Moody's Analytics

Modelling Low Default Portfolios

Overcoming data limitations and the importance of benchmarking

Prepared for: Actuarial Society of South Africa – Banking Seminar

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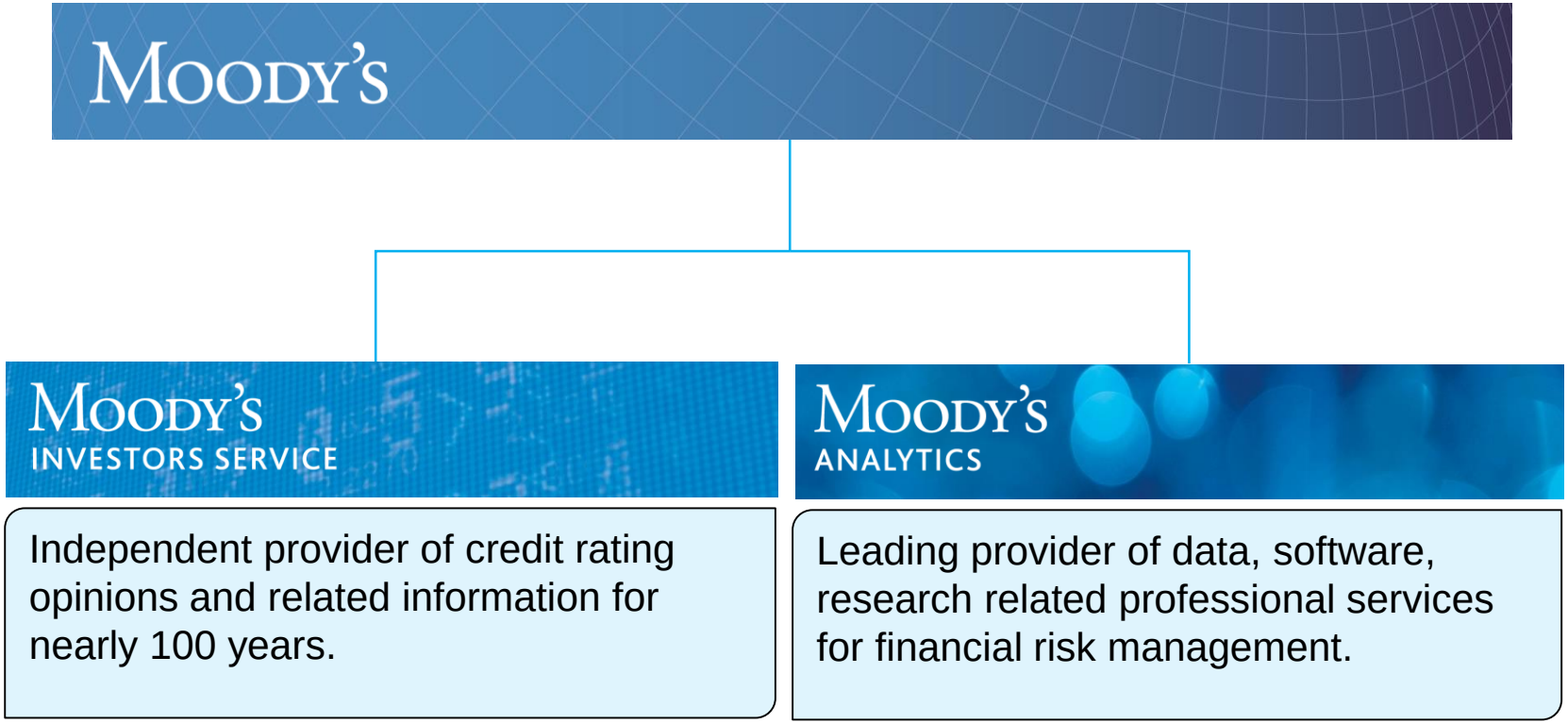
Agenda

1. Challenges and approaches for modelling low default portfolios
2. Benchmarking and use of external data
3. Improving statistical models with qualitative information
4. Summary and Q&A

Moody's Analytics helps our global clients measure, understand, and mitigate risk – beyond ratings



1

Challenges and approaches for modelling low default portfolios

Challenges faced by institutions in modelling credit risk

Data limitations make it particularly harder for institutions to model certain portions of their portfolios, especially for Low Default Portfolios

The common limitations are:

