ECB’s Targeted Review of Internal Models (TRIM)
Ad-interim Findings, LDP Challenges & New Regulatory Standards
Agenda

1. Insights from the General Topics and Retail Model Inspections
2. ECB’s Risk-Type-Specific Consultation on Internal Models
3. Post TRIM Towards Basel IV
Insights from the General Topics and Retail Model Inspections
TRIM’s Timeline

All ECB’s supervised banks (SIs) that have approved Pillar 1 internal models, 68 banks within the scope of the project.

SSM-wide multi-year project (2016-2019)

2016/2017
Retail SMEs
Retail and Small Medium Sized Portfolios

2018
Q2
Low-default Portfolios
Application to low default portfolios to take into account specific portfolio characteristics

2019
LDPs
Possibilities
“Risks will be modelled adequately and models will give consistent results”
Or...
Internal Rating Models might cease to exist

2020
Outcome
Outcome of General Topics Review

Carried out between 3Q-2016 and 1Q-2017. Review of Principles overarching different types of risk aligned to CRD IV, CRR and EBA’s RTS.

1. **Outright Non-Compliance.**
   Affected institutions must remediate the shortcomings within certain deadlines

2. **Additional potential misalignments with further aspects of the regulatory framework.**
   Communicated via follow-up letters, SIs asked to respond to the JSTs within certain timescale

3. **Main findings revolve around:**
   » Model Use, Model Change Management
   » Internal Model Governance
   » Implementation of IRB Approach
   » Internal Validation and Audit
   » Third Party Involvement
Outright Non-Compliance Cases

Model Risk Management: Lack of Model Change Policy and Back-testing Evidence*

Table 1 – General topics review: examples of non-compliance cases (non-exhaustive)

<table>
<thead>
<tr>
<th>#</th>
<th>Description of shortcomings</th>
<th>Share of institutions with obligations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Absence of a model change policy at the institution or absence of notification of material model changes to the competent authority</td>
<td>29%</td>
</tr>
<tr>
<td>2</td>
<td>Lack of evidence of annual back-testing for some rating systems</td>
<td>24%</td>
</tr>
<tr>
<td>3</td>
<td>Use of the standardised approach without formal authorisation of a permanent partial use (PPU)</td>
<td>19%</td>
</tr>
<tr>
<td>4</td>
<td>No strict separation of staff performing validation activities and staff involved in tasks of the credit risk control function (e.g. model development and monitoring)</td>
<td>19%</td>
</tr>
<tr>
<td>5</td>
<td>Current resources allocated to the internal validation function preventing a robust validation process</td>
<td>14%</td>
</tr>
</tbody>
</table>

» Measurement of model risk across internal models at group level

» Implementation of an effective model risk management framework for all models:
  1. Holistic model inventory
  2. Consistent group-wide model guidelines
  3. Clearly defined roles and responsibilities
  4. Clearly defined policies, measurement procedures and reporting

*ECB’s status update on TRIM, 11 June 2018
Follow-up Letters on Potential Misalignments

Model Risk Management: Change policy and re-rating approach, application of IRB approach, monitoring of PPU*

<table>
<thead>
<tr>
<th>#</th>
<th>Description of issues</th>
<th>Share of institutions affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Implementation of a model risk management framework</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Despite some measurement of model risk and partial controls in place, practices not formalised/document</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>• Absence of model risk management (steering and mitigation)</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>• Model risk not identified as a material risk by the institution (lack of awareness)</td>
<td>13%</td>
</tr>
<tr>
<td>2</td>
<td>Application of the IRB approach and monitoring of permanent partial use (PPU) provisions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Absence of monitoring of the PPU conditions</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td>• Absence of clear criteria for the decision of the application of the IRB approach (selection done on a case-by-case basis)</td>
<td>31%</td>
</tr>
<tr>
<td>3</td>
<td>Decision-making responsibilities and internal reporting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Level of detail in the reporting is not appropriate</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>• Management body (or a designated committee thereof) does not approve all risk management policies</td>
<td>25%</td>
</tr>
<tr>
<td>4</td>
<td>Organisation of the internal validation function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deficiencies in the validation policy and procedures</td>
<td>7%</td>
</tr>
<tr>
<td>5</td>
<td>Scope and frequency of the audit review of the rating systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Lack of resources to allow a relevant assessment of the IRB requirements</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>• Some of the rating systems not reviewed by internal audit</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>• Certain aspects of the rating systems not reviewed regularly</td>
<td>22%</td>
</tr>
</tbody>
</table>

