards for sustainability reporting*", available on *https://www.globalreporting.org/standards/.*

Organizations, including banks, will therefore increasingly have to rethink their strategies, identifying the actions needed to turn climate-related risks into new business opportunities. To do this, they must:

// assess, report, and integrate into business strategies the (financial) risks arising from climate change;

// improve disclosure to investors on the basis of the TCFD recommendations, 11 recommendations (see Table 2) which focus on four thematic areas (governance, strategy, risk management, and metrics and targets) and indicate how climate risk information should be passed on to investors and other stakeholders to help them understand how organizations assess climate risks and opportunities.

Governance	Strategy	Risk management	Metrics and targets
Disclose the organization's governance around climate-related risks and opportunities.	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	Disclose how the organization identifies, assesses, and manages climate-related risks.	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.
Recommended Disclosures	**Recommended Disclosures**	**Recommended Disclosures**	**Recommended Disclosures**
Describe the board's oversight of climate-related risks and opportunities.	Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	Describe the organization's processes for identifying and assessing climate-related risks.	Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.
Describe management's role in assessing and managing climate-related risks and opportunities.	Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning.	Describe the organization's processes for managing climate-related risks.	Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.
	Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

Table 2 - TCFD recommendations on disclosures

2.3.2. THE RISK APPETITE FRAMEWORK (RAF) AS A STARTING POINT FOR INCORPORATING ESG RISKS

The Risk Appetite Framework ("RAF") defines the level of risk an institution is willing to assume within its risk capacity, in line with its business model, to achieve its strategic objectives (EBA, 2017[14]). The definition of the risk appetite, risk tolerance and risk capacity, which make up the RAF, is the first step in the process through which the bank identifies the relevant risks and decides how to measure them by reference to capital adequacy, liquidity, operational risks, equity risk, and so on.

Over the coming years, the RAF is expected to also include ESG risks, or at least climate-related risks, as suggested from the guidelines and consultations on climate-related risks that have been issued in recent years (TCFD, 2018; ECB, *Guide on climate-related and environmental risks,* 2020; EBA, Discussion Paper, 2020).

For each risk category identified, the RAF defines the risk capacity, risk appetite, risk tolerance, and risk limits. The incorporation of ESG factors therefore requires careful evaluation. The risk tolerance and risk appetite for climate-related and environmental risks should be reported (e.g. in terms of concentration of climate-sensitive sectors in the overall portfolio, capital needed to cover risks, etc.). The ECB expects banks to incorporate the identification of environmental risks into their RAF and that the appropriate Key Performance Indicators (KPIs) are cascaded down to the relevant business lines (e.g., retail banking, private banking, commercial banking, and corporate banking) and portfolios. Examples of such indicators are carbon emissions from borrowers' activities, the average energy class of mortgage portfolios, and the number of real estate properties where loans were used to improve energy savings. The analysis should be adapted to the bank's business model and risk profile, taking into account the vulnerabilities of different economic sectors, transactions, and the physical locations of the bank and its counterparties.

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[14] EBA (2017), Guidelines on Internal Governance, November.

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In addition, to comply with article 79 of the CRD and with the EBA guidelines[15], institutions should adopt a holistic approach to account for climate risks and related environmental factors in their lending procedures and policies.

As for physical risks, banks should set limits to assess the potential impact of climate events (such as floods and droughts) on the customers' properties, infrastructures, and production activities. Similarly, from a social and governance point of view, banks should take strict measures to blacklist companies that exploit child labor or do not provide adequate levels of social protection to workers (EBA, 2020).

The integration of climate-related and environmental risks into the RAF increases the resilience of the banks' business models and improves their ability to manage risks (e.g., by setting credit caps on exposures to vulnerable sectors and areas). Since climate change risk is associated mainly with credit risk, its identification involves an approach that takes into account the measurement, monitoring, and reporting of exposures[16]. However, supervisors and regulators are aware that the relevant definitions and taxonomies are still under development.

The integration of climate-related risk into the RAF can occur through appropriate adjustments to the indicators relating to pre-existing risk areas (credit, market, liquidity, and operational). In both cases, intermediaries should:

// document/map in detail the climate-related and environmental risks relevant to their business model, in particular their transmission channels and the impact on the risk profile;

// develop appropriate risk indicators and set suitable limits for the effective management of climate-related and environmental risks in line with their regular monitoring processes;

// define the reference time periods (including long-term horizons) for the measurement and monitoring of the CER metrics integrated into the RAF;

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[15] See also Principle 2 (ii) and (iii) of the ECB Guide. Guide to the internal capital adequacy assessment process (ICAAP); see paragraphs 57, 126, 127, 146, 149 and 188 of the Guidelines on loan origination and monitoring (EBA/GL/2020/06).

[16] According to ECB expectations, banks should allocate quantitative metrics to such risks, particularly physical and transition risks.

//

// develop indicators that strengthen the bank's ability to respond to a sudden shift to a low-carbon economy (e.g., due to an environmental event that has a strong impact on the business model and/or loan portfolio). Simplified indicators (green asset ratio, green collateral ratio, green sector concentration, ad-hoc division of risk metrics for green lending and sustainable finance, etc.) should also be considered as a way to set things in motion and improve internal practices;

// Prepare a remediation plan setting out all the mitigation measures to be promptly taken if alert thresholds are exceeded.

2.3.3. ICAAP, ILAAP AND EARLY WARNING SYSTEMS

The inclusion of climate-related and environmental risks requires not only to update a bank's RAF, but also all other to review all other risk governance documents (including ICAAP and ILAAP), early warning systems and remuneration policies (TCFD, 2018; ECB, 2020). Risk planning, including for climate-related risks, together with capital planning, is seen by regulators as a fundamental component of risk management, along with the related documentation.

The integration of ESG factors should involve the bank's strategy, the policies relating to the main risks, the abovementioned risk governance infrastructure, the contingency funding plan, the internal stress test framework, measurement tools, internal reporting and, market disclosure (see Figure 2).

| Strategic planning/ business model | Risk governance system: /RAF, EWS, ICAAP, ILAAP, CFP, Recovery Plan, Internal Stress Test Framework) | Credit Policy, Market Risk Policy, Sustainable Investment Policy, Liquidity Police, Operational Risk Policy RemunerationPolicies | Internal Reporting, Market Disclosure |

Figure 2 - Sustainability Framework: areas of impact

At present, banks seem to have only partially achieved these objectives. Difficulties arise mainly from the lack of data and the misalignment between the Taxonomy and the RAF, as well as from the cross-cutting nature of climate-related and environmental risks. Furthermore, the ECB Guide on climate-related and environmental risks and the EBA consultation of November 2020 do not clearly indicate to what extent, and with what level of detail, climate-related risk and other environmental risks should be included in the RAF, as their importance can vary significantly depending on each bank's size and business model. In short, the integration of ESG risks into the risk management framework is still in the development phase and requires collaborative interaction between regulators, supervisors, and banks.

