



**Model Risk Management**  
Driving the value in modelling

# Agenda

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## **OUVERTURE**

Hervé Phaure, Deloitte

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## **INTRODUCTION**

Nadège Grennepois, Deloitte

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## **INTERVENTION**

Christopher Lotz, BaFin

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## **TABLE-RONDE ET Q&A**

Nathalie Bouez, BNP Paribas,  
Guillaume Figer, Société Générale,  
Tabourin, BPCE,  
Christopher Lotz, BaFin

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## **CONCLUSIONS**

Hervé Phaure, Deloitte

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## **NETWORKING COCKTAIL**

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# Introduction

Nadège Grennepois 

# After US... Regulatory references in the EU

## CRD IV / CRR



Defines Model Risk (Art. 3.1.11) and the process by which the Competent Authorities should assess how the institutions **manage and implement policies and processes to evaluate the exposure to Model Risk as part of the Operational Risk** (Art. 85).

## Guidelines on SREP



The '*Guidelines on common procedures and methodologies for the supervisory review and evaluation process*' define the **main activities that the Competent Authorities should assess in the institution's exposure to model risk** arising from the use of internal models in its main business areas and operations. In particular, the Competent Authorities should consider to what extent, and for which purposes, the institution uses models to make decisions and its level of awareness (Management Body and Senior Management) of and how it manages model risk.

According to SREP Guidelines, the model risk can be **split into two distinct forms of risk with two different impacts risk profiles.**

	Form of risks	Risk profile
1	"Risk relating to the underestimation of own funds requirements by <b>regulatory approved models</b> (e.g. internal ratings-based (IRB) models for credit risk)"	"Competent authorities should consider the model risk as part of the <b>assessment of specific risks to capital</b> (e.g. IRB model deficiency is considered as part of the credit risk assessment) and for the <b>capital adequacy assessment</b> "
2	"Risk of losses relating to the development, implementation or improper use of any other <b>models</b> by the institution <b>for decision-making</b> (e.g. product pricing, evaluation of financial instruments, monitoring of risk limits, etc.)"	"Competent authorities should consider the risk as part of the <b>assessment of operational risk</b> " and it should be evaluated within this perimeter

# Impact of the New Regulations and Standards

## IMPACT IRB

- EBA Guidelines on PD, LGD estimation and treatment of defaulted assets.

- **Default Definition revision** (EBA, 28/09/2016)

## IMPACT FRTB

The Fundamental Review of the Trading Book includes updates to both the **advanced and standardized models** as well as **stricter disclosure requirements and validation standards**. A key overall aim is to reduce the differences between RWAs for different banks with similar portfolios. It will involve major changes both for banks with model permissions and for those without.

## Impact TRIM

Impact TRIM exercise is integrated in the international efforts and takes into consideration all the possible upcoming changes in the supervisory framework regarding **the internal models**. **A targeted approach is envisaged to topics and models**, selected on the basis of supervisory knowledge of material issues requiring harmonization and supervisors' experience with particular portfolios and models.

## IMPACT OF IFRS9

The introduction of the IFRS 9 Impairments standard is demanding that **banks use a new set of credit risk models**; these models must be developed, deployed and maintained, which will literally double the number of Risk parameters models to manage.



*The EBA is mandated to develop Binding Technical Standards (BTS), **Guidelines and Reports to assess internal models** with the aim of ensuring a harmonized implementation of the rules for Internal Rating Based (IRB) Approaches for credit risk, Internal Model Methods (IMM) for counterparty credit risk, Advanced Measurement Approaches (AMA) for operational risk and Internal Models Approaches (IMA) for market risk.*

# Types of Models in the Scope

## Comprehensive Model Coverage

A large global bank has a wide range of model types that are subject to governance and model risk management (examples below). Model risk is connected both to the underestimation of own funds requirements by **regulatory approved models** and to the improper application of any other **models used for “managerial” purposes**.