- 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

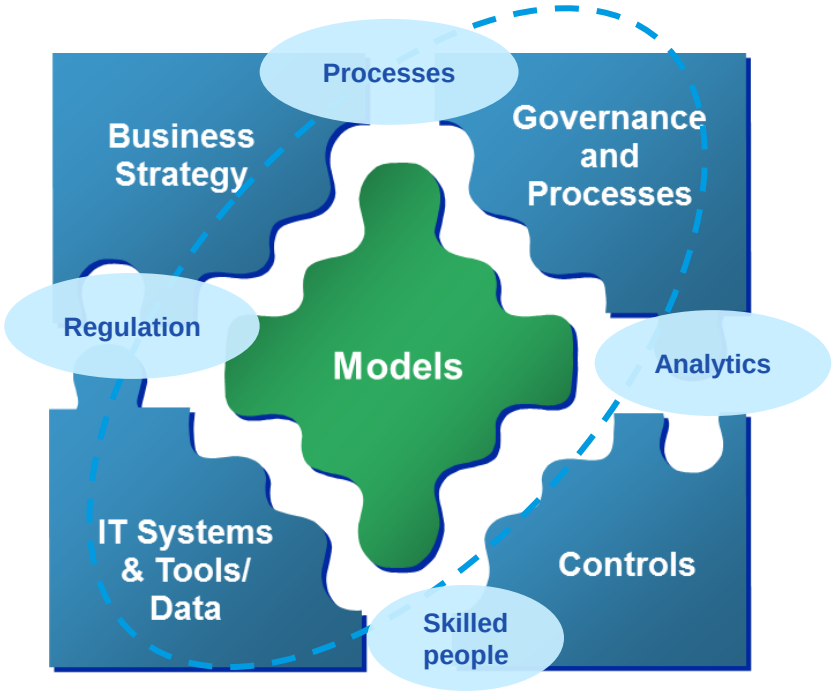
There is no consistently accepted definition of Low Default Portfolio

- Generally includes Large Corporates, Banks, Sovereigns, Project Finance, Specialised Lending
- Traditional tools need to be adapted in order to model this type of portfolios

Integration of models within the institution

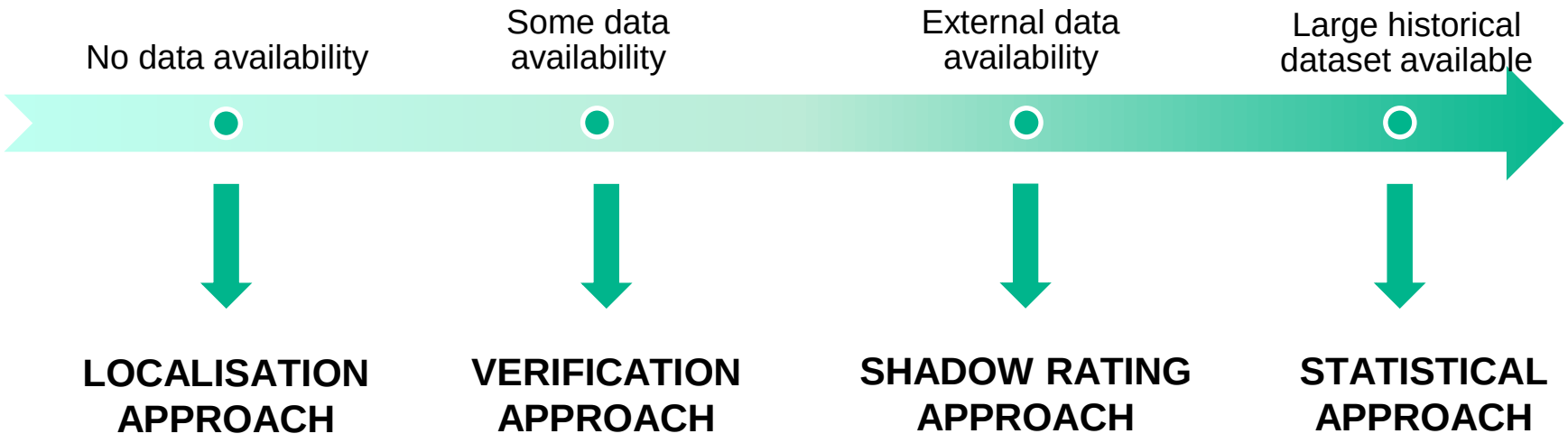
The modelling techniques need to fit the institution, both from an IT and user perspective, and the following points should be taken into account

- 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

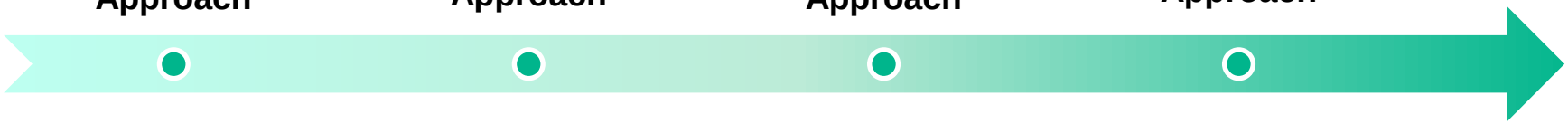


Moody's Analytics approach to modelling PD and LGD

The approach PD/LGD modelling approach depends on the amount of existing data in the organisation's respective portfolio:



Modelling approach driven by data availability



Localisation Approach

- 100% expert based
- Not statistical

Verification Approach

- Tailors the rating model to fit the bank's credit culture, portfolio and environment
- Integrates empirical modelling with expert judgment

