Integration of climate risk considerations into credit and stress test models

ECB Industry Outreach

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**Good practices report - overview**

**Expectation 11 of the ECB Guide on climate & environmental (C&E) risks**

“Institutions with material climate-related and environmental risks are expected to evaluate the appropriateness of their stress testing with a view to incorporating them into their baseline and adverse scenarios”

The **good practices report** is based on the information collected in the **2022 ECB Climate risk Stress Test (CST)** and aims at:

| Identifying good practices that should be considered as minimum standards for the industry |
| Differentiating practices according to banks’ level of advancement, thus applying the proportionality principle and indicating the first steps to be taken |
| Providing banks with suggestions and examples to help them overcome challenges |
| Providing also examples of weak practices that should be avoided |
| Improving consistency of practices and contributing to the dialogue within the banks |
| Helping banks and supervisors prepare for future CST exercises (also in the context of ICAAP) |
# Challenges in data availability and climate risk modelling

## Availability of data and information

Data issues affecting modelling approaches and quality of results

- **Higher granularity**: sectoral breakdown, counterparty specific and loan level data
- **New climate-related variables** needed:
  - Emission data: availability, discrepancies across providers and quality of proxies
  - Energy Performance Certificate (EPCs): heterogeneity in the regulation across EU countries leads to lack of data
- **Lack of information** related to calibration of physical risks impact
- Reliability of **portfolio level analysis** is distorted due to insufficient historical data.
- Lack of **risk mitigants** data led to exclusion from loss projections

## Models

Existing stress test models not designed to account for climate risks

- **New approaches** needed to adjust for climate risk factors (e.g. energy prices, carbon taxes)
- **Higher level of granularity** needed (e.g. sectoral level, EPC rating, counterparty level)

New requirements affect comparability with previous stress tests on macroeconomic aggregates as well as validation of new models

## Long-term horizon

Reliable projections of risk parameters over a 30 year horizon is challenging:

- **Short-term** nature of the available credit risk models
- Financial metrics, transition plans etc. at counterparty level require **granularity** of models
- Dynamic balance-sheet assumption requires to develop a **precise strategy** on the evolution of the business mix

Great deal of uncertainty for long-term projections
Greenhouse gas (GHG) emission data

**Actual data** should always be preferred when available

- Combination of **manual search** from sustainability and annual reports and use of **data providers**
- Reliance on **additional data providers** to fill in gaps
- **Direct engagement with counterparties** via submitted questionnaires

**Good practices**

- **Waterfall logic** with different estimation approaches
- Inclusion of **physical activity-based factors**
- Specificities of sectors/subsectors and counterparties at a **very granular level**, considering differences within sectors
- **Validation** of data: informed choice of providers and cross-checks of data

**Different estimation methodologies** have been put in place by banks when actual data is not available, categorized according to the following hierarchy (Partnership for Carbon Account Financials – PCAF – methodology):

1. Physical activity-based emissions
2. Economic activity-based emissions
3. Other methods

**Weak practices**

- Calculation of averages and definition of comparables based on **broad samples** and **macro sectors** → representativeness issue
- Scope 2 (S2) and scope 3 (S3) proxies based on **S2/S1 and S3/S2 emissions ratios** from reference counterparties → characteristics of each scope are not considered

Actual data should always be preferred when available
Energy Performance Certificate data

**Actual data** should always be preferred when available

- **Good practices**
  - Request EPC data at loan origination or when carrying out annual review or modifying a loan
  - Retrieve from public **EPC registers** where publicly accessible
  - Instruct valuers to collect the EPC data as part of the **collateral valuation review**

**Estimation methodologies**

- **Average values**
  - By year of construction
  - By energy demand

- **Replication of EPC distribution**
  - National
  - Regional

- **Simple model**
  - Step approach
  - One-variable estimation

- **Statistical model**
  - Regressions (linear and logistic)
  - Decision trees

- **Machine learning algorithm**
  - K-NN* method
  - Random forest
  - GBRT*

**Weak practices**

- Highest and lowest values are excluded

**Advanced practices**

- If the distribution replicated is based on 20% of real EPC data (most likely EPC collected from borrowers in the last few years), then the distribution may be **skewed towards higher EPC ratings**

- More sophisticated with use of multiple variables. **Main limitation: availability of these additional data** reduces the size of the sample and its representativeness, making the results skewed.