MODELS USED FOR « REGULATORY, MANAGERIAL AND ACCOUNTING » PURPOSES	MARKET AND LIQUIDITY RISK MODELS	CREDIT & COUNTERPARTY RISK MODELS	OPERATIONAL RISK MODELS	COMPLIANCE MODELS
	<ul style="list-style-type: none"> <li>• VaR (inc. Stressed VaR, IRC)</li> <li>• ALM &amp; Liquidity Risk</li> <li>• Expected Shortfall</li> </ul>	<ul style="list-style-type: none"> <li>• PD, LGD and EAD</li> <li>• Risk rating models</li> <li>• Exposure and CVA</li> <li>• IFRS 9 Impairment</li> </ul>	<ul style="list-style-type: none"> <li>• Loss Distribution Approach Model</li> <li>• Integration Model</li> </ul>	<ul style="list-style-type: none"> <li>• Anti-Money Laundering (AML)</li> <li>• Anti Fraud</li> <li>• Trader surveillance</li> </ul>
MODELS USED FOR OTHER PURPOSES	PORTFOLIO & FINANCIAL RISK MODELS	DECISION SUPPORT MODELS	VALUATION & PRICING MODELS	FINANCE MODELS
	<ul style="list-style-type: none"> <li>• Capital forecasting</li> <li>• Stress testing</li> <li>• Econometric models</li> </ul>	<ul style="list-style-type: none"> <li>• LOB models for customer targeting-marketing</li> <li>• Credit underwriting</li> <li>• Risk based collection models</li> </ul>	<ul style="list-style-type: none"> <li>• Derivatives</li> <li>• Structured products</li> <li>• Risk based pricing tools/models</li> </ul>	<ul style="list-style-type: none"> <li>• P&amp;L Attribution</li> <li>• Cash flow /NPV/Ratio Analysis</li> </ul>
	MARKETING MODELS	INSURANCE MODELS	INVESTMENT MANAGEMENT	OTHER MODELS
	<ul style="list-style-type: none"> <li>• Marketing models</li> <li>• Client Targeting</li> </ul>	<ul style="list-style-type: none"> <li>• Actuarial models</li> <li>• Loss Forecasting</li> <li>• Reserving models</li> </ul>	<ul style="list-style-type: none"> <li>• Trading</li> <li>• Security / Asset Pricing</li> <li>• Portfolio Allocation</li> </ul>	<ul style="list-style-type: none"> <li>• Corporate Finance Models (e.g. M&amp;A, LBO, MBO)</li> </ul>

# Elements of an objective MRM framework

## ORGANISATION AND GOVERNANCE

- Existence of a **Model Risk Management** that has been approved by the **Board**, who receive periodic **reports** regarding compliance.
- Existence of a **Model Risk function** that **reports directly to the CRO** and is responsible for the MRM framework and the governance.
- Existence of a model validation **function** responsible for the **independent validation of models**.

## MODEL RISK QUANTIFICATION

- **Quantitative techniques for model risk mitigation** (beyond regulatory requirements) regarding:
  - **Data**, sensitivity to errors or absence of variables;
  - **Estimates**, sensitivity of estimates (maximum impact, alternative models);
  - Uses, predictive power evolution, impact of erroneous use, etc.

## MODEL RISK MANAGEMENT PROCESSES & TECHNOLOGY

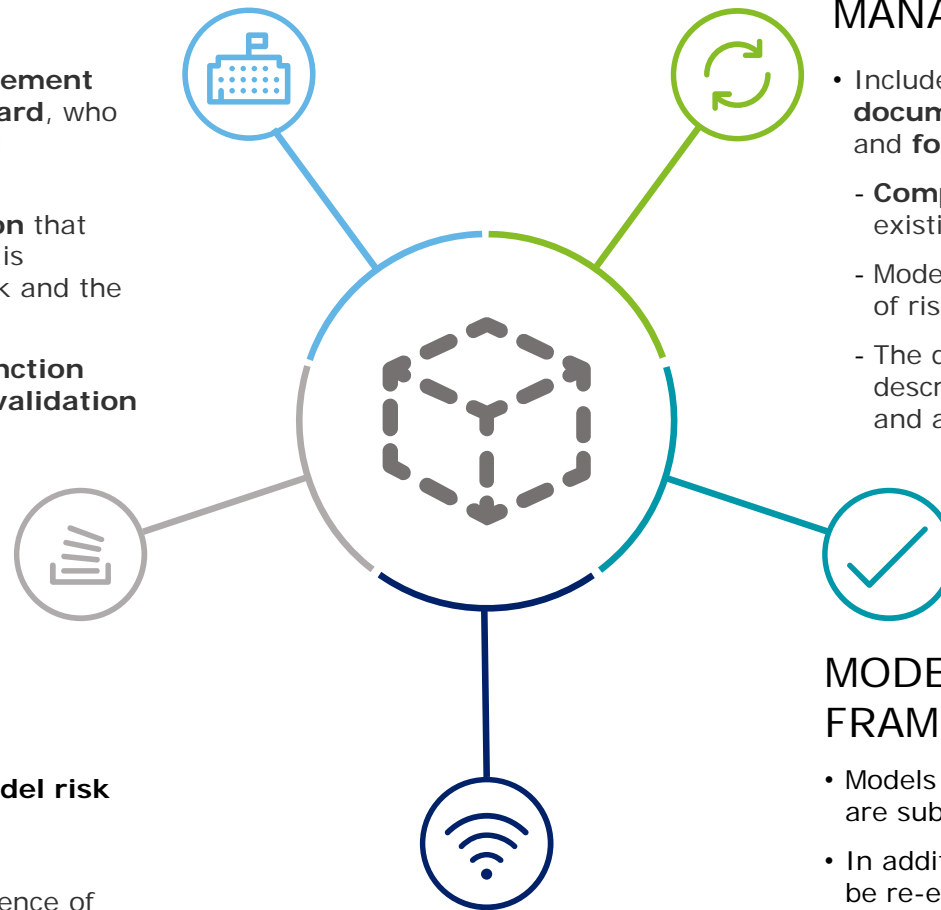
The MRM framework should be supported by a technological platform.

