

# Assessing Model Risk with Effective Validation

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# Presenters



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# Agenda

1. Model Risk in Spotlight
2. Effective Model Validation
3. Application to IFRS 9 Model
4. Key Takeaways

1

## Model Risk in Spotlight

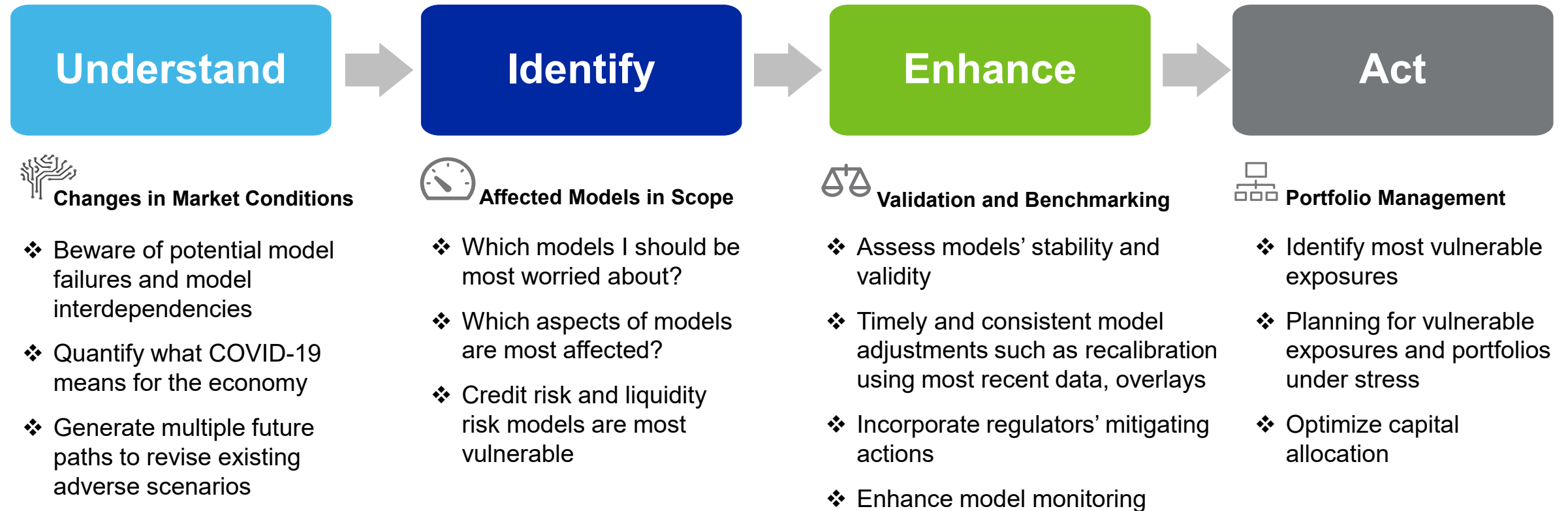
# Institutions Rely on Models to Guide Decisions

Manage risk, identify opportunities and comply with regulation



# COVID-19 Calls for Model Revision

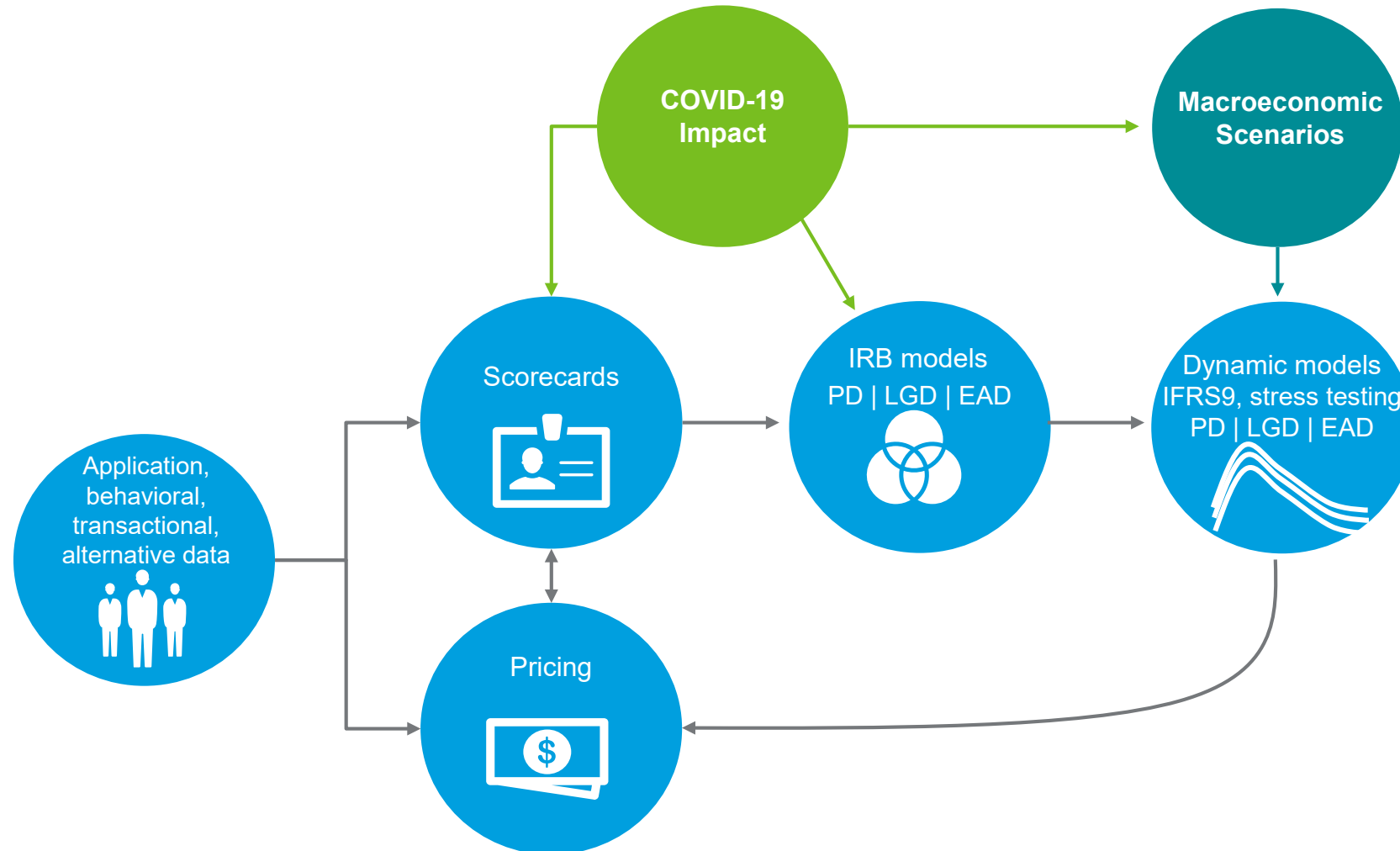
Mitigating model risk is a basis for effective crisis management



