

Validating Models Effectively

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Agenda

1. Our Approach
2. Key Challenges: *Scorecards, Stress Testing, CECL, IFRS 9*
3. Model Governance

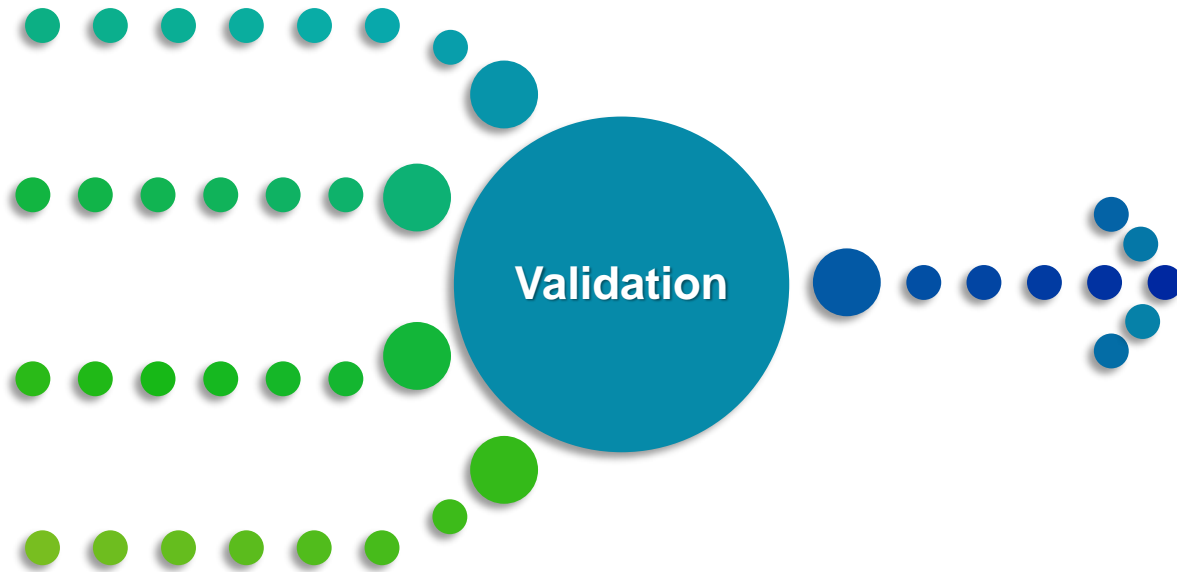
Validation Goes Beyond Ticking the Box

Validation is about evaluating whether the chosen model is capable of delivering sound results and whether it meets the needs for which it was designed.



Our Take on Validation

Why it is important



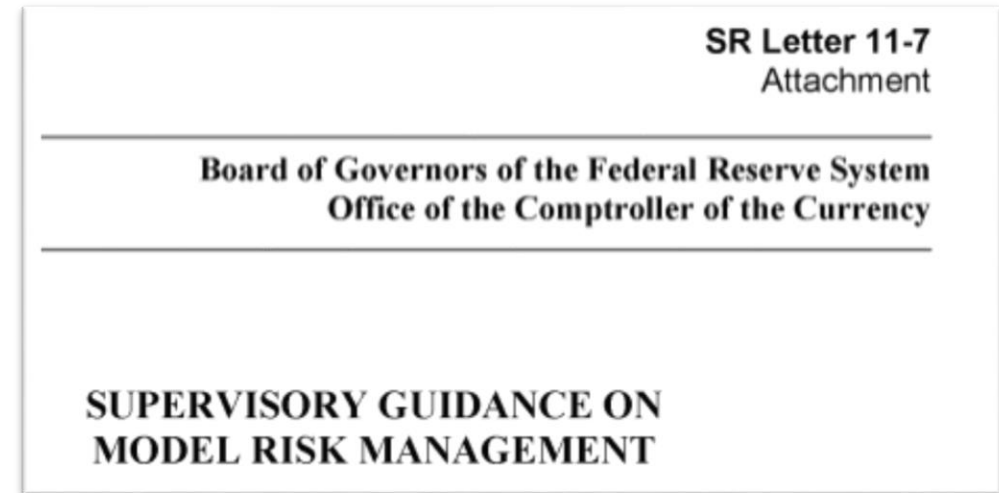
- » Reliable Second Line of Defense
- » External validation can review and challenge risk management without conflicts of interest
- » Constructive criticism
- » Unbiased advice
- » Guidance and direction
- » Top-notch expertise

Our Take on Validation

Regulatory Guidance

Moody's follows Federal Reserve/ OCC supervisory letter SR11-7, along with EBA and PRA guidance on validation.

