



BANCA D'ITALIA
EUROSISTEMA

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(Markets, Infrastructures, Payment Systems)

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by Lorenzo Esposito, Marisa Franzoni, Massimo Guglielmi,
Alessandra Iannamorelli and Raffaella Sorgente



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THE CREDIT ASSESSMENT OF LARGE FIRMS

by Lorenzo Esposito,* Marisa Franzoni,** Massimo Guglielmi,*** Alessandra Iannamorelli*** and Raffaella Sorgente****

Abstract

The paper provides a comparative review of the methodologies used to assess the creditworthiness of large non-financial corporations. We examine four major credit assessment systems: selected international External Credit Assessment Institutions (ECAIs), banks' Internal Ratings-Based (IRB) systems, the In-house Credit Assessment Systems (ICASes) of euro-area central banks, and credit rating agencies operating in the Italian market. Although these frameworks differ in terms of regulatory framework and objectives, several common methodological features emerge. These include the integration of soft information with hard data, group-level assessment, sector analysis and monitoring procedures. We also find some differences, particularly in the integration of environmental, social and governance (ESG) factors and in the use of artificial intelligence (AI) tools.

JEL Classification: G21, G24, G32, E52.

Keywords: large firms, credit risk assessment, rating methodologies, ESG, AI.

Sintesi

Il lavoro presenta un'analisi comparativa delle metodologie utilizzate per valutare il merito di credito delle grandi imprese non finanziarie. L'analisi prende in esame quattro principali sistemi di valutazione: un campione di agenzie internazionali di valutazione del merito di credito (ECAI), i sistemi interni di rating delle banche (IRB), i sistemi interni di valutazione creditizia delle banche centrali dell'Eurosistema (ICAS) e le agenzie di rating operanti sul mercato italiano. Sebbene tali sistemi differiscano per quadro regolamentare e finalità, emergono alcuni elementi metodologici comuni. Tra questi figurano l'integrazione delle informazioni desunte dalla documentazione aziendale con quelle raccolte direttamente presso le imprese, la valutazione a livello di gruppo, l'analisi settoriale e le procedure di monitoraggio. L'analisi evidenzia inoltre alcune differenze, in particolare nell'integrazione dei fattori ambientali, sociali e di governance (ESG) e nell'impiego di strumenti basati sull'intelligenza artificiale (IA).

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CONTENTS

1. INTRODUCTION	7
2. LITERATURE REVIEW	8
3. REVIEW DESIGN	11
4. DESCRIPTION OF RATING SYSTEMS	12
4.1 ECAIs	12
4.2 IRB SYSTEMS	13
4.3 ICASes	14
4.4 CERVED AND CRIF	16
5. COMPARATIVE REVIEW	17
5.1 DEFINITIONS AND REGULATIONS	18
5.2 DATA SOURCES	19
5.3 SECTOR ANALYSIS	20
5.4 GROUP STRUCTURE AND GOVERNMENT-RELATED ENTITIES	20
5.5 OVERRIDE AND MONITORING	20
5.6 ESG FACTORS	21
5.7 AI TOOLS	22
6. CONCLUSIONS	25
REFERENCES	26

1. Introduction

Credit ratings play a central role in financial decision-making for lenders, investors and policymakers, and comparing these measures is methodologically and practically relevant, especially when multiple rating sources coexist and provide differing assessments of the same firm.

Methodological differences matter, for example, in credit allocation, collateral eligibility within the Eurosystem framework and risk management, where differences in methodologies can lead to different outcomes.

This comparison helps explain how ratings work and supports a more informed assessment of the associated risks. To the best of our knowledge, the existing literature mainly focuses either on individual rating sources or on ex-post comparisons of rating outcomes. A comprehensive and systematic review of methodologies across providers is still lacking. This paper aims to fill this gap by comparing the methodologies used by major credit assessment sources for large non-financial corporations. It provides the first comprehensive overview of rating methodologies applied to large firms across these sources.

As of 2026, the Eurosystem credit assessment framework (ECAAF) includes the statistical component of in-house credit assessment systems (S-ICASes) among the sources used to assess small and medium-sized firms (SMEs), many of which are not covered by other sources (Duarte *et al.*, 2025). *Full ratings* are still required for large firms. As a result, the ICAS expert assessment will progressively concentrate on large firms. To support a more specialized expert assessment by firm size, we review the methodologies used by different rating sources to assess large non-financial corporations in order to identify best practices and recent developments. While this objective reflects the operational needs of central banks, the issues addressed are of broader relevance.

Because this review aims to support the refinement of Banca d'Italia's ICAS methodology, the analysis focuses on external and independent sources. It therefore excludes the Bank's own system (BI-ICAS), to preserve the neutrality of the comparison. The BI-ICAS is nevertheless discussed where relevant for comparative purposes.

The review covers the credit assessment sources accepted for Eurosystem collateral purposes:

- External Credit Assessment Institutions (ECAIs), such as Moody's, Standard & Poor's, and Fitch;
- selected ICASes with a long-standing use and publicly available documentation, including those of Banco de España, Banque de France, and Bundesbank;
- commercial banks' Internal Ratings-Based (IRB) systems;

- the two main domestic Italian rating agencies, Cerved and CRIF.¹

The analysis shows that rating entities rely on a broad set of financial and non-financial information. In particular, qualitative judgement based on interviews with top management and on the assessment of governance structures and market positioning, plays a key role in the evaluation of complex firms. Most systems share several features. These include sector-specific methodologies (especially in industries such as real estate and energy), group-level assessments, early warning tools, and structured procedures for overriding model outputs. The review also highlights recent methodological developments, including the integration of sustainability factors into credit risk assessment and the use of machine learning (ML) techniques.