**Proactive Overhaul of Model Risk Management**

# Credit Risk Models Are Among Most Vulnerable

Need to improve model resilience during pandemic and beyond

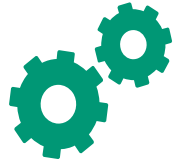




2

## Effective Model Validation

# Robust Model Governance as a Precondition for Effective Model Risk Management



More  
Models



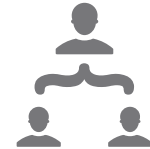
Greater Model  
Complexity



Significant  
Financial Impact



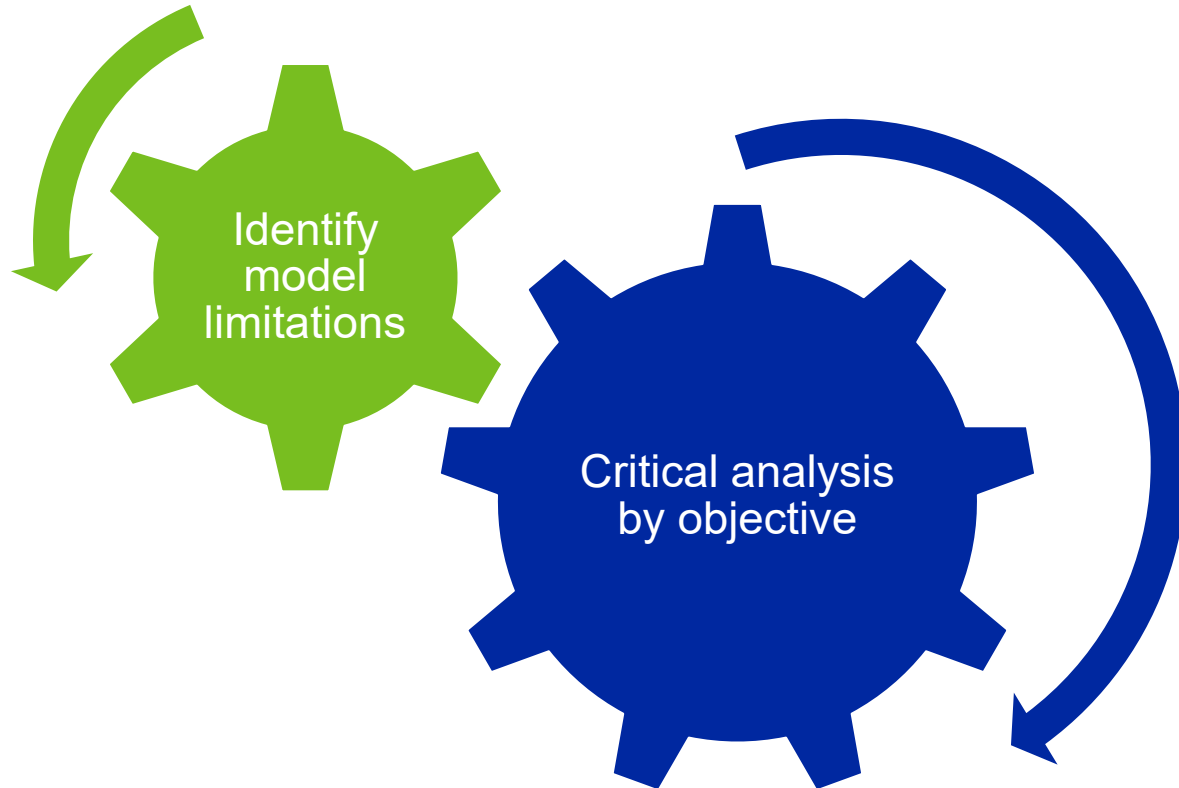
Increased Data  
Availability



Amplified  
Supervision

# Effective Model Validation

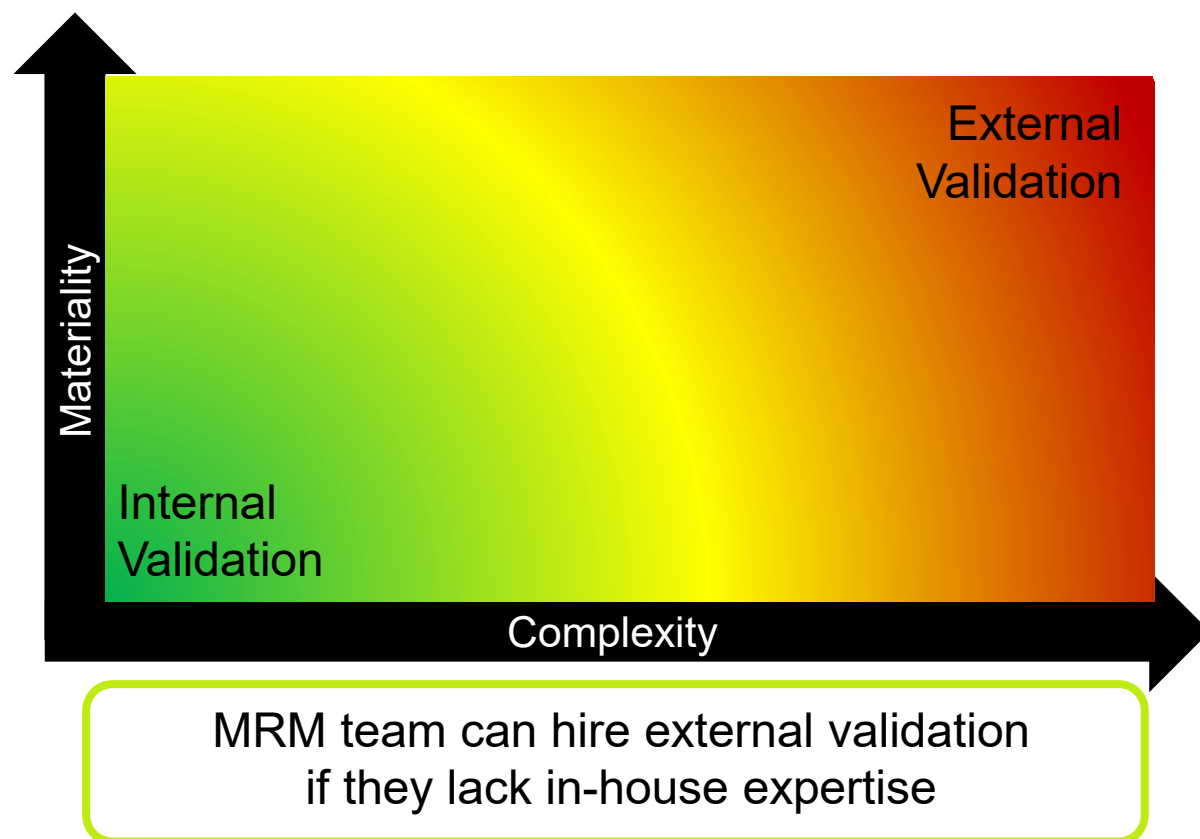
Managing Model Risk Involves Effective Challenge of Models



Effectiveness depends on a combination of incentives, competence, and influence

# Depth of Validation

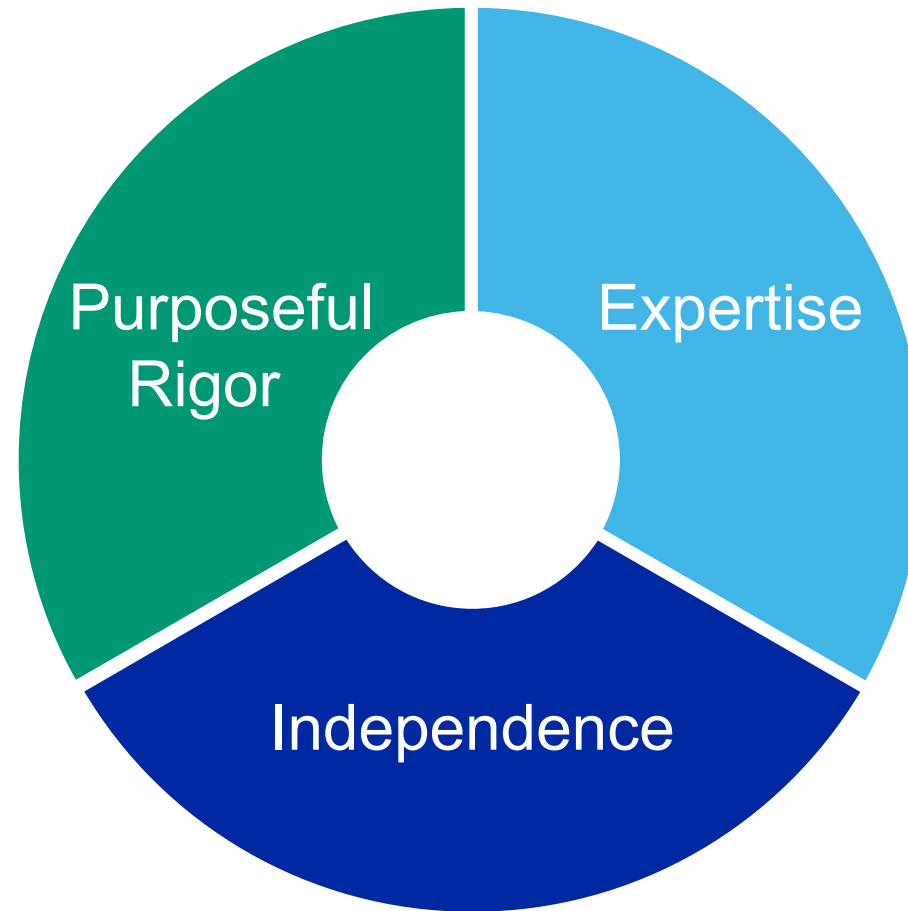
Intensity should be proportional to the materiality of the portfolio



In all cases,

- » MRM team should establish model performance thresholds for periodic monitoring.
- » MRM team should run periodic performance tests and perform formal annual validation.

# 3 Pillars for Effective Model Validation



# Expertise & Purposeful Rigor

## Loan Lifecycle Management Models

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

## Other Advisory Services

Gap Analysis, Best Practices and Model Governance

## Business & Strategic Planning Models

Credit Policy, Marketing, etc.



## Regulatory Capital & Stress Testing Models

Basel, CCAR, PRA, EBA etc.