Shadow Rating Approach

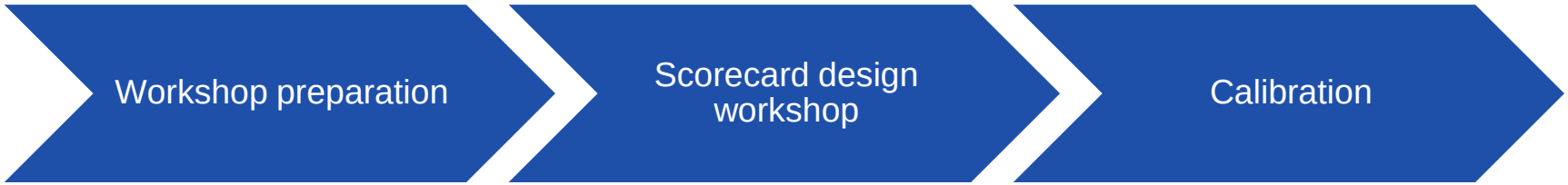
- Calibrated to historical default information of the rated universe
- Anchored on external ratings rank ordering
- Also incorporates expert judgment and alignment with the Bank's culture

Statistical Approach

- Data driven
- Empirical and statistically tested
- Optimised against Default or Loss Data

Localisation Approach

Solution for reduced portfolios allowing for the incorporation of internal expertise



Designed to provide:

- Transparent and objective risk assessment consistent with expert judgment
- A consistent approach to assessing credit risk
- A solution for small portfolios (less than 30 deals) and those with little or no default information

Model design workshop

One-day workshop where our team will work with experts from the institution to develop a rating model that is sufficiently complete and comprehensive for capturing data on existing customers

- Design initial model based on the expertise and judgment of the client's credit professionals and Moody's
- Leverage Moody's Investors Service rating methodologies for risk assessment techniques and factor selection
- Moody's Analytics provide expertise on rating model design and feedback on the benefits and drawbacks of various approaches based on first-hand experience
- The collaborative process ensures understanding of the institution's objectives, history and portfolio

Deliverable: A comprehensive report outlining the core methodology and results, and an Excel-based scorecard that the client can use in making credit decisions.

Verification Approach

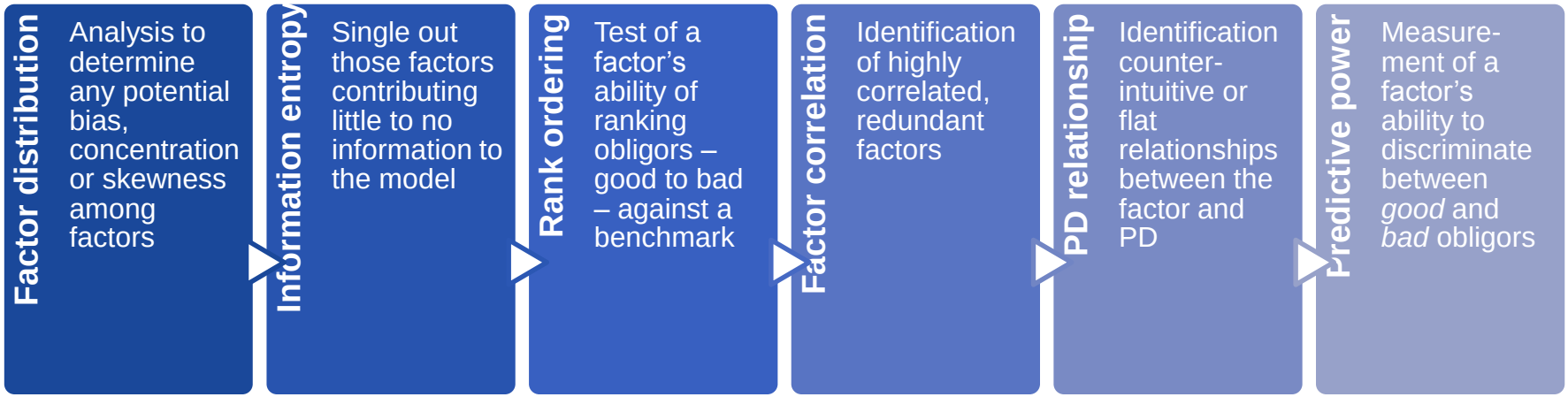
Moody's Analytics alternative to the Statistical approach for low default portfolios

Designed to provide:

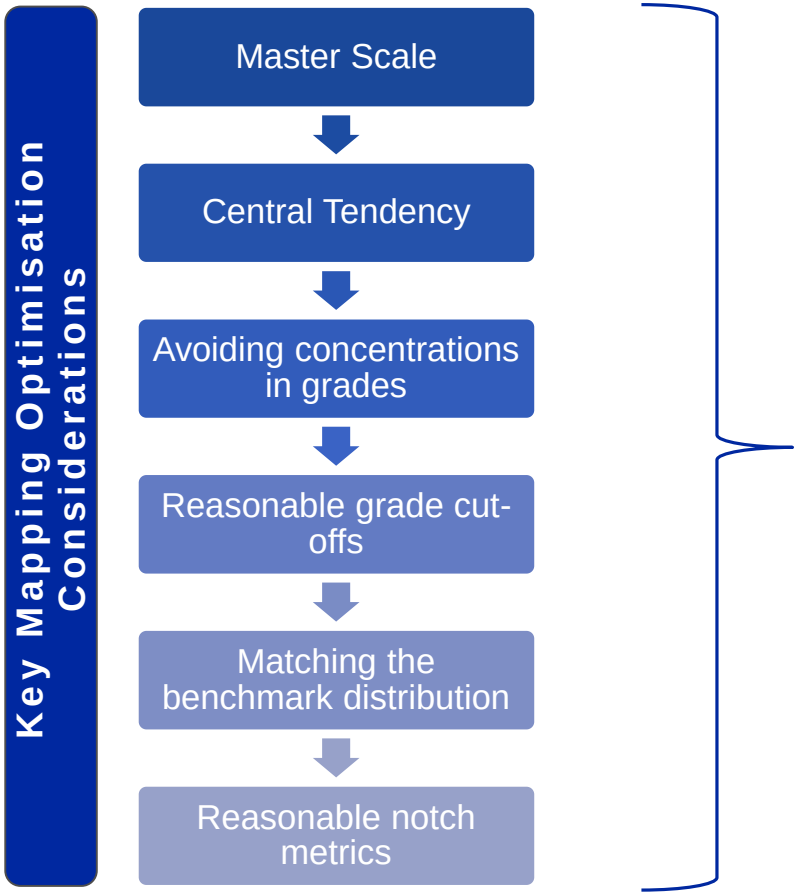
- Transparent and objective risk assessment consistent with expert judgment
- Model applicability to the given portfolio and asset class
- Enhancement to the risk metrics and model discriminatory power
- Transition to an empirically-derived and validated model

Single Factor Analysis

» Evaluate each potential factor to determine its impact on the clarity and usability of the model



Mapping Optimisation



- Mapping Optimisation is the process of mapping the scorecard model output (Score per client) to expert grades and associated PDs
- This mapping process involves mathematical optimisation and manual adjustments that will ultimately minimise differences between the scorecard and the institution expert judgement-based ratings while ensuring a scorecard average PD equal to the Central Default Tendency

2

Benchmarking and use of external data

The rationale for benchmarking

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

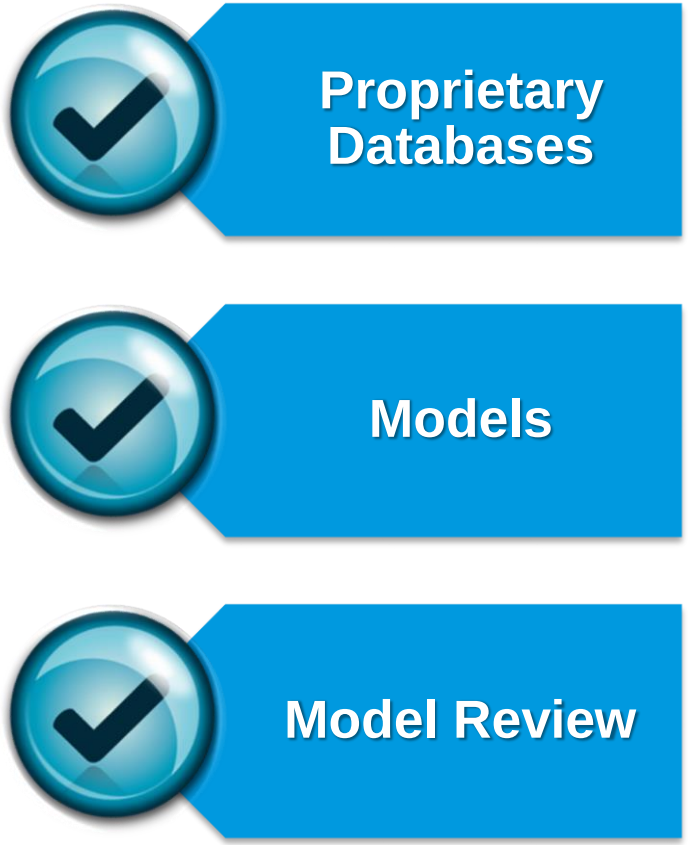
- **Wider data**: Models built internally might not be able to capture behaviours in case a institution expands to different segments or lowers its the lending criteria

All these aspects refer to one very important risk dimension: Model Risk.

Model Risk has important implications on both Pillar I and Pillar II.

Benchmarking low default portfolios

- **Proprietary databases**
  - CRD/DRD
  - Structured Finance Data
  - Project Finance Consortium
  - External Ratings
- **Off-the-shelf models**
  - CreditEdge / RiskCalc
  - LossCalc / PF LGD Model
- **Model design benchmarking**
  - Model Design
  - Risk Driver Comprehensiveness
  - Calibration



Example of PD benchmarking

1. Initial notch assessment to compare internal ratings against Challenger Model ratings
2. PD assessment per each internal rating class comparing internal PD vs Challenger Model PD using percentile analysis as well as for the overall portfolio
3. Perform rank order correlation between internal ratings against Challenger Ratings
4. Comparison of the predictive power, measured for example via the Accuracy Ratio, of Internal and Challenger Model (if enough defaults are available)
5. Segmentation analysis across size, industry and geography

