Driving sustainability from within

The role of central banks' credit rating in mitigating climate and environmental risks

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List of abbreviations

CCs	Credit Claims
CSR	Corporate Social Responsibility
C&E	Climate and Environmental (risks)
CRAs	Credit Rating Agencies
EBA	European Banking Authority
EC	European Commission
ECAF	Eurosystem Credit Assessment Framework
ECAI	External Credit Assessment Institution
ECB	European Central Bank
ECCBSO	European Committee of Central Balance-Sheet Data Offices
ECMS	European Collateral Management System
ELA	Emergency Liquidity Assistance
ESG	Environmental, Social, and Governance
ESMA	European Securities and Markets Authority
GHG	Greenhouse Gas
HQLA	High-Quality Liquid Assets
ICAS	In-house Credit Assessment System
IRB	Internal Ratings Based (system)
LOLR	Lender of Last Resort (function)
MFIs	Monetary and Financial Institutions
NCB	National Central Bank
NFCs	Non-Financial Corporations
PD	Probability of Default
SMEs	Small and Medium Enterprises

Executive summary

- The collateral framework is at the heart of central banking and serves many fundamental functions that shape the monetary-financial system, impact the real economy and inform prudential regulation. The Eurosystem is legally required to provide credit to market participants only against adequate collateral to minimise risks to its balance sheet and ensure a smooth transmission of monetary policy.

- The Eurosystem Credit Assessment Framework (ECAF) is tasked with checking the adequacy of collateral by gathering and checking credit assessment from three different sources of rating: the National Central Banks' (NCBs) in-house credit assessment (ICASs); external credit rating assessment institutions' assessment (ECAIs); and banks' internal credit rating (IRB). While the rating of private marketable assets is carried out by ECAIs, the rating of private non-marketable assets is mainly done by NCBs' ICASs in eight countries where they exist.

- Non-marketable assets in the form of credit claims are a large and growing part of the private sector collateral, especially since the onset of the Covid-19 pandemic. Credit claims are in essence bank loans to firms of different sizes, including SMEs. The collateral quality of credit claims is mainly assessed by ICASs based on a highly comprehensive quantitative and qualitative assessment process. Currently, the collateral quality is assessed, with exceptions, predominantly based on the financial health of the balance sheet of the firm.

- After having carried out extensive exchanges with the ECB's ECAF and the ICAS of two NCBs and a desk study, we find the ICAS assessment highly suitable for climate and environmental (C&E) risk integration. Furthermore, ICASs assessment is a potentially less biased and a more consistent source than that by the private-sector ESG providers. Particularly, for a large number of SMEs, ICAS assessment could serve as a credible, neutral and free resource of C&E risk assessment.

- We propose a non-exhaustive list of relevant metrics and the possible ways that the NCBs can already integrate them into their credit assessment. Some are already in use by some ICASs (e.g. information on GHG emissions, existing transition plans, etc.). However, this does not imply that those NCBs should stop there. Instead, they should venture beyond and start integrating other key environmental indicators.

- In this paper we make policy recommendations that can be considered as an ambitious roadmap with some actions potentially realisable now and some over the medium-term. Starting from now, the ECB and the NCBs should integrate certain C&E risks and develop a common, standardised approach to ensure consistency in

euro area; NCBs should start from the sectors that are most detrimental for climate change mitigation and nature conservation and consider excluding from collateral the most polluting and most detrimental firms without clear transition plans; and they should start integrating biodiversity concerns, even if data is imperfect.

- In the medium term, the ECB and the NCBs should ensure harmonisation of practises across ICASs; analyse the potential to expand ICAS to all Eurosystem NCBs; expand the default probability forecasting horizon as longer time-series become available; increase the scope and coverage of assessment to all large corporates, to all listed SMEs and further to cover all SMEs; recognise C&E risk integration in the collateral framework as an opportunity to ensure consistency between monetary policy and prudential regulation and encourage further research in this regard.

Introduction

The Eurosystem collateral framework plays numerous fundamental roles inherently shaping the monetary-financial system, impacting the real economy, and informing prudential regulation. The collateral framework has a direct impact on the real economy and has the power to shape the behaviour of wider market participants, "if central bank money is only available against igloos or igloo-backed securities, igloos will be built" (Nyborg, 2017). The collateral framework is the basis for monetary policy transmission with particular relevance for non-financial firms as loans to them constitute a large and growing share of the pledged collateral. And finally, collateral eligibility of assets affects the type of liquidity required for the determination of banks' stock of liquid assets for capital adequacy assessment, thus it can also inform prudential regulation (Bindseil, 2013)

A key task of the Eurosystem is to assess the credit quality of the collateral and assign a rating by relying on internal and third-party ratings. Taken together, credit assessment is the gateway to the collateral framework. Currently, the collateral quality is assessed, with exceptions, predominantly based on the financial health of the balance sheet of the firm. Given the large-scale, systemic risks climate emergency poses to virtually all sectors of the economy, it is entirely inadequate to assess the creditworthiness of the firm without taking into account the impact of climate change on the firm and the firm's impact on the wider environment. Therefore, it is crucial that the Eurosystem considers and mitigates climate and environmental (C&E) risks in its collateral framework.[1]

Recognising the need to integrate C&E risks into the collateral framework, on July 8th, 2021 the ECB published its climate action roadmap.[2] Therein, the Eurosystem commits to looking into climate change risks in the collateral framework to the benefit of both credit operations and purchase programmes. It will do so by developing minimum standards for internal ratings, assessing external rating agencies' incorporation of climate risk into their ratings and introducing climate-change related requirements into its credit assessment framework if warranted by 2025.

This paper revisits the importance of the Eurosystem in-house credit assessments and puts forward proposals for the Eurosystem to carry out far more ambitious and

[1] By climate and environmental (C&E) risks we mean risks arising from climate change, environmental degradation, and nature and biodiversity-related loss, as defined by the Network for Greening the Financial System (NGFS), https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_for_supervisors.pdf.

[2] ECB roadmap of climate-change related actions, https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210708_1_annex~f84ab35968.en.pdf.

impactful steps in integrating C&E risks in its credit assessment. In doing so, the Eurosystem not only minimises risks to its balance sheet, makes its collateral framework more sustainable, and ensures smoother functioning of its monetary policy, but also through its market-shaping powers it can drive more sustainability efforts for wider market participants.