## Financial Reporting

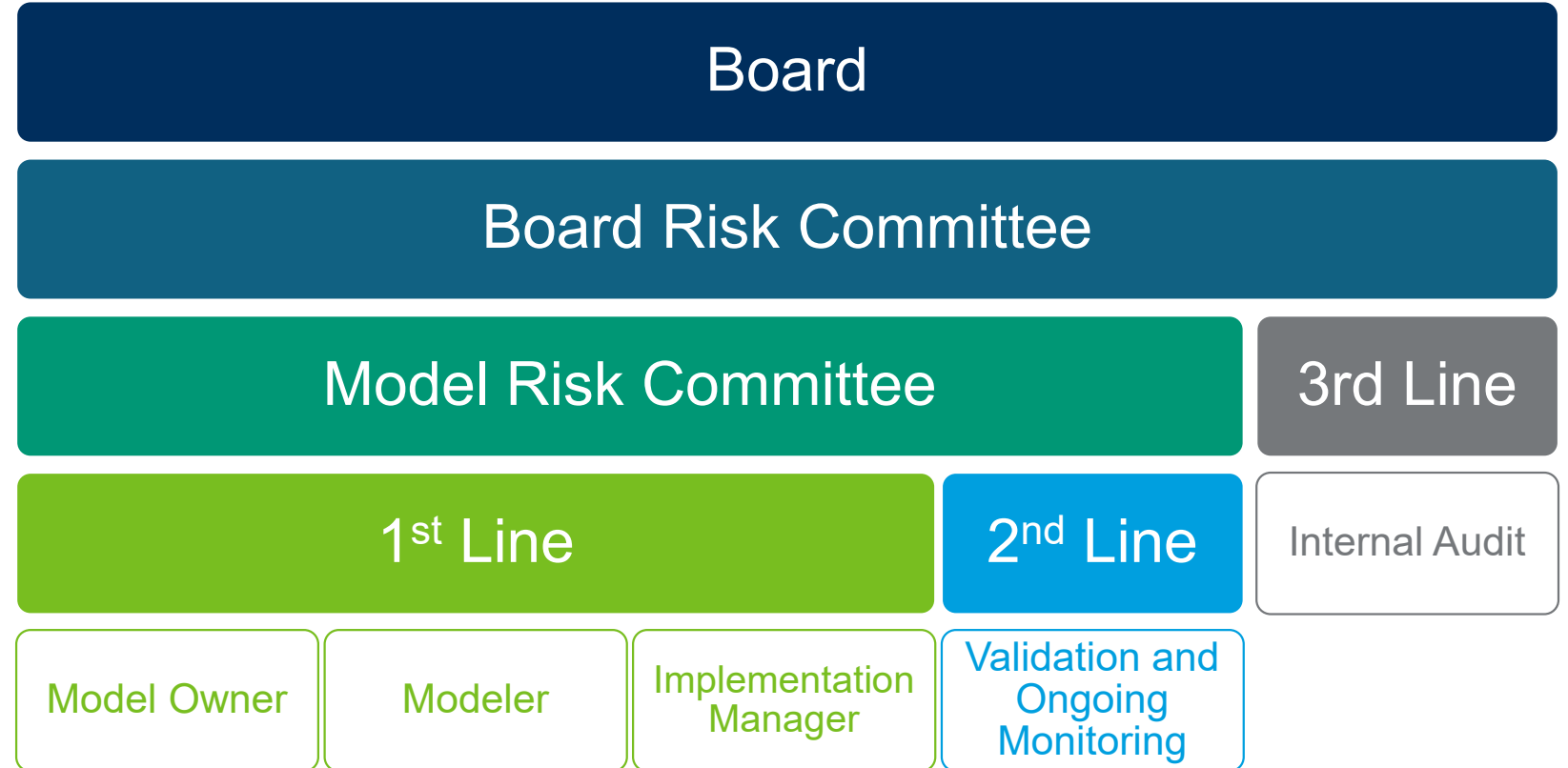
IFRS 9 and CECL

## Credit Portfolio Management Models

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

# Independence

- » Model developers and owners should coordinate all stages of model lifecycle, including implementation.
- » Validators should provide effective challenge to existing models, based on purpose and materiality.
- » To avoid conflicts of interest, validation should be performed by a team independent from model development.

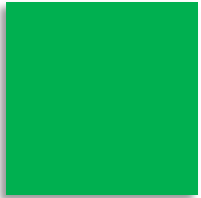


# Our Validation Process





# Model Evaluation – Action Ratings



## **Satisfactory**

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



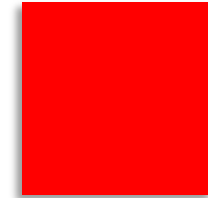
## **Satisfactory with Recommendations**

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.