The remainder of the paper is structured as follows: Section 2 reviews the related literature; Section 3 describes the methodology; Section 4 presents the results; Section 5 summarizes the main findings; and Section 6 concludes.

2. Literature review

The existing literature on credit rating systems mainly consists of (i) studies focused on individual rating sources and (ii) analyses addressing specific aspects of rating methodologies. Cross-system comparisons are relatively limited in scope and typically focus on selected features rather than providing a systematic methodological assessment.

The assessment of creditworthiness for large firms has gained increasing prominence in the context of market regulation, prudential supervision, and Eurosystem credit operations, in line with the growing systemic importance of these firms. The ECAF reflects this trend by recently introducing expert assessment for large firms as a condition for collateral eligibility (Duarte *et al.*, 2025). Several rating methodologies coexist within the European financial system, including those adopted by ECAIs, ICASes, and banks' Internal Ratings-Based (IRB) systems. While regulatory harmonization has progressed through regulatory coordination mechanisms, such as the mapping of ECAI ratings under Regulation (EC) No. 1060/2009 (European Commission, 2009), the Capital Requirements Regulation (CRR) (European Parliament and Council, 2013), and the definition of common eligibility criteria for ECAF purposes (ECB, 2015), the Eurosystem does not impose alignment across rating

¹ Cerved and CRIF were accepted for the assessment of Italian collateral until 2021. They are also ECAIs and their ratings are issued by Cerved Rating Agency and CRIF Ratings, which are distinct legal entities within their respective groups. Therefore, when referring to ratings, the terms “Cerved” and “CRIF” shall refer to these two entities.

methodologies. Each source continues to operate within distinct institutional settings and objectives, combining different data inputs, modelling approaches, time horizons, and judgmental components. Evidence on rating methodologies remains largely organised by rating source, with most studies focusing on individual systems rather than providing a cross-system perspective.

ECAIs primarily focus on large firms that issue bonds and structured securities. ECAIs typically adopt globally standardised Through-the-Cycle (TTC) rating methodologies aimed at assessing long-term creditworthiness (Lecomte and Torres, 2023). Their ratings are based on expert judgement and sector-specific financial analysis, enriched by interviews with senior management and the integration of macroeconomic and ESG-related information (Moody's, 2021 and 2023; S&P Global, 2021 and 2024; Fitch, 2023). While the global scope of ECAIs promotes methodological standardization, it may limit responsiveness to local economic conditions (Marandola, 2021).

Several national central banks within the Eurosystem have developed ICASes formally recognized for ECAF purposes (ECB, 2015). The ICAS process starts with a statistical evaluation based on financial ratios (Narizzano *et al.*, 2024), and the analysts subsequently conduct an expert assessment, largely of qualitative nature. Their analysis mainly covers governance issues, market positioning, and business strategies aspects that quantitative models do not fully capture (Giovannelli *et al.*, 2023). Although they are based on one-year default probabilities, closer to Point-in-Time (PIT) rating methodology, ICAS models include forward-looking adjustments that partially align with TTC characteristics (Auria *et al.*, 2021). ICASes assess firms of all sizes but have increasingly devoted the expert assessment to large firms in response to collateral policy changes (Duarte *et al.*, 2025).

Commercial banks originally developed IRB models under the Basel II and III frameworks to set capital requirements; as such, they are subject to supervisory validation (BCBS, 2001 and 2005, EBA, 2023b). Although financial statements and the Pillar 3 documentation provide general information, institutions disclose limited details about IRB methodologies. Some studies have raised concerns about transparency and overreliance on internal benchmarks (Bruno *et al.*, 2023). IRB models typically rely on PIT statistical estimation of default probability with financial ratios, sectoral indicators and, increasingly, governance factors (Ferri *et al.*, 2017; Gallo, 2021). Although formally defined as PIT under the Basel and CRR frameworks, in practice some banks employ smoothing techniques or hybrid calibration that partially approximate the TTC approach (BCBS, 2005; EBA, 2023b). Banks apply IRB systems to a wide range of borrowers, but they often calibrate these systems specifically for corporate loan portfolios.

The use of TTC or PIT approaches varies across rating sources. ECAIs generally adopt the TTC notion to assess credit risk over the economic cycle while IRB systems are formally based on PIT

methodologies and or hybrid calibrations that partially approximate the TTC approach. ICASes also typically rely on the PIT notion, although expert overrides and qualitative considerations allow partial convergence with the TTC approach (Auria *et al.*, 2021; ECB, 2015).

Nationally focused rating agencies, such as Cerved and CRIF in Italy, adopt proprietary methodologies based on financial statements, sector analysis, and qualitative interviews (Cerved Group, 2019 and 2023; CRIF Group, 2023). They cover all firm sizes; the available documentation does not reveal whether Credit Rating Agencies (CRAs) models differ by firm size. Their rating horizon typically ranges from one to three years,² and ratings are updated more frequently in cyclical sectors such as real estate and construction. In recent years, these agencies have increasingly incorporated ESG issues and advanced techniques, including machine learning and predictive modelling, to enhance firms' credit assessment.

