

# The Growing Trend for IRB Transition

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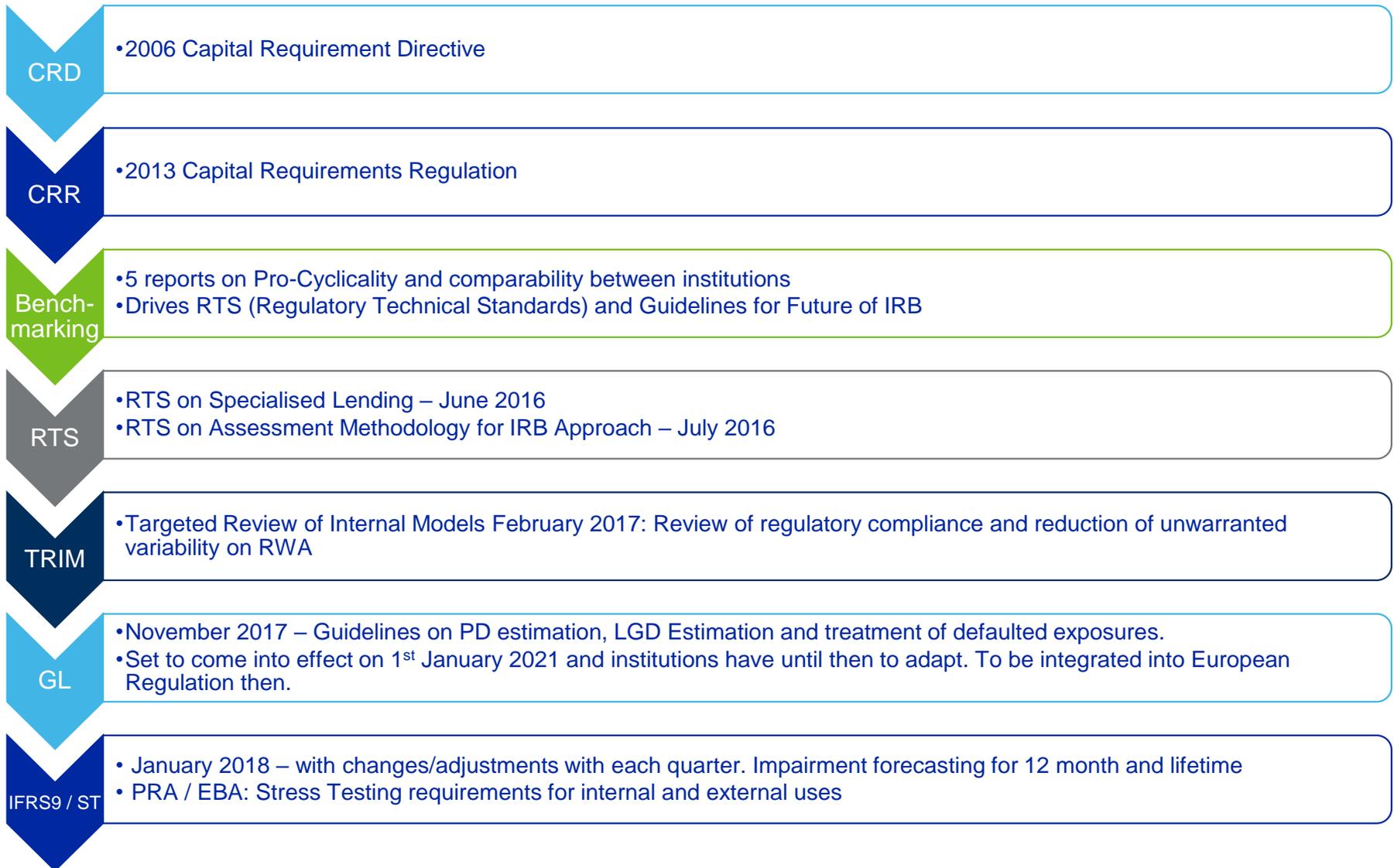
# Agenda

1. The Focus and Trends on IRB
  - 1.1 Regulation
  - 1.2 Modelling Approaches for Low and High Default Portfolios
  - 1.3 Use of External Data / Models
2. Role of IFRS9 / Stress Testing Models

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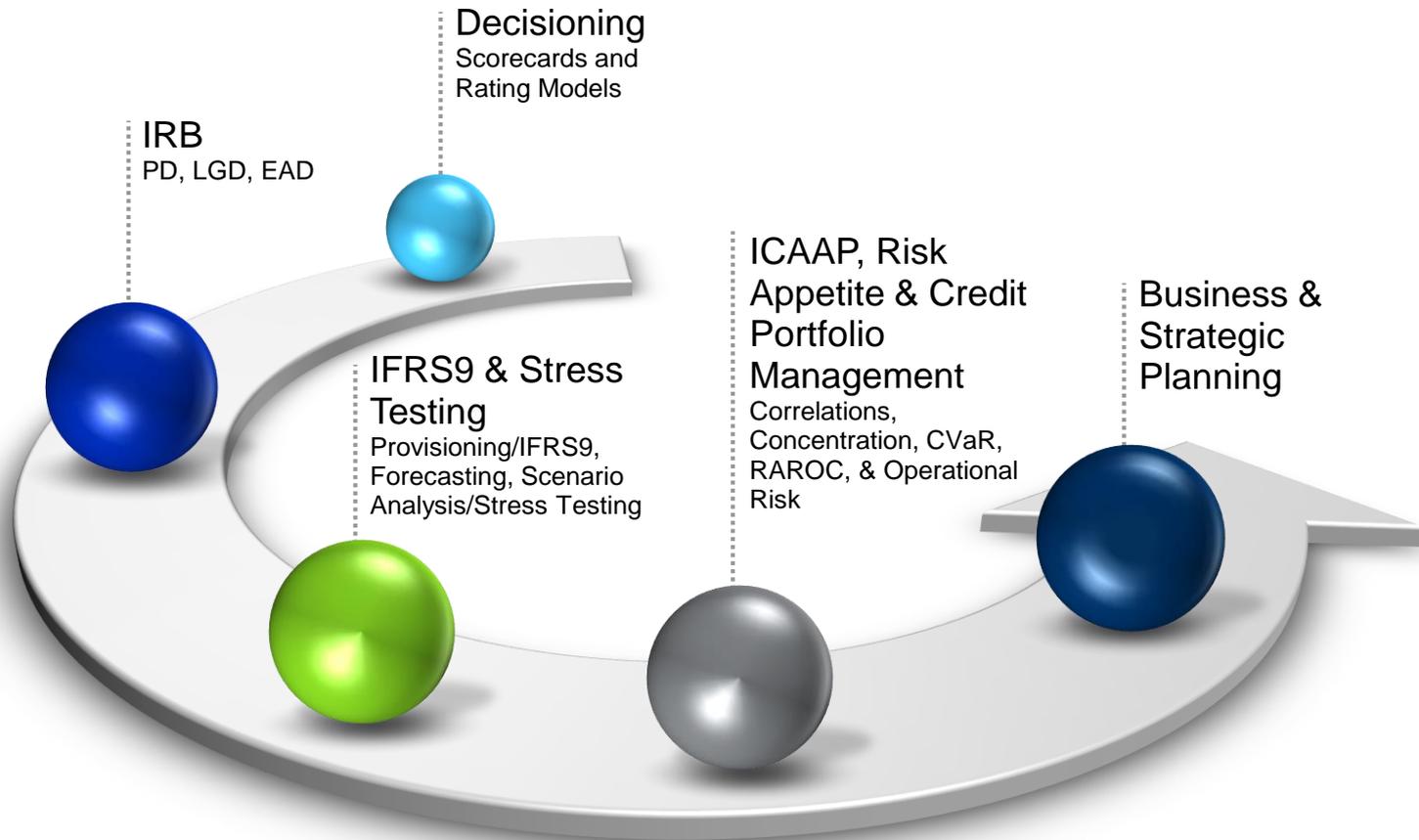
Focus and Trends on  
IRB