Notch Assessment

Benchmark internal ratings against Challenger Model implied ratings

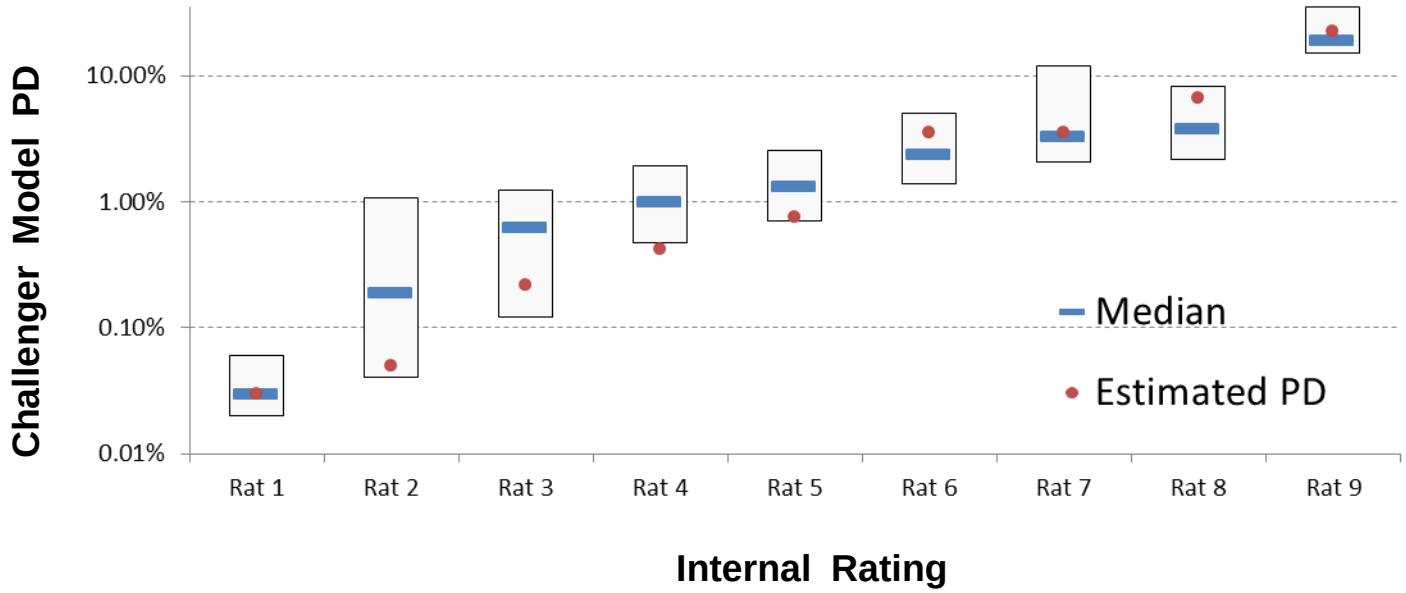
Obligor Type	Rating Type	Exact Match	Within +1/-1 Grade	Within +2/-2 Grade	Greater than 2 Notch Diff	Within 2 Notches
Public	PIT	x%	x%	x%	x%	x%
	TTC	x%	x%	x%	x%	x%
Private	PIT	x%	x%	x%	x%	x%
	TTC	x%	x%	x%	x%	x%

» Main outcome:

- Conclude if internal ratings have a better alignment with TTC or PIT measures
- Conclude the degree of alignment between internal and challenger model

Percentile Analysis

Default risk assessment against Challenger Model to be performed in each of the rating classes using percentile analysis



» Main outcomes:

- Identify the dispersion of Challenger PD per each internal rating class
- Conclude if internal model comprises enough conservatism when compared against challenger model

Rank Order Correlation

Perform rank order correlation between internal ratings against Challenger implied ratings

» Measures: (1) Pearson (2) Spearman's Rho (3) Kendall's Tau correlation

Correlation coefficients buckets (absolute value)	Evaluation	Interpretation
[0 , X1 [	weak	Internal and challenger ratings/PDs have a weak association
[X1 , X2 [	medium	Internal and challenger ratings/PDs have a medium association
[X2 , X3]	high	Internal and challenger ratings/PDs have a high association

» Main outcomes:

- Evaluate the degree of association between internal and challenger ratings
- This analysis can be done for ratings before and after overrides