## MODEL LIFECYCLE MANAGEMENT

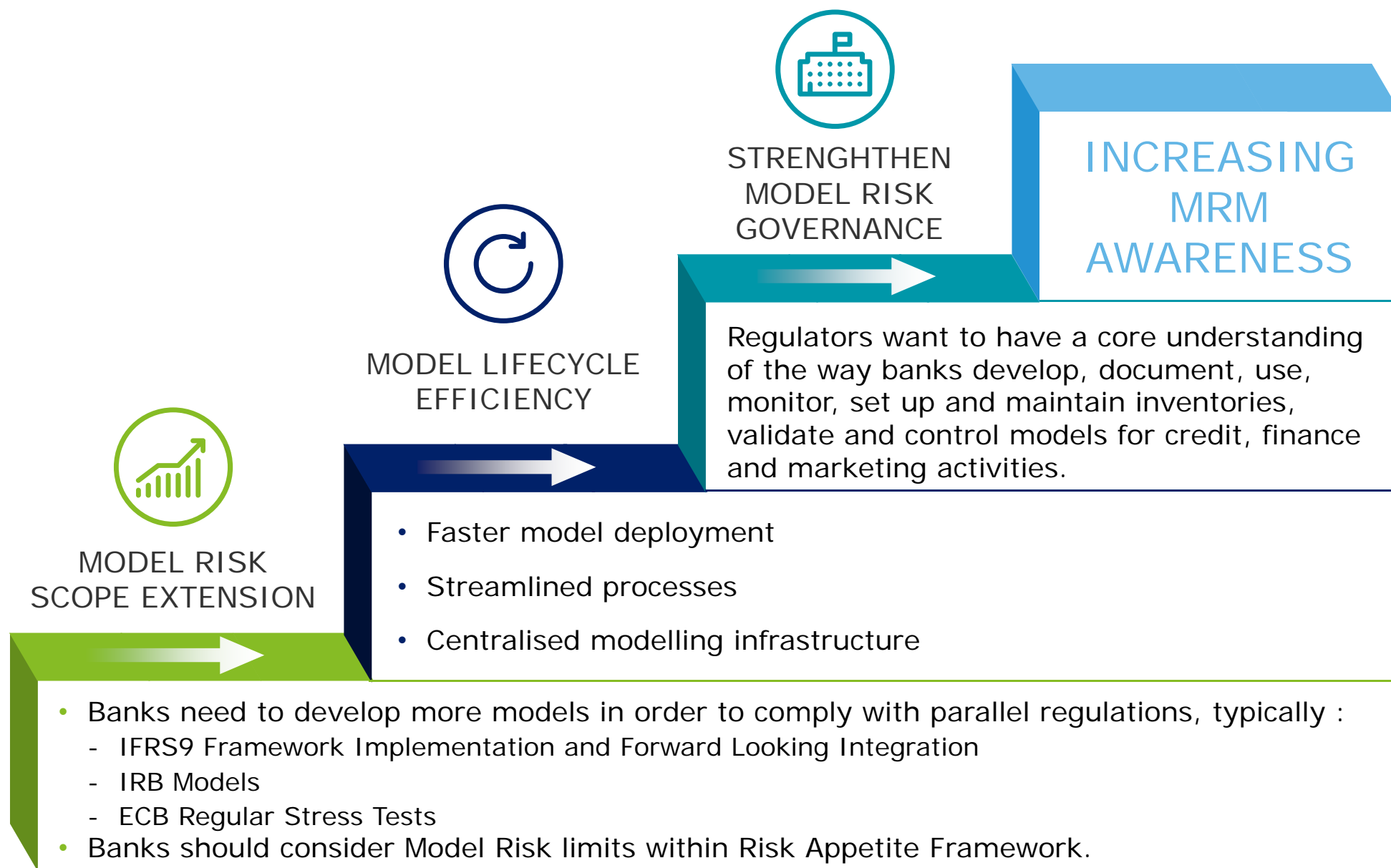
- Includes the **model development, documentation, inventory, classification and follow-up**:
  - **Comprehensive inventory** covering all existing models and framework scope.
  - Models are classified according to the level of risk and prioritised.
  - The documentation should include description, key variables, assumptions and algorithms.