# Regulation Evolution



# Why the focus on IRB?

Capital, Restrictions, Consistency

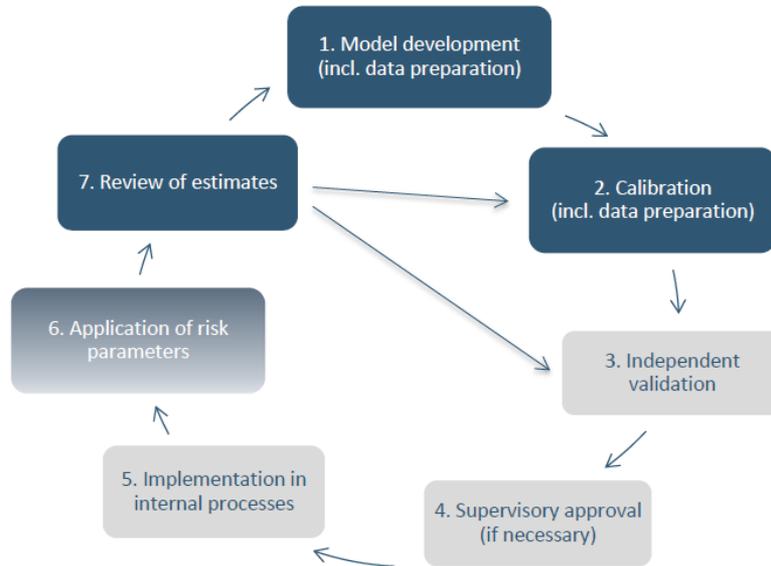


1.1

Regulation

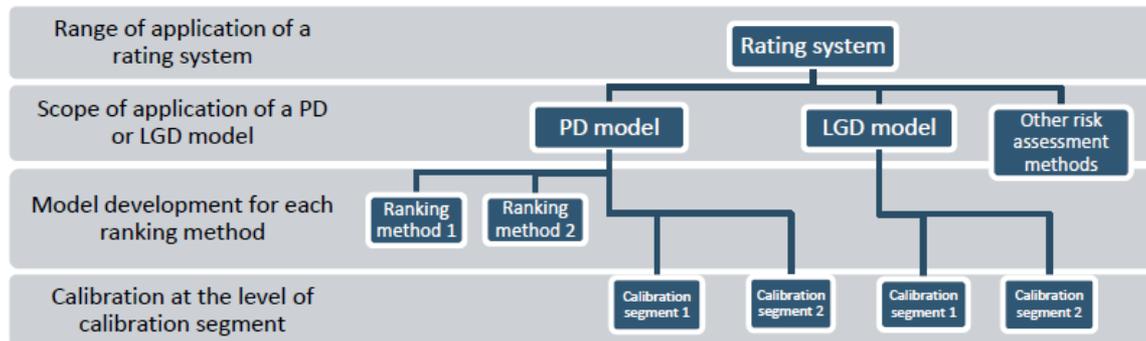
# GL – Key Focus on future IRB Guidelines (1/2)

Figure 1: Life cycle of the estimates of risk parameters



- Importance of managing the models lifecycle regarding governance, process, auditability and policies. Beyond the usual statistical testing
- Need of a robust system to determine the model to apply for each exposure. Deciding the Rating System and PD Model/Sub Model to apply
- Distinction between rank ordering and calibration. Different methods and constrains to be applied
- More focus is placed on the calibration leaving space for the methodology regarding rank ordering

Figure 2: Possible structure of the rating system

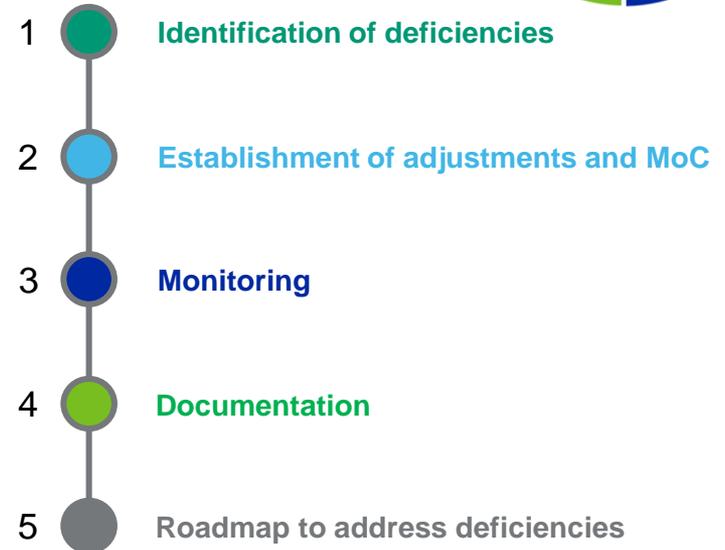
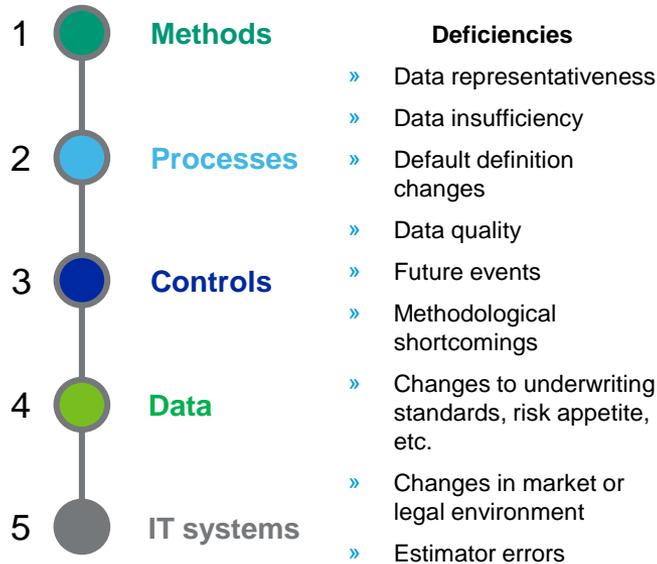
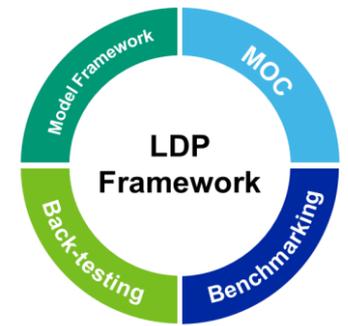


# GL – Key Focus on Future IRB Guidelines (2/2)

- Importance of data representativeness regarding both external as internal data (for calibration Institutions need to evaluate historical data versus current and foreseeable economic conditions). For example for central default tendency assess the default rate of last 5 years versus long run default rate.
- Margin of Conservatism needs to outline all the potential model risks identifying it's sources and measuring the potential impact. Furthermore these limitations are expected to be monitored and to reduce through time.
- Defines the calibration techniques that can be used either at portfolio level or obligor level.
- One year default rate calculation:
  - Arithmetic average of one year default rates (different than retail).
  - Overlapping vs Non Overlapping 1 year periods – Study impact of short term credit
  - Representativeness of historical default rate time series – Need to include good and bad years and conduct an assessment of the variability in the time series.