- » Model risk management, benchmarking, monitoring



Three Elements to Our Validation Process



Qualitative

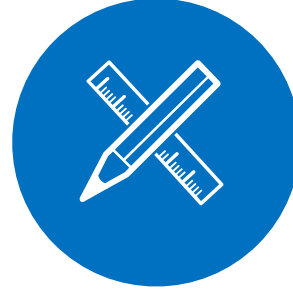
Documentation

Methodology

Data use, description and treatment

Regulatory compliance

Model governance



Quantitative

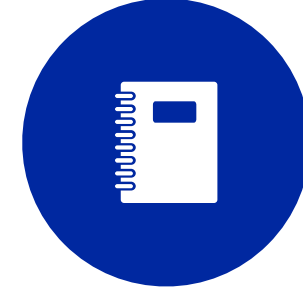
Data analysis

Variable selection assessment

Model replication

Model performance
(out-of sample, out-of-time, etc.)
Development of benchmark models

- ✓ Challenge various shortcomings identified in proposed model
- ✓ Check robustness of the model to changes in modeling assumptions



Final Assessment

Written report and presentation

Model evaluation

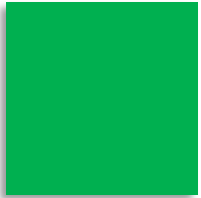
ACTION RATINGS:

- ✓ Satisfactory
- ✓ Satisfactory with Recommendations
- ⚠ Needs Improvement
- ✗ Unfit for Use

Observations, findings (critical & non-critical), recommendations and or remedial actions

Model Evaluation

Action Ratings



Satisfactory

The model has no critical findings and is suitable for deployment.



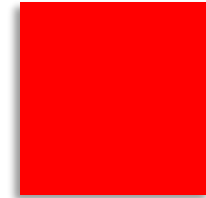
Satisfactory with recommendations

The model's performance is satisfactory and is suitable for deployment. Nevertheless, the validators have identified areas where the model could undergo improvements that may improve its overall performance.



Needs improvement

The validators have identified multiple critical findings that have a negative impact on the model's performance. The current model provides at least a minimally adequate level of performance and can be used in its present form.










Unfit for Use

There are important flaws in the model's underlying data, conceptual framework, or development process. Either i) the model cannot perform its intended function and should not be used in any decision-making capacity or ii) there is not enough evidence to show that the model can perform its intended function and it should not be used in any decision-making capacity until such evidence becomes available.

Final Assessment: Model Ratings by Category

Issues Identified and Recommended Actions

Overall Rating 

Risk Category	Rating	Comments
Documentation		The documentation should include a comprehensive list of all the variables considered.
Data		...
Variable Selection		...
Segmentation		...
Model Performance		...
Model Replication		...
Monitoring and Performance Tracking		...

We Validate Models to Meet Diverse Objectives

Model Types

Predictive scorecard models

- ✓ Traditional logistic
- ✓ Machine learning

Econometric forecast models for ECL

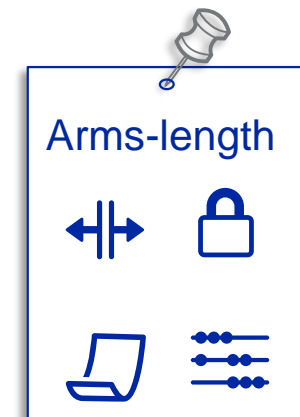
- ✓ Survival, competing risk
- ✓ Transition matrix model



Partnership Approach

- » Type of client: bank vs. start-up
- » Why are clients seeking validation: regulated vs. not
- » Appropriate level of validation given profile and needs
- » Level of experience the client has with validation

Either way, we preserve and protect our autonomy and independence



Example 1



FinTech

Purpose: Underwriting

Model type: Machine Learning Ensemble

Platform: MS Azure



Qualitative

Documentation

Data quality analysis

Model design & statistical
techniques

Stability & robustness

Governance



Quantitative

Data collection & cleansing

Classing

Feature (variable) selection criteria

Model replication

Model performance

Challenger models



Final Assessment

Written report and presentation

Model evaluation

Observations, findings (critical
& non-critical),
recommendations and or
remedial actions

Example 2: Impairment Model Validation



Mid-size European Bank

Purpose: IFRS9

Model type: Vintage-level PD model



Qualitative

Documentation

Data quality

Model design & statistical techniques

Stability & robustness

Governance

BAU use & integration into
origination, pricing, stress testing &
portfolio management