» Monitoring of Compliance with Permanent Partial Use Provisions:

1. Triggers for re-assessment of PPU suitability of authorized exposures (e.g. # Obligors, EAD, Av. RW Exposures)
2. Reporting Process on materiality of changes
3. Process and Guidelines for IRB exposures to become eligible for PPU

**Change Policy and Re-rating Process:**

1. Approved Extension or Changed Model must be part of the Change Policy
2. Immediate re-rating for material changes, otherwise impact analysis for LDPs:
   - Simulated sample of RW exposure impact based on materiality with 25% quarterly removal

*ECB’s status update on TRIM, 11 June 2018
Outcome of Retail / SMEs Review

Completed by June 2018. Ad-interim view which may change after completion of LDP assessment

1. **Supervisory decision directly after investigation**
   for cases of non-compliance

2. **A separate letter, when appropriate, accounting for:**
   - Horizontal Analysis
   - New Regulations
   - Updated ECB Guides

3. **Ad-interim main findings revolve around***:
   - PD Parameters:
     - Long-run Average PD
     - Risk Differentiation
   - LGD Parameters:
     - Calculation of Realized LGD
     - Long-run Average LGD
   - MOC and Review of Estimates

* Excl. data quality, focused mainly on Residential Real Estate
Ad-Interim PD/LGD Findings

PD and LGD Parameter Shortcomings relate to: Long-Run Averages, Risk Differentiation, Realised LGDs, Framework for Review of Estimates and MoC

Learning from general weaknesses

1. Consideration of Relevant Risk Drivers, in particular when related to risk of misspecification (overfitting) is present looking at:
   1. Portfolio distribution
   2. Homogeneity
   3. Potential (ex ante) risk drivers

2. MoC framework for
   1. Structured identification of biases
   2. Sound quantification (not only judgmental)
   3. Better use of adjustments

Comparability of Parameters and RWA sensitivities across countries/industry to explain differences in risk estimates
Our Experience Working with SSM Banks: Findings & Remediation Strategies
Model Change Policy

Clear Model Change Definition, Implementation and Reporting Structure

Management Holistic View

» Comprehensive Model Overview
» Governance of Roll-out Plans and Model Changes
» Adequacy of Reporting Processes on PPU
» Awareness/Approval of Material Changes or Exceptions from Established Policies (CRR 189)

Roles & Responsibilities

» Three lines of Defense
» Clearly Defined Roles and Task Allocation
» Written mandate for CRCU, interaction with Validation and remediation activities
» Management of Model Changes

Model Registry

» Holistic and Robust Model Inventory & Classification: Model Owner, Range of Application, Materiality, Approval Date, Conditions, Weaknesses and Change Version
» Documentation inventory, including annual review
» Adequate Archiving and Maintenance

Transparency

» Guidelines and Documentation policies, including Model Implementation Testing
» Independency and Transparency of Model Validation
» Facilitate Model Checks from Auditing
» Ex-ante and ex-post material changes/extensions and application

MA Suggested Approach

1. Focus on Model Risk with practical steps around Model Archiving and Registry
2. Introduction of a Model Risk Governance Framework across the Model Life-cycle
3. Definition of key Roles and Responsibilities for Model Risk and Workflow
Minimize Model Risk