# Margin of Conservatism

Model deficiencies leading to bias addressed through 5 key blocks



## 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

1.2

Wholesale

# Lessons learned from practice

- » First focus should be the **risk drivers** and not the data available
- » Be prepared to combine different methodologies – **Use data where available** and **complement** always with **expert judgment** to cover all risk drivers
- » Plan for the second model generation and **start collecting data for the future**
- » When using expert judgment collect **opinions of a group of persons** and not a single individual
- » **Review outliers** at the end and **identify a clear reason for their existence** (Model Limitations) possibly defining the override policies

# Data Limitation – Challenges Faced by Many Institutions

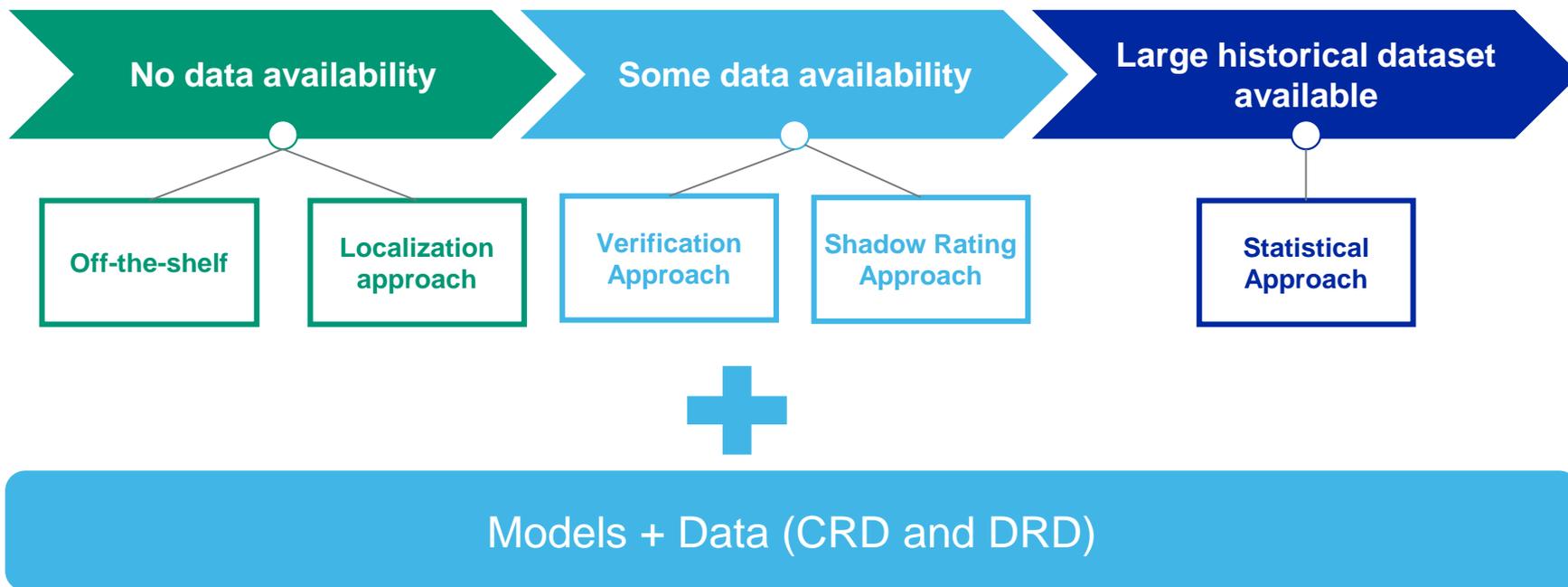
Many institutions have advanced into models that have a way to determine Probability of Default (PD) however data limitations stop institutions from creating models for certain parts of their portfolios.

The common limitations are:

- » Low Default Portfolios
- » Lack of historical information (Financial Statements and other inputs)
- » No consistency in the default definition/identification
- » Non relevance of historical information due to change in business practices or mergers
- » New Portfolios

# PD Modelling Approach: Driven by data availability

The approach to PD modelling depends on the amount of existing data in the organization's respective portfolio:



**Data Availability:** The two key elements are number of obligors and number of defaults in the past (for example over the last 5 years) per relevant portfolio.

**IRB Accelerator :** The use of an off the shelf model as for Example RiskCalc as the starting point can reduce the Development Timelines and increase the statistical robustness of the final model



# Verification approach

# Verification Approach Overview

Moody's alternative to the Statistical Approach for low-default portfolios



## Key Characteristics:

- » Importance of the Model Design Workshop regarding justifying the rationale of each factor included in the scorecard
- » Reliance on expert rank ordering of the portfolio replacing the usual Default Flag
- » Objective is to maximize the Kendall's tau correlation between scorecard and expert rank ordering
- » Statistical analysis aims at verifying the initial expert designed scorecard
- » For IRB is critical the use of actual observed default data via external data sources
- » Importance of Bootstrapping techniques to conduct reliability tests replacing the usual out-of-time and out-of-sample validation tests.

# Verification Approach - Custom Project Finance PD for IRB

## Case Study

### Client Situation

- » Bank wanting to evolve from Slotting Criteria expert based scorecard into a Advance IRB model
- » **The rationale for the decision was to increase the IRB coverage of the portfolio and reduce the capital spending in the segment**
- » Moody's suggested the Verification Approach, due to the lack of past default information (i.e. less than 20, in combination with the use of Moody's Project Finance Consortium data.

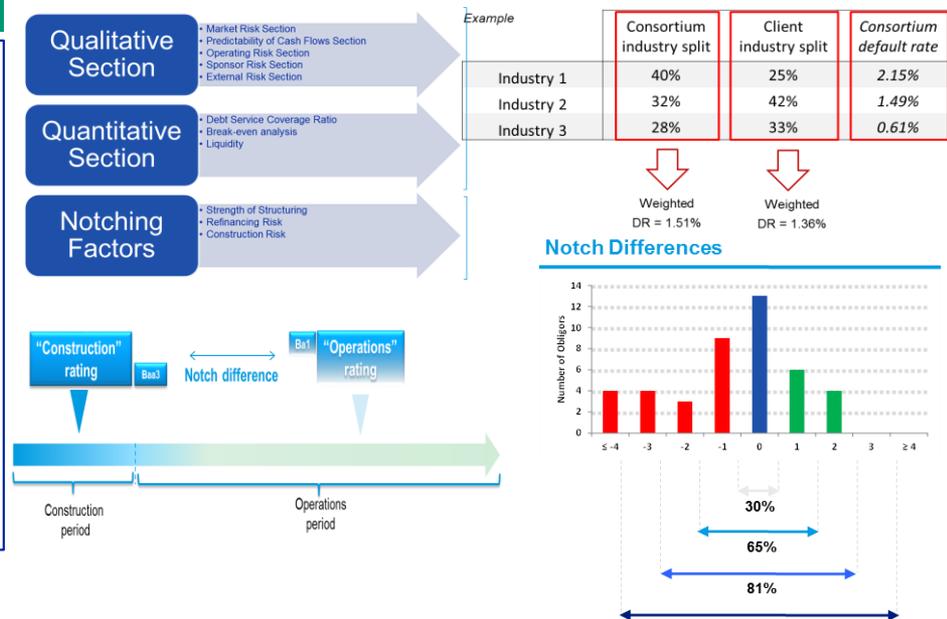
### Solution Provided / Key Highlights

- » Development of 5 scorecards to cover the segment, following a segmentation analysis, with final deliverables including model documentation, prototype and development codes.
- » Supported the institution throughout the internal validation process and the final outcome was a PRA approval for capital calculations.