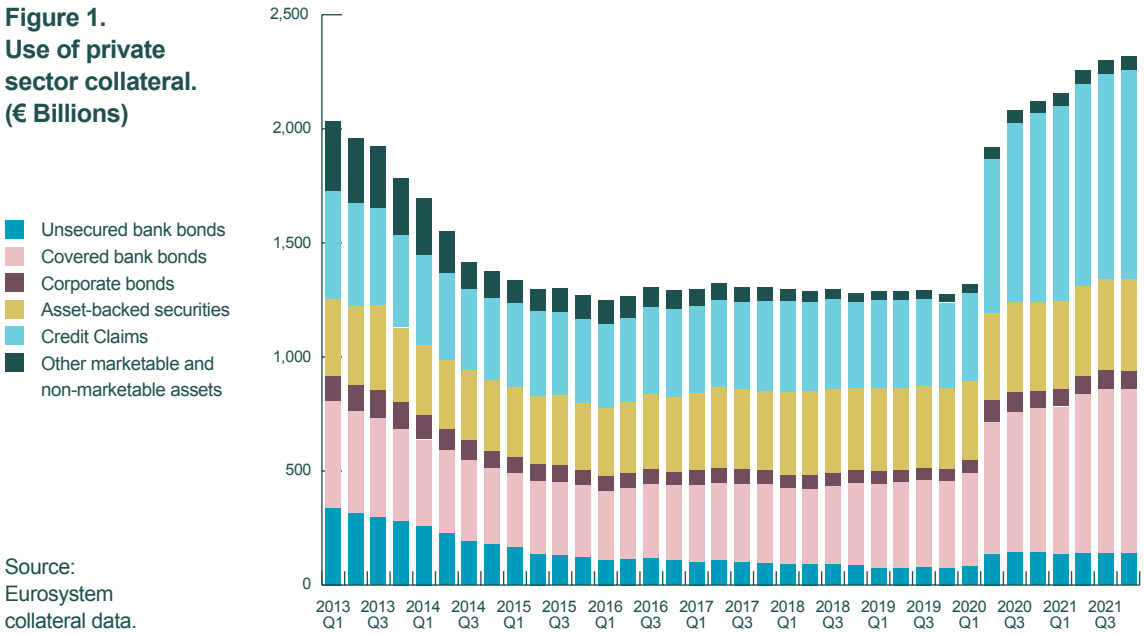
The authors advocate for the expansion of Eurosystem's in-house credit assessment capacity in evaluating C&E risks based on a desk study as well as after having carried out in-depth bilateral exchanges with two National Central Banks (NCBs) as well as the ECB's Eurosystem Credit Assessment Framework (ECAF) team.

1 Eurosystem collateral framework and credit assessment

It is required by law that the Eurosystem provides credit to market participants only against adequate collateral.[3] The collateral framework is one of the main monetary policy transmission channels playing an important role, particularly for refinancing operations. As of the end of 2021 total collateral of the Eurosystem stood at €2,838 billion.[4] Of the used collateral, 81.5 percent originate from the private sector and the rest constitute public sector securities (central and regional government securities).

Collateral eligible assets originating from the private sector are divided into marketable and non-marketable assets.[5] Marketable assets include unsecured bank bonds, covered bank bonds, corporate bonds, asset-backed securities, and other marketable assets, while non-marketable securities are almost entirely composed of credit claims (CCs) and a negligible amount of other non-marketable assets (fixed-term and cash deposits) (Figure 1).

Figure 1. Use of private sector collateral. (€ Billions)



Source: Eurosystem collateral data.

[3] Article 18.1 of the Statute of the European System of Central Banks and of the European Central Bank.

[4] The total eligible universe stands at €16,352 billion composed of public sector assets and private sector marketable assets. Eurosystem publishes daily data on collateral eligible assets, https://www.ecb.europa.eu/paym/html/midEA.en.html.

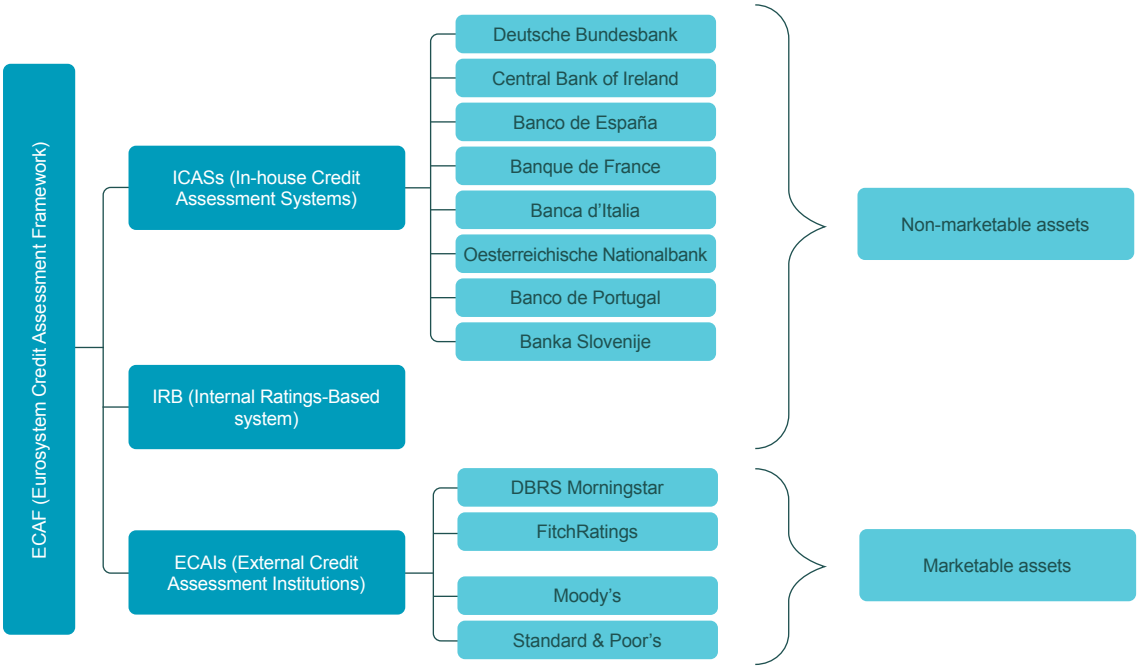
[5] Marketable assets are assets which could be easily converted into cash on financial markets.

Given its sheer size and importance in the monetary policy transmission channel, assessing the risks in the collateral framework not only ensures the smooth functioning of monetary policy, but also serves as a mechanism of awareness and mitigation of risks within the Eurosystem.

Given that the Eurosystem accepts a diverse range of collateral, the eligibility requirements and credit assessments vary by asset. The Eurosystem Credit Assessment Framework (ECAF) is tasked with overseeing the adequacy of collateral and ensuring that proper risk assessment is carried out.

To assess the eligibility and the risks associated with the collateral, ECAF relies on a hybrid model drawing from three sources of credit rating: 1) Eight National Central Banks' (NCB) In-house Credit Assessment Systems (ICASs); 2) Banks' Internal Ratings-Based (IRB) system; 3) Four External Credit Assessment Institutions (ECAIs).

Graph 1. Set-up of the Eurosystem Credit Assessment Framework (ECAF)



Besides collecting credit information from various sources and setting up the rules, procedures and techniques for ensuring high-quality standards for credit rating, the ECAF is also tasked with due diligence of the three credit assessment systems.[6]

The ECAIs are mainly used for providing credit assessments for marketable assets, while ICASs[7] and IRB systems are used for assessing non-marketable assets.