Key requirements

<table>
<thead>
<tr>
<th>Data</th>
<th>Estimation</th>
<th>Calibration</th>
<th>MoC</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Banks must use internal data to reflect their credit history</td>
<td>✓ Scoring functions must lead to consistent performance over time and appropriate risk differentiation</td>
<td>✓ Rating classes from internal data analysis</td>
<td>✓ A MoC framework must be established to manage data and model assumptions</td>
</tr>
<tr>
<td>✓ External data to improve performance testing must reflect portfolio composition and experience (i.e. performance vs representativeness)</td>
<td>✓ Perceived lack of risk differentiation is not acceptable</td>
<td>✓ Expert based decisions must be assessed</td>
<td>✓ Institutions must have a robust process for identifying all deficiencies, including data errors or any uncertainties which may lead to estimation errors</td>
</tr>
<tr>
<td></td>
<td>✓ Estimation criteria / data treatments must be assessed</td>
<td>✓ PDs derived through CDT over the portfolio</td>
<td></td>
</tr>
</tbody>
</table>
Lessons Learnt for LDP Inspections
TRIM to Expand on Data Quality Framework

Data Quality Framework throughout the IRB process, from data entry to reporting

- IT Systems
- Internal Reporting & Controls
- Data Sources
- Accuracy
- Processing
- Testing & Documentation

Completeness - Accuracy - Consistency - Timeliness - Uniqueness - Validity - Traceability

**MA Suggested Approach**

» Focus on DQF Principles, historical data at data entry point and across data sources including all transformation and aggregation processes up to the modelling dataset

» Perform mandatory tests across key risk drivers/variables with highest weights e.g. default flag, cash flow data, obligor size, financial ratios, external rating
Margin of Conservatism
Model Deficiencies Leading to Biasness addressed through 5 key blocks

1. Methods
   - Deficiencies
     - Data representativeness
     - Data insufficiency

2. Processes
   - Default definition changes
     - Data quality
     - Future events
     - Methodological shortcomings

3. Controls
   - Changes to underwriting standards, risk appetite, etc.
     - Changes in market or legal environment
     - Estimator errors

4. Data
   - IT systems

5. Roadmap to address deficiencies

MA Suggested Approach

1. Identify deficiencies leading to potential biasness or uncertainty in the risk quantification
2. Establish effective governance processes to address these deficiencies
3. Review of data quality, policies, model adequacy
4. Review of model design, methodology and portfolio representativeness e.g. risk drivers, discriminatory powers, sensitivity analysis, rating distribution, qualitative variables
5. Use of bank LRA default rates / external data for model performance e.g. predictive power, calibration, PS, rank ordering (KS)
6. Ensure alignment with risk appetite / credit policies
Three Phased Approach
In preparation, during and post on-site inspections

PHASE 1
Model Framework & Performance Review

PHASE 2
Supervisory Review Preparation & Support
- Model Framework
- Benchmarking
- Margin of Conservatism
- Back-testing

PHASE 3
Supervisory Feedback

Supervisory Review Preparation
Supervisory Feedback
ECB’s Risk-Type-Specific Consultation on Internal Models
ECB’s Risk-Type-Specific Consultation Paper

Ensuring consistency over PD models implementation

1. Error-free implementation framework

2. Ent-to-end data quality framework

3. Modelling PDs in a LDP context, when systematic risk is material
Error-free Implementation Framework

Rationalizing systems, implementation and governance processes

**Ex ante framework**

- Data flows workflows across ETLs and storage, specifications (functional/technical),
- Organizational wide policy and procedures, documentation,
- Audit trail and on-going validation framework

**Ex post controls**

- Comprehensive implementation testing triggers across model lifecycle, IT and regulatory changes
- Granular testing across units/components/modules and multiple relevant stakeholders (code testers, developers,..)
- Documented tests even under stress scenarios

Strong expectation on the historical consistency of the implementation framework
How do MA’s Solutions Facilitate Compliance

Leveraging an integrated platform

- **Unique environment** where data flows are assessed by multiple type of stakeholders

- **Ongoing triggers** and possibility to **simulate** stress scenarios (e.g. massive release of new models, inaccurate mapping of the models, wrong data migration,..)