### Analytical Approach

Workshop	Single Factor Analysis	Weight Optimisation	Calibration
<ul style="list-style-type: none"> <li>» Review of the client portfolio to understand the key industries and size distribution</li> <li>» Mapping of industries from the client portfolio to Moody's Investors Services rating methodologies to understand the key risk drivers relevant for the client portfolio</li> <li>» Discussion of factors to include in scorecards</li> </ul>	<ul style="list-style-type: none"> <li>» Discussion and selection of Overlay Factors</li> <li>» Balancing of factors and initial weight assessment by expert judgment</li> </ul>	<ul style="list-style-type: none"> <li>» Optimise the scorecards by maximizing alignment between scorecard result and benchmark ratings</li> <li>» Use of external ratings to help determine the benchmark ratings</li> </ul>	<ul style="list-style-type: none"> <li>» Definition of Central Default Tendency taking into account Consortium Default Rate information as well as internal</li> <li>» Alignment with the expert based benchmarks</li> </ul>

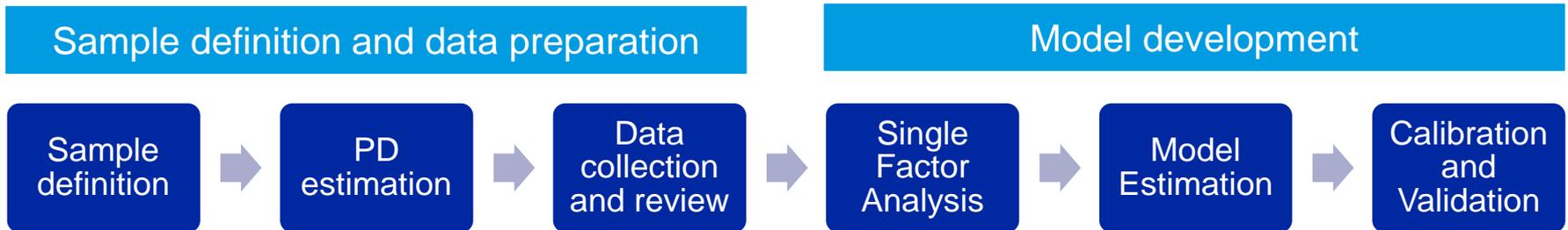
### Illustrative Output





# Shadow Rating Approach

# Shadow Rating Approach Overview



## Key Characteristics:

- » Definition of the development sample (externally rated universe) in a representative way of the institutions portfolio
- » Determination of the PD's applicable per each rating grade within the scope of the model (for example Corporate, Banks, Sovereigns).
- » The PD associated to the external rating replaces the usual default flag has the target variable.
- » Use of historical information (for example financial information or indexes for qualitative dimensions).
- » Qualitative components can be added but with a neutral calibration perspective.
- » For calibration testing is essential to incorporate the non externally rated part of the portfolio as well as test tranching techniques (normally on LDP's the number of data points on non investment grade is lower than investment grades)



# Use of External Data and Benchmarking

# Key Principles when using External Data/Models

## Representative

- The data should be compared between external source and internal portfolio (Ex. Industries/Countries)
- This assessment should also include an evaluation of default definition and the Credit Origination Policies

## Validated

- Model performance to be tested on Institution Portfolio
- Model re-estimated with a new representative portfolio if required

## Incorporate Internal Profile

- Even when using external input information the Institution is expected to combine it with the Internal Criteria.
- Important to evaluate the alignment of the model versus internal expertise and adjust if needed

## Ownership

- Institutions are expected to have a good degree of understanding of the external information. Avoidance of Black Box
- Solutions should be auditable and replicable

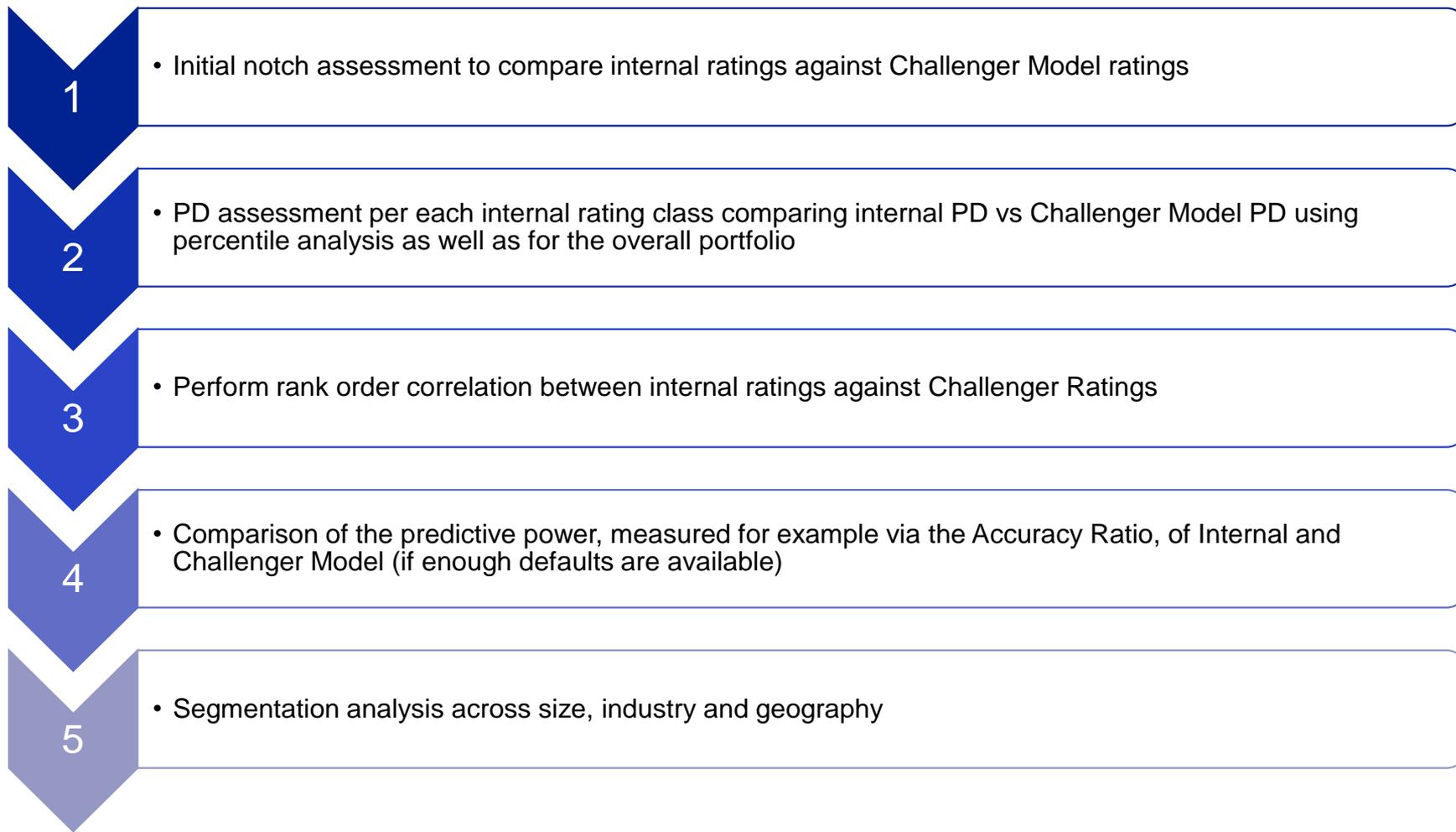
# Use of Benchmarking - Rationale

## Why the need for Benchmarking:

- » **Regulatory Driven:** Regulation asks that financial institutions conduct benchmark analysis as part of their annual validation processes against a “**Challenger Model**”
- » **Lack of Data:** For Low Default Portfolios, it is specially important for an institution to demonstrate the conservativeness of its calibration
- » **Best Practices:** The need to compare and know the best practices in the market
- » **Wider Data:** Models built internally might not be able to capture behaviours in case a bank expands to different segments or lowers the lending criteria.