## **Unsatisfactory**

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 – Generic Example

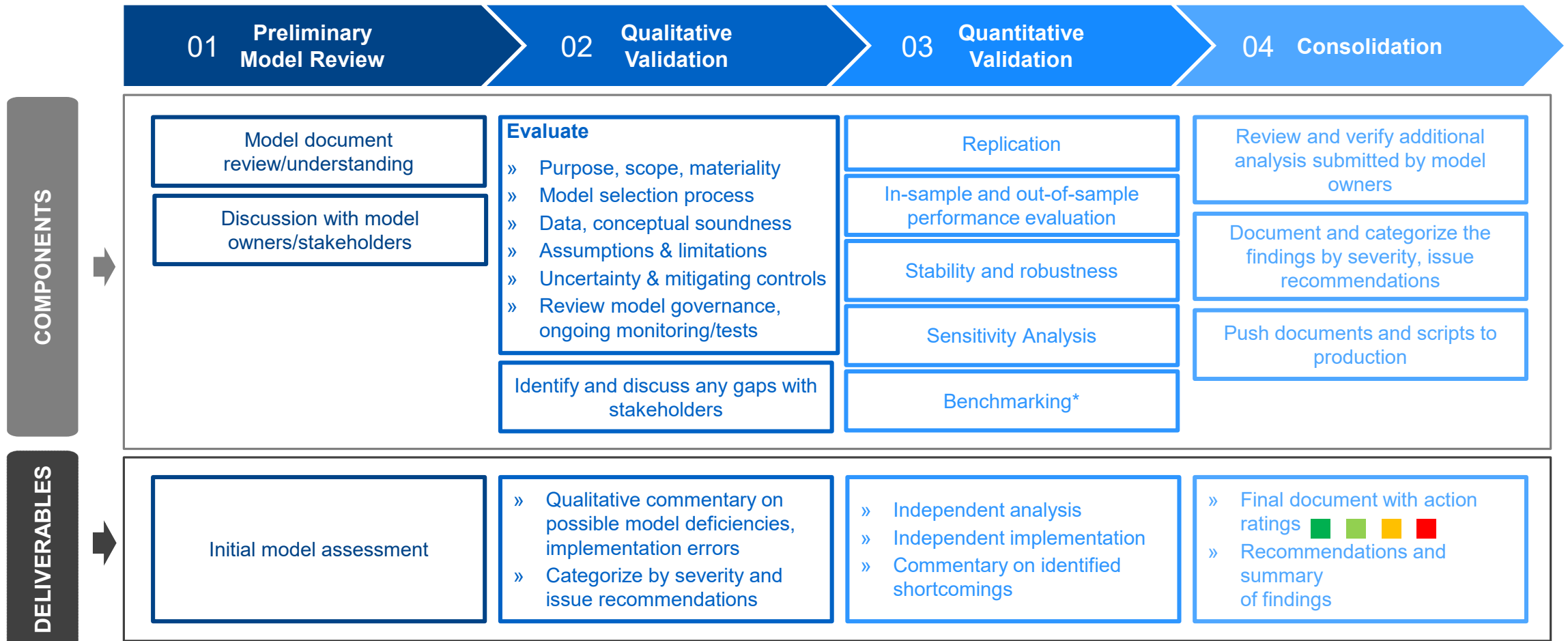
Overall Rating



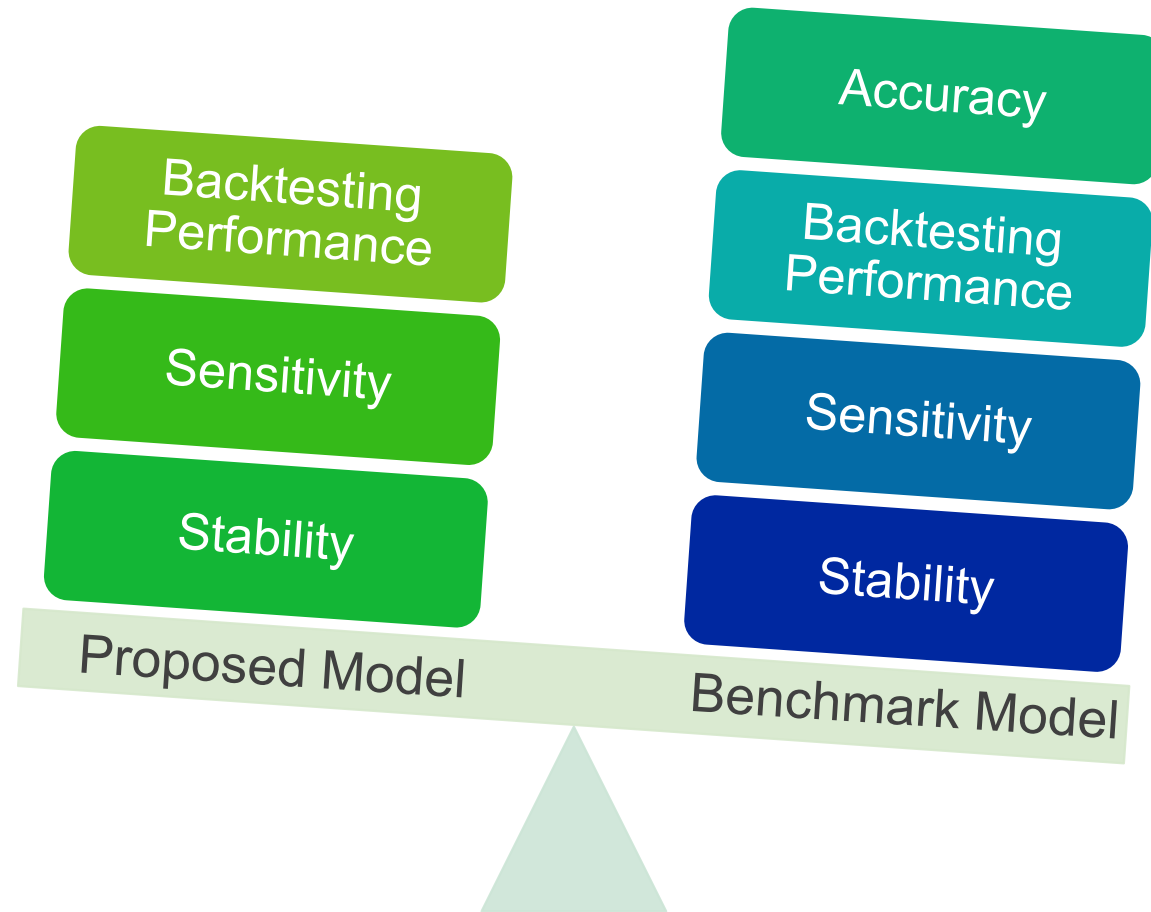
Risk Category	Rating	Comments
Documentation		The documentation needs to include XYZ.
Data Cleaning and Treatments		...
Variable Selection Process		...
Model Selection		...
Model Performance		...
Sensitivity Analysis		
Model Replication		...
Monitoring and Performance Tracking		...

The report will explicitly describe that the above risk categories do not hold equal weighting. The categories shown may not reflect actual categories used.