IRB models may rely on the ECAI ratings as a benchmark under the so-called *shadow rating* approach, which is prominent for banks with lending portfolios concentrated on large firms (Mediobanca, 2024). Major ECAIs generally assign consistent ratings to important firms (Morgan, 2002). They may express this alignment through outlooks (such as 'stable' or 'negative'), subtly signalling a possible future change in the rating (Alsakka *et al.*, 2014; Livingston and Zhou, 2020).

Several studies have examined the rating methodologies and their use within the Eurosystem framework. Some contributions focus on the role of ratings in collateral policy and regulatory practices (e.g. Lecomte and Torres, 2023), while others analyse the structure and evolution of ICASes (Auria *et al.*, 2021) or the effect of ICAS eligibility on collateral availability (Calza *et al.*, 2021). Further studies compare internal ratings with standardized approaches or examine the mapping and validation of ECAI ratings (Cucinelli *et al.*, 2018; Columba *et al.*, 2024; Gagliardone and Papadia, 2022). This literature does not provide a systematic comparison of the methodological approaches used to assess large firms across different rating sources.

In addition to methodological reviews, quantitative evidence exists regarding the degree of alignment and divergence in firms' credit assessments produced by different rating sources, particularly within the ECAF. Empirical comparisons across the main ECAF-accepted credit assessment sources, including IRBs, ICASes and ECAIs, show that rating outputs may differ in terms of calibration and discriminatory power, even when they serve similar operational purposes (Coppens *et al.*, 2007). Related evidence suggests that corporate risk estimates produced by banks' internal models and those derived from ICAS-based assessments may display some degree of heterogeneity, reflecting

² CRIF medium term ratings span from three to five years.

differences in data, modelling choices, and institutional settings (Calza *et al.*, 2021; Columba *et al.*, 2024). More generally, statistical validation methods based on multi-rater information provide a quantitative framework for assessing coherence and systematic differences across rating providers, complementing single-system performance measures (Hornik *et al.*, 2007). These contributions focus on the comparison of rating outcomes, regardless of firm size, rather than on ex-ante methodological design. This distinction helps frame the originality of the present paper, which provides a comparative assessment of rating methodologies for large non-financial corporations, with particular attention to larger and more complex corporate exposures.

3. Review design

To carry out the review, we conducted detailed analyses of the methodologies adopted by each rating source, drawing on publications describing the criteria employed by ECAs such as Fitch, Moody's and S&P, as well as publicly available information on the IRB models used by commercial banks. For ICASes we examined public documentation and information from exchanges and seminars with Banco de España, Banque de France and Bundesbank. Additionally, we conducted interviews with representatives from nearly all the rating sources, except for IRBs, to address specific issues on their methods.

We examine rating sources using homogeneous criteria with respect to the methodologies and the organization of the process. The assessment focuses on three components: the rating model architecture, the nature and sources of input data, and the process for the generation of ratings. For each system under review, we try to establish whether the approach is predominantly quantitative, qualitative, or both. In the case of statistical models, the analysis explores how the relative contribution of different categories of input data - such as balance sheet financial statements, credit register information, and alternative sources - may vary along with the firm's size, with specific attention to large firms.

For the qualitative dimension of credit assessment, the review identifies the risk profiles considered by each rating system, as well as the criteria used to form individual assessments. In addition, we examine how each system aggregates these assessments to produce the final rating, exploring whether aggregation follows a formalized scoring algorithm, expert assessments, or both. This step helps to assess the transparency and replicability of the rating process, particularly when it involves a large degree of qualitative judgement. The analysis explores several operational features underlying the governance and reliability of rating issuance. These include the procedure for rating approval, the internal control mechanisms in place to ensure rating consistency and accuracy, and the protocols for

monitoring rated entities over time. Furthermore, the review evaluates the frequency and triggers for rating updates, with the aim of understanding how timely and responsive each system is to new information or evolving risk conditions.

4. Description of rating systems

The analytical framework outlined above is applied to examine each rating source individually, focusing on its methodological and operational features.

4.1 ECAIs

The CRA Regulation (European Commission, 2009) governs ECAIs, while ESMA supervises their methodologies. The Eurosystem recognises their ratings for monetary policy purposes. The ESAs and the EBA periodically update the mapping rules applied to ECAI ratings (EBA 2023a).

These ratings assess the issuer's ability to meet financial commitments, based on a qualitative analysis of company data.³ Each rating provider defines its methodology based on its purpose and applicable regulation. Rating purposes also influence how large companies are defined. For ECAIs, the definition of a large company is not explicit, as they mainly rate widely traded corporate bonds that are typically issued by large firms.

ECAI methodologies rely on a globally standardised TTC approach aimed at assessing the firm's long-term ability to meet financial obligations, with a strong emphasis on stability over the business cycle. The assessment is forward-looking and qualitative, integrating a wide range of data sources, including audited financial statements, sectoral benchmarks, macroeconomic indicators, and ESG information. Qualitative judgement is a key component of the overall evaluation. In addition, structured interviews with senior management play a central role in evaluating qualitative factors such as corporate strategy, governance, and market positioning. All three agencies consider ESG risks, although with different intensity and methodological roles. Some agencies, such as Moody's and S&P, link environmental and governance risks to regulatory compliance costs, while others, such as Fitch, do not treat climate risk as an independent rating factor but as part of the overall assessment.