## MODEL CONTROL FRAMEWORK

- Models assigned the **highest level** of risk are subject to **continuous assessment**.
- In addition to the above, all models should be re-evaluated by Validation:
  - Annually.
  - If they undergo material changes.
- **Before they are deployed to production, they should have been approved.**



# Model Risk: the next risk type?







# Introduction

Christopher Lotz



# **From Model Validation to Model Risk Management**

The regulator's perspective

# Disclaimer

All statements in this presentation reflect solely the presenter's personal views and should not be construed to represent BaFin.

# Content

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## 1. EVOLUTION OF MODELS

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## 2. VALIDATION

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## 3. MODEL RISK MANAGEMENT

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# Louis Bachelier, "Theorie de la speculation" (Paris 1900)

*"The factors that determine activity on the Exchange are innumerable, with events, current or expected, often bearing no apparent relation to price variation.*

*Beside the somewhat natural causes for variation come artificial causes: The Exchange reacts to itself, and the current trading is a function, not only of prior trading, but also of its relationship to the rest of the market. The determination of this activity depends on an infinite number of factors. It is thus impossible to hope for mathematical forecasting. Contradictory opinions about these variations are so evenly divided that at the same instant buyers expect a rise and sellers a fall."*

# All models have model risk...

- 1 Models were introduced because real world too complex for rules / standard formula
- 2 Models acted as a control for risks
- 3 Modelling hubris:  
„Everything can be modelled“ - model risks not acknowledged
- 4 Severe crisis of trust in internal models  
(although most IRB models went life only after 2008)
- 5 More rules and restrictions for internal models?

At the same time: Models became more and more pervasive (Pillar II, Margin Models, Prudent Valuation, IFRS 9, ...)

# Excursion:

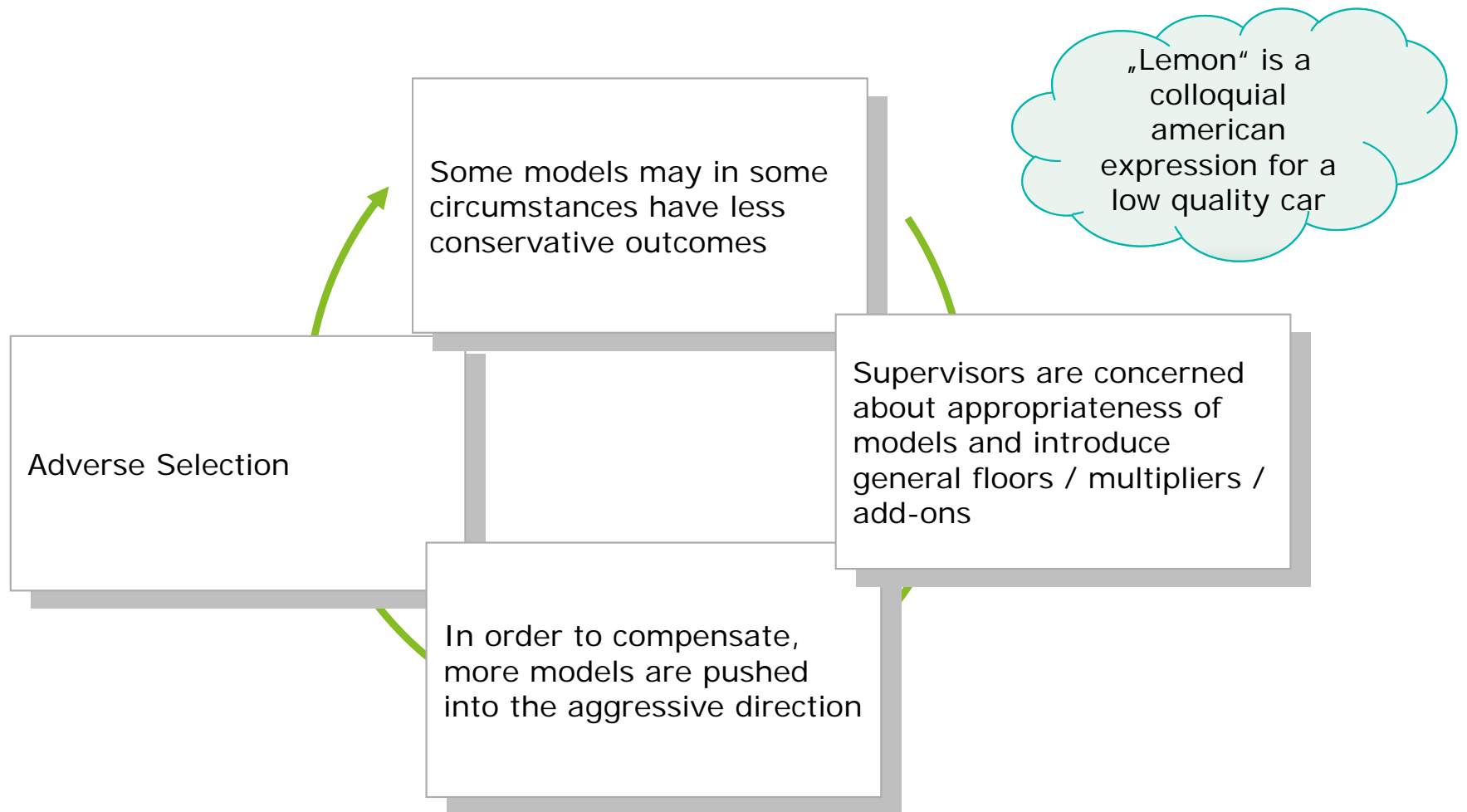
## What creates mistrust in models?