# Our Validation Process



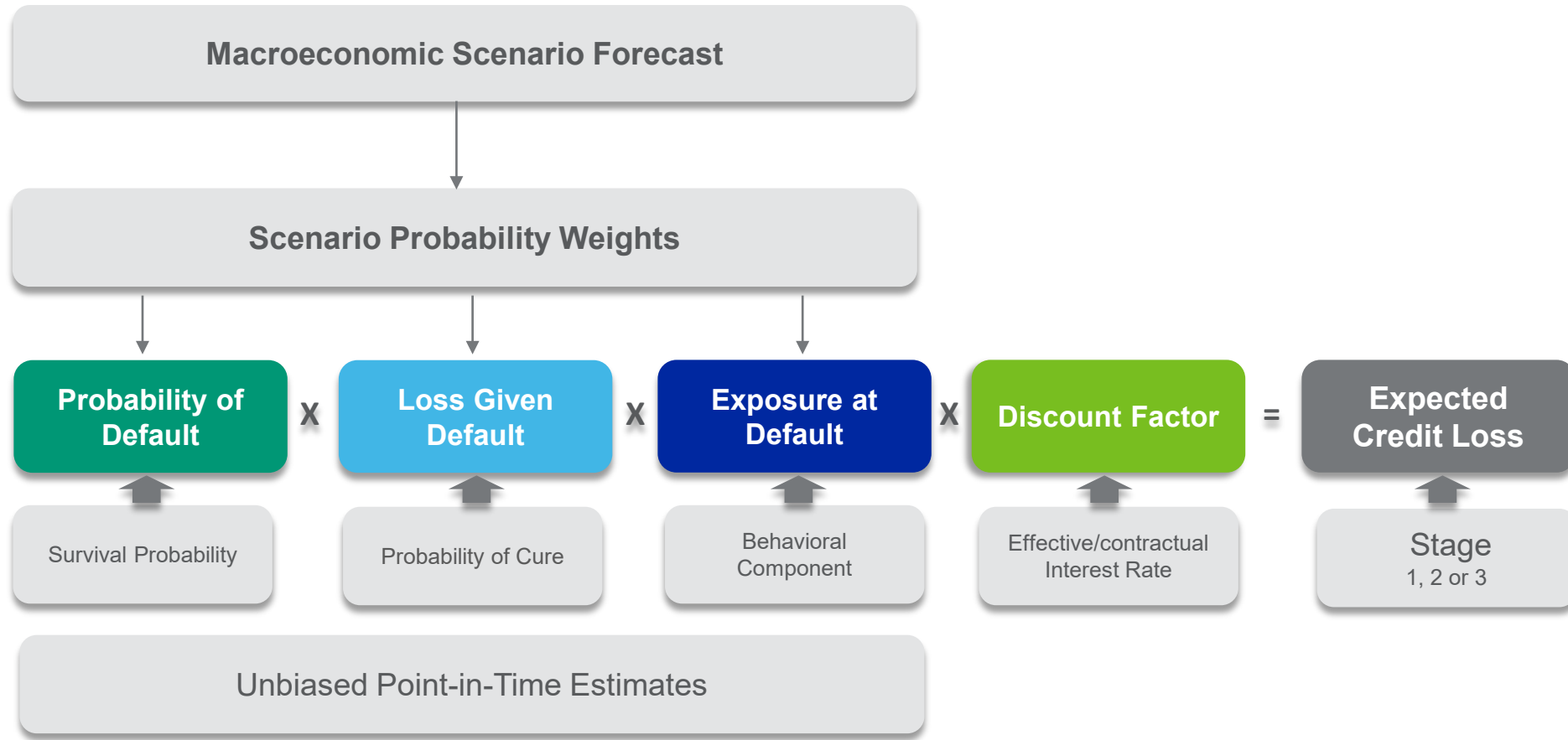
# We Measure Model Risk by Benchmarking



# 3

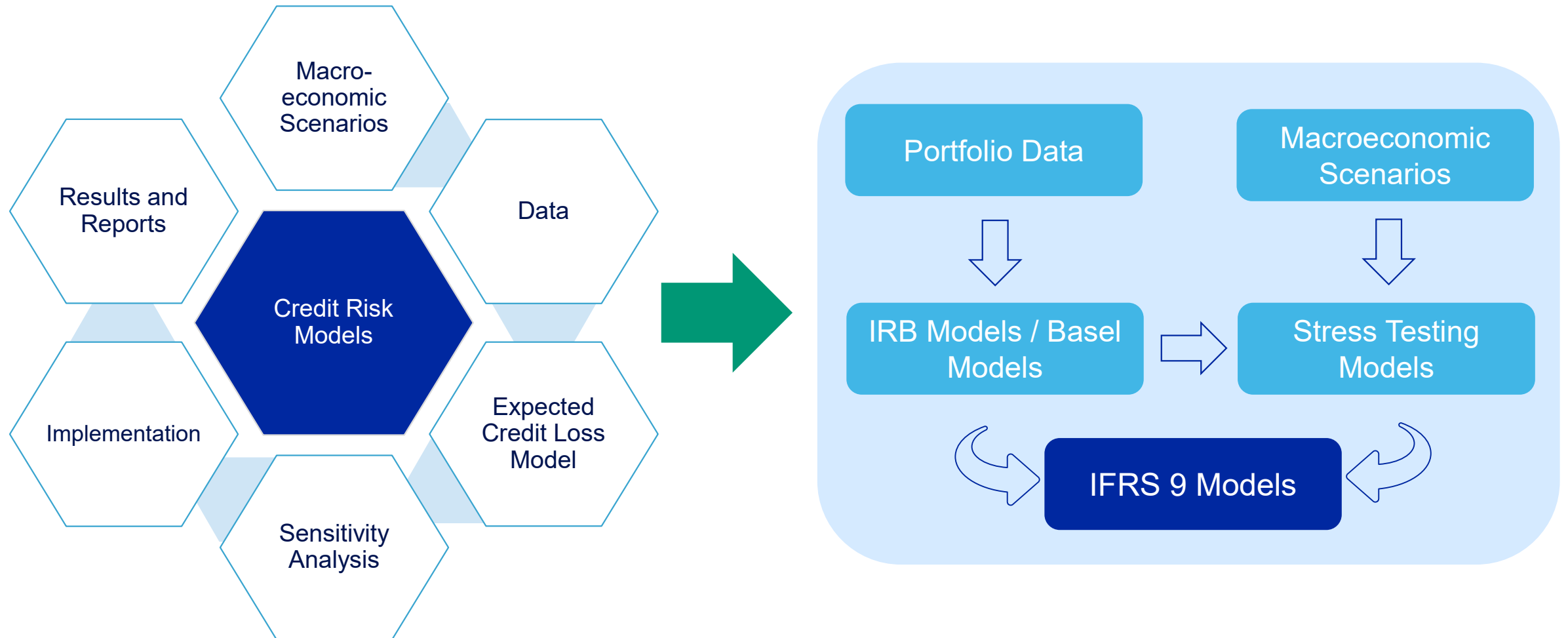
## Application to IFRS 9 Models

# Impairment Model

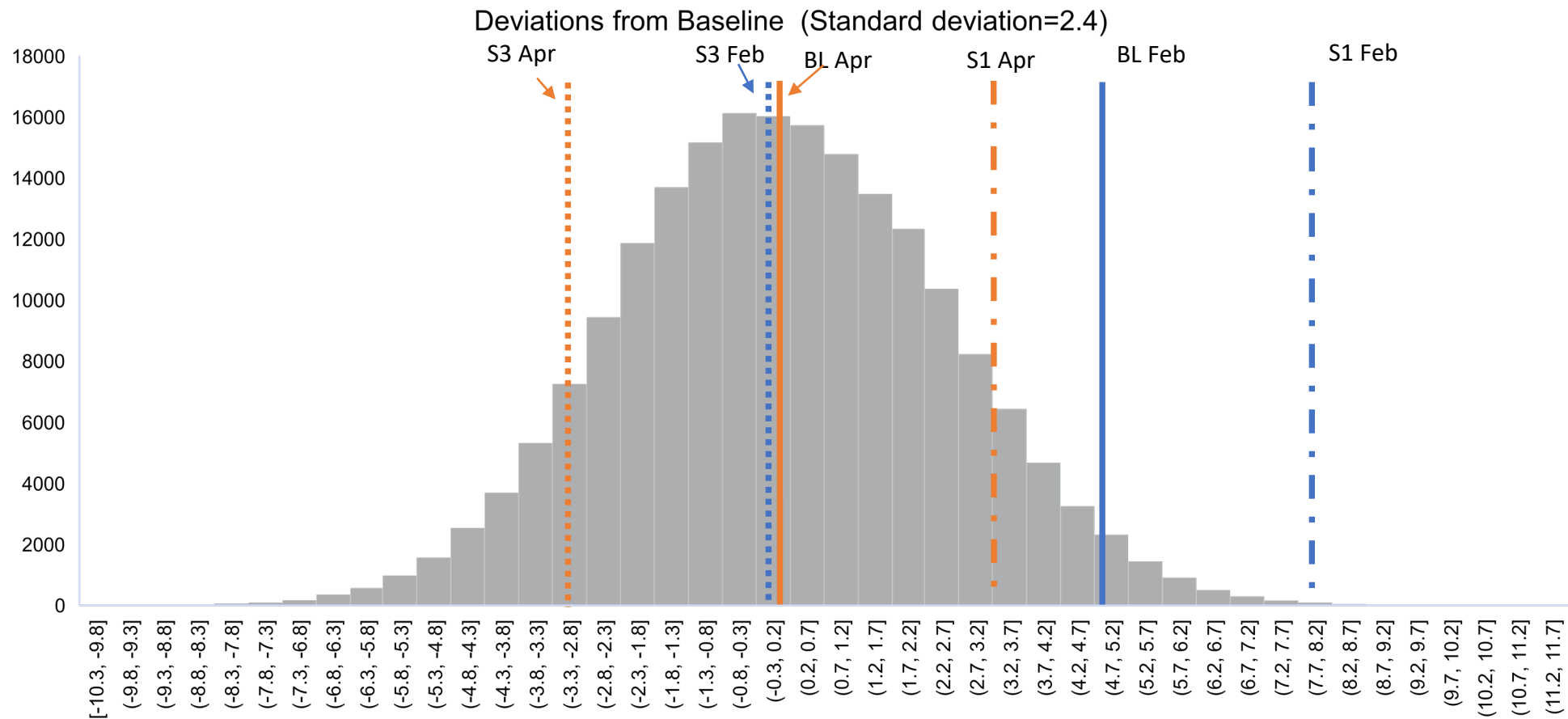


# Credit Risk Models

## An Integrated Process



# Scenario Severity Shift



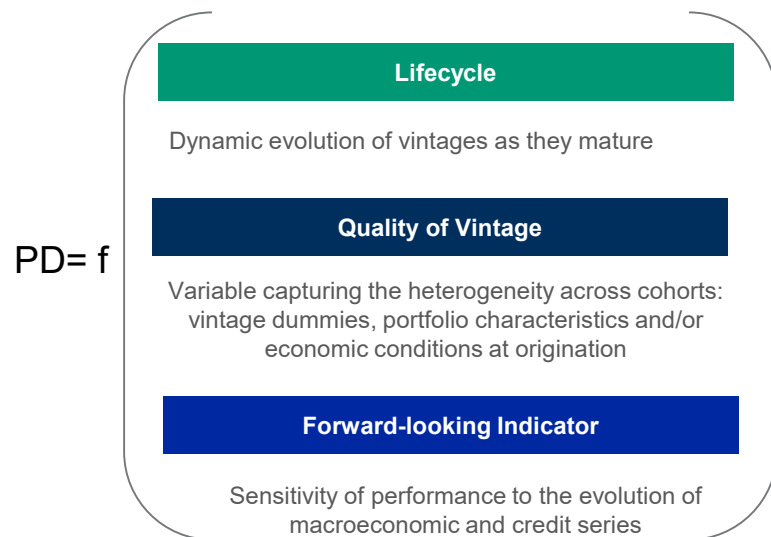
Source: Moody's Analytics



# PD Modelling Approaches

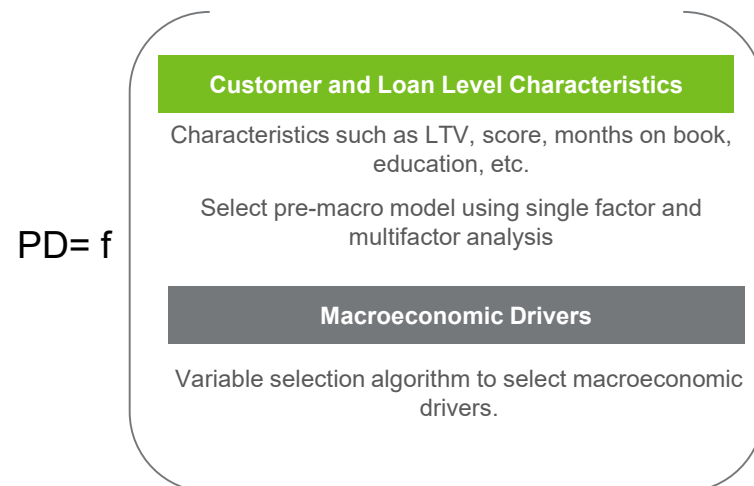
## Segment level

Modelling approach with three key factors influencing vintage segment performance:



## Account level

PD is forecasted using customer and loan characteristics, and macroeconomic indicators using panel data econometric techniques