- **Structured analytical assessments** at multiple points in the process
End-to-end Data Quality Framework

Ensuring quality of the data across the whole data life cycle

Data quality controls across multiple dimensions

Implemented governance through continuous assessment, prompt remediation and spread reporting

Extended DQM across the data life cycle from its collection/input to its use and final interpretation

Key data qualities

• Correct
• Complete
• Appropriate
How do MA’s Solutions Facilitate Compliance

Leveraging an integrated platform

- Structured and formalized DQ framework across the data life cycle
- Automated exchange of information and relevant reporting with key data and model users or relevant stakeholders
- Information flow enabling expert/qualitative evaluation of data appropriateness from key business owners
Modelling PDs for LDPs 1/2

Overcoming lack of data issues

Representative and consistent data over the portfolio and across time

“ECB’s view is that Banks may still use external data if the information gained from the use of external data outweighs any drawbacks”

LRA (credit cycle volatility)

Data Enhancement

Geography-industry relevant credit cycle information

Performance / Representativity

Third Party / Pool data models / ..

MoC

Internalization and consistency of the resulting measures

Qualitative & quantitative analysis to reduce bias

RWE Amounts sensitivity and peer comparison across the process is key to avoid systematic or material bias
Modelling PDs for LDPs 2/2

Leveraging MA data and EDF modelling framework

- having enough defaults to calibrate rating models does not automatically mean that there is enough data for LRA purposes; variability in the economic environment is needed
- internal data might be adequate for overall portfolio calibration but higher granularity might be needed leveraging industry-level data per country/region and additional drivers for LRA purpose

Through CRD / DRD and EDF models

- Historical series of DR / EDF
- Global / Country specific tendencies / adjustments
- Global / Industry specific tendencies / adjustments

Indicative Credit Cycles of a European sovereign
When Systematic Risk is Material 1/2

Highlighting forward looking and macroeconomic scenarios components

“The rating/grade/pool assignment process should also adequately anticipate and reflect risk over longer time horizons and take into account plausible changes in economic conditions”

- Balance between drivers predictive over short and long (2/3 years) time horizon
- Adjustments based on
  - Credit migrations not strictly due to idiosyncratic risks
  - Gap between external and internal

Data

- Relevant historical default patterns

Estimation

- Predictive of risk over longer time horizon
- Performance under different macroeconomic scenarios

Calibration

MoC
When Systematic Risk is Material 2/2

Enriching the model design and validation framework

**Modelling**

- Historical data assessment
- Macroeconomic drivers sensitivities
- CT recalibration including expected 2/3 years forecasted rates

**Validation**

Through MA forward looking model framework

Unconditional fwd-looking estimates

Conditional PD - Rating B1

MOODY'S ANALYTICS

ECB’s Targeted Review of Internal Models (TRIM)
Post TRIM Towards Basel IV
SREP and Annual Validation

TRIM Ramifications

Merging Impact of TRIM into SREP

Internal capital allocation

(i) *Banks are expected to make use of IRB parameters, including adjusted ones, to calculate their internal capital under the ICAAP (RWA could also be used as an additional driver).

Ongoing Monitoring and Deep-dive

Group level and sub-consolidated

Banks will be required to conduct ongoing monitoring and annual validation of their models. In certain cases including a deep-dive.

Top-down view (Art.33 RTS) Senior Management will have to be informed of the outcome of the validation on an aggregate basis for each rating system at least annually

Risk profiles and the comparison of realized and expected default rates should be reported to senior management more frequently than annually

*ECB’s TRIM Feb. 2017
Strategically Manage IRB models

Modelling

Strategy definition

1. High risk and highly systematic risky assets may become relevant as part of portfolio review strategies under IFRS9/RWA perspective

2. Non-risk related volatility may affect capital requirements through prudential buffers leading banks in need of additional capital

3. Credit processes / limits / pricing strategies must be revised to account for revised risk parameters / MoC

Internal models refinement needs to be part of the strategic process
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