Quantitative

Macroeconomic scenarios

(forecast paths + probabilities)

PiT, 12m & lifetime PD

PiT, 12m & lifetime LGD

(unsecure + collateral modelling)

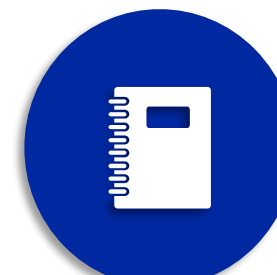
PiT, 12m & lifetime EAD

(cash flow generation + behavioural modelling)

Stage allocation criteria

Lifetime ECL

(combining PD/LGD/EAD + discounting +
comparison with actual losses)



Final Assessment

Written report and presentation

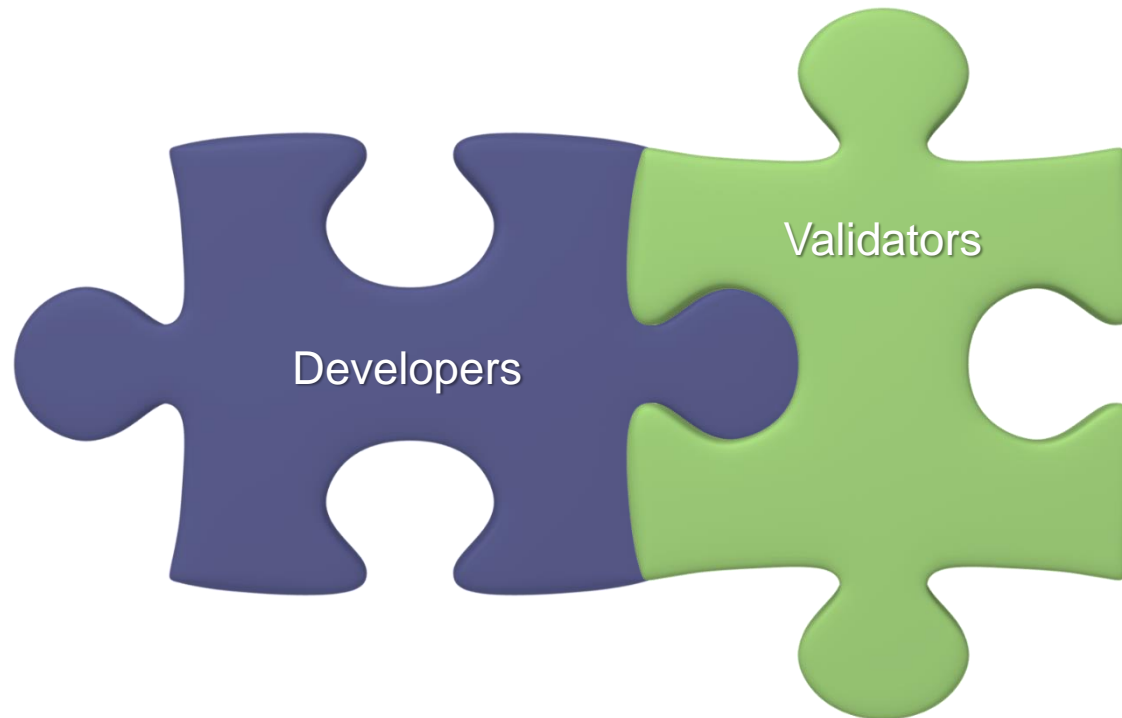
Model evaluation (rating)

Observations, findings and
recommendations and or remedial
actions

Roles and Responsibilities

Our recommendations

- » Develop multiple models
- » Write effective, relevant documentation
- » Archive data, scripts, etc., for future reference
- » Respond to validators promptly



- » Provide an independent opinion of model
- » Benchmark, then benchmark some more
- » Write an effective, useful validation report
- » Avoid the “checking the box” trap



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Key Challenges

Key Challenges: Scorecards



Target Variable Definition & Classification

‘**Bad**’ definition based on the objective of the scorecard.
Classification based on **performance window**



Variable / Feature Selection

Relevant **credit and loan characteristics** should be included to be selected as predictors.