The rating process typically begins with the collection and analysis of financial and non-financial data, followed by sector-specific modelling. Sector specialisation is high, with dedicated teams applying frameworks tailored to the structural and cyclical features of each industry. The process integrates the outputs of this analysis with input from the analysts' qualitative assessment. A rating

³ Rating agencies provide two rating scales for both issuers and emissions: one for the long term and one for the short term.

committee discusses and validates the draft rating proposals, ensuring methodological consistency and independence of judgement. The rating committee acts as the final decision-making body.

ECAIs place strong emphasis on direct engagement with rated entities. Management meetings are a core component of the evaluation process, especially for first-time ratings or following material events. These meetings allow analysts to assess aspects not directly observable in financial statements, such as strategic adaptability, internal control systems, and ESG positioning. This interaction is designed to preserve rating independence and objectivity.

Monitoring procedures are systematic and frequent. Ratings are subject to ongoing surveillance and may be reassessed when new information becomes available or at scheduled intervals. The use of watchlists and outlooks allows timely signalling of potential changes in creditworthiness. ECAIs also apply an override mechanism that is formally regulated and must be documented and justified within the internal control system.

AI tools are being tested by ECAIs, although their use remains at an experimental level. They are also constrained by confidentiality requirements and regulatory considerations.

4.2 IRB systems

IRB systems are risk assessment frameworks used by banks to measure and manage credit risk. They are part of the international regulatory framework established by the Basel Committee on Banking Supervision, particularly under the Basel II and Basel III accords. The main purpose of IRB systems is to allow banks to estimate key risk parameters, which are then used to calculate regulatory capital requirements for credit risk. In Europe, the CRR regulates IRB models, and national authorities validate them in line with Chapter 3 of the CRR and the EBA Supervisory Handbook. Article 178 of the CRR provides the default definition for IRB systems.

In IRB models, banks classify firms according to the size of their turnover. The size thresholds for large firms vary between banks, ranging between 150 and 500 million euros in turnover, with different approaches for consolidated groups or specific exposures. In some sectors total assets are used.

Large banking groups use IRB models to assess the creditworthiness of firms, particularly those with significant exposures. These models typically apply to medium and large firms within the banking book and are used to support internal credit decisions and capital requirement calculations. Each banking institution tailors its rating system to its own lending portfolio and risk management practices.

The methodological framework combines statistical estimation of risk parameters with qualitative assessment modules. Banks use firm-level financial data and behavioural indicators from internal

datasets, often complemented by macroeconomic or sectoral variables. Each institution defines its own credit risk parameters, such as the probability of default, which supervisors review.

Credit institutions assess qualitative aspects through structured frameworks, focusing on governance, strategic outlook and management reliability. Their weight varies across institutions and becomes more important when quantitative input is limited or volatile. Some banks segment their portfolios by industry or product type, applying different models or assessment procedures accordingly. Group-level exposures are often evaluated on a consolidated basis, especially when intra-group dependencies are material.

Interaction with firms is an integral part of the process, particularly for larger or more complex firms. Meetings with management help validate strategic assumptions and integrate forward-looking considerations into the assessment.

Override procedures allow analysts to modify the model output based on documented evidence. These interventions are subject to internal controls and regular review.

Banks conduct monitoring regularly, with greater intensity for high-risk or large exposures. Dedicated teams often support portfolio surveillance and early warning activities. While the use of artificial intelligence (AI) is still limited, some banks have initiated exploratory projects in areas such as data screening and anomaly detection.

Credit institutions increasingly consider ESG factors, mainly through dedicated questionnaires or desk-based analysis. They can also trigger override decisions when qualitative assessments identify risks not captured by the statistical model. The impact of ESG factors on the rating remains limited, and credit institutions generally treat them as complementary to financial risk drivers.

4.3 ICASes

In the framework of the Eurosystem, ICASes are internal credit assessment systems developed and used by central banks to assess the credit quality of counterparties or assets submitted as collateral in monetary policy operations. They are one of the accepted credit assessment sources within the ECAF. The main legal reference is Guideline (EU) 2015/510 of the European Central Bank (ECB, 2015), also known as the General Documentation Guideline, which defines the operational framework of the Eurosystem's monetary policy, including collateral eligibility and the ECAF.

ICASes currently follow the European Commission Recommendation 2003/361 (European Commission, 2003) to define large firms, i.e. those with over 250 employees and a turnover exceeding 50 million euros or total balance sheet assets exceeding 43 million euros. Under the S-ICAS framework, Central banks may authorize these systems to operate also as statistical sources, under

enhanced governance and in compliance with Eurosystem standards. Directive 2013/34/EU (the so-called Accounting Directive), as amended by Directive 2023/2775/EU, will replace this definition under the new S-ICAS framework. According to the new criteria, a large company fulfils at least two of the following requirements: assets above 25 million euros, turnover exceeding 50 million euros, more than 250 employees. The ECAF recognises ICASes, which follow the default definition in Article 178 of the CRR, like IRBs.