## Transition Matrix Approach

### 1. Segmentation

- » Switch to bucketing based on DPD & LTV
- » No further segmentation

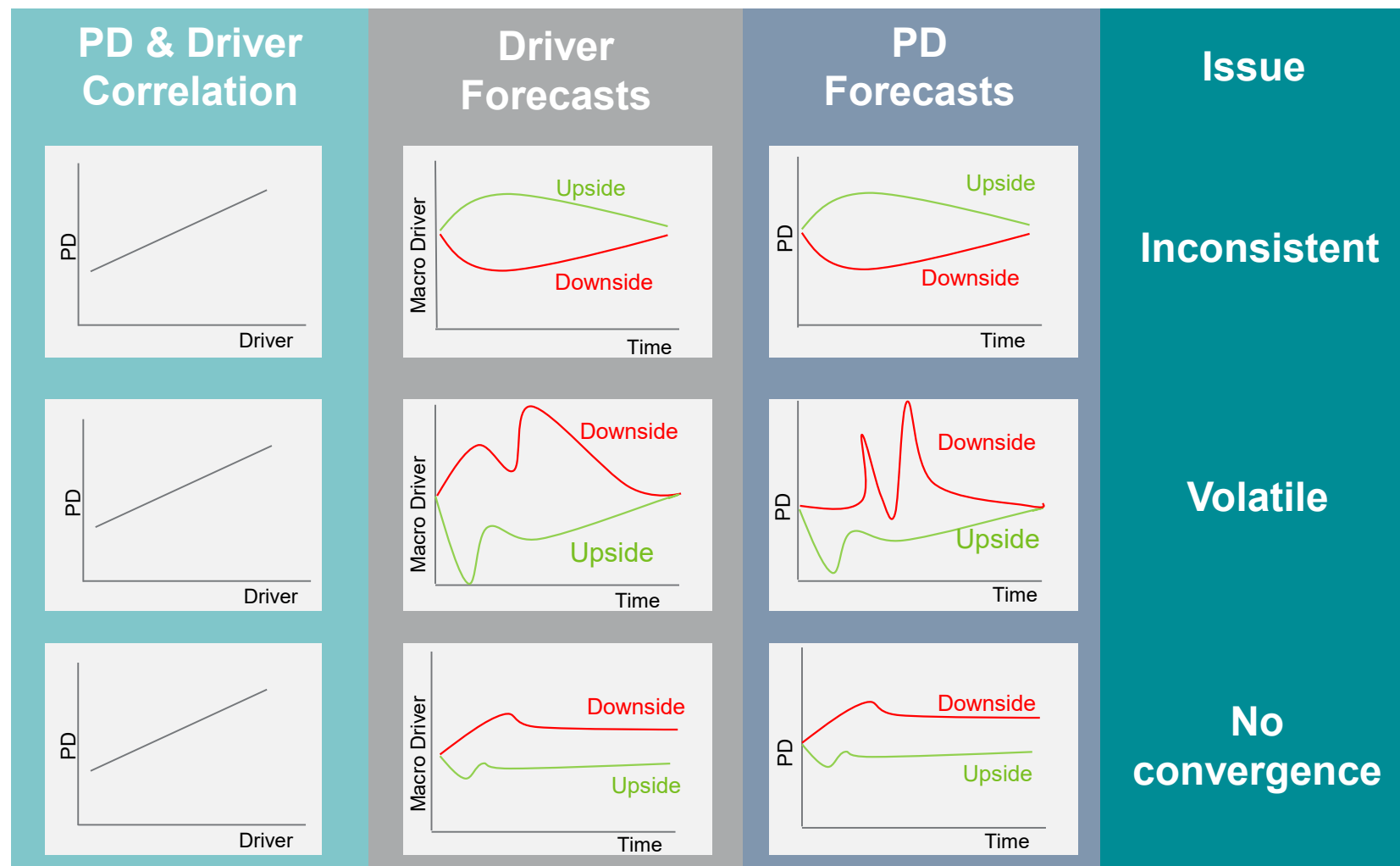
### 2. Data Inputs

- » Internal portfolio
- » Macro data

### 3. TTC Matrix Creation

- » Initial estimation
- » Smoothing
- » Scaling

# Looking at Forecast Properties



- » Policy variables, e.g. CPI
- » Changes in past correlations
- » Non-cyclical sectors
- » Growth rates:
  - Low range level variables, e.g. RMM
  - QoQ growth rate
- » Long-term forecast property of transformation

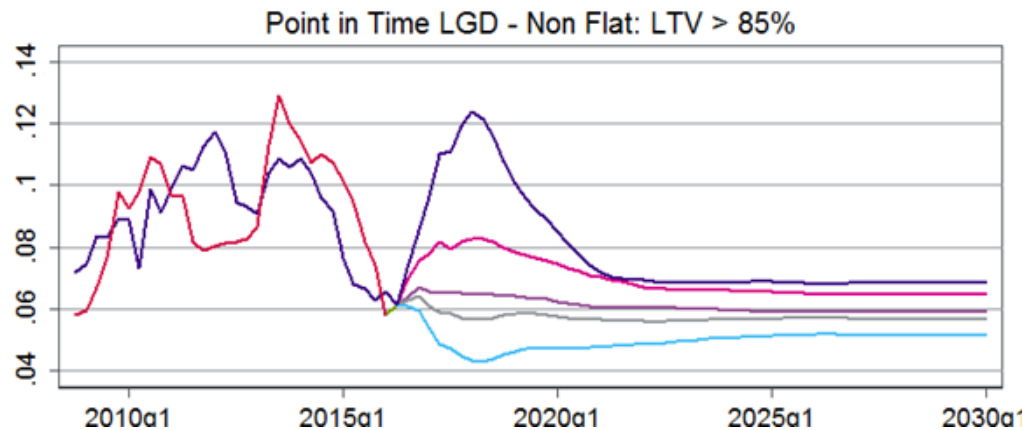
# LGD Design Approaches

## Balance and Recoveries

For a facility  $i$ , time  $t$  and workout period  $w$ :

$$LGD_i = 1 - \frac{balance_{i,t} - balance_{i,t+w}}{balance_{i,t}}$$

## Default Vintages & Macro Drivers



## By Assumption

LGD of 50-60% for PF, 30-40% for RE and 65-75% for CC; fully insured products usually get LGD of 5-10%.

Estimates of recovery costs range from 1-2%.