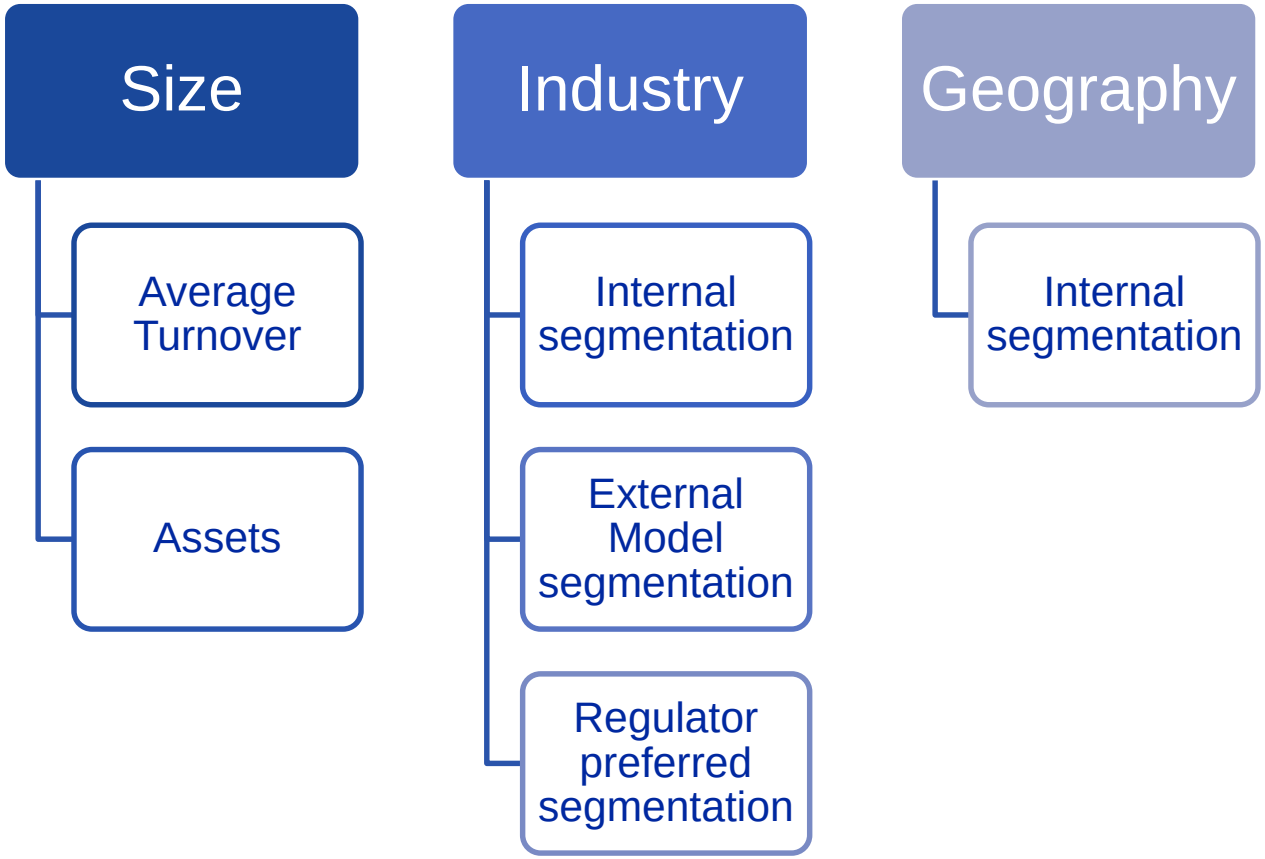
Predictive Power

Compare Accuracy Ratio of the Two Models

Accuracy Ratio (Internal Vs Challenger)	Evaluation	Interpretation
<X1	Underperform	The Internal model is underperforming versus the Challenger Model
[X1 , X2]	In line	The predictive power of the two models are aligned
> X2	Outperform	The Internal model is outperforming versus the Challenger Model

- Main outcomes:
  - Evaluate the predictive power of the two models
  - Threshold values to define if a model is underperforming

Segmentation Analysis



Moody's Project Finance Consortium is leading efforts to collect project finance data

- Includes 5,880 projects representing 62% of all project finance transactions originated worldwide over a 30+ year period Jan 1983 to Dec 2014

- Includes 425 defaulted projects, based on Basel II criteria

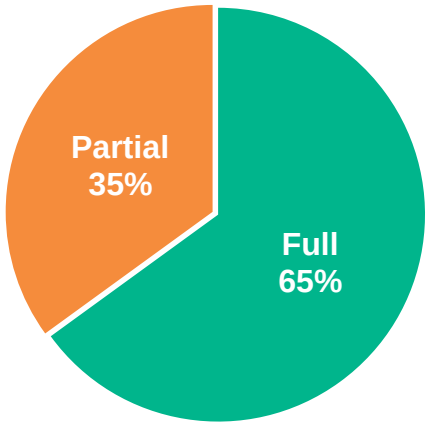
Ultimate Recoveries	226
Distressed Sales	40
Defaults in Work Out	159

- The database has been used to develop a statistically driven LGD model and can be used for the calibration of PD models. Future collection of financial information will support the development of data driven PD models.