In line with Eurosystem Guidelines, the ICASes of Banca d'Italia, Banco de España, Banque de France and Deutsche Bundesbank apply structured procedures to evaluate the creditworthiness of non-financial firms. Under the revised S-ICAS framework, the expert assessment component of these systems will progressively concentrate on large firms, due to methodological priorities and operational constraints.

The primary data source consists of financial statements, complemented by credit register information and other administrative or supervisory records when available. Depending on the institutional context, ICASes may also access tax or supervisory databases. Public sources, such as business registers, are used to complement core datasets. In some cases, ICASes directly interview the companies under assessment.

The methodological structure is modular, combining a statistical component and an expert assessment component. The statistical model estimates default probabilities using firm-level and, in most cases, macroeconomic variables, typically by sector and firm size.⁴ The expert module allows analysts to adjust the model output based on qualitative factors, such as sector outlook, exposure to external shocks, or governance-related issues. Internal protocols define adjustment procedures to ensure consistency and accountability. The oversight on override practices is integrated into the internal governance of the system.

The use of overrides requires appropriate documentation and internal validation. Analysts may follow scheduled cycles for reviews or be prompted by the emergence of new information.

Each ICAS adapts its monitoring activities to its operational structure. ICASes routinely conduct consistency checks, periodic validation and backtesting exercises to ensure the robustness of model-based and expert-based results. Rating systems are segmented by sector, size or product type. For large firms, ICASes typically adopt dedicated statistical expert procedures and monitoring frequencies.

⁴ From 2026 the S-ICAS will become an ECAF accepted source to evaluate SMEs. According to Eurosystem guidelines, only large firms will require an expert assessment, while SMEs will rely solely on statistical assessments (Duarte *et al.*, 2025).

ICASes currently consider ESG factors mainly within the expert assessment module, in line with the common minimum standards issued by the ECB. ESG information has not yet been integrated into the statistical models. In several ICASes, ESG factors form separate qualitative risk profiles within the expert assessment, often supported by questionnaires or scoring tools.

Also, some ICASes are starting to use AI tools to support the expert assessment. Some institutions are exploring the potential use of AI in support functions such as data pre-processing or validation.

4.4 Cerved and CRIF

Cerved and CRIF operate as registered ECAs under the CRA regulation (European Commission, 2009) and are subject to the supervision of ESMA. Regulators accept their ratings, and the EBA includes them in the credit risk mapping. Cerved defines a large company as one with a turnover exceeding 150 million euros, or as a listed company with a turnover exceeding 5 million euros. CRIF applies different criteria by size cluster and generally defines large firms as firms with a turnover between 50 million euros and 200 million euros, while very large firms exceed 200 million euros in annual revenues.

Cerved ratings evaluate the company's ability to generate cash flows for debt repayment, based on an analysis of its economic and financial situation, sector positioning and prospective sustainability. CRIF estimates the probability of default over a one-year horizon through its ratings. Due to their regulatory framework,⁵ these agencies adopt a definition of default that implies substantial convergence with the CRR definition, as operationalized for prudential purposes. Internal validation procedures apply in case of disagreement among analysts.

Cerved and CRIF provide credit ratings for a broad set of Italian firms, including SMEs and large firms. Banks and financial institutions primarily use these assessments for commercial purposes and internal credit risk management. Users often employ them in the early stages of loan origination, portfolio segmentation, and pre-screening processes, and in some cases as auxiliary information alongside internal ratings or expert assessments.

The information base includes financial statements, official registries, payment records, and a wide range of proprietary sources. Both providers rely on statistical models that operate without direct contact with rated firms. They also offer tailored services to institutional clients, including case-by-case analytical reports or enriched datasets for specific borrower profiles.

The evaluation model combines quantitative and qualitative analysis. Quantitative analysis is based on scoring methodologies calibrated on large historical datasets. Core indicators typically include

⁵ They are registered ECAs under the CRA Regulation.

balance-sheet ratios, profitability margins, liquidity metrics, and payment punctuality. They assign scores by applying thresholds to weighted composite indicators. While qualitative factors are not measured directly, external proxies - such as negative events, sectoral dynamics, or payment anomalies - approximate them.

The standard rating output does not include override mechanisms. However, institutional clients often integrate ratings with internal evaluations or request customized solutions. For example, banks may supplement them with internal classifications for high-exposure clients or embed them into broader early warning systems.

Both providers update ratings when firms file new balance-sheet or administrative data. They offer value-added services such as alert systems, dynamic dashboards, and benchmarking reports, supporting credit monitoring and risk portfolio management, particularly for banks with large corporate portfolios.

ESG factors are not yet included in the credit rating models. Nevertheless, both Cerved and CRIF have launched initiatives to develop ESG methodologies aligned with international standards and national guidelines, as they are increasingly used by financial intermediaries for due diligence and sustainability reporting. ESG integration relies on a broad set of qualitative and semi-quantitative indicators, including environmental, labour and governance factors. Limited standardisation and short time series constrain the identification of robust statistical links with credit risk metrics. They apply machine learning and other AI technologies to enhance data classification, anomaly detection, and predictive analytics. These tools are particularly effective in pre-processing large-scale datasets and in identifying behavioural patterns. However, they do not replace the core statistical models used for credit ratings. Cerved, for example, uses big data analytics and ML to improve the accuracy and timeliness of its credit assessment. It also employs text mining and natural language processing (NLP) techniques to extract information from large volumes of unstructured data, including online news sources.