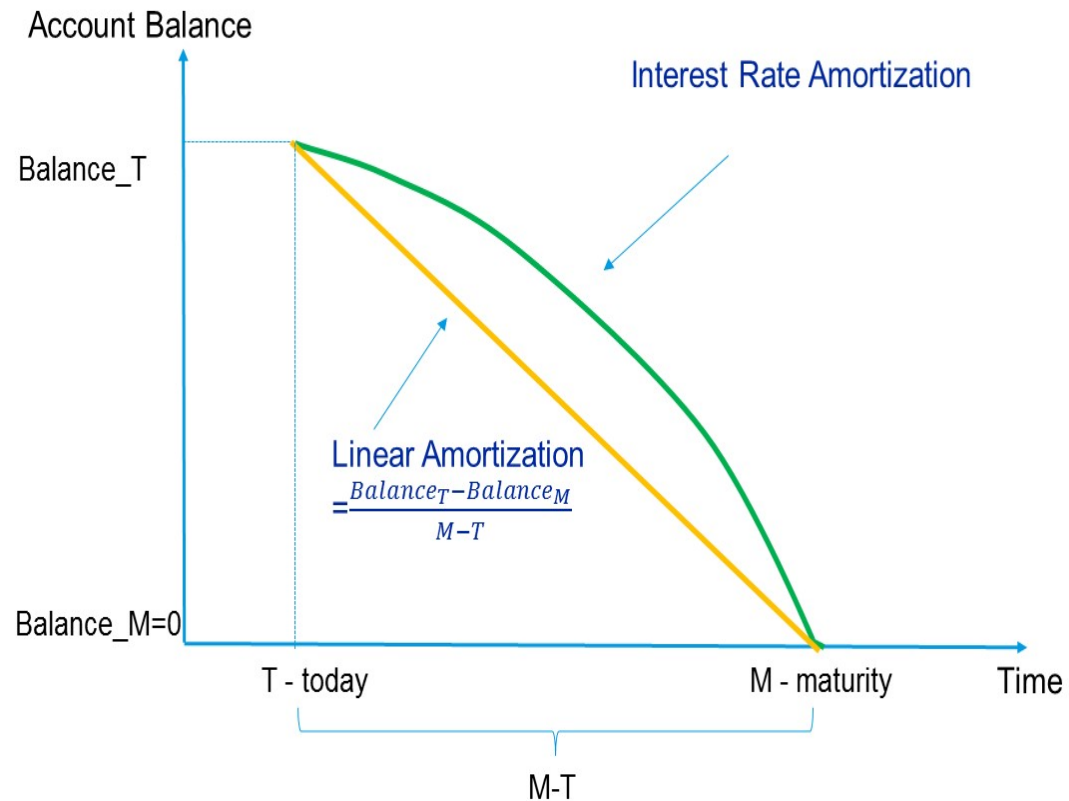
## Roll Rate Modelling

$$RR_{it} = 1 - LGD_{it}$$

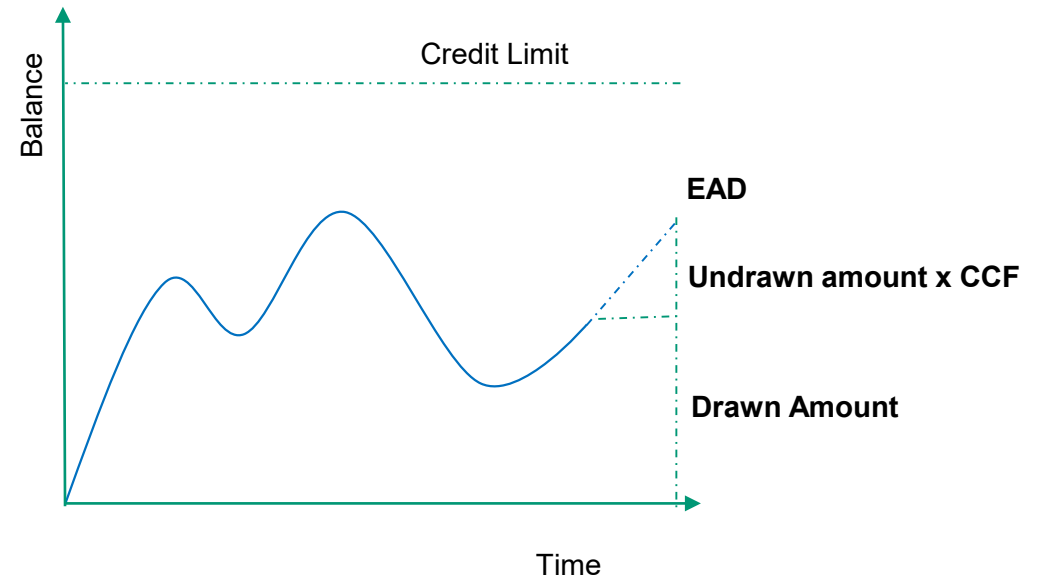
		0	1	2	3	4	5	6	7	8	9	10	11	12
Performing	Cycle 0													
	Cycle 1													
	Cycle 2	0.00%	4.73%	5.95%	6.70%	7.23%	7.53%	7.59%	7.61%	7.63%	7.57%	7.63%	7.68%	7.79%
	Cycle 3													
Non - Performing	Cycle 4													
	Cycle 5													
	Cycle 6	100.00%	95.27%	94.05%	93.30%	92.77%	92.47%	92.41%	92.39%	92.37%	92.43%	92.37%	92.32%	92.21%
	Cycle 7													
	Denounced													

# EAD Design Approaches

## Fixed Term Products - Amortization



## Revolving Products - CCF



$$EAD_{i,t+h} = BAL_{i,t+h} + CCF * UNDRAWN_{i,t}$$

# Evaluation of SICR

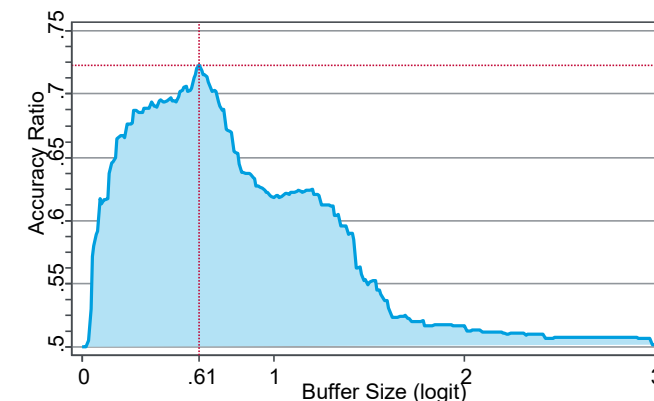
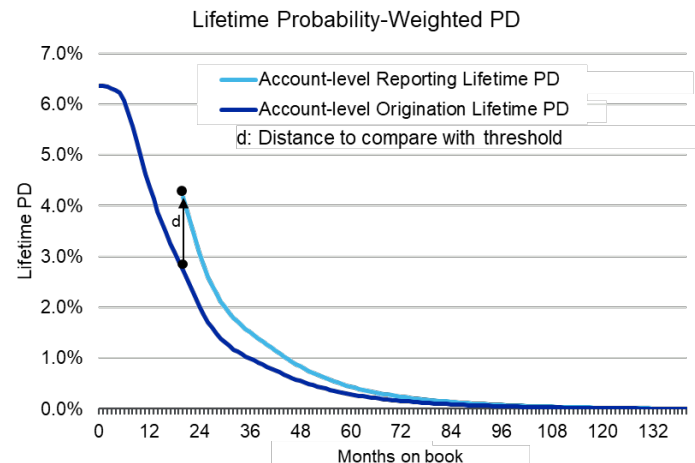
## Quantitative Approach

Characteristics of the metric:

- » Forward-looking (scenarios)
- » Capture risk of default
- » Lifetime information
- » Available at origination and at reporting date

What is the optimal  $d$  to identify SICR?

- » Buffer is the optimal value of  $d$  that maximizes an accuracy ratio from good:bad odds analysis
- » We examine differences (in logit) between
  - the lifetime PD at the reporting date  $\rightarrow$  Lifetime PD(T)
  - the lifetime PD at the same age as the reporting date forecasted at origination  $\rightarrow$  Lifetime PD<sub>0</sub>(T)
 for different historical reporting dates



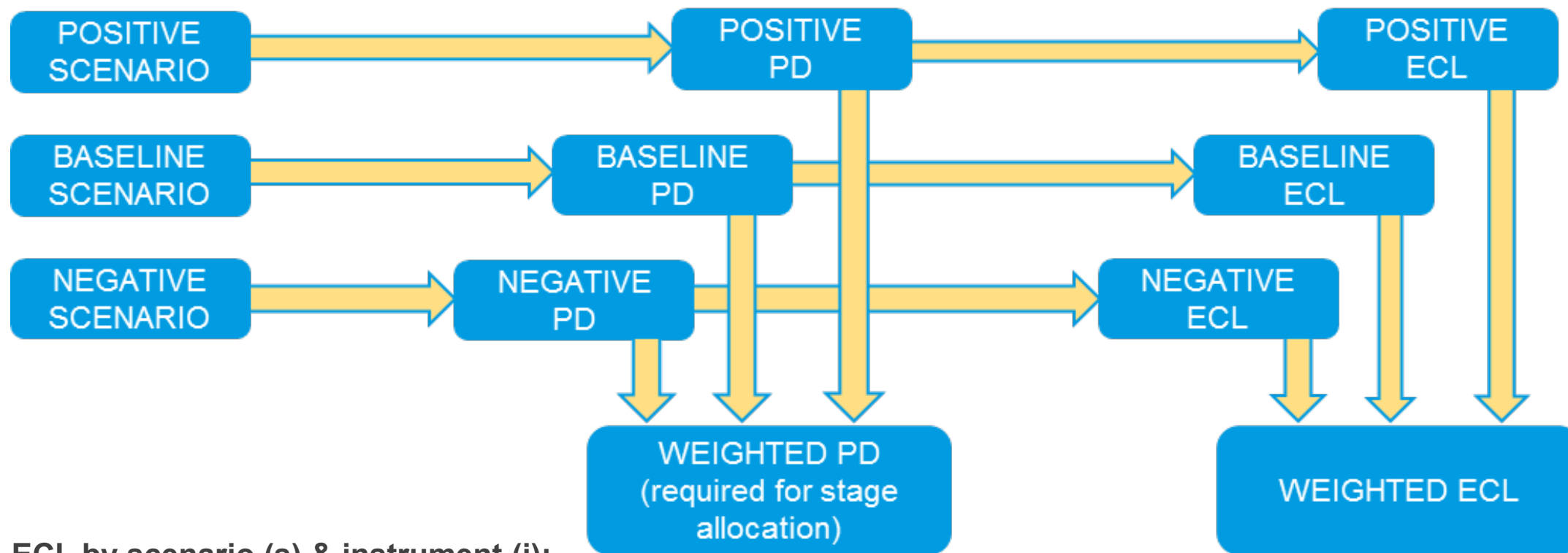
Status	Criteria	Stage
Non-Default	$\text{Lifetime PD}(T) \leq \text{Lifetime PD}_0(T) + \text{Buffer}$	1
Non-Default	$\text{Lifetime PD}(T) > \text{Lifetime PD}_0(T) + \text{Buffer}$	2
Default		3



## Qualitative Approach

- » DPD
- » Forbearance
- » Watch list
- » ...