According to the ECB, the integration of ESG issues into strategic planning requires intermediaries to:

// promote of an internal sustainability risk culture;

// analyze the impact of climate-related and environmental risks in the bank's market context from a short- and long-term perspective, in order to take decisions that are consistent with the strategic plan and the business model;

// conduct longer-term assessments (beyond the usual 3 to 5-year time horizon typical of planning activities) focusing on the resilience of the current business model against plausible and relevant future scenarios that embed public policy commitments to transitioning to a more sustainable economy;

// define strategic objectives linked to climate-related and environmental risks for the different lending and trading portfolios;

// define measurable and quantifiable KPIs for each climate-related or environmental risk (where possible). Depending on the nature of the activities carried out by each bank, the KPIs should cascade down to the relevant business lines and portfolios;

// integrate significant climate-related and environmental risks into all relevant levels of the organization, assigning specific tasks (including an ad-hoc organizational role dedicated to sustainability management), ensuring ongoing communication between the various functions, monitoring progress, taking timely corrective action, and keeping track of all costs;

// integrate climate-related and environmental risks into the bank's risk governance infrastructure, consistent with its strategic objectives, associating quantitative metrics with those risks (particularly to physical and transition risks).

Box 1 – Restructuring the ICAAP to include ESG factors

ICAAP restructuring must cover all phases and therefore include:

☐ the incorporation of the definition of climate-related risks, other environmental risks, and other ESG risks among the **"mapped" risks;**

☐ The definition of the roles and responsibilities of the bodies and functions involved in the ESG framework within the **ICAAP governance framework** (e.g., by assigning new tasks to the Risk Committee, the Management Planning and Control function, the CRO, the Board of Directors, the Internal Auditors, the Sustainability Manager, or the Sustainability Committee);

☐ The incorporation of the strategic lines relating to climate-related risk and other ESG risks into the **business model description**, also referring to the potential impacts of environmental disasters and other climate-related risks on the long-term validity of the current business model. For this evaluation, it is useful to use stress testing;

☐ **The integration of climate-related risk and other ESG risks into the assessment of current and future capital adequacy,** from both an economic and regulatory perspective. The former perspective considers the potential risks to the economic value of the bank and the level of the so-called "internal capital". The latter assesses the potential impact on regulatory capital ratios, taking this into account a baseline scenario and one or more adverse ones.

The ECB expects the results of this assessment to be taken into account in the definition of risk appetite and the business strategy and, more generally, in all strategic and managerial decision-making;

☐ **Periodic reviews** of the ICAAP in order to verify if the internal methodologies and processes have led to strong results and whether they continue to be adequate in light of the current situation and future developments. Given the rapid evolution of data availability and methodologies for the identification and measurement of climate-related and environmental risks, the ECB expects banks to regularly assess their adequacy and quality.

In order to test capital adequacy under stressed conditions, adverse scenarios should include all risks relevant to internal capital and regulatory ratios. In carrying out these scenario analyses and stress tests in relation to climate-related and environmental risks, the following aspects should be taken into account:

☐ how the institution could be affected by physical risk and transition risk;

☐ how climate-related and environmental risks could evolve within the various scenarios, bearing in mind that they may not be fully reflected in the historical data;

☐ how climate-related and environmental risks could materialize in the short, medium, and long term, depending on the scenarios considered.

The ECB expects institutions to define their own risk profile and individual characteristics and to consider various scenarios based on different combinations of assumptions. Adverse scenarios should assume unusual but plausible situations with an appropriate degree of severity in terms of impact on regulatory capital adequacy ratios. In accordance with the ECB ICAAP guide, the forward-looking simulation should cover at least three years. For material risk types, however, institutions should take into account trends beyond this minimum time horizon in a proportionate manner, including in the context of strategic planning. Intermediaries must have a forward-looking view of climate-related and environmental risks, given the significant impact they have in terms of potential losses and a reduction in the economic value of the bank's assets.

In order to establish an effective ESG risk management system, additions to the RAF, ICAAP and ILAAP must be supported by appropriate changes to the early warning system (including through the calibration of all relevant limits).

Box 2 – Restructuring the ILAAP to include ESG factors

In parallel with the ICAAP, banks must also review their liquidity governance system, assessing whether climate-related and environmental risks could have a reputational impact that would reduce their ability to raise funds on the market, affect the net stable funding ratio, impact the survival period and produce net cash outflows that would have a tangible effect on the supply of High-Quality Liquid Assets (HQLA) and the asset encumbrance level.

Based on the results of these analyses, it may be necessary to realign the bank's funding plan and the contingency funding plan. The ECB therefore expects intermediaries to assess whether environmental risks can significantly change net cash outflows and liquidity reserves, taking them into account when managing liquidity risk and calibrating reserves, including for specific geographical areas where significant climate-related or environmental risks materialize.

Finally, within the framework of liquidity management, banks should plan the development of green funding instruments in line with the principles developed by the International Capital Market Association ("Green Bond Principles") and the Technical Expert Group ("Climate Bond Standard" and "EU Green Bond Standard").

2.4. ESG FACTORS IN LOAN ORIGINATION AND MONITORING MODELS

2.4.1. PORTFOLIO-LEVEL AND SINGLE-NAME ASSESSMENTS

As far as credit risk is concerned, a bank must be able to assess the creditworthiness of a customer or a loan by taking into account all risk factors, including ESG risks if relevant. Furthermore, once a loan has been originated, its risk profile must be monitored, on a single-counterparty basis and/or looking at homogeneous portfolios.

In its discussion paper on the management and supervision of ESG risks (EBA/DP/2020/03), the EBA argues that banks need to combine risk identification with quantitative methodologies to assess the degree of alignment of their credit portfolios with sustainability objectives. In particular, three possible approaches exist:

// the *Portfolio Alignment Method*, which assesses the changes necessary to align the bank's portfolio with its sustainability targets;

// the *Risk Framework Method*, which assesses the sensitivity of the bank's portfolio – in terms of risk – to potential changes linked to ESG factors;

// the *Exposure Method*, which assesses the performance of individual exposures in relation to ESG factors, producing a score/rating.

The supervisor leaves it to the banks to decide what methodologies to apply and is aware that, given the increasing awareness about ESG issues and the rapid evolution of available data, the effectiveness of the approaches initially chosen could change over time, including due to changes in business strategies. Therefore, banks should carry out regular assessments of the adequacy of the methodologies and approaches adopted for the assessment and mitigation of ESG risks (as expressly stated by the ECB regarding climate-related risks)[17].

In this context, there are several possible approaches to incorporating ESG factors into loan origination and monitoring phases (either from a portfolio-wide or a single-name perspective), which are discussed below.

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[17] See Expectation 7.7 – ECB Guide on climate-related and environmental risks

2.4.1.1. THE LOAN ORIGINATION STEP

The origination and the renewal of a loan should be guided by well-defined risk objectives and clear policies. The various departments involved should have appropriate tools (in terms of procedures and information) to carry out a credit assessment taking into account all relevant risk factors.

Today's customer segmentation criteria (legal status, size, characteristics of the requested facility, type of collateral, and sector of economic activity) should be expanded to consider ESG risks, in line with the identification and definition of the significant factors and with the business strategies.

As already mentioned, the European Union has established a taxonomy as consistent as possible with the sustainability goals (in terms of low emissions) contained in the Sustainable Finance Action Plan and the Paris Agreement. It identifies industries and economic activities that can help achieve the objective of reducing net CO_2 emissions to zero by 2050. Based on these guidelines, credit institutions should be able to update the breakdown by industry of their loan portfolios.