### Examples:

- Losses which surpass model forecasts by many magnitudes
- Variances between internal model results for seemingly identical portfolios
- Huge benefits from diversification
- Model changes which all seem sensible individually, but can lower capital over time (“model drift”)
- But most of all: little transparency and communication, while models were sometimes used as a free ticket to justify almost everything.

# Excursion: Trend towards Lemon Models

(cf. George A. Akerlof: The market for „lemons“, 1970)



Driver: Asymmetric information between principal (the supervisor) and agent (the bank)

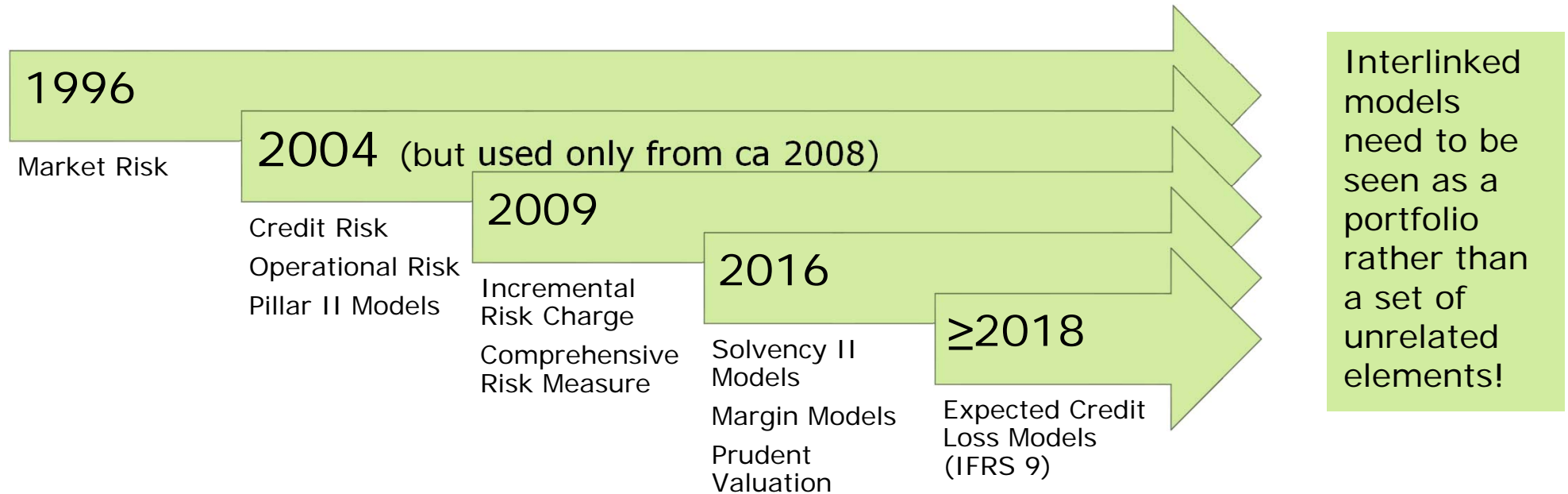
Solution: Provide transparency about model performance!

Alternatives: Screening vs Signalling



# Introduction of models for regulatory purposes

## Requires a portfolio view of models



# Challenges in Validation

1. Separation of Model RM from other QA processes
2. Triggers for ad-hoc validation
3. Consistent approach across model categories and the group, specific to the individual needs
4. Structured & readable individual validation reports
5. Aggregation of validation results
6. List of „Risks not in Model“
7. Conclusions and Action Points
8. Implementation of action points, follow-up & escalation