- MIS has published a research piece summarizing the default and recovery findings: Project Finance Bank Loan Default & Recovery Study 1983-2014

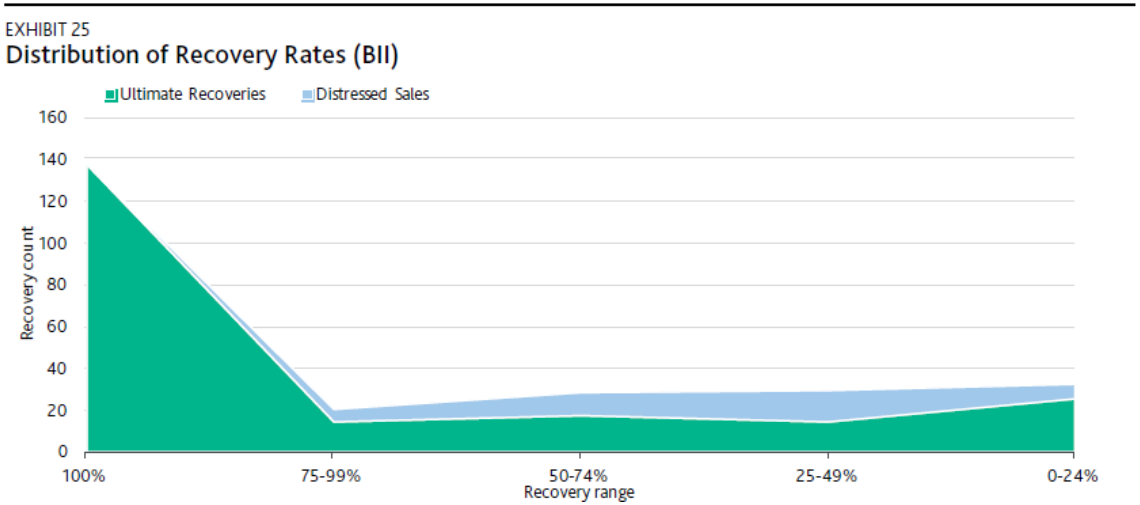
Moody's Project Finance Consortium – Recoveries

Ultimate recovery



Average recovery rate for Ultimate Recovery: **80.3%**

Distressed sale



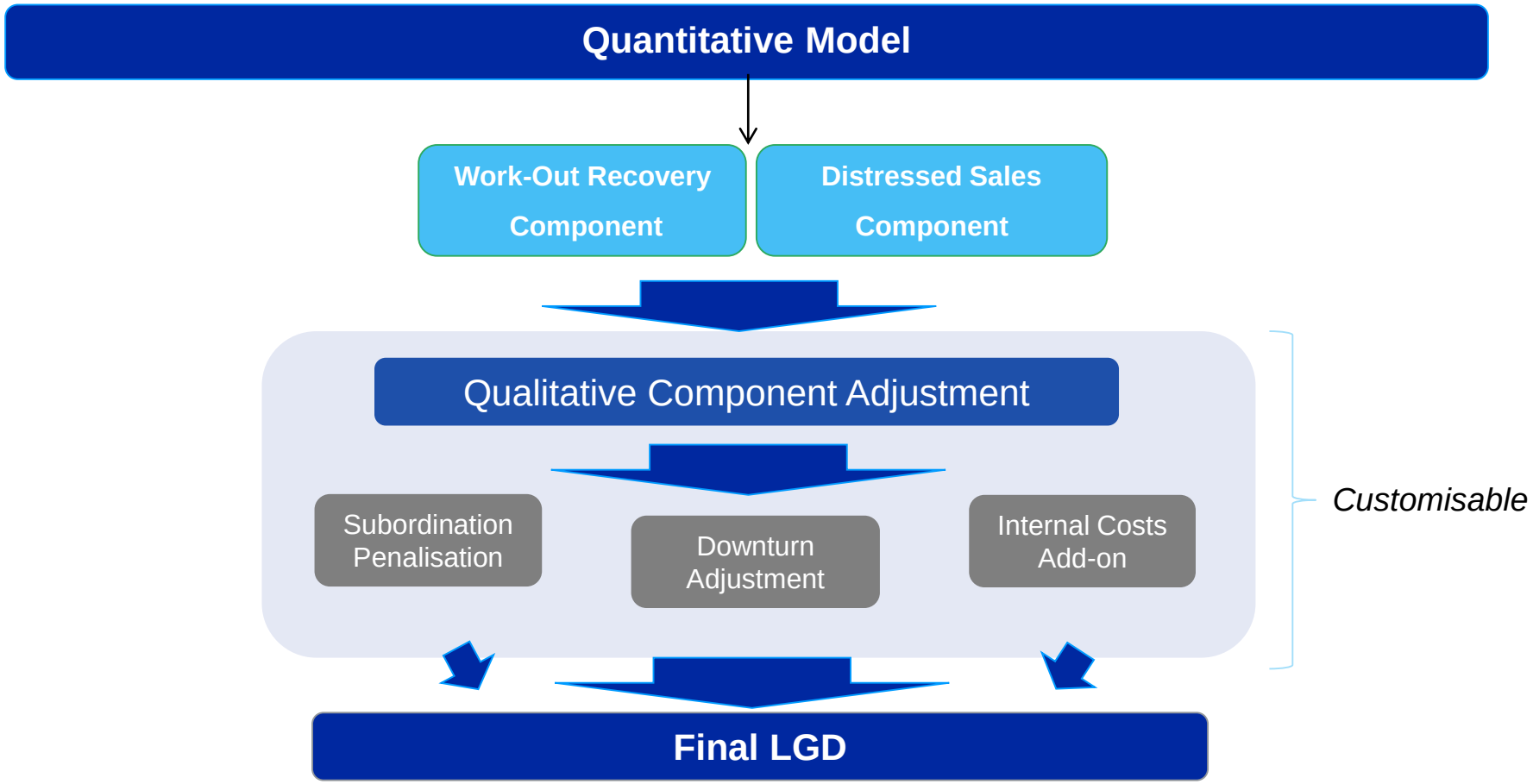
Average recovery rate for distressed sale: **50.3%**