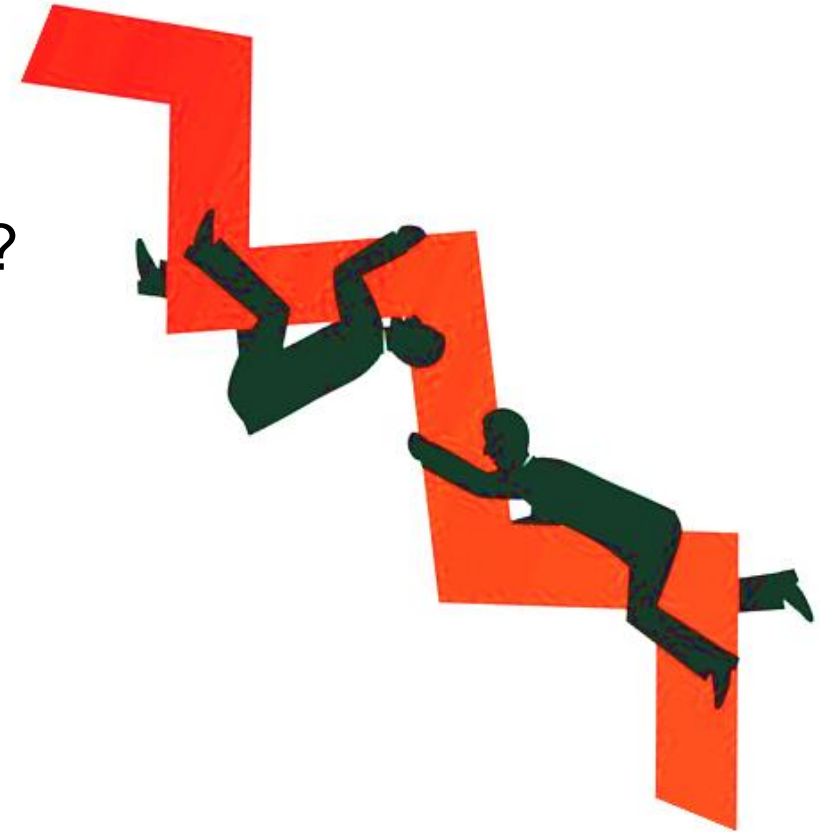


External Validity

Is the snapshot representative of future traffic?

Key Challenges: Stress Testing

- » Internal data availability vs. economic cycle
- » How does the bank's experience compare to its peers?
- » Will the next severely adverse shock generate a recession that looks like the previous financial crisis?



CECL Model Validation

Questions

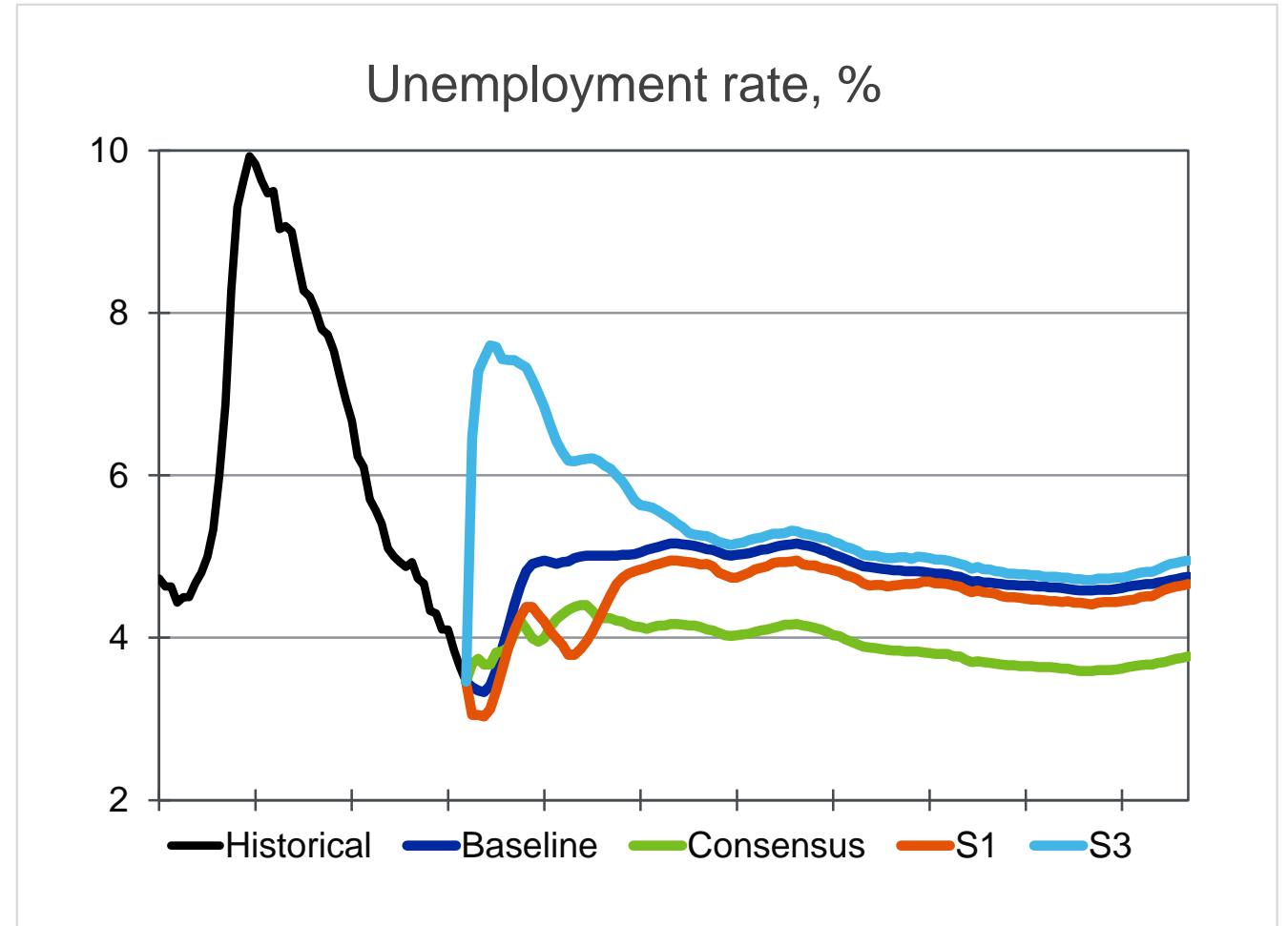
1. How am I incorporating forward-looking information?
2. How do I determine and defend reasonable and supportable horizon?
3. How do I determine the lifetime of the loan?
4. How are TDR's accounted for?