# Traditional validation often does not cover all sources of model risk:

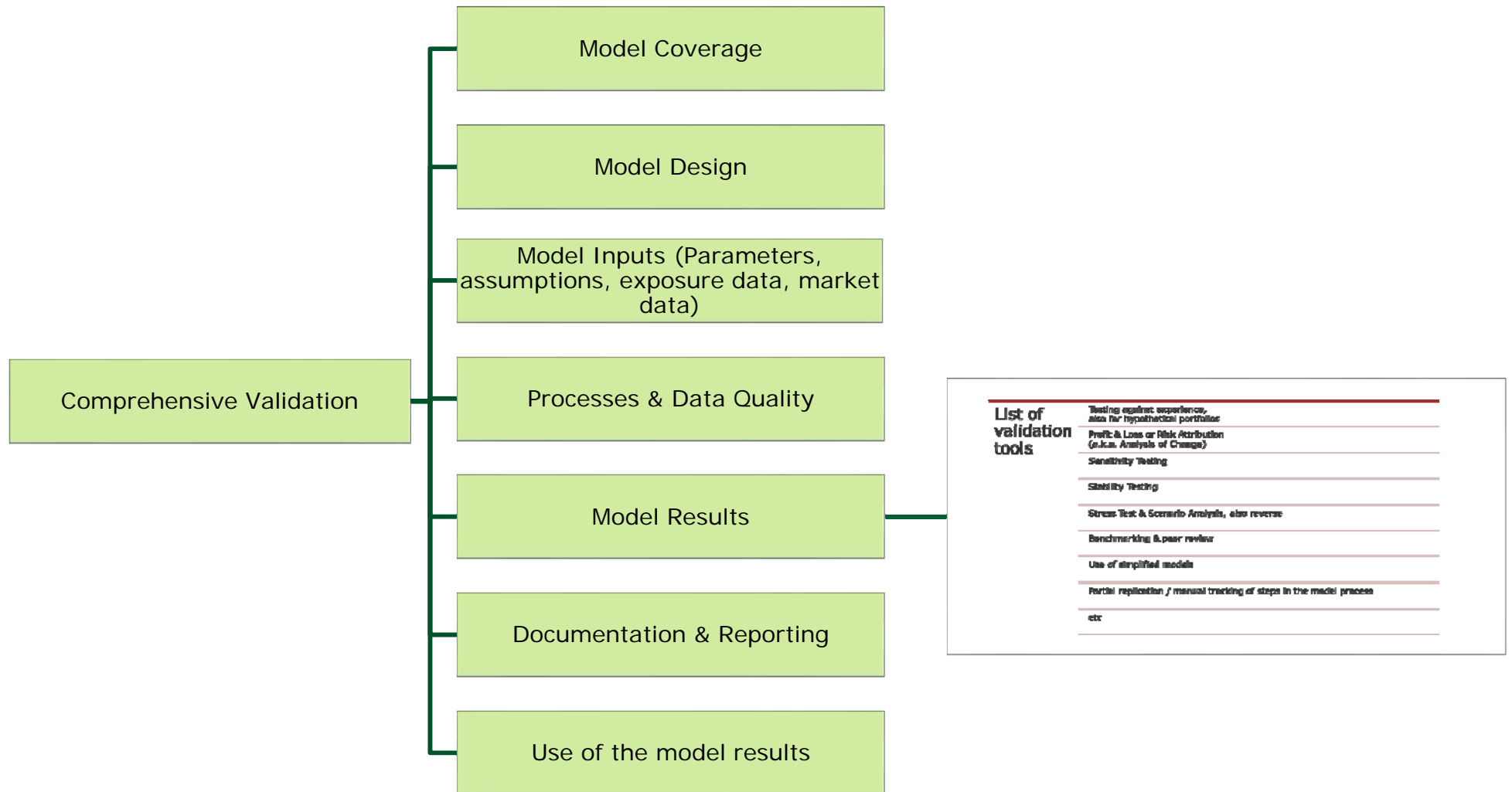
- Input data, parameters and expert judgement
- Mappings, proxies, model points
- Choice of methodologies
- IT implementation
- Process quality
- Outputs
- Consistency between models
- With regard to full portfolio or individual portfolios?
- Use