All these aspects refer to one very important risk dimension: Model Risk. Model Risk has important implications on both Pillar I and Pillar II.

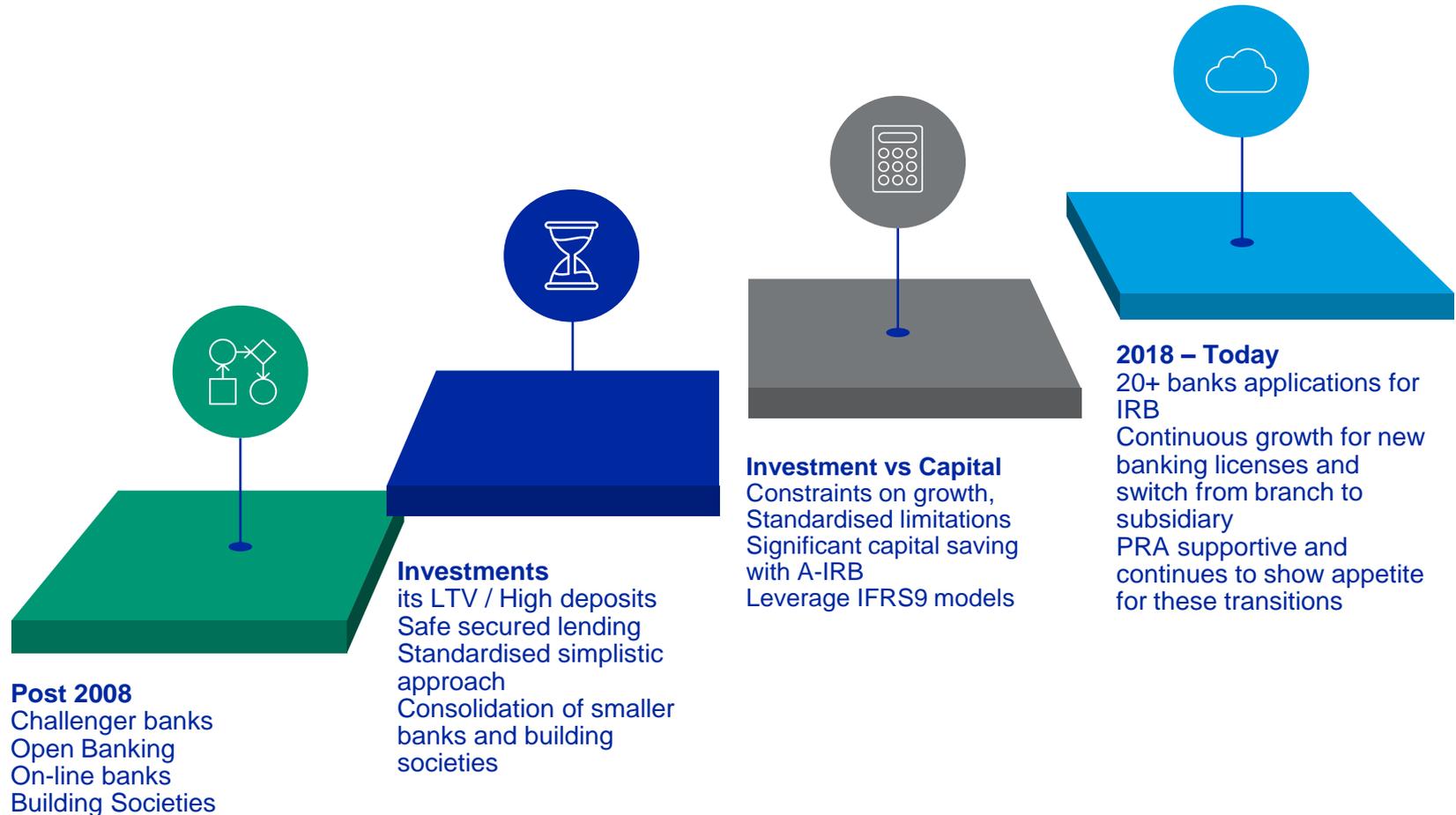
# Overview of PD benchmarking quantitative analysis