CECL Model Validation

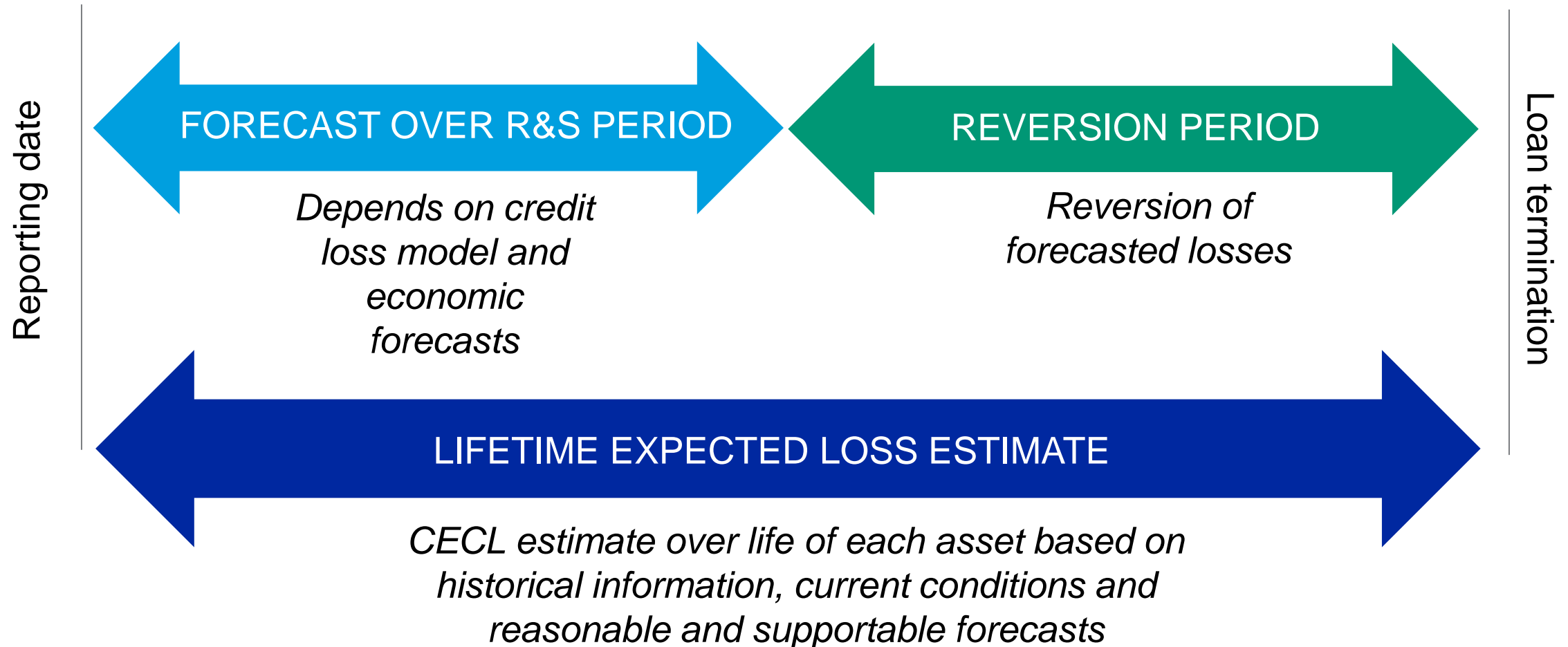
Forward Looking Information

- » CECL models need consider current and future economic conditions.
- » No need to use more than one scenario.
- » Must determine reasonable and supportable period.



CECL Model Validation