[6] ECB General guideline (2014/60, Article 59.1, 59.2, 119.3, 119.5), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02014O0060-20210101.

[7] Central Bank of Ireland only assesses Mortgage-Backed Promissory Notes (MBPN) issued by Irish banks, not CCs, and therefore uses very different methodologies compared to the other 7 ICASs, https://www.ecb.europa.eu/paym/coll/risk/ecaf/html/index.en.html.

2 The role of In-house Credit Assessment Systems

The Eurosystem In-house Credit Assessment Systems (ICASs) is mainly used for credit rating of non-financial corporations (NFCs, hereafter referred to as firms). The ratings are used to determine whether non-marketable assets in the form of credit claims (CCs) can be used as collateral. CCs stand at €914 billion, representing close to 40 percent of the outstanding private sector collateral in the Eurosystem (Figure 1). CCs are in essence loans to firms of different sizes, including SMEs, or to public sector entities, provided by banks. To be eligible for collateral, CCs have to meet credit quality step 3 in the Eurosystem harmonised rating scale, which is equivalent to a probability of default (PD) of 40 basis points over a one-year horizon. CCs are not used in repo transactions, unlike the more liquid marketable assets. Since CCs are mainly assessed through the ICASs and the IRB, this also leads to lower reliance on ECAIs in the ECAF (Auria et al, 2021). At the same time, given the size and composition of CCs and their less liquid nature compared to marketable securities, the role of the ICAS rating becomes even more important.

The share of CCs in collateral has increased dramatically since the onset of Covid-19 pandemic with the expansion and modification of eligibility criteria.[8] Given that CCs are assessed by ICASs, the role of the ICAS rating to deliver the highest quality credit assessment becomes even more important, further highlighting its growing role within the ECAF.

The existing risk assessment of ICAS is a highly comprehensive process involving quantitative and qualitative approaches with different stakeholders within the NCBs. The general steps in credit assessment are composed of data collection, development of methodologies, credit assessment, approval and validation with different departments within each NCB covering a segment of this process.

Seven ICASs produce around 308,250 full ratings and four ICASs produce partial ratings for 1,368,000 firms in their respective jurisdictions (Table 1).

[8] ECB Decision 2020/506, April 2020 includes the following, but not limited to removal of the minimum threshold for CCs, increased availability of credit assessment systems, reduction in reporting requirements and reduction of haircuts on individual claims, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32020D0506.

Table 1. Overview of the main features of ICASs

	Oesterreichis-che National-bank	Deutsche Bundesbank	Banco de España	Banque de France	Banca d'Italia	Banco de Portugal	Banka Slovenije
Prediction horizon	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Ratings scale	20	20	21	21	19	20	14
Model	Consensus approach	Consensus approach	Logistic regression	Logistic regression	Logistic regression	Logistic regression	Logistic regression
Number of ratings	7,000 full	26,000 full	5000 full, 950,000 partial	270,000 full	4,000 full 350,000 partial	250 full 38,000 partial	500 full 30,000 partial
Units responsible for methodology development and rating	Statistics Department – Model Development and Secondary Statistics Unit, Statistical Analysis and ICAS Unit	Directorate General Markets, Regional Offices	Financial Risk Department – Rating Methodologies Unit, Risk Assessment Unit	Corporate Methodology Division, Branches	Risk Management Directorate, Branches	Statistics Department – Sectoral Analysis Unit, Credit Assessment Unit	Banking Supervision
Implement-ing branches	1	9	–	115	15	1	–

Sources: Auria et al (2021), Table 2: Cross-comparison of the main features of ICASs.
Note: Full ratings mean a combination of both quantitative and expert assessment, see below for elaboration.

All ICASs operationalise the credit risk by estimating the PD over a one-year projection horizon. The credit rating process is composed of quantitative estimation, resulting in a model proposal based on statistic information, an expert assessment stage and an approval and validation stage:

Assessment stage

Quantitative estimation

This stage involves calculating the PD using a logistic regression in case of five ICASs, and a combination of consensus and linear regression in the case of the Oesterreichische Nationalbank and the Bundesbank. The latter two ICASs share a Common Credit Assessment System (CoCAS) and have a common methodology and a common web application for data collection, analysis, and validation (Bundesbank, 2015). The quantitative data is gathered using different sources at this stage, including the firm's balance sheet information, data from National Credit Registries, AnaCredit,[9] financial statements from commercial banks and other information requested from third parties.

[9] AnaCredit stands for analytical credit datasets and it is an initiative by the ECB to harmonise detailed information on individual bank loans in the euro area, https://www.ecb.europa.eu/stats/money_credit_banking/anacredit/html/index.en.html.

Expert assessment

The expert assessment represents a second phase of the rating assessment, so that the final rating combines the quantitative criteria inherent to statistical estimation techniques and the qualitative criteria provided by the analysts. At this stage, the quantitative data is supplemented with more recent and forward-looking information gathered by the analysts from different information sources.[10] This way, the credit assessment can take into account the most recent economic or business events, since those are not usually reflected in the financial statements due to a time lag between when they take place and when they are disclosed to the public.

Each ICAS has different criteria when defining the expert assessment. However, compared to the quantitative assessment based on historical data, expert assessment tries to incorporate more forward-looking information not captured by past balance sheet performance. Experts assess additional information such as those relevant to the firm at the group/market/sector level, quality of management, transparency, and financial flexibility, future organisational strategy and certain ESG considerations.[11] Expert assessment can change the rating by downgrading or upgrading based on the additional information and the number of notches varies by the ICAS. Experts, therefore, determine the final rating combining the two stages, which is then passed onto the validation stage.

Validation stage

All ratings produced by the assessment stage go through an approval process. This so-called four-eyes-principle ensures that every rating is approved by another independent person. If there is a difference or rating disagreement, the process is transferred to a rating committee for evaluation. Taken together this internal validation process ensures that ICASs ratings are an outcome of a highly unbiased process. Furthermore, the Eurosystem ensures that the ICAS rating system itself goes through an independent internal performance monitoring process once a year. Lastly, the ECB's ECAF carries out broader due diligence of each ICAS (Auria et al, 2021).

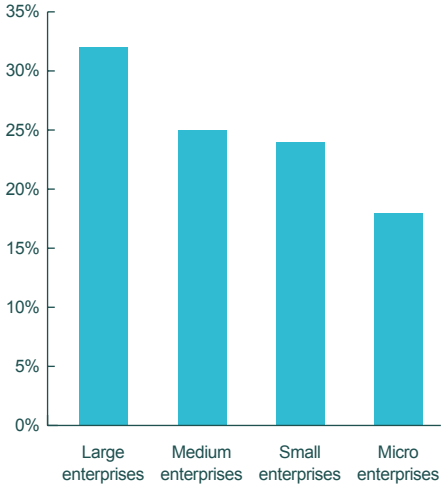
ICASs serve another crucial role in assessing credit rating not only of large and/or listed corporations, but also of a great number of SMEs in Europe. In fact, only a small proportion of firms are listed firms, which means that for a majority of SMEs the main rating is done by ICASs. Around one-third of all ICAS assessed firms are large firms, but not all are listed firms. The remaining two-thirds are distributed almost equally among the medium, small and micro-enterprises. In terms of sectoral distribution, most of the assessed firms are in the services and financial services sectors, followed by real estate, transportation, energy and other manufacturing sectors (Figure 2).