A portfolio segmentation based on the EU taxonomy could help the bank when assessing its business model or when choosing investment strategies or the choice to disinvest from certain asset classes (according to the portfolio alignment approach identified by the EBA and described above). For example, an institution may decide to increase loan supply to "zero-emission" firms or to the so-called "transitional" sectors (whose activity requires substantial investments to update their energy consumption model). Also, with reference to the Risk Framework Method, the bank could identify which sectors would be most at risk from climate-related changes and fine-tune its investment strategies for some asset types. In order to identify those customers that are most exposed to ESG risks, either directly or indirectly, banks could also consider using heat maps and scores which highlight, for example, the climate-related and environmental risks of individual economic sectors and sub-sectors, as suggested by the Exposure Method.

These portfolio-wide approaches must certainly be combined, at least initially, with an assessment of individual customers and loans. In fact, belonging to a sector and/or segment characterized by high ESG risk does not necessarily imply a similar risk for each individual customer. The bank should therefore carry out an in-depth analysis of large borrowers, including an examination of current and projected greenhouse gas emissions, their market context, ESG supervisory requirements, and the likely impact of ESG regulations on the customer's financial position[18].

In assessing the creditworthiness of borrowers, a key role is played by the valuation of collateral, especially for real estate. With regard to climate-related risk, a bank could supplement the traditional valuation of real estate assets with indexes of vulnerability to physical events (such as landslides, floods, or earthquakes); this could be made by examining the geographical location of the property on one or more risk maps that indicate the likelihood of such extreme climate events. In the case of collaterals or counterparties with a high environmental risk, banks could charge higher rates in order to ensure that higher risks are paid for by the customers.

With regard to other ESG risks, i.e., social and governance risks, there are currently no agreed taxonomies at a European level. Expert discussions are at a much earlier stage than for climate-related/environmental risks, in part due to the broad and heterogeneous nature of the "S" and "G" factors. Some initiatives led by trade associations aim to raise awareness about the general Sustainable Development Goals contained in the United Nations Agenda 2030, to highlight the benefits of disclosing non-financial information and to spread best practices on how that disclosure should occur.

The origination stage provides a great opportunity to acquire missing ESG-related information from the customer. Such information, if collected systematically and consistently[19], will allow banks to experiment with new credit risk assessment algorithms. One example is the data relating to the energy efficiency classification of the property, which appears to be related to the borrower's risk[20]. Banks do not currently file that piece of information on a systematic basis, and must therefore acquire it when the loan is granted or when the property valuation is renewed. This aspect is also important in view of the creation of adequate time series for the development of internal scoring models.

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[18] EBA Guidelines – Loan Origination and Monitoring, §127.

[19] See Expectation 6.2 – ECB Guide on climate-related and environmental risks: "As climate-related and environmental risks have distinctive characteristics, institutions are expected to consider adapting their IT systems to systematically collect and aggregate the necessary data in order to assess their exposures to these risks".

[20] Refer to the study promoted by the EedaPP (Energy efficiency Data Protocol and Portal, Final report on econonometric assessment and results, 2020, available at https://eemap.energyefficientmortgages.eu/.).

2.4.1.2. THE RISK MANAGEMENT/MONITORING STEP

According to Expectation 8.4 of the ECB Guide on climate-related and environmental risks, banks should "monitor and manage credit risks in their portfolios, in particular through sectoral/geographic/single-name concentration analysis, including credit risk concentrations stemming from climate-related and environmental risks, and using exposure limits or deleveraging strategies". The same authority advises institutions "to develop their monitoring capabilities in conjunction with the metrics and limits developed for the purposes of their risk appetite and data governance framework".

To monitor the solvency status of borrowers, institutions use early warning indicators, internal ratings, or other anomaly detection systems to intercept adverse developments as soon as possible. Based on these indicators and other characteristics, a bank, where appropriate, initiates its collection strategies, which depend on the type of loan and customer. The assessment of the initial anomalies experienced by a customer is usually delegated to the branch network.

The integration of ESG factors into credit monitoring could certainly improve the understanding of the borrower's difficulties and provide additional criteria for effective segmentation of non-performing loans. As with the risk assumption stage, the bank should have the appropriate level of information in its internal systems to conduct a comprehensive assessment.

ESG indicators and metrics could therefore be integrated into the banks' monitoring tools (performance ratings, early warning systems, Level 2 controls…), highlighting those positions that are most sensitive to them and providing information on their deterioration, including in relation to environmental risk. When assessing any signs of decline, the branch network could also use ad hoc ESG ratings assigned by external providers or a qualitative ESG risk assessment drawn up internally (possibly on the basis of the counterparties' sector of activity and the presence of specific risks).

[14] EBA (2017), Guidelines on Internal Governance, November.

//

The EBA guidelines on loan origination and monitoring also suggest assessing the inclusion of such risks within internal rating models, considering the development of ad-hoc modules in order to streamline the validation process. These modules do not necessarily have to be statistical, but can be based on qualitative questionnaires and expert opinions.

In the monitoring phase, the following factors could be used:

// *Geographical:* examining the portfolio concentration in areas linked to special phenomena: climate (floods, earthquakes, hydrological instability), environmental (CO_2 emissions), social (companies with lower levels of occupational health and safety, with low levels of inclusion, etc.), or governance (companies without an effective code of conduct and/or appropriate remuneration policies);

// *Sector-based:* examining the concentration in sectors identified in the EU taxonomy (or other taxonomies), with particular regard to those associated with transition risk;

// *Energy:* examining the distribution by energy efficiency class of the properties used as collateral.

ESG vulnerabilities could also affect non-performing loan management. In fact, a bank could choose to carry out massive actions on its non-performing portfolio (or to target individual positions) in light of the forecasts published by specialized external providers.

Finally, the introduction of segmentation criteria and risk metrics driven by ESG factors would also enrich the information set available to the risk management department to perform Level 2 checks, e.g., when verifying whether impaired exposures have been correctly identified and provisioned.

3.THE LINK BETWEEN ESG FACTORS AND CREDIT RISK

We now look at the potential relationship between ESG variables and credit risk. The introduction of an ESG component into internal rating systems has long been debated by analysts, banks and regulators. This was made, e.g., by the ECB Guide on climate-related and environmental risks (see Box 3) as well as by the EBA Guidelines on loan origination and monitoring (2020), which also require credit institutions to incorporate sustainability factors into their lending policies.

Box 3 – Relationship between ESG and credit ratings in the ECB guidelines

The introduction of ESG factors into rating systems responds to the following regulatory requirements in the ECB Guide on climate-related and environmental risks:

☐ **Loan origination and monitoring processes:** climate-related and environmental risks are expected to be included in all relevant stages of the credit-granting process and credit processing. Institutions are expected to monitor and manage credit risks in their portfolios, in particular through sectoral/geographic/single-name concentration analysis, including credit risk concentrations stemming from climate-related and environmental risks, and using exposure limits or deleveraging strategies

☐ **Risk classification procedures:** institutions are expected to adjust risk classification procedures in order to identify and evaluate, at least qualitatively, climate-related and environmental risks. Critical exposures to such risks should be highlighted and, where applicable, considered under various scenarios with the aim of ensuring the ability to assess and introduce in a timely manner any appropriate risk mitigation measures, including pricing

☐ **Collateral valuation:** Institutions are expected to consider climate-related and environmental risks in their collateral valuations

☐ **Pricing:** institutions' loan pricing is expected to reflect the different costs driven by climate-related and environmental risks

☐ **Risk appetite and business strategy:** Institutions' loan pricing frameworks are expected to reflect their credit risk appetite and business strategy with regard to climate-related and environmental risks.