Reasonable and Supportable Period



CECL Model Validation

Determining Lifetime

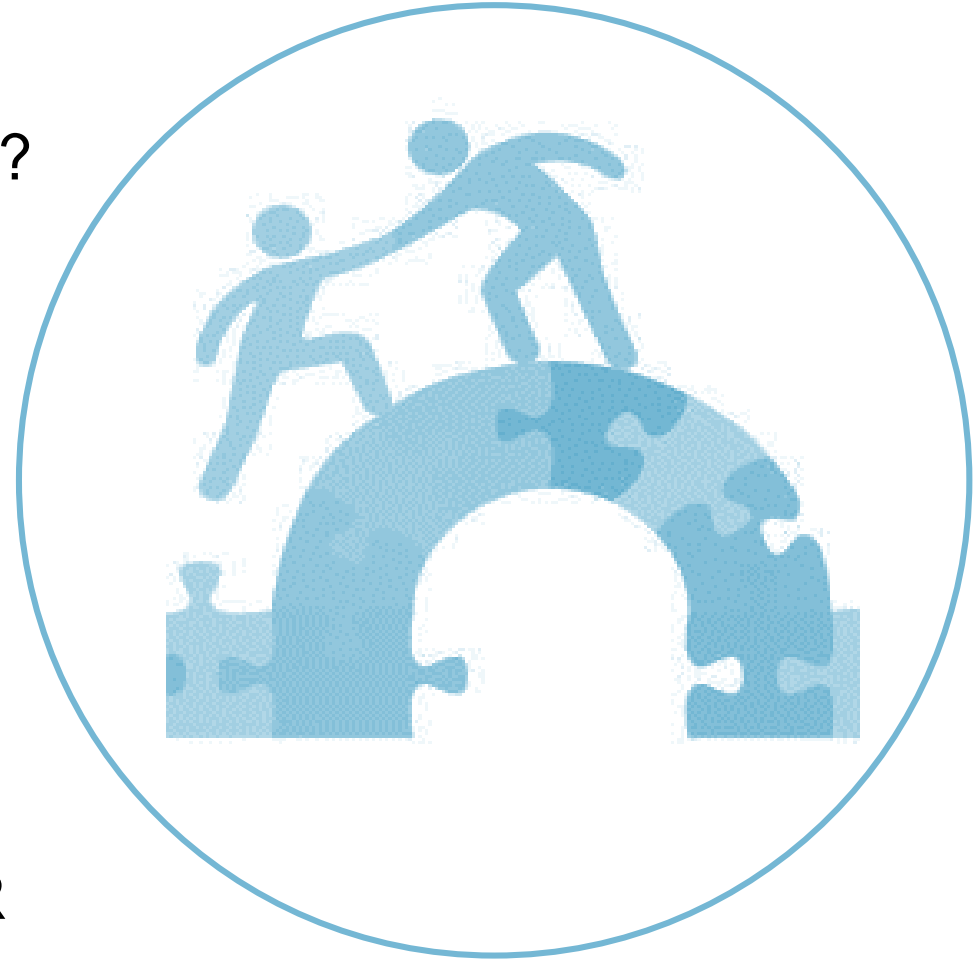
- » Many loans will use contractual end date
- » Methodology for revolving loans will be scrutinized
- » Appropriateness of lifetime assumption needs to be tested against actuals.