5. Comparative review

Regulatory obligations and the need to capture the nuances of large and complex firms shape rating methodologies, giving rise to both common elements and differences across sources.

While empirical evidence shows that credit assessments produced by different rating systems may be broadly aligned but not fully equivalent (Coppens *et al.*, 2007; Columba *et al.*, 2024), the literature also indicates that differences in modelling choices, data inputs and calibration approaches contribute

to heterogeneity in risk estimates (Calza *et al.*, 2021). Differences in time horizon assumptions and in the degree of risk sensitivity may lead to non-identical assessments when applied to similar exposures. This is consistent with evidence from regulatory and prudential applications showing that alternative risk assessment systems applied to the same portfolios may produce different outcomes, reflecting structural differences in model design and calibration (Pop and Pop, 2025).

5.1 Definitions and Regulations

Definitions of large firms, rating objectives and regulatory requirements vary across rating sources and contribute to differences in methodological approaches. While ECAIs rely primarily on qualitative methods, ICASes, IRBs, and Cerved incorporate both quantitative and qualitative assessments to provide a comprehensive and adaptable evaluation of credit risk (Moody's Investors Service, 2024; Cerved Group, 2019 and 2023).

Table 1 - Definitions and Regulations

Source	Definition of large firms	Definition of rating	Regulatory framework
ECAI	Implicit in mandate; only assess issuers of widely traded corporate securities, typically large firms	Forward-looking assessment of the ability to meet financial commitments	CRA Regulation (EC No 1060/2009), supervised by ESMA; included in ECAF and EBA mapping
IRB	Size thresholds vary by bank; typically, between €150m and €500m in turnover; in some sectors total assets are used	Quantification of credit risk for regulatory capital purposes	CRR Regulation; validation by competent authorities; EBA Supervisory Handbook
ICAS	EC Rec. 2003/361; to be replaced by thresholds in Directive 2013/34/EU and 2023/2775/EU	Probability of default over one year	ECAF; governed by Eurosystem standards; default definition from Article 178 CRR
Cerved	Defined as firms with turnover > €150m, or listed firms with turnover > €5m	Assessment of ability to generate cash flows for debt repayment	Registered as ECAI under Regulation (EC) No 1060/2009; supervised by ESMA; included in EBA mapping
CRIF	"Large corporations" defined as firms with turnover > €200m	Forward-looking assessment of the ability to meet financial commitments	

Despite differences in default definitions, rating sources largely align in their application, reflecting the common objective of capturing material credit events for large firms. The data sources, overall methodology, and interaction with assessed entities may differ according to the institutional framework. ECAIs emphasize structured engagement and global standardization; IRBs leverage long-term bank-firm relationships; ICASes integrate statistical and expert assessment within a structured process; Cerved combines real-time monitoring with granular insight.

5.2 Data sources

Across rating sources, the underlying data sets largely overlap, while the objectives and the analytical time horizon are similar. The outcome of one assessment (e.g., by rating agencies) often serves as a benchmark for subsequent analyses, as noted in the discussion of shadow ratings.

As for the data, financial statements are the primary data source across all rating methodologies. In industries such as real estate, energy or infrastructure – where volatility and regulatory exposure are higher – ECAIs and, to a lesser extent, IRBs incorporate industry-specific performance metrics.

Rating sources include macroeconomic indicators to account for broader cyclical conditions. Variables such as GDP growth, inflation and interest rates are especially significant in sectors sensitive to macroeconomic trends, such as construction and manufacturing. Macroeconomic assessment plays a greater role in through-the-cycle models.

Non-financial data are another important input, particularly for large firms and selected sectors. All ECAIs, ICASes and IRBs consider aspects such as governance, ownership, competitive positioning, and business strategy in their assessment.

For large firms, the weight of data drawn from credit registers tends to be lower in deciding their ratings, due to their more diversified funding structure and lower reliance on short-term credit lines.

All rating sources integrate financial information with qualitative input gathered through direct interactions with firms. ECAIs routinely conduct management interviews, which are also carried out by Cerved for solicited ratings. IRBs benefit from continuous relationships with clients and may use them to gather additional insights, particularly in high-risk sectors or when covenants apply. Some ICASes also conduct structured interviews, although practices vary due to institutional constraints. These interactions help assess governance, market strategy and the capacity to respond to sectoral or firm-specific developments. Banque de France and Deutsche Bundesbank systematically interact with firms through interviews or structured questionnaires to support the collection of forward-looking information. Banca d'Italia started on an experimental basis, interviewing Italian non-financial companies in 2024 to collect management information on climate change risk management (Colletti *et al.*, 2025). Banco de España does not currently conduct interactions.

In addition, all models use intra-annual data (e.g., quarterly reports for large firms), corporate presentations, and updates on sectoral and firm-specific events, such as M&A transactions or business plans.

5.3 Sector analysis

All rating providers use industry-based methodologies to reflect differences in firms' financial profile. These methods capture the heterogeneity of financial structures across sectors, including the role of fixed assets, leverage levels and regulation. These factors influence the construction and weighting of financial indicators in sectoral models.

The degree of segmentation depends on portfolio composition and business model. ECAIs serving multiple jurisdictions tend to adopt uniform sector-specific templates. Banking groups with centralised IRB models apply industry modules across countries. For institutions with concentrated exposures in one or more sectors, sector-specific models help to improve calibration.