ESG phenomena can affect the financial performance of enterprises. This suggests that this should be taken into account in creditworthiness assessments, including through the use of a rating system that incorporates these factors qualitatively or quantitatively.

Generally speaking, it would be desirable for financial institutions to grant credit to counterparties that are more virtuous in relation to ESG issues, giving them easier access to lower-cost loans. To this end, it makes sense to ask whether mandatory capital requirements could be adjusted – if necessary by introducing a special "ESG Supporting Factor", as it was proposed by the EBF – by giving a "discount" on loans granted to more "sustainable" counterparties.

However, the introduction of any "discounts" associated with the ESG profile would become much easier, both conceptually and in terms of consensus among policymakers, if a positive ESG profile can be shown to statistically associated with a lower credit risk.

In the following pages we present a case study, carried out by CRIF, on the introduction of some ESG variables into a bank's rating process. The results are incomplete and preliminary, but suggest that there is a potentially positive and statistically significant impact of ESG factors on the creditworthiness of borrowers.

3.1. ESG FACTORS AND CREDIT RISK: A STRUCTURED APPROACH

3.1.1. ESG RISK AND CREDIT RISK

A borrower's exposure to ESG factors can be captured through an ad-hoc rating system (sometimes called an "environmental rating", as social and governance factors are not always measured on a systematic basis). This system, which can be developed in-house, is based on a predominantly qualitative approach, coming from questionnaires, on-site visits, information gathering, and a direct assessment of the counterparty's "environmental behavior".

ESG factors can affect the performance of a company, as well as of an industry/area. In the first instance, ESG risks affect a single borrower, not the entire market, and are due to specific factors such as the company's governance, regulatory compliance, and brand reputation. In the second case, however, there are wider issues that concern a whole industry or area, and can be linked e.g. to legislation, technological changes, or upstream/downstream markets.

//

Given the intangible nature of many ESG factors, building a quantitative score can be complex. It is even more difficult to establish whether there is a link between environmental ratings and credit risk: the relative novelty of the topic means that less good-quality data is available and that risk measurement models are still under development. Nevertheless, integrating ESG factors into credit risk analysis is crucial, as it enables banks to capture latent vulnerabilities that may emerge over time and indirectly affect creditworthiness (since their materialization would trigger significant financial effects). An enterprise's ESG performance can affect the probability of default, as a stronger ESG awareness means a lower risk of experiencing events that can negatively affect the orderly operation of the company, its ability to produce income, and therefore ultimately its reliability towards creditors.

3.1.2. DATA CONTRAINTS

Data availability is a key constraint when assessing the exposure of a credit portfolio to ESG risks. These include quantitative metrics (e.g., the customer's carbon emissions), qualitative information about the borrower's organizational structure and activities (e.g., the presence of task forces and policies focused on ESG risks, plans to achieve net zero greenhouse gas emissions, adequate procurement practices), as well as broader macroeconomic, social, and environmental information (e.g., shared socio-economic scenarios).

Most banks currently use a mix of internal customer data and external data from third-party providers. External data is used both to validate existing information and to collect more granular data for specific portfolios.

However, many banks have raised concerns about the procedures followed by data providers and have expressed a preference for developing their own methodologies. This points to a need for standardization in ESG factor measurement methods, to reduce the risk of distortion and strengthen the credibility of the metrics obtained. Some banks also acquire scenarios from specialist environmental agencies (such as the Intergovernmental Panel on Climate Change), in order to use them for their what-if analyses. Although there are many data providers, they typically do not offer full coverage of all asset classes, geographical areas, and counterparty types. As a result, banks need to combine multiple sources and enrich external information with internal data.

Many institutions collect customer data when granting credit, through specific questionnaires. The information required often depends on the industry and size of the customer, with a view to proportionality and cost/benefit optimization. The "G" component appears to be the area with the best information coverage, thanks to the data collected by banks (in particular, by significant ones) in accordance with "Know Your Customer" regulations. On the other hand, the "E" component, especially when it comes to climate change, seems to be affected by the most severe information gaps. There are also discrepancies in the data across portfolios, as well as between listed and unlisted counterparties; this often leads banks to rely on mean values and to use proxies, which are not always seen as fully reliable.

In a study by BlackRock (see Figure 3), the banks surveyed mentioned three main areas of concern regarding ESG data: data availability and coverage, data reliability and verifiability, and data comparability and standardization.
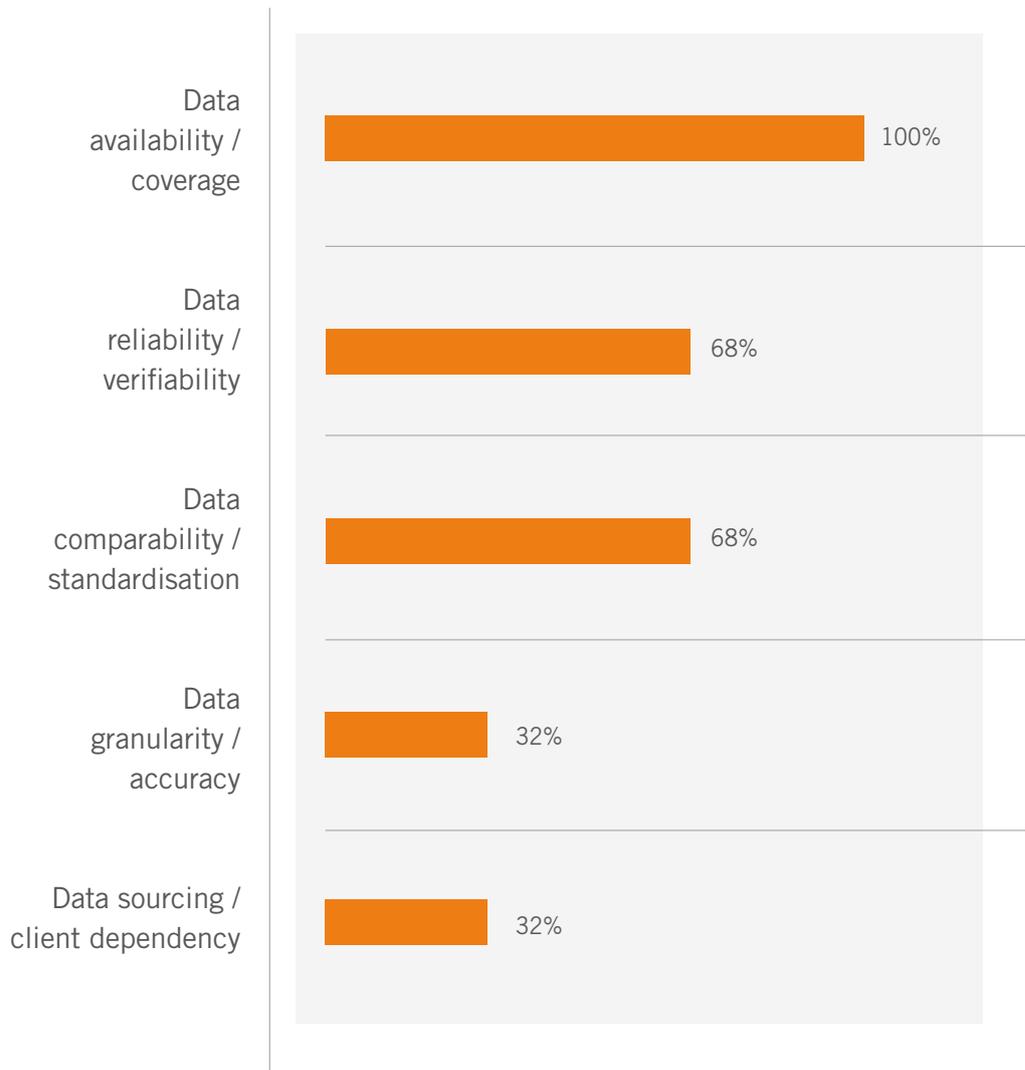
Commonly mentioned data concerns