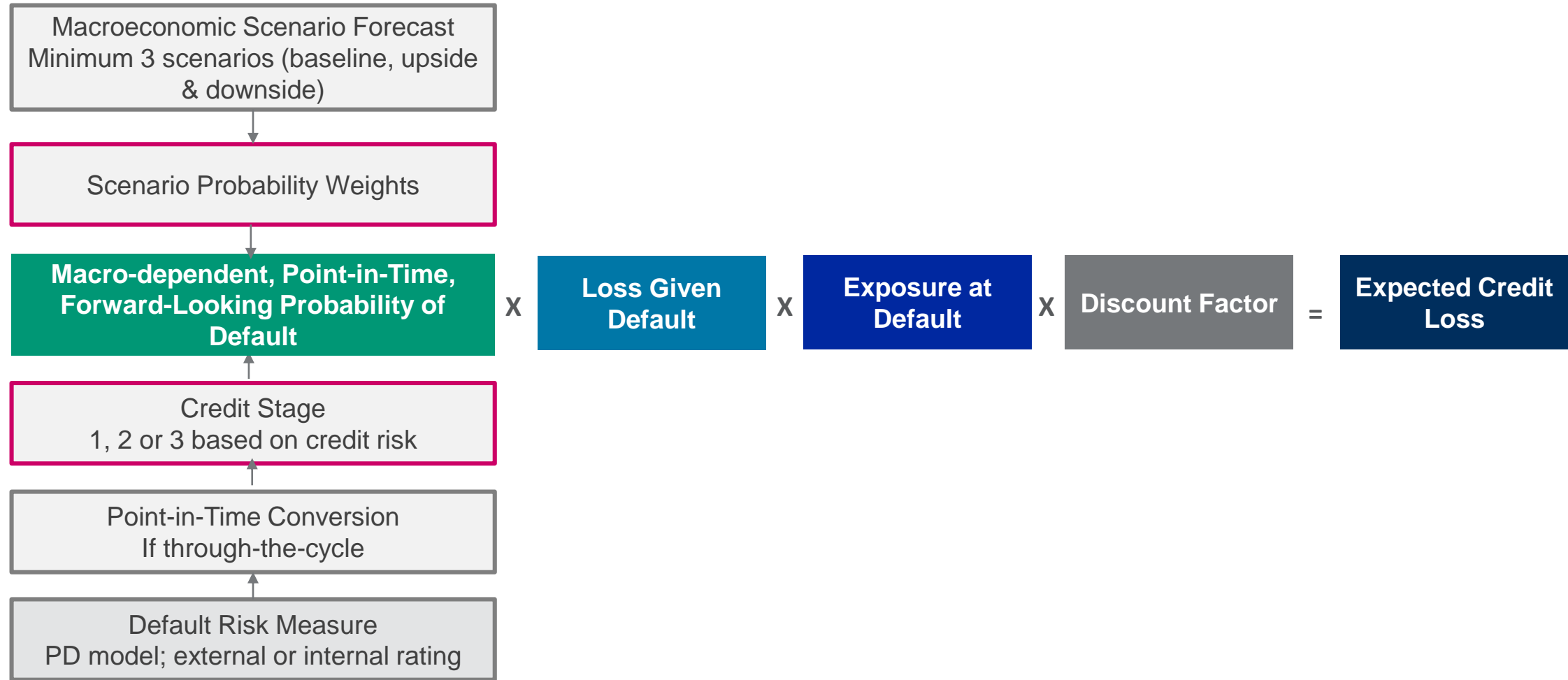
CECL Model Validation

Troubled Debt Restructurings (TDR)

- » How are reasonably expected TDRs determined?
 - General institution specific policy matters
- » Reasonably expected TDRs need to be accounted for using DCF method
- » Term extensions and interest rate concessions can complicate if built into model functionalities
- » Look at how the expected interest rate on a TDR is determined.