5.4 Group structure and government-related entities

For entities belonging to a group, rating providers assess the intensity of interlinkages between the firm and its parent company. In some systems, when the group relationship is strong, the parent company's rating is applied to the subsidiary without a stand-alone evaluation. In intermediate cases, the group rating is used as a benchmark and is adjusted to reflect specific risk factors. If the link is assessed as weak, rating providers typically disregard the group rating. In all cases, they assign the subsidiary a rating that is generally not above that of the parent company. This constraint (cap) is also present in the BI-ICAS. The rating assigned to a group entity combines the stand-alone assessment with the parent company's creditworthiness, depending on the strength of the relationship between the rated entity and the group.

This treatment reflects risk-sharing mechanisms and organisational efficiency. Specifically, relying on the parent's rating prevents duplicating analytical efforts when the financial and operational integration within the group is significant. Such practices are consistently observed across rating providers and are more important for subsidiaries operating as captive entities or benefiting from intra-group guarantees.

ECAIs apply a similar approach to government-related entities, whose ratings incorporate the probability of extraordinary public support in times of distress. These entities typically deliver services deemed strategic or essential and may be publicly owned or subject to close regulatory oversight. In these instances, the national sovereign rating serves either as a ceiling or is directly assigned to the corporation. ECAIs and banks employing IRB models often use structured questionnaires to assess the strength of government links and the nature of potential support.

5.5 Override and monitoring

In all rating systems, the analysts in charge of the expert assessment may override the model output when specific factors, not adequately captured by the standard methodology, are deemed material.

This mechanism is particularly important in assessing large firms with complex ownership, group-level guarantees, or extraordinary risk events. In most cases, they are submitted to a rating committee, which acts as the control body to ensure consistency and transparency.

For example, override procedures may be activated following mergers and acquisitions (as in Banco de España's ICAS), rapid deterioration in business outlook (as in IRB systems), major revisions of strategic plans (as in Deutsche Bundesbank's ICAS), or the emergence of public information that may materially affect a company's credit risk (as in the BI-ICAS). Overrides may involve hierarchical approval mechanisms and require adequate justification based on robust information gathered and assessed by analysts, which materially affects the credit-risk assessment.

In ECAIs, overrides are approved by committees that typically involve multiple experts and are structured by sector or geography.

Besides the override mechanism, all systems implement ongoing surveillance procedures. These include the regular update of financial information, usually on a quarterly basis for large firms, and monitoring of qualitative signals such as changes in ownership, business plans, or market positioning. For IRB systems, surveillance is also linked to credit operations, since reviews are often triggered by new exposures or renewals.

Some rating providers – such as the Banque de France's ICAS and major ECAIs – use automated monitoring tools to identify early warning signals and changes in firm-level conditions. These tools generally complement the analysts' assessment. In the systems under review, automated and expert-based monitoring coexist, with varying degrees of integration, depending on data availability and the operational structure of the rating function.

5.6 ESG factors

All rating sources incorporate ESG factors in their processes, although the degree and method of integration vary significantly across systems (European Commission, 2022). In general, rating institutions mainly incorporate ESG aspects through qualitative components rather than statistical models; this applies regardless of the firm size, although larger firms may disclose more structured information.

ICASes adopt a more systematic approach to climate-related risks, following the introduction by the ECB of minimum standards under the ECAF (Körding and Resch, 2022).

IRB systems have begun to consider ESG dimensions also in response to growing expectations from supervisory bodies such as the EBA, the ECB, and national authorities. Supervisors generally

recommend gradual and proportional incorporation of ESG factors, to avoid distortions in credit supply, such as those linked to stranded assets.

ESG ratings also present important limitations. One of the main issues is their heterogeneity: different providers use different methodologies, weighting criteria and information bases. In most cases, this leads to divergent results, to the point that the same issuer or financial instrument may receive very different assessments depending on the provider that produces them (Berg *et al.*, 2022; Del Giudice *et al.*, 2024). Differences also emerge across ESG dimensions: environmental factors are often linked to regulatory and transition risks, social factors are difficult to quantify, and governance is mainly assessed through qualitative frameworks. In addition, publicly available documentation is still limited, which makes it difficult to assess how ESG factors affect rating outcomes. This limitation can be partly mitigated by empirical studies that analyse rating outcomes directly. These studies generally find that ESG-related factors are associated with credit risk and rating levels, although with heterogeneous effects across environmental, social and governance dimensions, and often through indirect channels such as cash flow dynamics or the occurrence of material credit events (Devalle *et al.*, 2017; Henisz and McGlinch, 2019).

5.7 AI tools

Across rating sources, the use of advanced data analysis tools is expanding, especially for large firms, reflecting the volume and digital nature of available information. AI and ML increasingly support model performance and operational efficiency, although adoption varies across providers. Across rating sources, AI-based techniques are primarily used in supporting functions, with only limited integration into core rating processes.

ML models improve discriminatory power compared with traditional statistical techniques, particularly with limited data (Moscatelli *et al.*, 2019). However, this data scarcity is less common for large firms, which typically provide more structured and comprehensive information. Moreover, empirical results on ML in retail credit portfolios are mixed with some studies reporting improved predictive accuracy compared with traditional models, while others highlight limited gains or challenges related to interpretability (Bazarbash, 2019; Locatelli *et al.*, 2022).