3

Improving statistical models with qualitative information

LGD model: conceptual overview

» The Off-The-Shelf MA LGD model has the following components



Integration of quantitative and qualitative components

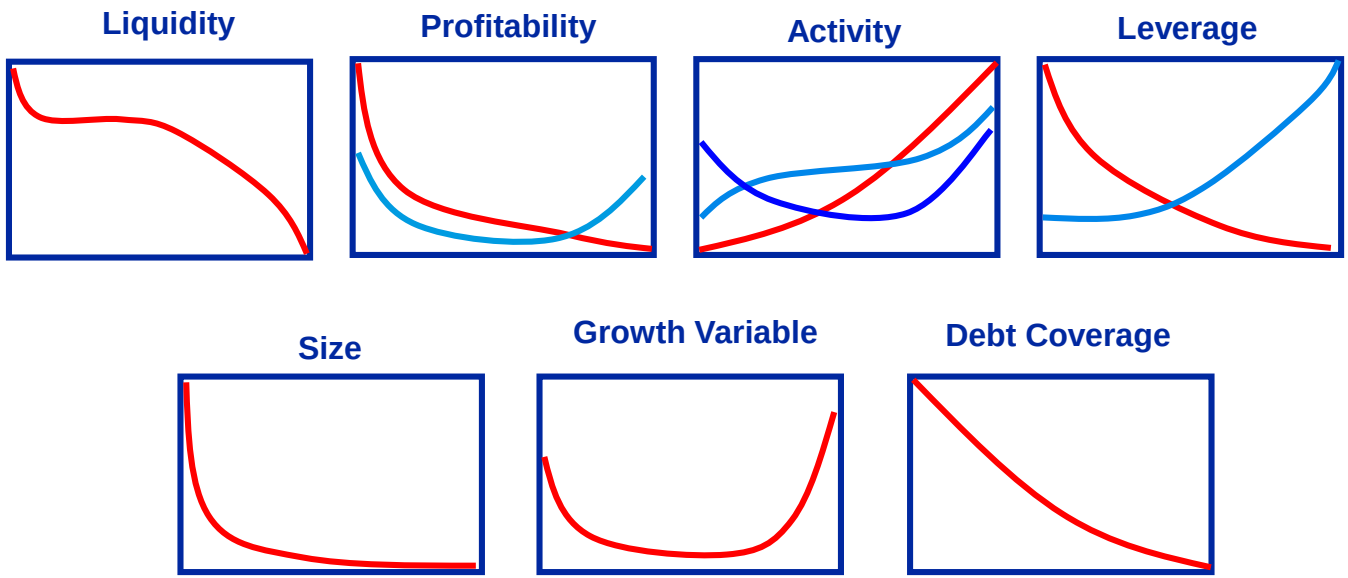
A statistical LGD solution that could be validated for regulatory purposes

- **Quantitative Component**
  - Estimates the expected level of losses based on based on intuitive regression modeling
  - Addition of a distressed sales component ensuring that lower recovery impacts the final LGD. This effect has a regional differentiation.
- **Qualitative Component**
  - Adds granularity to the model by including the factors which were not available in the database, as for example: Technology Risk, Legal Framework, Strategic Importance. The factor performance was tested in a sample of 50 deals from the MIS-rated PF Universe.
- **Calibration**
  - Qualitative component was calibrated on the same 50 sample deals, thus ensuring the average LGD is still aligned with the consortium loss data
- **Add-Ons**
  - Conservative LGD downturn; depending on regulatory requirements. Also accounts for internal costs of recovery

Statistical model for Large Corporates: Identifying the relevant ratios to estimate default risk

We first identify broad categories of ratios relevant to default.

We evaluate as many ratios per risk factor as possible



- Within each category, we then choose a limited number of ratios which have:
  - High predictive power
  - Data availability
  - Intuitive behavior

Adjusting a statistical model with qualitative factors – Example of a Bank PD model

OPERATING ENVIRONMENT	• Regulatory Environment • Financial Market Development • Banking System Outlook
COMPANY PROFILE	• Business and geographical Diversification • Credit Concentration • Competitive Position • Subjectivity to Market Risk
COMPANY BEHAVIOUR	• Management structure & governance • Risk, Liquidity Management and Appetite • Financial Reporting Transparency and Credit History

3

Summary and Q&A

Summary

- Data limitations restrict options for modelling low default portfolios
- The integration of a model into an institution day to day practice can unlock value
- Alternative approaches can be employed to overcome these challenges
- The use of external data in order to complement the internal data is key, especially for low default portfolios
- Challenger models enable institutions to constantly benchmark internal models and identify areas of possible improvement
- Leveraging a statistical model and adjusting it with a qualitative overlay can reconcile expert driven views with validation requirements

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