[10] National Central Banks' Central Balance Sheet Data Office (CBSO), Central Credit register (CCR), market information, IRBs, ECAI, press and media.

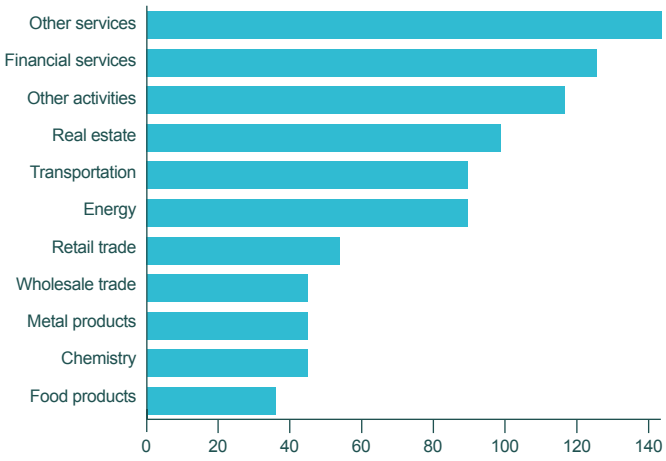
[11] Expert assessment may include in addition to the balance sheet information face-to-face interviews, press releases, court proceedings, governance indicators, ESG data, audit report, KPI data, etc. Expert assessment stage methodologies vary between ICASs.

Figure 2. ICAS assessed firms and sectoral distribution of mobilised collateral

ICAS assessed firms by size (percent)



Sectoral distribution of collateral (€ Billions)



Source: Auria et al (2021) Left-hand side: Chart 3; right-hand side: authors based on Chart 4. Note: Other activities include other manufacturing, machinery and equipment, construction and ICT.

3 Other roles of credit rating – the power of ICAS

The power of ICAS in shaping the collateral framework and wider market behaviour cannot be overstated, both for monetary policy and prudential supervision purposes.

3.1. ICAS and prudential regulation

Credit ratings are being used for various purposes by financial market actors in Europe, including prudential regulation for banks and insurance funds, alongside monetary policy operations. Banque de France has been recognized as an ECAI since 2007; the rating they provide can therefore be used by banks to calculate their capital requirements.[12] Under Basel III Standardised Approach, banks are allowed to use credit risk ratings from rating agencies, where available, to determine the risk weights.[13] Under the so-called IRB approach, banks are allowed to differentiate borrowers based on risk, i.e., they must categorise their borrowers and develop an internal estimation of PD for each borrower category (corporate, retail, banks, sovereigns). In this process, ICAS credit ratings may also serve as a benchmark for calculation of capital requirement at micro and macro level, in the case they are made available to banks.[14] Moreover, recently ICAS has been used by some central banks for their climate-related stress tests and this practice could also be expanded further in the near future.

Another important use of credit rating is for the calculation of liquidity requirements, where high-quality liquid assets (HQLA) must fulfil minimum requirements. In the same vein, the authors propose that ICAS ratings could be used for other prudential tools like settings of concentration limits[15] or large exposures[16] at micro and/or macro levels. They could also be used as a benchmark to define the minimum quality of assets for margin requirements.[17]

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[12] The Banque de France, https://entreprises.banque-france.fr/cotation

[13] Basel Framework, CRE (20.1.2), https://www.bis.org/basel_framework/chapter/CRE/20.htm.

[14] Banque de France shares credit ratings with banks via a subscription to a rating database called FIBEN, https://www.fiben.fr/lessentiel-de-fiben.

[15] "*concentration risk refers not only to risk related to credit granted to individual or interrelated borrowers but to any other significant interrelated asset or liability exposures which, in cases of distress in some markets/ sectors/ countries or areas of activity, may threaten the soundness of an institution*" EBA Guidelines on the management of concentration risk under the supervisory review process (GL31), https://www.eba.europa.eu/regulation-and-policy/supervisory-review/guidelines-on-the-management-of-concentration-risk-under-the-supervisory-review-process

[16] "*The core aim of the large exposures regime is to act as a backstop to prevent an institution from incurring disproportionately large losses as a result of the failure of an individual client or group of connected clients due to the occurrence of unforeseen events*" EBA Regulatory Activities Large Exposures, https://www.eba.europa.eu/regulation-and-policy/large-exposures

[17] *Collateral collected by a counterparty to cover its current and potential future exposure*, EC Delegated Regulation EU2016/225,1 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R2251&from=EN

3.2. Diversifying the sources of funding for firms

Compared to the US with its larger capital market and diversified funding sources, firms in Europe rely mostly on bank loans. Bank loan financing as a share of firms' debt-financing in the euro area stood at 90 percent, while even for the least bank loan dependent countries like France, Luxembourg and Austria, the share is up to 80 percent (Tamura and Tabakis, 2013). This underlines the importance of CCs as collateral in Eurosystem operations.

Within these firms and in contrast to larger firms with more diversified funding sources, SMEs, in particular, rely on the bank funding channel. This highlights the role of ICAS even further since for instance in France 95 percent of all firms assessed by ICAS are SMEs (Schirmer, 2014) and the figure is 82 percent for Germany (Bundesbank, 2015). ICAS assessment therefore could further facilitate and support access to liquidity for SMEs.

3.3. Informing other sources of credit rating

NCBs currently have a rich depository of the credit risk of different segments of the market by size and sectoral distribution. When available, access to ICAS ratings by banks plays an important role in banks' ability to benchmark their own ratings. ICAS methodologies also inform those of the banks', thus the NCB rating process has significant spill-over effects on IRB ratings.

3.4. Essential transmission channel

In Q1 of 2020 CCs constituted 29 percent of the pledged private sector collateral, increasing to 35 percent in Q2 of 2020 and there is no sign of decline with the most recent figure showing almost 40 percent as of last quarter 2021 (Figure 1). This increase inherently influences banks' balance sheets by "encouraging" banks to hold more CCs. With the expansion of CCs in the collateral, the rating process of ICAS comes into focus even more in ensuring the smooth functioning of the transmission channel of monetary policy to the real economy, minimising credit risk among market participants and in its own Eurosystem balance sheet. Gavilá et al. (2020) point out the essential function of the ICASs in the Eurosystem Emergency Liquidity Assistance (ELA) as a lender of last resort (LOLR) to solvent, but illiquid firms in the euro area. In such cases, ICASs ensure that sufficient and diverse collateral is available and that its risks are properly assessed to make sure that temporary liquidity is available (in the form of CCs).