Figure 3 - The most commonly mentioned data concerns – Source: BlackRock FMA analysis

Concerns about data availability and coverage usually relate to non-listed counterparties, but also to some geographical areas, especially emerging markets.

Data collection from customers can be done in a reasonably standardized way (e.g., through specific questionnaires). However, banks have not yet invested enough to check the accuracy and reliability of the data received. Therefore, external data is often used, thus shifting the burden of accuracy checks onto third-party information providers. Finally, poor data comparability and standardization is also seen as a major issue, since the quality and relevance of the information provided by issuers can vary considerably.

These challenges can be addressed through the use of emerging technologies, for example, through the adoption of new methods for using spatial data infrastructures within the financial sector. In order to fill the data gaps, especially for non-listed counterparties, many banks intend to work with non-financial companies to develop and standardize information. Some banks expect the new NFRD to provide an incentive to act in this way. Indeed, the likely increase of the range of entities to which the NFRD will apply, which is currently under discussion, could extend reporting requirements to non-listed companies.

3.1.3. A POSSIBLE "QUANTITATIVE" APPROACH

The lack of uniform and structured data makes it difficult to carry out an ESG risk assessment using a bottom-up approach, i.e., based on the specific characteristics of each counterparty. This approach would produce more robust ESG risk assessments, but it is difficult to apply, especially for small businesses. Even for larger counterparties, the situation is complex. While there are large international firms (such as Morgan Stanley CI, Refinitiv, Bloomberg) that offer ESG ratings for major listed companies, several studies have shown that such ratings can diverge substantially for the same company, due to the lack of a standardized, shared, and universally accepted methodology. There are also no real standards for certifying ESG data, meaning that different scores often originate from different indicators, which are analyzed and weighted arbitrarily by each rating agency.

Many banks are preparing for the collection of data on ESG factors through questionnaires to be submitted to companies upon loan origination and monitoring. This approach allows them to obtain detailed information at the single counterparty level, but it may take time to create a robust database that can be used for statistical analysis. An alternative route is to use external data from public sources, but these sources only exist at a macro level (industries or geographical areas), and hence can only be used for top-down assessments. By way of example one can look at the situation in Italy (other European countries enjoy similar data sources), where information can be obtained from:

// ISTAT (Italian Institute of Statistics), which collects information related to the environment, such as electricity consumption per capita, or to the social context, such as salaries by gender and age;

// ACCREDIA, which provides data on company certifications following a compliance assessment (voluntary and not voluntary);

// ISPRA (Italian National Institute for Environmental Protection and Research), which provides data on the management and consumption of natural resources, biodiversity, waste management, and climate events by geographical area.

Additional data items are also available, which can be used to cover other ESG factors, such as those generated by INAIL (Italy's National Institute for Insurance against Accidents at Work) and some ad-hoc proxies built by CRIF using its wide-ranging database (see Table 6).

Table 6 - CRIF and INAIL indicators by main subject area

Main subject area	Area	Indicator	Granularity	Source
Social factors	Community/society	Local offices in socially underdeveloped areas	VAT No.	CRIF
Social factors	Employee relations / employment standards	Accidents at work	ATECO/Region	INAIL
Social factors	Employee relations / employment standards	Occupational diseases	Region	INAIL

Additional information can be extracted from company websites through web scraping and web crawling. This can be done through some open source libraries (like the "Selenium" and "Beautiful Soup" packages available in Python, and the "Rvest" library for the "R" programming language) that can manage the large amounts of unstructured data present on web pages and in HTML code; such tools can recover the content of interest and translate it into a structured format to be used for further analysis. The procedure is illustrated in Figure 4, which shows how the information contained in the html code of a set of selected websites can be extracted and saved in structured .csv, Excel or .xml files.
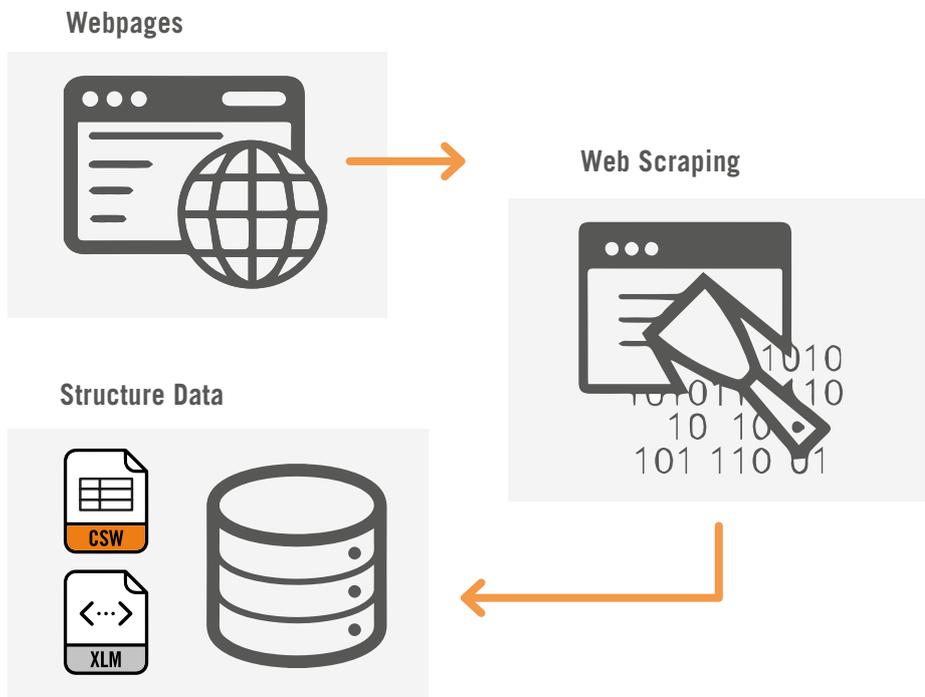
Webpages