**Request EPC data at loan origination** or when carrying out annual review or modifying a loan

**Retrieve from public EPC registers** where publicly accessible

**Instruct valuers to collect the EPC data as part of the collateral valuation review**
Climate risk modelling

Modelling approaches

The assessment and quantification of climate-related risks regarding their potential impact on banks’ exposures requires new modelling approaches and tools to account for the particularities of climate-related risks.

Combination of existing stress test models with newly developed climate risk models to capture the sectoral/EPC level or counterparty-specific impact of climate-related risk factors is observed, whereby granularity and complexity of modelling approaches increases with level of advancement:

- **Sectoral models** capture transition risk at sectoral level based on existing regular credit stress test infrastructure enhanced with additional components and breakdown. They include at least one climate-related variable, usually CO2 price.

- **Counterparty-level models**, first starting with a subset of counterparties identified as the most vulnerable to climate risks.

- **Asset class dimension** included into counterparty-specific models.

Long term modelling approaches: integration of banks’ de-carbonization commitments into the projections through dynamic balance sheet approaches. Long term *loss projections* should be interpreted as a qualitative yardstick for the direction of travel rather than as a robust quantitative measure, but they are of strategic relevance and should not be neglected.
Climate risk modelling

Short-term models

Sectoral models (bare minimum)

✓ Combination of direct and indirect transmission channels:
  ▪ **Indirect channels**: adaptation of existing macroeconomic models or creation of new ones with a higher granularity and new variables (e.g. GVA, GDP, unemployment rate, RRE and CRE price shocks) to account for the sectoral dimension
  ▪ **Direct channels**: new models with inclusion of the impacts of relevant climate related variables (e.g. carbon price, GHG emissions) on PDs at sectoral level

✓ External models are also used to estimate the impact of direct transmission channels: banks should ensure that the models include information that matches their needs (i.e. sectoral exposures, counterparty coverage)

Counterparty models (advanced approaches)

✓ Adaptation of corporates’ key financial metrics to reflect impact of relevant climate variables and recalculation of PDs
  ▪ Channels: counterparties’ profits and liabilities, operational costs, scenario-adjusted financials, vulnerability metrics or stranded assets

✓ Development of climate/environmental risk classification of counterparties, to adjust PDs and/or to inform strategic choices and exposure projections for long-term scenarios:
  ▪ **Transition risk metrics**: qualitative assessment of clients’ willingness and ability to transition and quantitative assessment of the impacts of climate-related risks
  ▪ **Physical risk metrics** based on location of the collateral, credit risk parameters and impact of extreme events

✓ Use of macroeconomic models to estimate a systemic risk factor (indirect channel) which feeds into the PD calculation
Climate risk modelling

Long-term models

Bare minimum practices

- Simplified approaches consider sectoral pathways, reconstructing models to have at least one sectoral variable
- Projection of exposure evolution depending on the scenario and internal strategy

Advanced practices

- Projection of financial & emissions data at counterparty level and reflection of portfolio characteristics
- Risk parameters for the full-time horizon with year-to-year frequency, based on the starting point portfolio embedding scenario-conditional rating deterioration and exposures reallocation and growth
- Integration of strategic plans and commitments with respect to different transition pathways:
  - Exposures projections account for expectations on how sectors will be affected by different transition pathways and banks’ and clients’ strategic transition plans
  - Development of internal climate metrics to measure vulnerability of exposures in highly affected sectors and to evaluate alignment of counterparties with de-carbonization pathways
- Very advanced approaches include extrapolation of ECB and NGFS datasets using general equilibrium models to enrich available pathways with additional variables
Climate and environmental risks will remain key priorities of the ECB and other European authorities: banks are expected to properly manage them by the end of 2024 and over time they should be fully integrated into prudential risks categories.

Supervisory climate stress tests:
- will remain a key tool to further incentivize banks’ efforts to build up relevant capabilities, seize the potential impact of climate-related risks
- could be used as an input to capital adequacy assessment, depending on future availability of sufficient granular sustainability data and advancement in banks’ stress testing models

Closing data gaps will remain key: customer relationships and regulatory developments* will help in this direction

It is crucial that banks develop transition plans fully integrated into their strategies and that build on their counterparties’ transition pathways which then can be used to estimate potential climate-related losses

Preparatory work for reviews of banks’ transition planning capabilities and readiness for environmental, social and governance (ESG) related mandates is expected in the sixth Capital Requirements Directive (CRD VI)

* EU regulation of disclosure and reporting of C&E data, proposed amendments to the Capital Requirements Directive (CRD VI)
Climate stress test within the supervisory perspective

2022 climate stress test exercise is part of a broader set of supervisory activities on the topic climate-related risks

- The **Guide on climate-related and environmental risks** lays down ECB’s expectations with respect to management of climate and environmental risks.