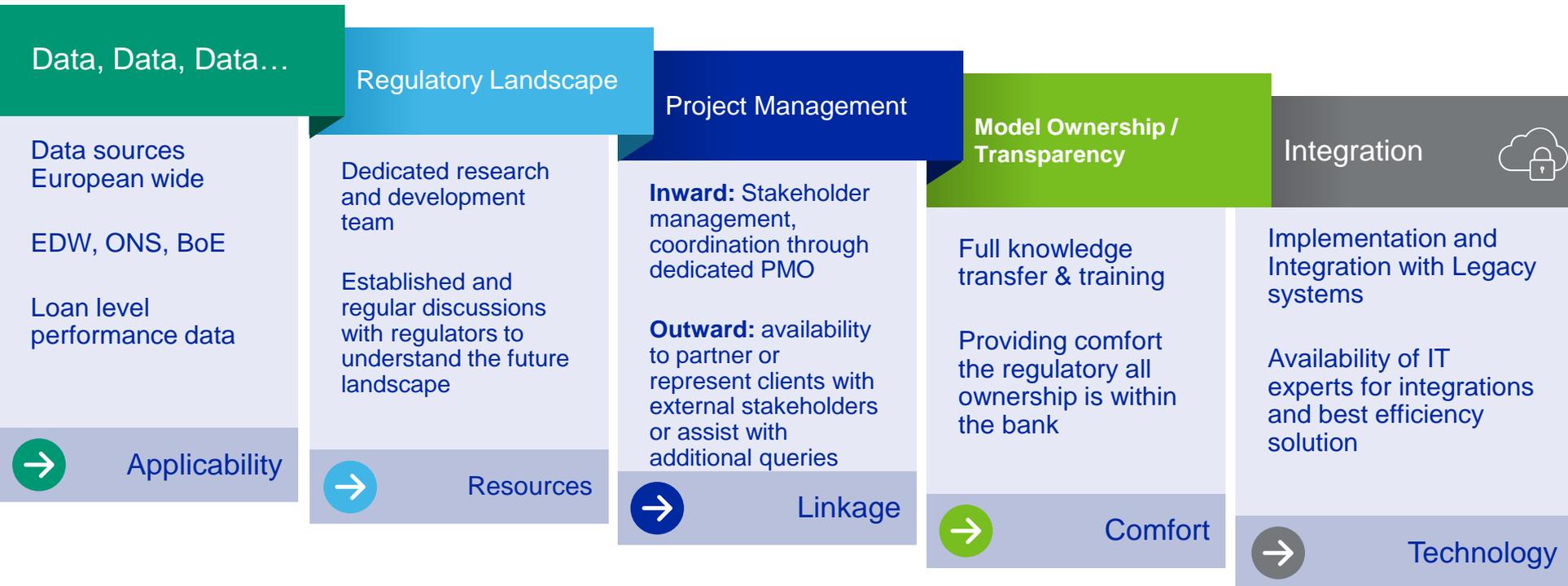
1.3

Retail

# The Trend for Retail – UK as an example

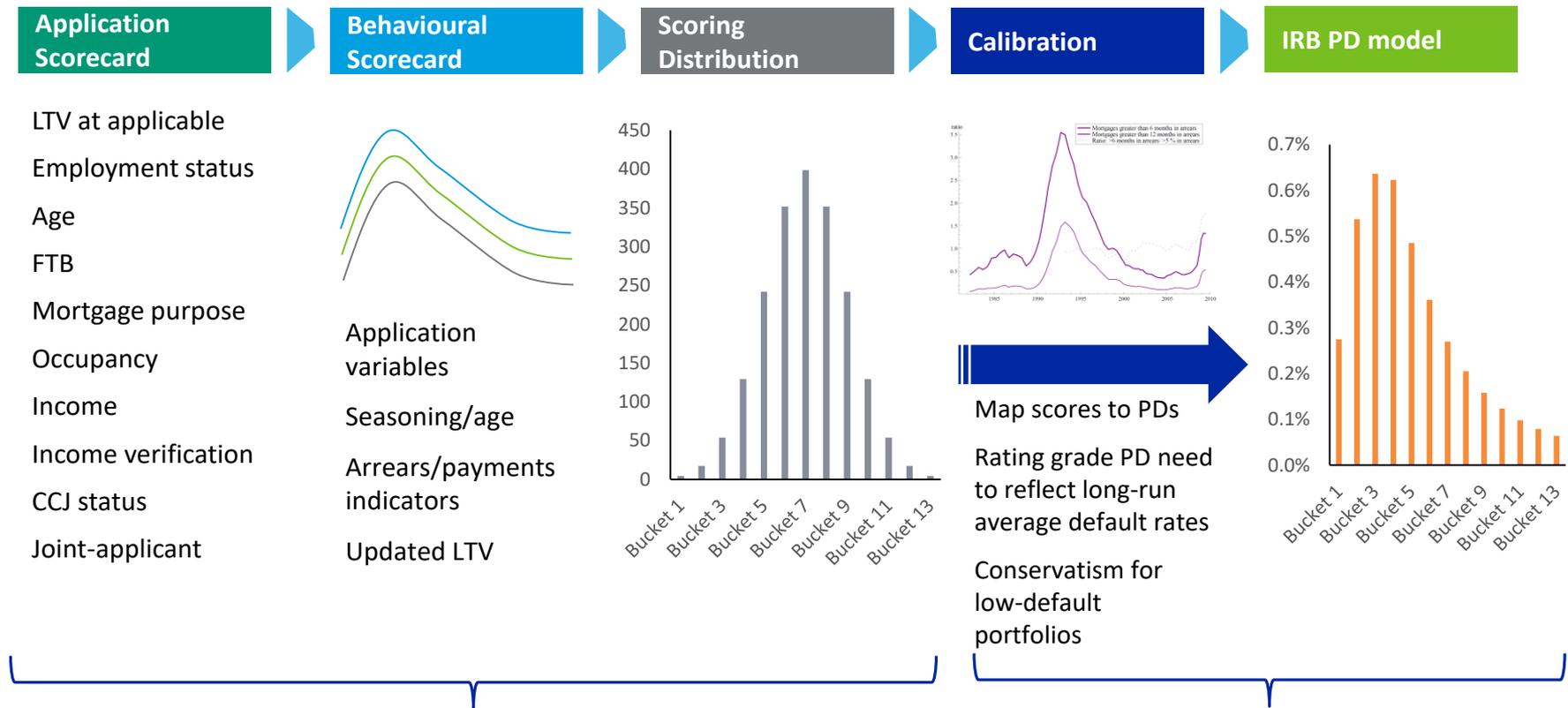


# Typical challenges



# A-IRB PD Modelling

## Key modelling steps



- » Model Development
  - Statistical scoring models
  - Information value variable selection
  - Variable clustering
  - Multivariate analysis/multi-colinearity
  - Stepwise selection

- » Calibration step
- » Cyclicity assessment
- Include model validation*
  - Gini/discriminatory power
  - Stability
  - Out of sample and time validation

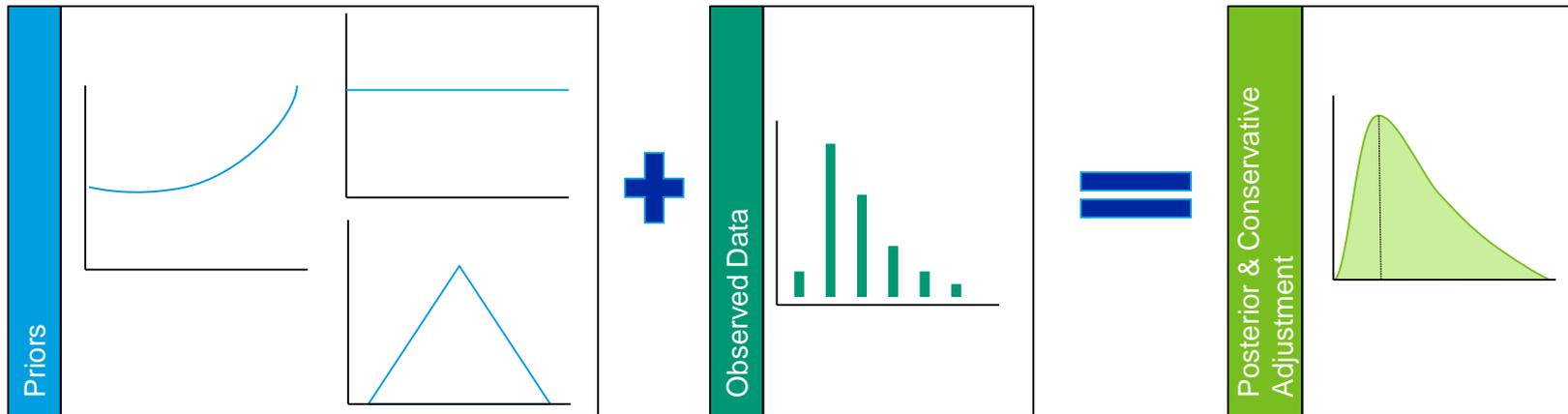
# Calibration of Mortgage PD Models

PRA CP29/16 paper

- » Calibration steps
  - Find long-run DR (including early '90s experience)
    - Easier if long history of internal data is available
    - Finding relevant external data if internal data is inadequate
    - Representativeness of historical data (internal or external)
  - Determine cyclicalities
    - Which definition to use?
    - Cyclicalities could be time-varying (due to model not following default patterns perfectly)
  - Uplift or reduce current default rates to long-run average
    - Uplift or reduction in proportion to the cyclicalities of the model
  - Monitoring cyclicalities
    - Recalibration should be infrequent if cyclicalities assumptions are correct
    - Assess cyclicalities for Pillar II/stress testing purposes
  
- » Our experience in modelling and calibrating hybrid mortgage PD models
  - Alternative definitions of cyclicalities (Vasicek/Z-Factor)
  - Build scoring/PD models that include macroeconomic variables

# Margin of Conservatism

EBA/CP/2016/03 paper



## » Long experience in adding conservatism for LDP

- New retail books post downturn
- Investment-grade corporate portfolios
- Sovereign exposures

## » Backfilling missing data

- Leveraging public and proprietary data to identify likely values of historical missing data
- Multiple imputation
- Conservative data imputation based on Bayesian priors