Web Scraping

Structure Data

Figure 4 - How web scraping works

Another method used to obtain information from the web is web crawling, which can prove very useful to check whether a certain company has released specific information on its website regarding socially-oriented initiatives, specific certifications or environmental commitments. This technique is used, among others, by search engines like Google in order to extract URLs by analyzing the text of each individual site. In short, a search is performed for all the links connected to each desired search key by accessing all relevant sites, extracting the text, analyzing it according to certain rules (the "build list"), and indexing the web addresses associated with the relevant page. The information is then stored in a database on which future queries can be quickly performed (see Figure 5).
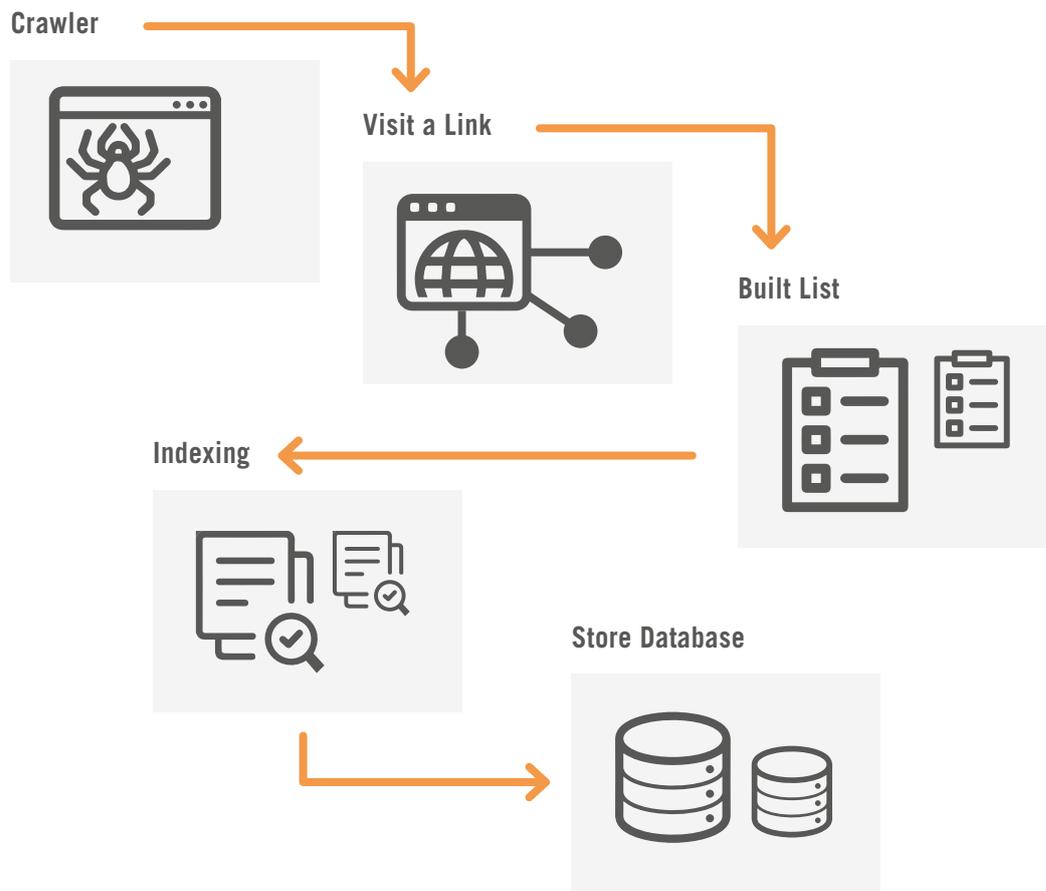
Web Crawler

Crawler

Visit a Link

Built List

Indexing

Store Database

Figure 5 - How web crawling works

To conclude, let us recall that using data that is available only at an industry/area level has some disadvantages. In particular, this top-down approach does not allow an assessment of the actual management of ESG risks by a specific counterparty, since all companies in a given cluster are assigned the same average level.

This could penalize some companies which, although they belong to high-risk sectors or geographical areas, are trying to reduce their negative impact on the environment, the economy, or the community. In addition, the estimate of the average risk for a certain aggregation of counterparties is typically carried out on a sample of observations for which detailed data and assessments are available; if such sample is not representative of the reference population, the evaluation can be biased.

3.1.4. THE IMPACT OF SOME ESG FACTORS AND CREDIT RISK

Due to the lack of widely-available quantitative ESG data (both at a single-name and industry/area level), ESG risks can be incorporated into rating models through a series of specific questions, added to the questionnaire used for the qualitative assessment of borrowers. A large Eurozone bank (whose name cannot be disclosed for confidentiality reasons) adopted this approach in order to incorporate ESG risk factors into the "qualitative" component of its PD estimation models. In the remainder of this section, we look at that data to verify the existence of a correlation with credit risk.

The qualitative questionnaire was filled by credit analysts during the rating process, based on their expert judgment and specific guidelines. The latter were aimed at making the responses consistent across different borrowers (i.e., leading to identical values in the case of counterparties with the same characteristics). All responses provided by analysts were saved to build a time series of ESG factor assessments, with enough of information depth to be used for statistical analysis.

It should be noted that such a qualitative approach has its own weaknesses. Old data show some counterintuitive values, especially before the signing of the Paris Agreement and the creation of the TCFD in 2015, which provided a significant stimulus to recent regulatory developments in climate change and standardized industry practices. The absence of a clear, universally recognized taxonomy introduced further uncertainty in the identification of enterprises that can be defined as "green" or "brown". Additionally, the level at which exposure to ESG risks should be assessed may also differ (e.g., for a counterparty rather than a business branch or product), sometimes leading to conflicting results. Finally, some ESG risks relate to large companies with a more sophisticated business structure, extending across many economic sectors and industries.

Therefore, the same counterparty could be considered "green" or "brown", depending on the business segment being assessed.

Even with these caveats, the historical data collected through the qualitative questionnaire enables an analysis of the historical default rates broken down by different ESG characteristics. The latter are measured at time "T" and linked to the default rates observed in the following 12 months ("$T+1$").

As shown in Figure 1, exposure to socio-environmental risks (emissions of harmful substances, negative environmental impacts, occupational health and safety issues, human rights issues, etc.) is associated with a higher default rate, meaning that such borrowers pose a greater credit risk.
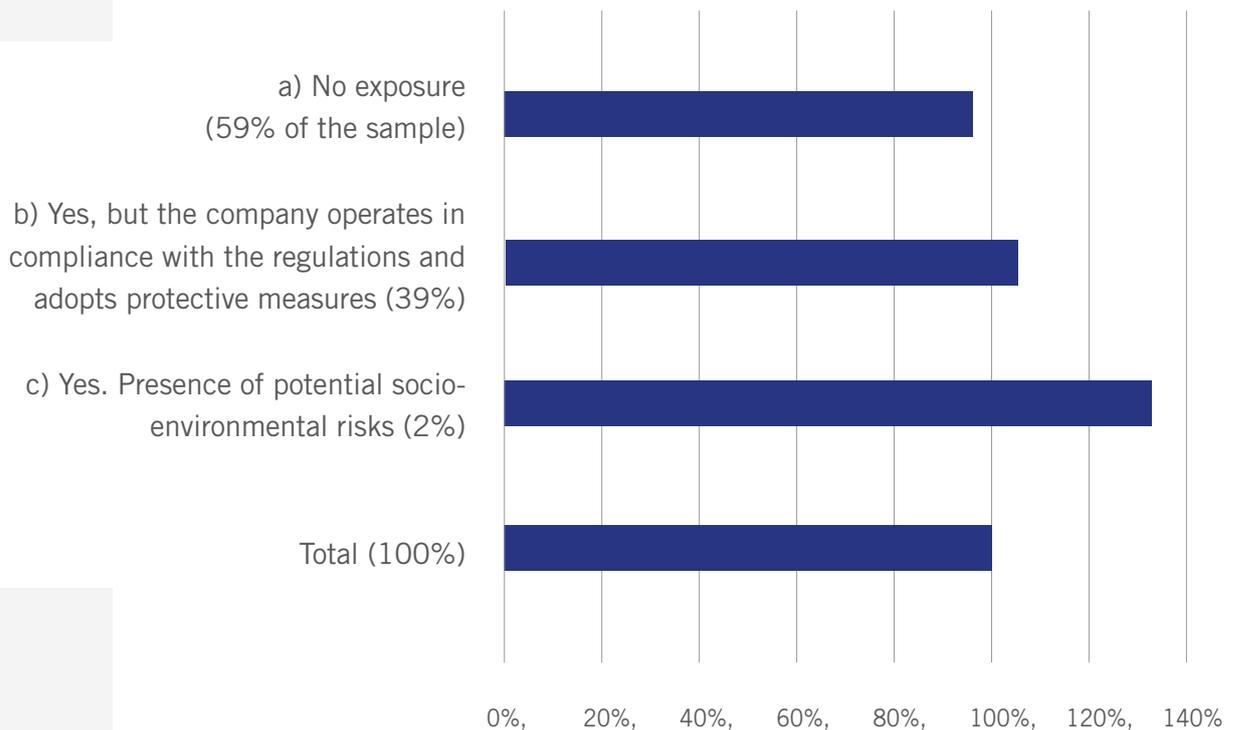