ECAIs are experimenting with AI only to a very limited extent, partly because of regulatory constraints. Furthermore, the confidential nature of some input data limits the applicability of ML tools and raises data-sharing risks. ECAIs are therefore cautious in adopting ML techniques, especially for core modelling activities.

In IRB systems, early experiences confirm the potential of ML to enhance predictive performance in specific sub-models or tasks. Nonetheless, banks must balance potential accuracy gains against

explainability constraints, as ML models often operate as ‘black boxes’. Limited transparency may create reputational or commercial risks in client relationships (EBA, 2023c). These concerns support the supervisory emphasis on maintaining human oversight and interpretability in credit risk models (BCBS, 2023).

Some ICASes are exploring AI applications for early warning or data-quality purposes, but these developments are still at an early stage. Several years ago, ML models had already been shown to improve the accuracy of rating models, although they exhibited certain biases – for instance, in data collection (Bonaccorsi *et al.*, 2022) – which may have been mitigated by recent methodological and technological developments, although they remain relevant from a governance and implementation perspective. A recent paper compared the performance of the statistical ICAS model with various machine learning and deep learning models, finding that deep learning enhances discriminative power, especially when models are combined (Columba *et al.*, 2026).

More generally, AI evolution in credit risk models is influenced by the European regulatory framework. The AI Act (Regulation EU 2024/1689) introduces a risk-based approach for AI systems. Credit rating applications may fall under the ‘high-risk’ category, especially if they affect financial decisions or involve individuals’ profiling, although human intervention can help reduce the risk level. This classification implies stringent obligations in terms of transparency, robustness, human oversight, and data governance. Rating systems - particularly those run by public institutions - must assess their compliance accordingly, also considering existing General Data Protection Regulation (GDPR) provisions and EBA guidance. The need to take the regulatory framework into account helps explain the gradual and cautious approach adopted in implementing AI in credit-scoring models.

Table 2: Rating methodologies for large firms

	ECAIs	IRB systems	ICASes	Cerved /CRIF
Data sources and information	Financials, sectoral data, macro, governance, interviews, infra-annual and event info	Financials, sectoral data, macro, governance, client interaction	Financials, sectoral data, macro, governance, structured interviews, climate-related data	Financials, sectoral data, governance, structured interviews (esp. Cerved), use of M&A and strategic plan info
Sector analysis	Sector models and analyst allocation by industry	Used when exposure justifies it; models and analysts may be allocated by industry	Present depending on internal data availability and structure	Sector models (Cerved: utilities, construction, real estate); analyst specialization by industry
Group & government	Group rating cascades to subsidiaries; sovereign ceiling applies to public sector entities	Group link assessment; government-related firms assessed with specific tools	Group logic applied, especially if guarantees/funding are in place	Group logic applied (esp. CRIF); public support assessed and based on indirect criteria
Override and monitoring	Overrides by committees; quarterly updates; early warning tools	Overrides require approval; reviews linked to exposure changes; automated tools complement human checks	Overrides with internal procedures; monitoring via early warning tools and ECB reporting	Overrides and monitoring tools used; Cerved integrates news/NLP for monitoring
Sustainability factors	ESG integrated case-by-case if material; sourced from disclosures or providers	ESG gradually integrated under supervisory pressure; attention to stranded assets	Coordinated implementation under ECAF; minimum standards on climate risk	ESG indicators included in sectoral models; expert judgement module considers ESG
Use of AI tools	Limited due to regulation and explainability; experimentation ongoing	Some ML modules explored; use constrained by explainability and supervision	Exploration phase only; use for early warning or data quality under evaluation	Cerved: ML, big data analytics, NLP for text mining. CRIF limited due to regulation and explainability; experimentation ongoing

6. Conclusions

The review of ECAIs, ICASes, IRBs, and national rating agencies reveals a broad range of practices in assessing the creditworthiness of large, complex firms. These differences largely reflect the specific objectives, mandates and regulatory constraints of each system. Still, some common features emerge across rating providers. All entities combine financial data with qualitative factors, particularly on governance and market positioning. A sector-specific analysis is often carried out, with tailored approaches for complex industries such as real estate and infrastructure. Group linkages, override mechanisms, and monitoring tools such as early warning systems also emerge as recurrent features. Structured interviews and regular contacts with large firms are key tools for the collection of qualitative information on governance, strategic positioning, and risk outlook. Clear governance procedures support override mechanisms, allowing ratings to be adjusted for firm-specific features, particularly for large, internationally active firms. Taken together, these features represent a set of best practices for the rating industry.

Although ESG integration varies across providers, it is gaining momentum in line with regulatory developments, such as the ECB common minimum standard for ICASes (Körding and Resch, 2022). AI applications remain limited, but they offer some support in data processing and anomaly detection.

Future research could investigate the regulatory impact of forthcoming EU initiatives, such as the AI Act and ESG disclosure requirements under the Omnibus Directive package, on credit assessment systems based on expert input or hybrid methodologies. These developments are likely to influence standards on data governance, model transparency and oversight, especially where qualitative evaluation plays a central role. A complementary line of research could examine more systematically how methodological differences across rating systems translate into differences in rating outcomes, building on empirical evidence and model-based analysis.

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