Grandia et. al (2019) analyse the transformational power of central banks in accepting less liquid assets, such as CCs, from counterparties as collateral and injecting more liquid assets in return. This mechanism both smoothens the functioning of transmission channels for effective monetary policy and better informs banks' capital holding for prudential supervision.

4 Integration of climate and environmental risks in credit rating so far

Given the importance and impact of central bank credit rating for the behaviour of market participants, it is not only crucial but also feasible, as demonstrated by the authors below, to carry out ambitious steps in incorporating C&E risk into NCBs' existing risk assessment framework.

C&E risk considerations are minimally considered across ICASs, with some exceptions, at the discretion of assessors when estimating the PD. When C&E risks are considered, they constitute part of the expert assessment stage (see previous section) under ESG rating analysed together with quality of corporate governance and management. Under E, the most commonly referred variable of interest is the greenhouse gas (GHG) emissions data, when available (Auria et al, 2021).

The process of integrating C&E risks into credit risk assessment is still at a nascent stage and remains a work in progress. The Eurosystem plans to develop minimum standards for internal credit rating as per Eurosystem roadmap of climate change-related actions by mid-2022, while the implementation is foreseen to take place thereafter, until 2024.[18] The Eurosystem is legally required (Article 18.1) to provide funding for market participants only against "adequate" collateral. There are multiple reasons that ICASs can and should serve as a focal point in integrating C&E risks, not least because of its growing importance with increasing CCs. As we argue in this section, the purpose and the structure of ICAS make it highly suitable for undertaking ambitious steps in C&E risk integration for reasons elaborated below.

4.1. Minimising Eurosystem balance sheet risks

If the sectoral distribution of the pledged collateral mirrors the existing market structure, this means that it has high carbon intensity and is a source of future (potentially systemic) risk. The sectoral distribution shows a large amount of collateral in carbon intensive sectors, such as energy, transportation, construction, real estate, and chemicals (Figure 2). Making the collateral framework more sustainable, in our view, will undoubtedly have to start with integrating C&E risk assessment into ICASs.[19] However, this should entail steps

[18] Action point 7 of ECB Detailed roadmap of climate-change related actions, https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210708_1_annex~f84ab35968.en.pdf.

[19] ICAS are more flexible in that regard since it has operational independence but also supervision by the ECAF, compared to the other two sources of credit assessment, the ECAIs which are private sector entities supervised by ESMA, and IRBs whose integration of C&E risk is ongoing, but across-the-board standardisation remains time-consuming and challenging.

beyond integrating minimal requirements. Taking into account only GHG emissions data is not enough if a sectoral, systemic decarbonization of the balance sheet is foreseen to be in line with the 1.5 degree warming goal and other environmental objectives.

4.2. Two-steps approach

The existing structure of ICAS allows for both backward and forward-looking indicators. It is crucial to integrate existing available GHG emissions data in the first step of credit assessment using company disclosures and other sources of data. However, the PD is at the moment assessed for a 1-year horizon, with limited C&E risk integration, which means that medium-to-longer term risks arising from climate change, environmental degradation, including biodiversity loss are not at all being captured. The unique feature of ICAS is that it is already possible to integrate such medium-to-long term forward-looking C&E indicators in the second, expert assessment stage, while waiting for the development of quantitative methods to include forward-looking C&E indicators in the first stage. In this expert qualitative stage, the assessor can look into whether the firm has a transition plan in place as well as look into the C&E impact of the firm's operations within the level of the group, sector and geography.[20]

4.3. Neutral alternative to the current ESG rating providers

Private providers of ESG data and ratings have proliferated in recent years with more demand by asset managers to obtain information and rating of firms. Besides the largest providers such as the MSCI, S&P, Moody's, Fitch (last three used as ECAIs by ECAF) and Carbon Disclosure Project (CDP) there are at least 30-40 approved ESG rating providers operating in Europe (EC, 2020). Currently, the market for ESG providers is unregulated and unsupervised, which leads to problems like greenwashing and capital misallocation.[21] Furthermore, a study carried out by the European Commission documented low transparency, problems with timeliness, accuracy and reliability, bias, conflicts of interest and the general lack of clear and consistent terminology as the challenges facing the ESG rating providers (EC, 2020). The convergence of ESG ratings by these providers is also shown to be low (Berg et al, 2019, Bingler et al, 2020 and 2021). While large corporates and listed companies have more resources to invest in more comprehensive ratings from a bigger provider, the overwhelming majority of firms, being SMEs, tend to have less. ICASs in this regard play a crucial role as their structure and assessment process are exceptionally suited to deliver less biased and more consistent ratings. With the credibility of the ICAS rating, NCBs can step in to fill the rating gap, especially for SMEs.

[20] FSB (2020) Task Force on Climate-related financial disclosures: forward-looking financial sector metrics, https://www.fsb.org/wp-content/uploads/P291020-4.pdf.

[21] European Securities and Markets Authority (ESMA) has called on the EC to initiate a legislative action on ESG action and legislative tools in January 2021, https://www.esma.europa.eu/sites/default/files/library/esma30-379-423_esma_letter_to_ec_on_esg_ratings.pdf.

4.4. Filling the gaps in the disclosure rules

ICASs are uniquely positioned to provide C&E risk integrated credit assessment for SMEs. EU regulation on disclosure of C&E risks is addressed in the Non-Financial Reporting Directive (NFRD) and Corporate Sustainability Reporting Directive (CSRD), yet some SMEs do not fall under their scope. The NFRD applied to large companies with more than 500 employees, including listed companies. The new CSRD plans to expand the scope of coverage by including all large and listed companies as well as listed SMEs to disclose non-financial information. However, non-financial disclosure of listed SMEs will only come three years after the information on large and listed companies, while non-listed SMEs are only invited to disclose voluntarily (EC, 2021).

It means that C&E risk information will only be available for a fraction of the firms assessed by ICAS and unavailable for a large section of SMEs. Even where CSRD applies, as it will be the case for listed SMEs, it will only be the case a few years later. Via ICAS, NCBs can step in to fill this gap by requesting information from SMEs with the purpose to minimise the risks in the collateral framework.[22]

In practice, this could mean directly sending a questionnaire to the firms they assess, or mandating another institution such as the European Committee of Central Balance-Sheet Data Offices (ECCBSO) to take on this role (Monnin, 2020). Either way, this leaves the Eurosystem as the only completely neutral, unbiased source when it comes to a large majority of SMEs and their C&E risk assessment.

For the purpose of delving deeper into the integration of C&E risk into credit assessment, the authors conducted in-depth bilateral exchanges with the ICASs of Banque de France and Banco de España. With the former, its ICAS has a strong qualitative expert rating stage with an opportunity to better integrate forward-looking indicators. In the long term, and once the data is standardised and the regulation is broadened to SMEs, Banco de España would be in a position to integrate C&E risk in its quantitative stage. This information has a potential for impact with BoE's sizable coverage of close to 1 million SMEs that it assesses.