Figure 6 - Exposure to socio-environmental risks and impact on a credit risk index[21]

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[11] This is an index number, where 100% denotes the average default rate of the sample.

This kind of evidence was confirmed by more sophisticated statistical analysis, showing a satisfactory predictive capacity of ESG risk factors included in credit rating models. Indeed, the bank chose to retain all ESG-related questions in its qualitative questionnaire, as they proved statistically significant with respect to default risk. Also, some further ESG-related questions were added to the questionnaire and the analysis of social and environmental information was eventually included in the quantitative section of the bank's PD model.

As regards new questions, the questionnaire was enriched with items covering governance risks, the presence of insurance against the interruption of activities/payments caused by environmental catastrophes (fires, earthquakes, floods, etc.), the availability of certain ESG certificates (quality, environmental, occupational health and safety, or information security certifications, etc.) which was captured through a binary variable. Figure 2 shows how default rates in the sample change when different types of ESG certifications are available.
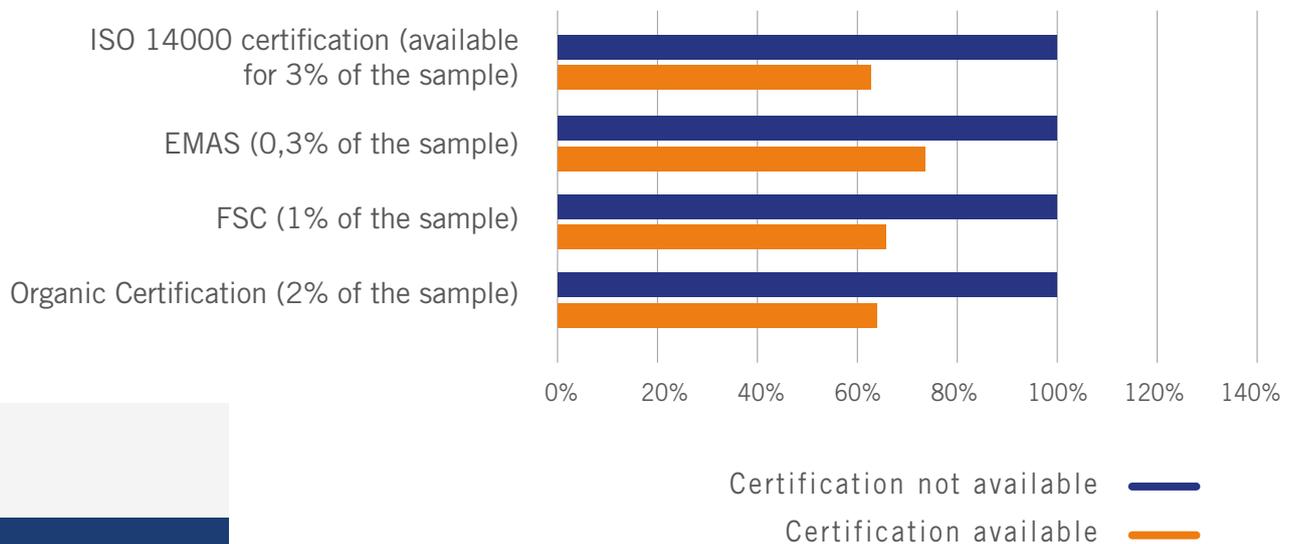

Figure 7 - Environmental certifications[22] and impact on our credit risk index

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[22] ISO 14001 certification: a technical standard of the International Organization for Standardization (ISO) on Environmental Management Systems (EMS) to help organizations minimize the negative effects of their activities on the environment (energy efficiency, material and water efficiency, proper waste management, emissions, etc.). EMAS (Eco-Management and Audit Scheme - environmental efficiency): this is a tool created by the European Community consisting of an environmental management system based on the ISO 14001:2004 standard, referring to all the requirements, while open dialog with the public is pursued by requiring organizations to publish (and keep up to date) an Environmental Statement containing key information and data from the organization on its environmental aspects and impacts. FSC (Forest Stewardship Council): an internationally recognized forestry certification system. The purpose of the certification is to ensure correct forest management and the traceability of product derivatives. The FSC logo guarantees that the product has been made from raw materials from properly managed forests according to the principles of the two main standards: forest management and chain of custody. Organic certification: specific certifications on agricultural methods (in the case of farms) or on the origin of raw materials (in the case of food producers).

One can see that environmentally certified firms have a lower default rate. This applies to all types of certifications analyzed. The incorporation of certifications into the rating model through a quantitative approach, i.e., based on statistical analysis, allows the bank to allocate a relative weight to all new data items, that is consistent with their statistical significance and discriminating power. Factors that are materially linked to default are therefore excluded or assigned very low weights (something that cannot be taken for granted when one adopts an expert-based approach). However, a quantitative approach is only possible when a representative data sample is available. Moreover, a qualitative approach can be used as a data collection tool, making it easier to transition to a quantitative approach at a later stage. The structured storage of historical data allows *ex-post* validation of the weight attributed to *ex-ante* risk factors, calibrating the assumptions that were initially adopted using an expert-based approach.

3.1.5. AN ALTERNATIVE APPROACH TO ASSESSING THE IMPACT ESG FACTORS ON CREDIT RISK

When limited, unstructured data are available, one could use machine learning ("ML") techniques to process available information and generate a score that highlights the extent of the ESG risks associated with each borrower. The use of ML models can support a data-driven approach, without committing to an overly rigid set-up (expert-based or model-based). The output of this analysis, a summary assessment of ESG risks, can then be used to verify whether ESG scores show a significant correlation with credit risk.

Academic literature shows a wide array of ML approaches, with different levels of sophistication. As far as ESG is concerned, a widespread solution uses a combination of models in an approach known as ensemble modeling, i.e., multiple models working together to produce forecasts. Algorithms which, taken individually, would perform poorly, are grouped together and often provide better results than advanced, complex models.