## » Confidence-based approaches for LDP

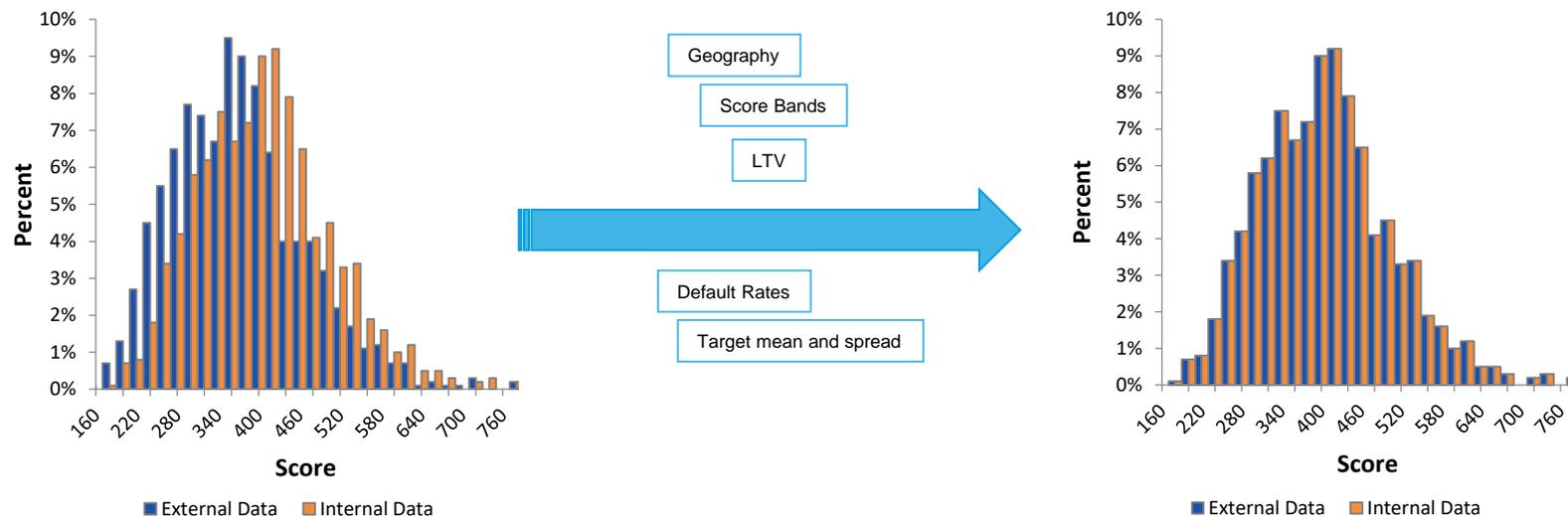
- Pluto & Tasche, Benjamin, Cathcart, Ryan, Forrest
- Independent and correlated cases
- Static and dynamic cases

## » Bayesian approaches for LDP

- Wide choice of priors, informative and uninformative
- Asset and inter-temporal correlation
- Extension of the approach to other credit risk parameters in addition to PD

# Representativeness of Historical Data

EBA/CP/2016/03 paper



- » We always advertise the appropriate use of past internal or external data
  - When internal data is not available, we have used our extensive proprietary performance & loss data based on structured finance deals
  - Current engagement includes combining internal, Bureau and RMBS data to create representative sample for estimation
- » Appropriately weight sample or scoring model
  - Weights to be based on multiple dimensions (geography, scores, LTVs) to ensure current portfolio risk is represented accurately in estimation dataset
- » Select appropriate sample on which to build the model
  - Stratified and bootstrapped samples matched across different dimensions, also targeting DR mean and spread

# Demonstrating Use-Test

## » What is the 'Use Test'

- Central to the approval of IRB use, Regulators expect firms to demonstrate that the internal models form an integral part of the firm's credit risk management process
- Ability to demonstrate and evidence meeting these requirements will need to be covered in self-assessments ahead of SIF attestation
- The requirements of the use-test cover the following areas:

## » Decision Making and Credit Approval

- Demonstrate immateriality of non-rated or 'stale' ratings
- Incorporate ratings into lending policies and credit approvals or rejections
- Incorporate ratings into the limit setting process and monitoring of exposures
- Incorporate ratings into watch list process or doubtful credit reviews

## » Capital Allocation

- Demonstrate use of capital planning, regulatory reporting to senior management and into ICAAP
- Integration into stress-testing for Pillar 2B
- Use IRB framework in limit setting & decisions (if not based on capital)

## » Corporate Governance

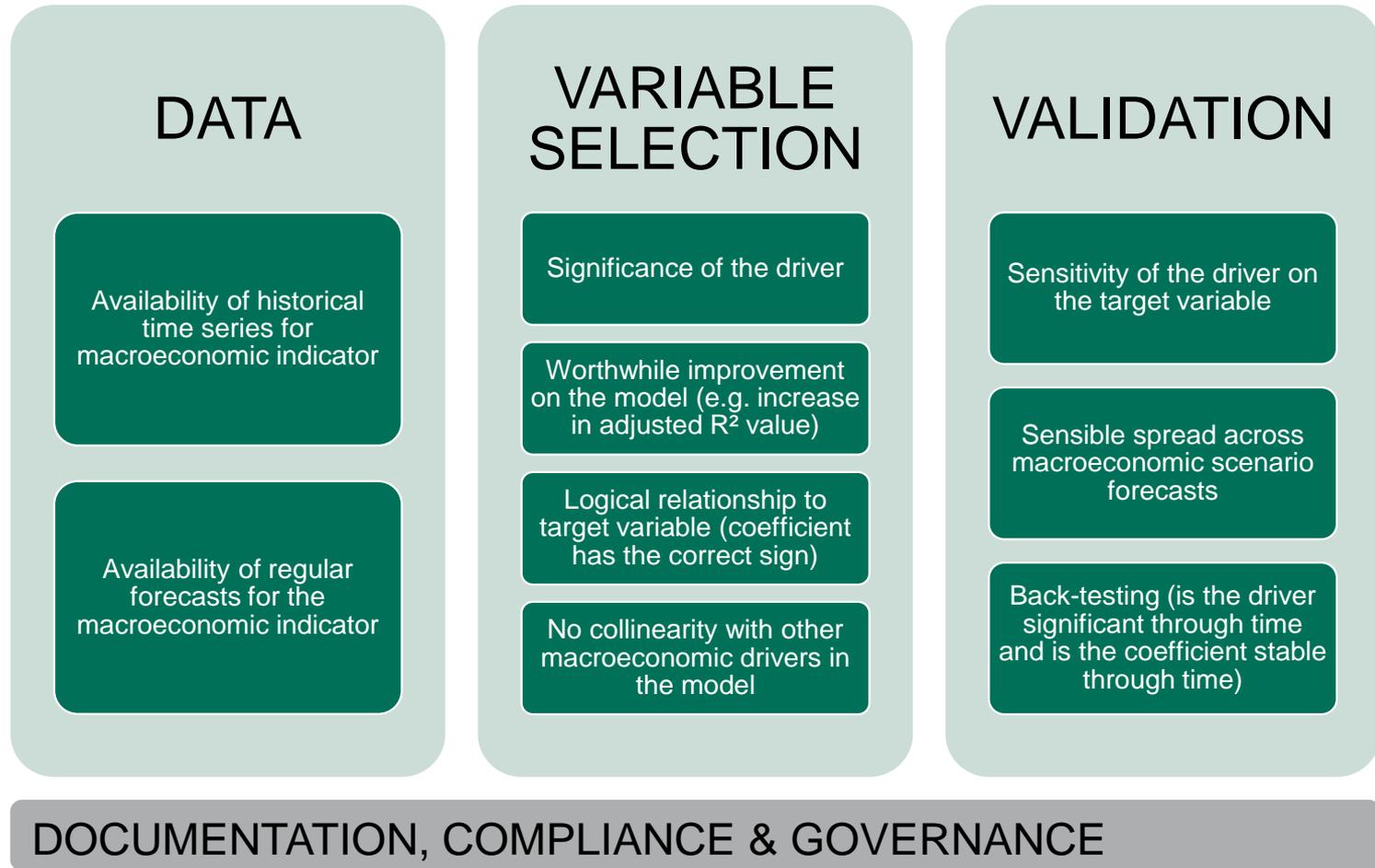
- Management information into Risk Management committees and Executive committees
- Internal audit planning & scoping of Risk Management practices