[22] See Footnote 3.

5 C&E and financial rating in France and Spain

5.1. Banque de France

Since 1970, Banque de France (BdF) evaluates the creditworthiness of companies through its "cotation Banque de France" framework. Since 2007, BdF has been recognized as meeting equivalence in coverage to an accepted ECAI (EBA, 2014), meaning that the rating system of BdF, among other information-bases, aids credit institutions in determining their capital requirements (Banque de France, 2020a).

Similar to other ECAIs, BdF bases its credit assessment partly on a statistical methodology (Banque de France, 2020b). In concrete terms, BdF each year assesses roughly 260,000 companies with a turnover above €750,000 (excl. tax) by, on the one hand, analysing the most recently available financial statements and on the other hand, by considering qualitative insights that since 2015 also cover Corporate Social Responsibility (CSR) aspects (EBA, 2014). The assessment culminates then into a snapshot rating that represents the ability of a company to "meet its financial commitments over a three-year horizon" (Banque de France, 2020).

BdF assesses the creditworthiness of firms via an expert that conducts "case-by-case and in-depth assessments" of the quantitatively assessed companies. Within this qualitative assessment insights regarding market development within which the company operates in or the company's social and environmental impact, flow into this second stage of the assessment. For this purpose, the expert also conducts interviews with the companies' chief executives. The current rationale for focusing on qualitative assessment, particularly on ESG information, is due to missing data to sufficiently nourish quantitative assessments. However, the final decision may not solely rest on the interviewers' decision but must be validated against the results of the quantitative assessment (Banque de France, 2020a, p. 15).

The ICAS of the BdF focuses particularly on complementing the gap presented by other ECAIs. Banks and to a lesser extent also asset managers mandated to manage corporate credit instruments rely on the BdF's ICAS when it comes to gathering creditworthiness of SMEs – still a major blind-spot for private credit rating agencies (CRAs) that is too costly to tackle. Even though there is currently no quantitative integration of ESG aspects, the ambition is, in the first step, to have climate risks feed into traditional and existing quantitative risk estimation measures with the potential for future independence to the point of being able to have green ratings. Currently, the aim is to build quantitative and qualitative metrics and indicators to be integrated into conventional assessment approaches – making the best of the short-time horizon limit of BdF's mandate.

5.2. Banco de España

Banco de España has been performing credit assessment for ECAF since 1990. The exercise was first restricted to listed companies, but it has been progressively extended to non-listed large companies and SMEs. Their scope of credit assessment is larger than that of ECAIs'. Banco de España implemented a solid governance structure to increase its ICAS capacities and increase the number of firms subject to this credit analysis. The strength of Banco de España is its very broad scope of the credit risk assessment covering 5000 large corporates and nearly 1 million SMEs. Furthermore, Banco de España is planning on expanding its credit assessment to cover all remaining SMEs in Spain (Gavilá et al, 2020). The assessments are done in two stages like all ICASs, the quantitative statistical assessment stage and the expert assessment stage. Contrary to the Banque de France's model, the expert model of the Banco de España does not rely on direct contact or information sharing with the firms.

Banco de España also already includes ESG indicators throughout the analysis process. The consideration of these factors in the credit assessment is only based on qualitative information at this stage and may rely on external ESG ratings when they are available. ESG factors will be taken into account only if they could have an impact on firms' credit risk. To further develop the integration of ESG factors into credit ratings, Banco de España is also participating in a Eurosystem initiative to develop minimum standards on the integration of climate-related risks into its ICAS.

These two concrete case studies show that it is already possible to integrate non-financial information into a credit rating, using a qualitative approach to fill the data gap. In the case of Banque de France, the interviews conducted with firms and information sharing could have a very strong impact in incentivising companies to develop their capacity to integrate environmental and social aspects. Likewise, the various sources of information used by Banco de España to integrate ESG into its credit rating, participate in the build-up of necessary knowledge and capacity to understand how and to what extent C&E risk factors could impact a firm's creditworthiness.

6 Integration of C&E risks into the current framework

Currently, the financial risk assessment structure of ICAS is very comprehensive (as described in section 2). The risk assessment process involves multiple stages of approval until the final rating is produced. Moreover, the NCBs themselves conduct model validation of their ICASs internally. Finally, ICASs undergo frequent due diligence carried out by the ECAF. With the process and methodology for financial assessment already at an advanced stage, the present structure can and should be a firm foundation for integrating C&E risks.

In doing so and looking broadly into the ICAS process, we determine two areas where there are challenges as well as opportunities to integrate C&E risks into the assessment process. These are data and methodology, and assessment and verification.

6.1. Data and methodology

ICASs source quantitative data on firms' C&E performance, when available, from numerous sources, including their balance sheet, data available to the banks, National Credit Registries, and other sources such as the AnaCredit and private ESG providers.

While the perfect approach to factor in material C&E risks is not here, and might not be for a while, a staged adaptation of existing assessment frameworks is possible and necessary, starting now. This process should be accompanied by transparent disclosure of chosen approaches, metrics, methodologies, databases and tools. Making the source of decisions public and providing clear justification for modelling decisions and underlying assumptions of those will help ensure credibility and reliability—characteristics already associated with ICASs—but a threat if not complemented to reflect material paradigm shifts.

We present below some practical approaches of how action can be taken in the immediate short-term to integrate climate (Table 2) and environment-related aspects in ICASs (see more on biodiversity metrics in Box 1). These metrics can help determine the physical and transition risks of firms and serve as a lens through which to improve data collection in existing platforms such as AnaCredit. Arguably, some of these metrics are more easily quantifiable than others and, therefore, possible to integrate within the quantitative stage of credit assessments (e.g. GHG emissions-based metrics relying on historical data). Nonetheless, it needs to be mentioned that all metrics presented below can be integrated into the qualitative expert assessment stage.

The list presented below serves as a starting point and may cover metrics that are already in use by some ICASs (e.g. information on GHG emissions, existing transition plans, etc). However, this does not imply that those NCBs should stop there. Instead, they should venture beyond and start integrating other key environmental indicators (see Box 1).

Table 2: Existing climate metrics for key drivers of creditworthiness and integration possibilities

(Non-exhaustive list of climate-related relevant metrics based on European Commission, 2019; TCFD, 2021, with ICAS integration suggestions by authors).