- The **thematic review** of banks’ climate-related and environmental risk management practices seeks to comprehensively assess how banks have incorporated these risks into their strategy, governance and risk management frameworks and processes.

- Climate risk stress test and thematic review are complemented by **deep dives** (e.g. commercial real estate) and **on-site missions**.
2022 climate stress test: set-up and objectives

Questionnaire and peer benchmarks (Modules 1&2)

- 104 significant institutions
- **Rationale:** All significant institutions (SIs) are being assessed as part of the regular climate risk assessments and will be subject to the **new EBA Pillar 3 requirements** (including requirements close to metrics in Module 2)

Bottom-up projections (Module 3)

- 41 significant institutions
- **Rationale:** Proportionality principle being applied to factor in **different levels of preparedness** of the banks

**Objectives**

- **Contribute to the overall Supervisory Review and Evaluation Process (SREP)** in a qualitative way. It was not a capital adequacy exercise
- **Joint learning exercise** to enhance banks’ and supervisors’ ability to assess climate-related risk
- **Make more information available** on climate risk stress-testing
- **Prepare banks** for the upcoming regulatory changes\(^1\)
- **Leverage** on ECB’s stress-testing approach
- **Support other ECB/SSM Banking supervision initiatives**, e.g. thematic review

\(^1\) EBA’s report on Environmental Social Governance (ESG) risk management and supervision, i.e. inclusion of ESG in SREP and stress-testing.
Follow-up work to supervisory initiatives

The ECB is providing banks with additional tools and recommendations to support banks in their journey of aligning with supervisory expectations on C&E risk management:

- Individual feedback letters to Significant Institutions
  - Setting out *individual institutions’ shortcomings* against supervisory expectations and indicating *timelines for compliance*

- Good practices report from thematic review
  - Providing examples and suggestions to address all expectations in the Guide, apart from 11 and 13. Touching on aspects such as *governance, risk strategy and risk management practices*

- Good practices report on climate stress testing
  - Providing *technical suggestions and good practices* on climate stress testing, diving into *data capabilities issues and credit risk modelling*
Criteria applied to select banks

Criteria defined to group banks per module and level of advancement:

**Module 1**
Within the 43 banks with a CST framework in place, selection of the ones with the best sub-scores on:
- **Block 1**: general climate stress test framework and other processes including climate-related factors
- **Block 4**: CST methodology
- **Block 5**: scenarios and types of risks included

**Module 2**
Within the 104 banks participating in Module 2, selection of the ones with the following criteria:
- **Metric 1**: banks that do not use proxies to split interest income and fee and commission income at NACE 2-digit sector level for at least 90% of reported income, are consistent with the 2022 CST methodology (instruments included in volumes, inclusion of NFC exposures, treatment of holding companies) and without major data quality issues
- **Metric 2**: For actual data, banks showing the highest share of actual data to compute S1-S2 and S3 GHG emissions, conditional on having a number of reported counterparties higher than the business model median. For proxies, banks reporting the closest estimated S1,S2 and S3 emissions to a benchmark source or identified as best in class by M2 experts during execution phase

**Module 3**
Within the 41 projecting banks, selection of the ones with the following criteria:
- **Short-term scenarios**: banks which sufficiently reflect the scenario-implied GVA shocks in the PDs for the most carbon-intensive sectors (expert judgment)
- **Short-term modelling**: banks which properly transmitted transition risk in the adverse scenario showing PD changes between the ST disorderly and baseline scenario (above lower quartile)
- **Short-term impairment losses**: banks which show higher relative impairment losses in the adverse scenario across all years and are above the lower quartile of this distribution
- **Flood risk transmission**: banks which properly transmit physical climate risk from LTVs to LGDs comparing the adverse and baseline scenarios (expert judgment)
- **Long-term balance sheet approach**: banks which elaborate on the ECB expectations on the long-term modelling in terms of strategy, business environment, EPC evolvement, and credit risk parameters (expert judgment)