# 2

## Linkage to IFRS9 and Stress Testing

# IFRS 9 and Stress Testing Models

Linking Macroeconomic Drivers to Risk Parameters



# IFRS 9 and Stress Testing Models

## Common Challenges

### **IFRS 9 Challenges**

- » Using macroeconomic drivers in impairment models: probability assignment, frequency of updates
- » Lifetime length determination: particularly for open-ended products
- » Lifetime PDs at origination: accounting for age of the account
- » Threshold setting: definition of a significant credit deterioration
- » Discounting

### **Stress Testing Challenges**

- » Macroeconomic drivers: variable selection, balance between statistical search methods and practical understanding of the models
- » Correlation with macroeconomic series at different levels of portfolio granularity
- » Sensitivity analysis and scenario spreads
- » Comparison with previous crisis



Q&A

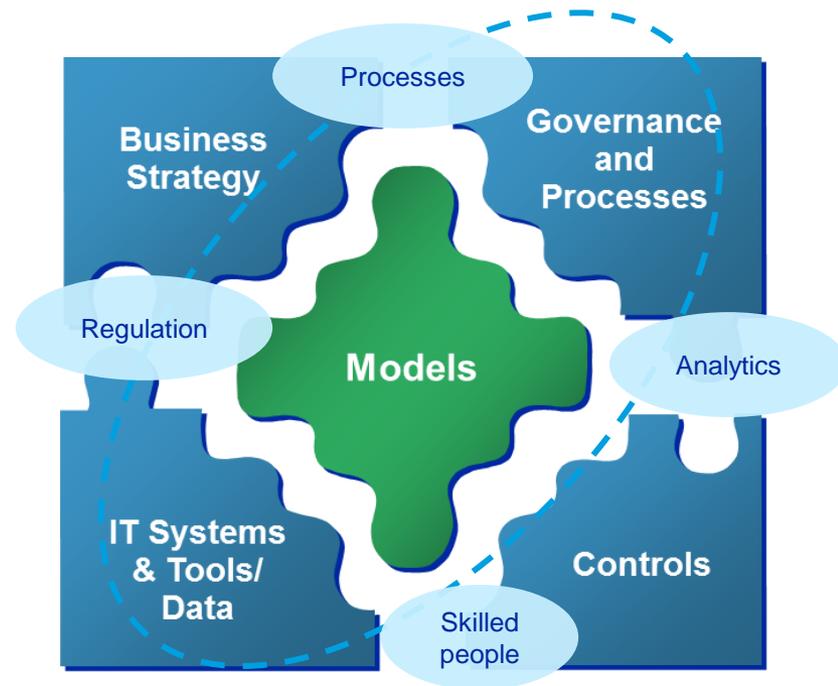


# Appendix

# Integration of Models in the Institution

The modelling techniques need to fit the institution, both from an IT and user perspective, and the following points should be taken into account

- » Balance between the statistical sophistication and the data available
- » Models sophistication can grow through different generations
- » Inclusion of the Key Stakeholders (Risk, Credit, Business) in the modelling process
- » Transparency in the model calculation and final output that can be understood
- » Importance of capturing the day to day credit/risk assessment
- » Impact of the rating process, for example filling in the qualitative factors, in the model quality



# Illustrative Application Programme

	Feasibility Phase	Development Phase	Application Phase 1	Application Phase 2	Application Phase 3
Objective	Feasibility phase is critical in defining the overall implementation programme for the application	Implement enhancements to IRB regulatory standards for risk measurement and management requirements	Phase 1 covers overview of firms approach and implementation plan	Phase 2 covers technical details of the models and risk management processes	Phase 3 covers details of the approach to stress testing, financial reporting, independent validation, internal audit and governance
Activities	<ul style="list-style-type: none"> <li>Initial self-assessment against regulatory requirements</li> <li>Identify gaps in regulatory expectations and requirements for closure</li> <li>Identify stakeholders, development phase ownership and define resource requirements.</li> <li>Perform cost-benefit analysis</li> <li>Confirm prioritisation of resources and stakeholder sponsorship</li> <li>Approval from senior management for entering development phase.</li> <li>Planning and communication strategy with Regulator</li> </ul>	<p><b>Workstreams to include:</b></p> <p><b>Modelling</b></p> <ul style="list-style-type: none"> <li>Data sourcing</li> <li>Model development</li> <li>Model Performance (&amp; on-going)</li> <li>Model Validation</li> </ul> <p><b>Infrastructure &amp; IT</b></p> <ul style="list-style-type: none"> <li>Data sourcing</li> <li>Data Controls</li> <li>Regulatory reporting processes</li> </ul> <p><b>Credit Risk Management</b></p> <ul style="list-style-type: none"> <li>Policies</li> <li>Credit Officer Rating approach &amp; approvals</li> <li>Credit MI</li> <li>Stress Testing</li> </ul> <p><b>Risk Oversight &amp; Governance</b></p> <ul style="list-style-type: none"> <li>Committee structure &amp; ToR</li> <li>Senior Management understanding</li> </ul>	<p><b>Submission requirements</b></p> <ul style="list-style-type: none"> <li>Rationale and Scope (models &amp; entity application)</li> <li>Model inventory and materiality</li> <li>Roll-out plan (if applicable)</li> <li>Impact analysis</li> <li>Final Self-assessment against CRR requirements</li> <li>Gaps in assessment and remediation</li> <li>Self-assessment and Governance process</li> </ul>	<p><b>Technical Model details</b></p> <ul style="list-style-type: none"> <li>Complete model documentation</li> <li>Independent model validation report</li> <li>Internal audit reports</li> <li>Model performance reports</li> <li>Committee minutes reviewing &amp; approving models</li> </ul> <p><b>IT &amp; Data</b></p> <ul style="list-style-type: none"> <li>Data management</li> <li>Architecture of Infrastructure, data and systems in IRB capital reporting</li> <li>Reconciliations between finance and risk systems</li> <li>Data quality controls and reports</li> </ul> <p><b>Use &amp; Experience</b></p> <ul style="list-style-type: none"> <li>Integration of IRB into the firms business processes</li> <li>Internal vs regulatory variances</li> <li>IRB infrastructure</li> <li>Evidence of meeting prior experience (3 years monitoring)</li> </ul> <p><b>Partial use &amp; Roll-out Plans</b></p>	<p><b>Stress Testing</b></p> <ul style="list-style-type: none"> <li>Stress testing framework, identification of risks and application to the portfolios</li> <li>Stress testing models and methodologies</li> <li>Validation and approval of methodologies</li> <li>Impairment calculation &amp; forecasts</li> </ul> <p><b>Model Validation &amp; Audit</b></p> <ul style="list-style-type: none"> <li>Model validation framework</li> <li>Policies, approval process, documentation</li> <li>Organisational structure &amp; reporting lines</li> <li>Validation reports</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>Governance of Credit Risk</li> <li>Involvement of Board and Senior Management understanding</li> <li>Risk reporting presented to Governance committees</li> <li>Model change policies</li> </ul>