# While proper validation is at the core of model risk management...

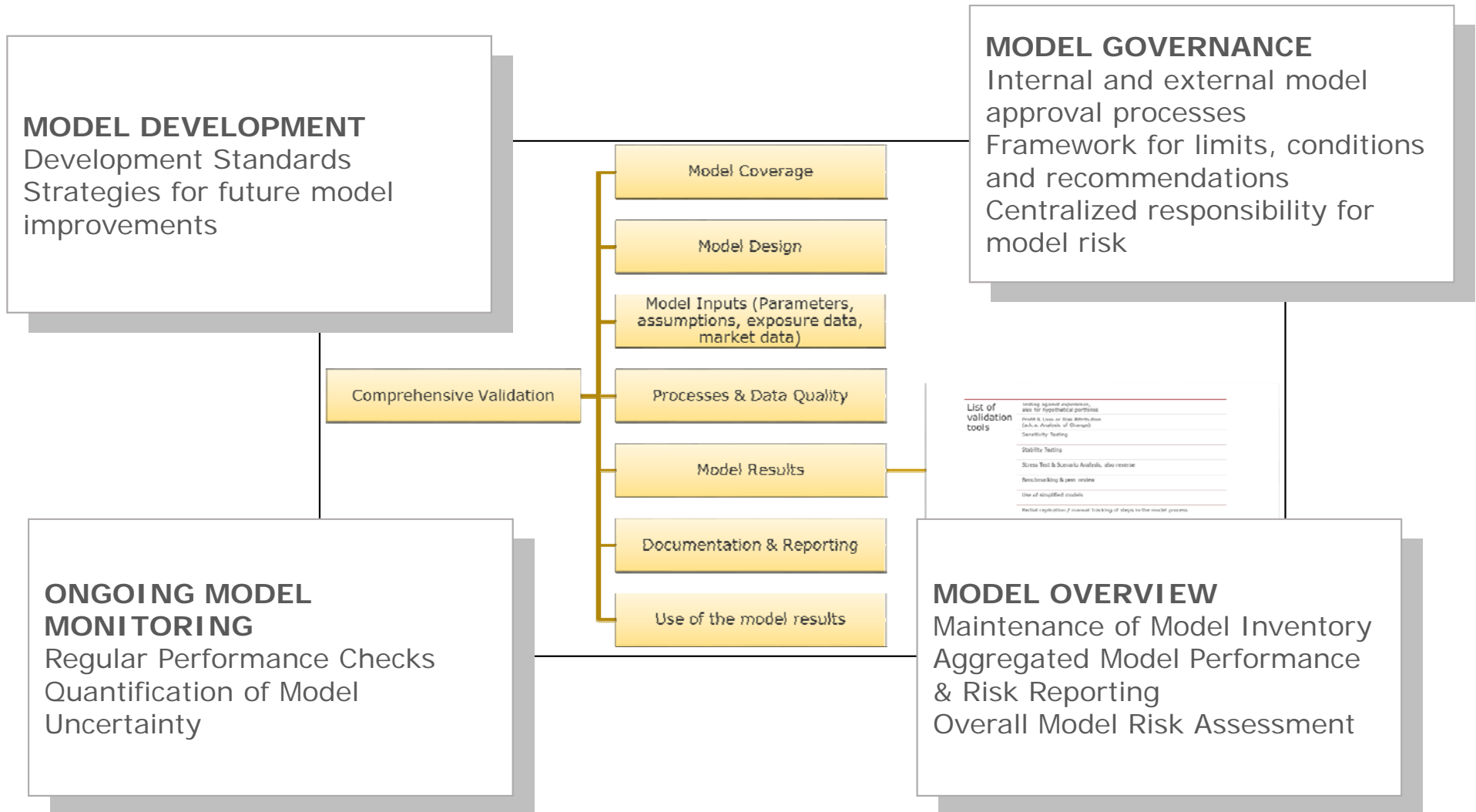
## **List of validation tools**

- Testing against experience, also for hypothetical portfolios
- Profit & Loss or Risk Attribution (a.k.a. Analysis of Change)
- Sensitivity Testing
- Stability Testing
- Stress Test & Scenario Analysis, also reverse
- Benchmarking & peer review
- Use of simplified models
- Partial replication / manual tracking of steps in the model process
- etc

... and evolved into comprehensive validation ...



... model risk management is much more than model validation:



# „Model Risk Management“ in current banking regulation

## EUROPE

### Focus on traditional validation

- Numerous validation requirements appear throughout the CRR and beyond... (MR, CR, OR, Margin Models, Stress Testing, ...)
- BUT: Each requirement is focused on the needs of the particular model at hand.
- Many regulators still concentrate on validation within the boundaries of one risk category, rather than as an overarching concept.  
Regulators seem to adopt a bottom up approach to address the challenge.
- Compare this to Solvency II: One article + L2 / L3 standards

### Missing Model Risk and Model Risk Management

- Currently no overarching concept of validation in EU regulation.
- Currently no concept of „model risk“, or a desired or required precision or admissible model uncertainty in EU regulation.
- Currently no concept of „Portfolio of Models“, and hence no concept of model risk management in EU regulation

US: SR Letter 11-7 „Supervisory Guidance on Model Risk Management“

# The portfolio of models is at the center of model risk management

## **Why portfolio of models?**

Models do not sit one next to the other without connection, but are interlinked:

1. One model's outputs feeds other models
2. Results from different models are aggregated, therefore there is a need for consistency
3. Some models share the same risk drivers

A holistic and integrated view of models is necessary!