# ECL Calculation



**ECL by scenario (s) & instrument (i):**

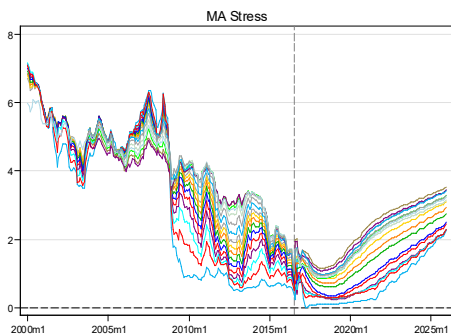
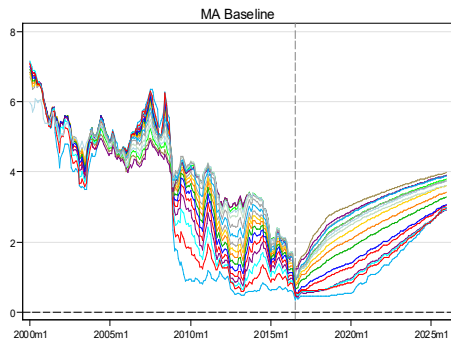
$$ECL(i|s) = \sum_t [PD(i, t|s) * LGD(i, t|s) * EAD(i, t|s) * DF(i, t|s)]$$

**Probability-Weighted ECL by instrument:**

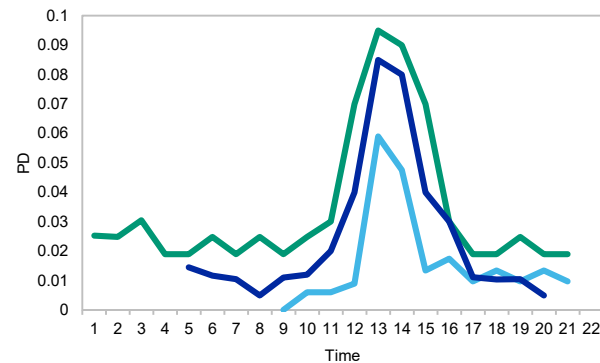
$$ECL(i) = p_1 ECL(i, |s_1) + p_2 ECL(i|s_2) + ... + p_s ECL(i|s_s)$$

# IFRS 9 Validation Process

## Robustness & Sensitivity Analysis



### Portfolio Behavior to Changing Macroeconomic Conditions



## Report

### Qualitative

- ✓ Methodology
- ✓ Data use, description & treatment
- ✓ Regulatory compliance
- ✓ Model governance

### Quantitative

- ✓ Data analysis
- ✓ Model replication
- ✓ Model performance
- ✓ Benchmark model development

### Final Assessment

- ✓ Written report
- ✓ Observation, findings and recommendations and or remedial actions



# IFRS 9 Case Study – Impact of COVID-19

## Baseline Feb 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.03
1	92,090	99.00	8,275,327,246	0.00
2	717	0.83	69,352,356	0.89
3	146	0.17	13,986,747	12.21

## Upside Feb 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.03
1	92,093	99.01	8,275,597,498	0.00
2	714	0.83	69,082,104	0.79
3	146	0.17	13,986,747	12.21

## Downside Feb 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.04
1	92,079	98.97	8,272,959,874	0.01
2	728	0.86	71,719,727	1.35
3	146	0.17	13,986,747	12.21

## Prob-weighted Feb 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.03
1	92,086	99.00	8,274,895,046	0.01
2	721	0.83	69,784,556	1.00
3	146	0.17	13,986,747	12.21

## Baseline Apr 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.05
1	92,047	98.90	8,266,730,875	0.01
2	760	0.93	77,948,726	1.68
3	146	0.17	13,986,747	12.82

## Upside Apr 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.04
1	92,082	98.99	8,273,841,624	0.01
2	725	0.85	70,837,977	1.31
3	146	0.17	13,986,747	12.82

## Downside Apr 2020

IFRS 9 Stage	#	%	Exposure	ECL=0.07
1	91,770	98.34	8,219,603,740	0.02
2	1,037	1.50	125,075,861	1.88
3	146	0.17	13,986,747	12.81

## Prob-weighted Apr 2020

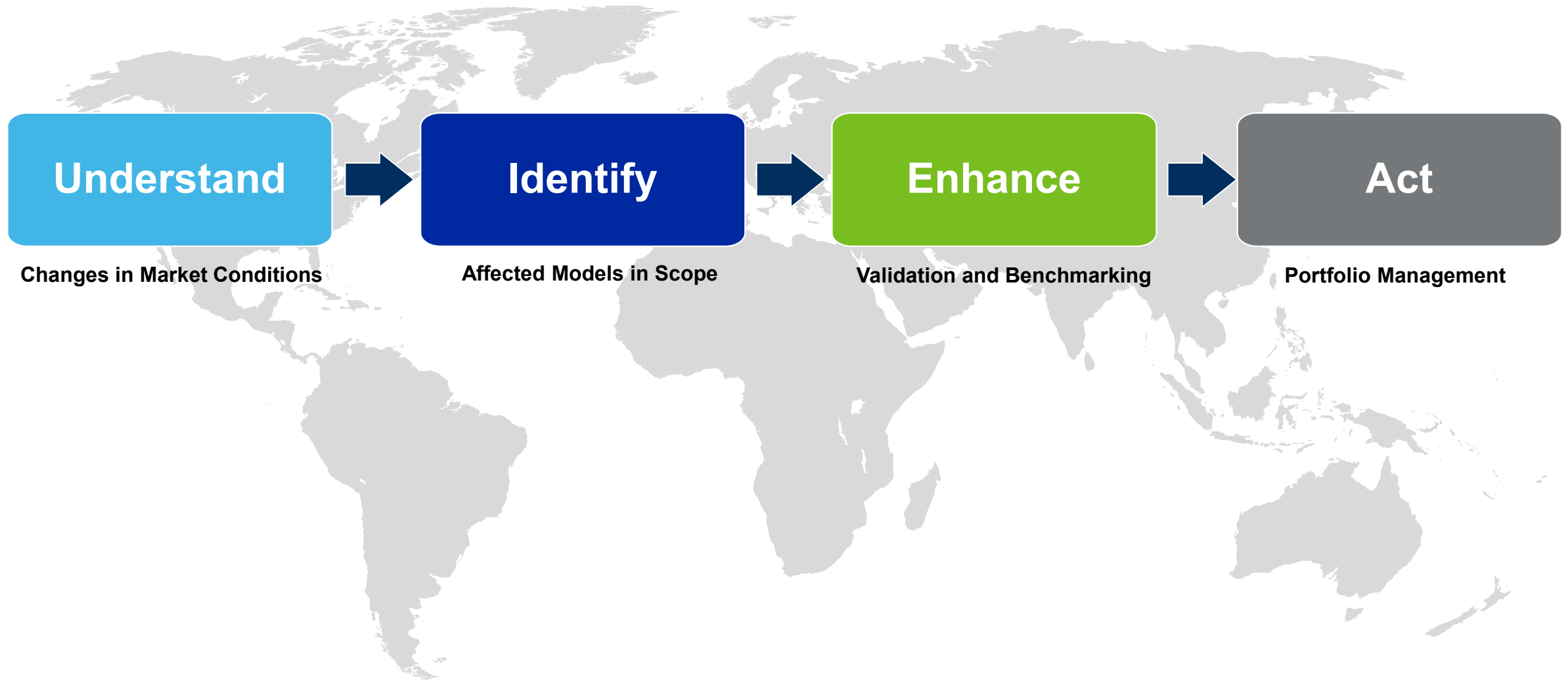
IFRS 9 Stage	#	%	Exposure	ECL=0.05
1	92,020	98.84	8,261,408,180	0.01
2	787	1.00	83,271,421	1.76
3	146	0.17	13,986,747	12.81



4

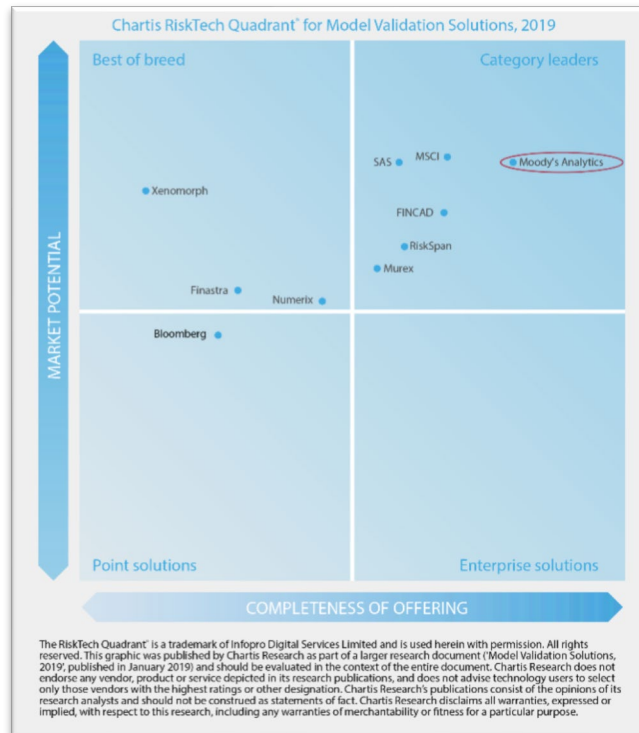
Key Takeaways

# Proactive Overhaul of Model Risk Management



# Thank You

Questions? Contact us at [help@economy.com](mailto:help@economy.com)



Chartis  
RiskTech Quadrant  
Category Leader  
Model Validation Solutions, 2019



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