//

The decision tree is the basis of many ensemble model solutions. The most important qualities of this approach are:

// automatic management of characteristics (with very limited need for pre-processing the data) and mixed-type predictors (meaning that, e.g., missing variables are managed automatically);

// the selection of relevant features at the expense of redundant features;

// excellent performance without the need to modify the so-called "hyperparameters"[23];

// a forecasting process that is a summary of a set of cascading rules.

A very well-known variant of ensemble models based on decision trees involves replicating the tree building process many times (including over 1000 times) using only a subset of the available variables. This approach is called "random forest", and is based on a regression and classification algorithm that uses a large number of decision trees built on different datasets, generated through a so-called bootstrap (random sampling) methodology. If the problem to be resolved is classification, the most frequent response is used as output. If, on the other hand, the problem is predictive in nature, the average of all the regressions calculated within the trees is used.

CRIF has developed an ESG score based on ML techniques, covering all companies included in its credit bureau and enriching data by means of web scraping techniques and direct access to web sites (both internal and external to the company to be assessed). This score is a statistical, quantitative assessment of the level of compliance of companies to ESG factors, and can be related to credit ratings (including those produced by CRIF itself through its proprietary "CBDI" model) through a cross tabulation like the one shown in Figure 6 (green represents low risk and red means high risk).

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[23] In ML, a hyperparameter is a parameter whose value is used to control the learning process (from which the values of the remaining parameters derive).

Figure 8 - Matrix for CRIF CBDI rating classes and ESG score classes

By combining the CRIF credit rating (CBDI) with the ESG score, it is possible to obtain a more granular assessment of borrowers. For any level of the CBDI rating, the ESG score allows the borrowers to be sorted into three subsets characterized by different ESG risk. It is interesting to note that these three subsets are normally characterized by a default risk that increases as the ESG score worsens, indicating the presence of a (statistically significant) correlation between ESG assessments and credit risk.

The ESG risk assessment therefore looks capable of improving the discriminating power of traditional credit risk assessment models, even when the information is scarce and unstructured. Needless to say, such results need to be extended to include additional ESG risk factors (as dictating by a growing academic literature and by continuously-improving industry practices) and to additional segments (e.g., small enterprises and structured finance projects), building public data hubs that can be used for ESG assessments by all interested stakeholders.

4. CONCLUDING REMARKS

To conclude, we would like to recall some of our findings and highlight some challenges for the future. Let's start from the basics: the case study examined in Chapter 3 suggests – with all the caveats due to a limited data sample – that there is a link between ESG indicators and credit risk that deserves further investigation, extending the analysis to other types of counterparties and portfolios. Further work is still needed, however, not in terms of statistical techniques, but as concerns the day-to-day operations of banks. Before fine tuning the models, it is necessary to update the processes, so that ESG profiles are adequately captured during loan origination, monitoring and collection, both in quantitative terms (by recording as objectively as possible the existence of certain requirements) and at a qualitative level (through expert analysis that highlights additional sensitive profiles, and allows banks to refrain from "shortcuts", such as SIC codes, which are as useful as they are potentially untrustworthy).

Bringing ESG approaches into processes is necessary to respond to the requirements set out by the EBA in its guidelines on loan origination and monitoring[24], as well as to accelerate the transition to more "sustainable" portfolios. But it also is a prerequisite for developing quality databases, which can be used to verify how strong the inverse link is, that seems to emerge between ESG ratings and credit risk. While such a link would be a strong incentive to develop asset allocation policies that are more open to ESG criteria, it is also true that – unless operating processes are made more sensitive to such metrics – the lower risk associated with "responsible" investments may not be properly recognized. Indeed, a recent publication of the NGFS[25], which does *not* find significant evidence of a risk differential between "green" and "brown" activities (based on a sample of nine large banks), argues that it is still impossible to carry out robust analyses, as only a few countries have clear criteria in place to distinguish between those two types of investments.

The difficulties still present in the tagging phase (where loans and borrowers are "labeled" according to whether they meet ESG criteria) were also highlighted in the recent EBA "pilot" on climate-related risks. It is worth recalling that the EBA exercise deliberately excluded SMEs (small and medium-sized enterprises) and focused on larger counterparties, which were deemed easier to label: what would have happened if smaller companies had also been taken into account?

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[24]   See EBA "Guidelines on loan origination and monitoring", EBA/GL/2020/06, European Banking Authority, Paris. See, for example, §56, which states that "institutions should incorporate ESG factors and associated risks in their credit risk appetite and risk management policies, credit risk policies and procedures, adopting a holistic approach".

[25]   Network for Greening the Financial System, "A Status Report on Financial Institutions' Experiences from working with green, non green and brown financial assets and a potential risk differential", May 2020, Banque de France, Paris.

How can tagging be effectively addressed in many European countries where SMEs are an essential component of the production system? This looks as a huge challenge and one wonders whether the banking system should be equipped with a common infrastructure that, similar to a central credit register, allows banks to share the burden of an unprecedented investment, while helping them to align to best practices. Such an "ESG data register", which would provide individual institutions with a "semi-finished product" that they can individually enrich without harming competition, is certainly an ambitious objective whose practical feasibility should be carefully examined. It would bring significant cost savings, improve performance and – last but not least – it would cut operating expenses for enterprises, which would have to deal with a single questionnaire rather than face multiple requests from different banks (leading to a less careful attitude towards filling in the required information).

It should be noted, however, that measuring how close a borrower lies to the ESG paradigm is inherently difficult for a very straightforward reason: while traditional credit risk scores can be assessed on the basis of their ability to predict default or to estimated LGDs (something that is relatively easy to define and measure on an ex post basis), an ESG score is not directly related to a simple target variable against which its predictive ability can be assessed. The lack of an objective benchmark against which ESG classifications can be back-tested adds an additional layer of uncertainty to the analysis, and requires banks (as well as supervisors and academics) to think out of the box in order to identify appropriate validation methods.

Finally, the measurement of ESG factors raises two potential dangers that periodically re-emerge in the regulatory and supervisory practices of bank risks.

The former is the temptation to entrust the banking system with a task (redirecting individual behaviors toward socially-desirable goals) that is primarily a policy issue, and therefore should be pursued through taxation, consumer education, information campaigns on the long-term consequences of certain lifestyles and consumption habits. The latter is the risk that the "rules of the game" keep changing while the race is already in progress, rather than being defined from the start providing everyone with a clear and common way forward (ultimately penalizing early spenders who are willing to commit to substantial investments and process to align with the ESG new paradigm). Banks – and their risk managers – must play their part (and the more coherent the principles and rules, the more they can do so); but they cannot be the ultimate driver of a societal and economic change that calls for strong and clear policy actions.

Contacts

Andrea Resti
CRIF Senior Advisor and Associate Professor at Bocconi
University in Milan

Giorgio Costantino
Executive Director Global Transformation Services
g.costantino@crif.com

Daniele Vergari
Director – Risk & Predictive Analytics Leader
d.vergari@crif.com

Marco Macellari
Director – Process & Risk Advisory Leader
m.macellari@crif.com

Valeria Nale
CRIF Transformation Services – Principal
v.nale@crif.com

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