Metric Category	Example Metrics[23] (Examples unit of measurement)	Examples of how this could be integrated in ICAS concretely
Transition Risk[24], business activities vulnerable to transition risk (driven by policy, technological and consumer preference changes)	**Direct and indirect GHG Emissions Targets (Mt CO2e)[25]:** Absolute (scope 1-3) GHG emissions and targets Intensity of (scope 1-3) GHG (e.g. GHG emissions by country, region, business activity and/or subsidiary)	Explore the relationship between quantitative GHG emissions metrics (in combination with other metric mentioned) and PD in the statistical regressions and transparently disclose the methodology used. In the qualitative stage, ask about the coverage (scopes) of their GHG emissions measurements and targets. For forward-looking insights inquire about science-based time-bound targets[26] and transition plans. Additionally, this could be substantiated by inquiring on CaPex and OpEx contributing to climate change mitigation and adaptation (that are taxonomy-eligible and aligned). Alternatively or additionally, inquire in the qualitative stage of the assessment how the company is or intends to finance adaptation measures for its business.
	Energy (MWh or percent): Total consumption and/or production from non-renewable and renewable energy sources Targets for energy efficiency Targets for renewable energy consumption and/or production	
	Products and services (percent): Turnover percent from products and services in a reporting year and/or CapEx and OpEx for activities that meet EU Taxonomy criteria for climate change mitigation or adaptation[27] Percentage of annual revenue invested in R&D of low-carbon products/services Investment in climate adaptation measures (e.g. soil health, irrigation, technology)	
	Green Finance (percent): Ratio of green bonds to non-green bonds and/or green debt-ratio[28]	

[23] Assessed companies should also disclose their methodologies and metrics. Transparency can also be used as an indicator towards assessing credit reliability.

[24] If value for transition risk is not disclosed by the company, backward-looking GHG emissions can be used as a proxy for vulnerability to transition risks (see ECB, 2021). See suggestions in the table.

[25] Measured in line with the methodology of GHG Protocol or the ISO 14064-1:2018 or if applicable the Commission Recommendation 179/2013 for common methods on life-cycle based GHG performance measurement (European Commission, 2019)

[26] An indicator for this could be whether the entity is committed to the science-based target initiative (SBTi).

[27] The authors want to outline that taxonomy-eligibility or alignment should not be considered in isolation but rather in conjunction with other internationally accepted standards as well as with other taxonomy-independent metrics outlined in the table.

[28] When applicable according to the EU Green Bond Standard and until then adhere to the Green Bond Principles and the Green Loan Principles (see European Commission, 2019)

Metric Category	Example Metrics[23] (Examples unit of measurement)	Examples of how this could be integrated in ICAS concretely
Physical Risks[29], business activities vulnerable to physical risk (acute and chronic risks)	**Assets committed in regions likely to become more exposed to acute or chronic physical risks (amount or percent):** Proportion of property, infrastructure, or other alternative assets in an area subject to flooding, heat stress, or water stress. Proportion property or infrastructure (real assets) exposed to 1:100 or 1:200 climate-related hazards	Explore the relationship between the exposure of material business activities and real assets in hazardous geolocations and PD. What can not be quantitatively assessed, can be evaluated in the qualitative stage. For example, with the help of the Water Risk Filter[30] or the Aqueduct platform,[31] inquire the location of relevant assets of the company and gain a picture of the exposure to climate-related physical risks such as flood risks.
Internal Carbon Prices, price on each ton of GHG used internally by the organisation (price in reporting currency, per ton of CO2e)	Internal carbon price Shadow carbon price, by geography	In the qualitative stage of the assessment assess if the company has set up a carbon price that accurately reflects the real cost of carbon.[32]
Remuneration, proportion of remuneration linked to climate considerations	**Incentive structures linked to climate goals (percent, weighting description, or reporting currency):** Share of employee's annual discretionary bonus linked to investments in climate-related products Weighting of climate goals on long-term incentive scorecards for Executive Director Weighting of performance against operational emissions' targets for remuneration scorecard	In the qualitative assessment stage evaluate to which extent the firm has climate-linked remuneration policies in place.

Private ESG data for SMEs and other firms could be used, but it should be given a proportional weight considering their numerous disadvantages (see section 3.3).

All national central banks which run ICAS have dedicated departments in charge of developing credit assessment methodologies (see Table 1). These departments develop a methodology for C&E risk integration into both the quantitative assessment stage and the expert assessment stage. Integrating more forward-looking as opposed to backward-looking metrics (relying solely on historical data) will do more justice to the severity of increasingly intensifying environmental crises and the financial risks associated with them. However, it is without doubt, that the cost of inaction until the perfect solution is there is much higher than the cost of an imperfect but precautionary approach in measuring eligibility of collaterals.[33]

[29] If value for physical risks is not disclosed, consider proxies as an insight to how the company may be exposed to physical risks (see TCFD, 2021; European Commission, 2019). See suggestions in the table.

[30] WWF, https://waterriskfilter.org/.

[31] ISRIC datahub, https://data.isric.org/geonetwork/srv/eng/catalog.search#/metadata/9e84c15e-cb46-45e2-9126-1ca38bd5cd22.

[32] Min. USD 80 per ton of CO2e in countries where no higher estimates are available (see Grandpré, Hofstetter & Öttl, 2020).

[33] As voiced for a number of times by ECB Executive Board member Frank Elderson, see speech, "*Patchy data is a good start: from Kuznets and Clark to supervisors and climate*", 16 June 2021.

BOX 1

The case of biodiversity loss–existing metrics and integration possibilities

(Non-exhaustive selected biodiversity-related metrics based on Finance for Biodiversity, 2021; IUCN, 2021 & WWF, 2020)

Certain business models are deeply interwoven and dependent on functioning ecosystem services (particularly in certain sectors, e.g. food & beverages, agriculture and fisheries) (WEF, 2020). Ecosystem services are what links business to nature. These services stemming from nature facilitate or enable business production processes which in turn represents a benefit to the business (UNEP, 2022). Ecosystem services flow from natural capital assets: atmosphere, habitats, land geomorphology, minerals, ocean geomorphology, soils and sediments, species and water. Natural capital is under threat by 26 drivers of environmental change (or pressures) that include pollution, habitat modification and climate change (Nordheim et. al, 2018). Negative impact of businesses on natural capital affects the quality of ecosystem services which certain firm's business significantly depend on. Factoring in the relationship of a firm to ecosystem services and natural capital is key in assessing the short- and long-term credit risk of that firm. Compared to approaches in measuring climate-related financial risks, attempts in assessing biodiversity-related financial risks are still in their infancy.[34] However, today's impacts are tomorrow's risks.[35] Several initiatives have developed impact tools and methodologies, defined metrics and compiled data sets that could be leveraged within ICASs to more accurately estimate a firm's creditworthiness (e.g., Biodiversity Impact Metric (BIM) by Cambridge Institute for Sustainability Leadership, see Annex 1)

Metric	Description
Mean Species Abundance (MSA)	This metric compares the status quo abundance of native species within an ecosystem area to its hypothetical pristine state. Overall, this metric measures the "intactness" of an ecosystem.
Potentially Disappeared Fraction (PDF)	This metric measures the percentage of lost species in $1m^3$ of water and $1m^2$ of land due to pressures on the environment. Likewise to MSA, this metric measures "intactness".
STAR (Risk of extinction)	This metric adds up the risks of species extinction that is weighted by their 'threat status'. An ecosystem is deemed under pressure if there is a presence of threatened species. Overall, this metric measures the risk of extinction of species.
Living Planet Index (LPI)	This metric tracks trends in abundance of a large number of populations of vertebrate species. The data used in constructing the index are time-series of either population size, density (population size per unit area), abundance (number of individuals per sample), or a proxy of abundance (for example, the number of nests recorded may be used instead of a direct population count)
Red List Index	This metric, based on the IUCN Red List of Threatened Species, is an indicator of the changing state of global biodiversity. It defines the conservation status of major species groups, and measures trends in extinction risk over time.