Key Challenges: IFRS 9





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Model Governance

Model Governance

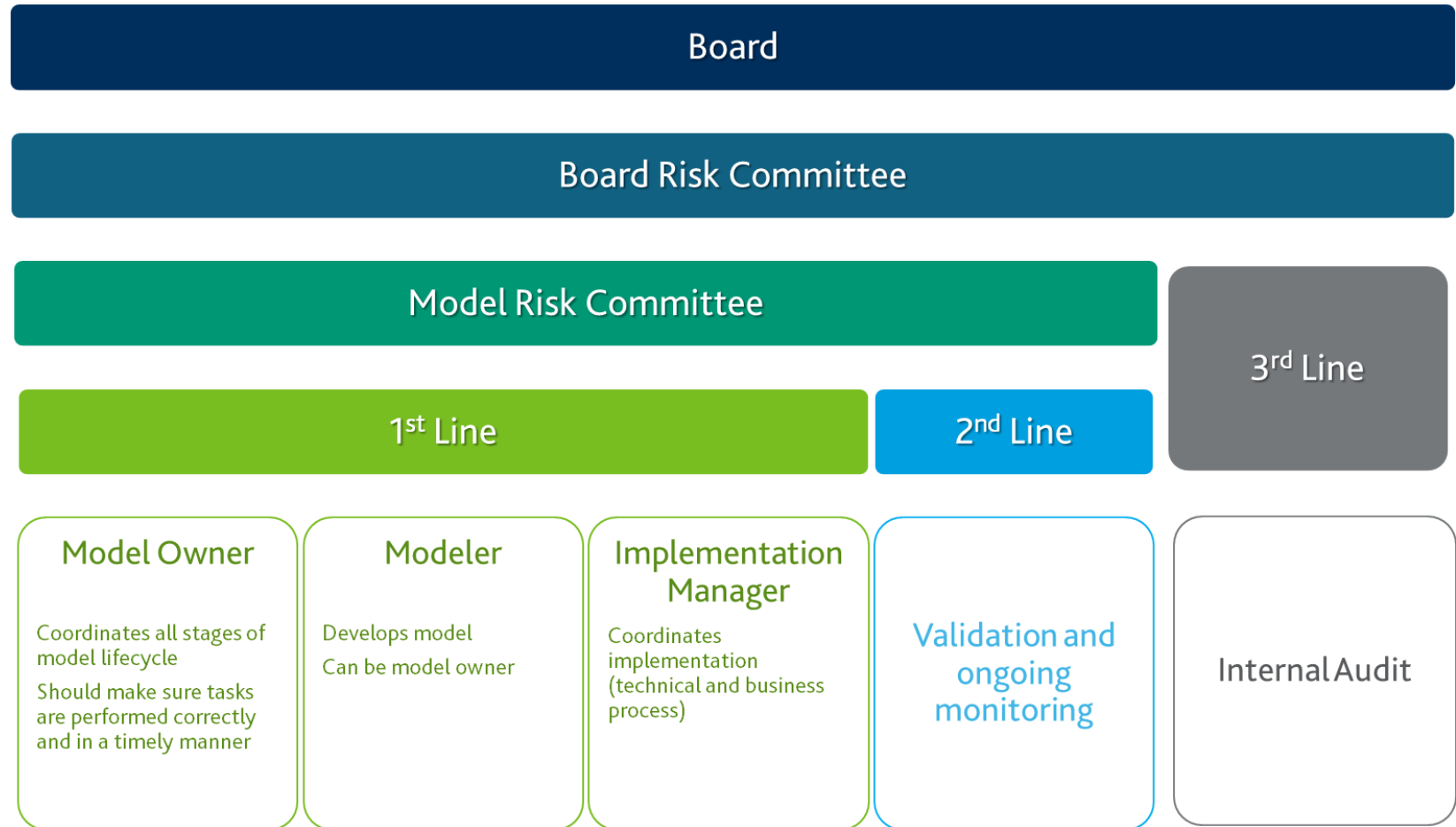
Robust model governance is of paramount importance for banks these days for several reasons,



Well-structured model governance framework is an important precondition for enabling banks develop models and manage associated risks in an efficient manner

Typical Model Governance Structuring

- » Complete ownership of model risk is assigned to **1st line of defense** – owner, modeler, implementation manager
- » **2nd and 3rd lines of defense** should be fully independent from the former to avoid conflict of interest
- » Different decision-making authorities are formed based on proportionality principle, e.g. model specific committees, bank risk committee and board of directors



About Us

Validation & Advisory Services

Custom services for all aspects of model risk management



Loan Lifecycle Management Models

Application, Pricing, Origination, Monitoring, Loss Mitigation, Disposition



Credit Portfolio Management Models

Risk Appetite, Concentration Risk, Counterparty, Operational, etc.



Regulatory Capital & Stress Testing Models

Basel, CCAR, PRA, EBA etc.



Business & Strategic Planning Models

Credit Policy, Marketing, etc.



Financial Reporting

IFRS 9 and CECL



Other Advisory Services

Gap Analysis, Best Practices and Model Governance

What Sets Us Apart

- » Economic, statistical and econometric expertise
- » Our team has more than 100 economists; over 40% hold PhD degrees
- » Leverage our stress scenarios and macroeconomic data to benchmark stress testing, IFRS 9 and CECL models



What Sets Us Apart



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Q&A

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