[34] The ENCORE platform by the Natural Capital Finance Alliance can be a useful starting point to understanding how economic activities are dependent on natural capital-related risks.

[35] The European Commission highlighted the principle of double materiality to be of essence in upcoming disclosure regulations (European Commission, 2021).

It is important to note that while these tools and methodologies can be a useful starting point to understand the impact of an assessed firm on biodiversity loss there are swifter means to integrate environmental considerations in ICASs. In the qualitative stage, experts can inquire on the firm's policies covering the main drivers of biodiversity loss such as deforestation and overfishing. Furthermore, companies can be asked to share if there are transition plans in place and whether a materiality assessment has been conducted, including an analysis of a company's impact on nature.

6.2. Assessment and validation

In integrating C&E risks, we find the ICASs of Banque de France, as the most comprehensive and suitable to potentially integrate forward-looking C&E metrics. Its "case-by-case and in-depth assessments" are highly suitable for C&E risk integration and forward-looking indicators that are not captured in the quantitative assessment stage (see section 4.1). Banque de France's highly comprehensive assessment is made possible by the use of its 115 branches and hundreds of analysts collecting and aggregating the data. Banque de France remains an exception in this regard (Table 1). We propose scaling-up as one potential way to incorporate more comprehensive C&E assessments into ICAS ratings. We suggest the NCBs together with the support of ECB's ECAF explore the opportunities and challenges of such a proposal.

As discussed in this paper, credit ratings performed by ICASs are used in various ways from monetary policy to prudential regulation, including amplifying lending possibilities for SMEs and thus enhancing the transmission channel of monetary policy. The neutrality embedded in ICAS, compared to ECAIs and private CRAs, is also the best guarantee to ensure better quality of data. That is why both the integration of C&E consideration into ICAS and potentially extending ICAS to the whole Eurosystem perimeter could be an important direction moving ahead.

7 Policy recommendations

The authors see the increasing role and potential of ICAS as a concrete, workable and impactful way to integrate C&E considerations into the heart of the financial system. The policy recommendations below can be considered as an ambitious roadmap with some actions realisable now and some over the medium-term. These recommendations serve as a basis for further discussions with the ECB and the NCBs.

7.1. Act now

Central banks should practice what they preach and lead by example when asking financial institutions to better understand and integrate C&E risks into their activities. Central banks should also take the lead in developing and internalising the integration of C&E aspects into credit ratings. Doing so in a transparent manner, will enable market participants to benefit from their experience and methodologies while favouring a common, standardised approach in the euro area. A plurality of credit ratings sources is necessary, but harmonised ICAS ratings are particularly important and therefore should serve as a benchmark.

ECB and NCBs should start integrating C&E considerations starting from the most polluting sectors and consider excluding from collateral most environmentally detrimental activities and firms without clear science-based transition plans. Integrating C&E risks into ICAS and introducing the same criteria and considerations at the same time in prudential treatment for macro and micro-financial risks should enable targeted exclusion of activities that are not Paris-aligned to avoid any inconsistency between monetary policy and prudential supervision.

ECB and NCBs credit rating should start integrating biodiversity considerations. Even if full data packages and methodologies are not yet ready on biodiversity aspects, central banks should start by looking into already existing data, thus beyond focusing solely on climate risk metrics (see Box 1). ECB should also play a key role and broaden the scope of its roadmap to all environmental csonsiderations.[36]

[36] "Monitor the adequacy of the collateral valuation and risk control framework to ensure that climate change **and environmental degradation** risks are properly reflected", see Footnote 2.

7.2. Act over the medium-term

ECB and NCBs should work on common guidance to ensure harmonisation of practises across ICAS as well as support the development of ICAS in other Eurosystem NCBs. In this regard, the launch of the European Collateral Management System (ECMS) platform[37] in 2023 could be a fantastic opportunity for C&E risk integration. ECMS platform should enable the necessary standardisation and simplification for Eurosystem NCBs to pursue or develop their ICAS.

Extend the forecasting horizon as more data points become available. With the extended time series on C&E risk available to ICASs in both forward and backward-looking indicators, it will become possible to extend the forecasting horizon and review the transition trajectory of larger firms on an annual basis. Moreover, non-financial information and interviews will provide more and more insights on firms' trajectories regarding C&E risk.

ICASs should aim to increase the scope of their coverage by including all large corporates, listed SMEs and all other SMEs in time. European regulation will soon provide non-financial information for SMEs. The increasing scope should pave the way to accelerate the transformation of our economies and redirect credit flows towards Paris-aligned activities and in line with the upcoming Global Biodiversity Framework. The possibility of SMEs to obtain a completely neutral ICAS rating (as already the case for financial risk rating) should not only encourage them to make their activities more sustainable but also increase access to more financing opportunities to enable the transition.

Ensure consistency between monetary policy and prudential regulation. Collateral rating and classification to a great extent could also inform liquidity requirements of banks and thus can have an impact on prudential regulation. Integration of C&E risks into the collateral framework and ICAS assessment of these risks is an opportunity to ensure alignment of monetary policy and prudential regulation. The Eurosystem should encourage the development of further research by the central banking and the research community in this regard.

[37] On ECMS, https://www.ecb.europa.eu/paym/target/ecms/html/index.en.html.

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Annex 1

The Example of Biodiversity Impact Metric (BIM) by Cambridge Institute for Sustainability Leadership (CISL)

The Biodiversity Impact Metric (BIM) is a measurement approach to determine how a company's sourcing decisions impact nature. It is measured by a formula consisting of three components multiplied with each other: land area, the proportion of biodiversity lost and biodiversity importance (Institute for Sustainability Leadership, 2020).

Biodiversity Impact Metric =

Land area (business data on the amount of commodity and source location)	x	Proportion of biodiversity lost (Global MSA values for land use types)	x	Biodiversity importance (global datasets on range rarity and commodity production by location)

The output unit is "weighted hectares" which is the hectares weighted by the biodiversity impact. The final product can then also be divided by the total quantity of purchased commodities to gain the indicator of impact per unit sourced to allow for global average comparison (Lammerant et. al, 2021, p. 96).

While this is first and foremost an impact metric and not one that assesses risks to the business it is a useful indicator to understand the role of a company in driving biodiversity loss and with that potential transition risk it may face in the short-term and in the long-term when augmented with information on science-based, time-bound biodiversity-related targets and their fulfilment over time.

For further biodiversity measurement approaches see Finance for Biodiversity, 2022; Lammerant et. al, 2021; Hilton & Lee, 2021; UNEP, 2022.

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