# Model Risk Management answers the question: How to improve controls around models?

Albert Einstein: *"We can not solve our problems with the same level of thinking that created them."*

Rules are unable to deal with the complexity of models

Enter "Principle-Based Model Risk Management"

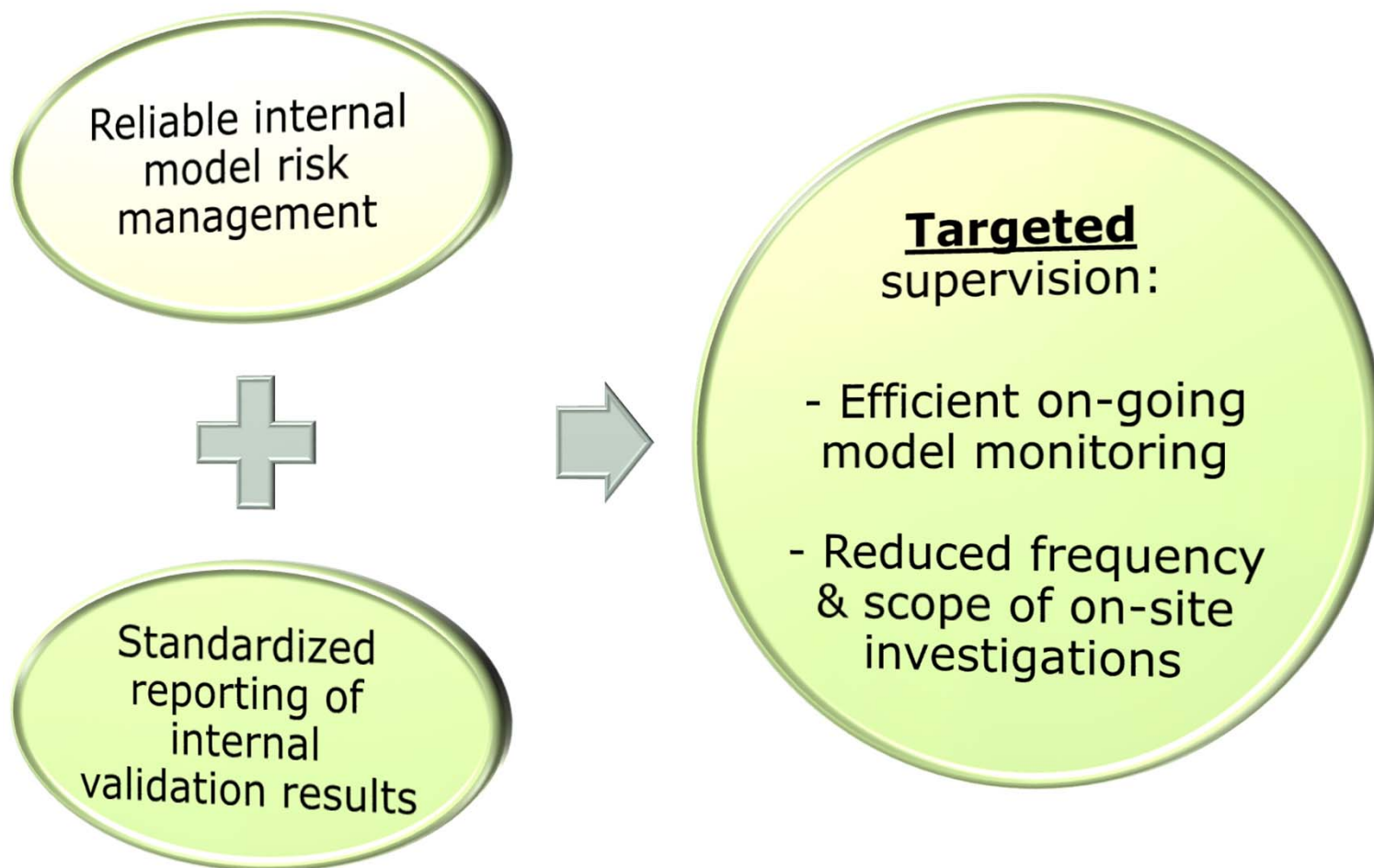
Transparency is key: Remember the market for lemons

Model Risk Management may also help in making transparent the true costs of maintaining complex models, and therefore reduce unnecessary complexity

# Some Principles of Model Risk Management

1. **Comprehensive** – covers models from beginning to end, from input data to final capital (or other) figure
2. **Holistic** – covers data, methodology, processes, governance etc
3. **Adapted** – recognizes the interdependencies between model
4. **Integrated** – summarizes validation results across models
5. **Action-oriented** – results trigger model improvements
6. **Practice-based** – involves business
7. **Focused** – bears in mind the ultimate purpose of the model
8. **Documented** – all methodologies, processes and results are properly documented
9. **Relevant** – senior management gets involved

# Smoother & more efficient interaction between bank and supervisor





# Table ronde

Guillaume Figer  
Nathalie Bouez  
Guillaume Tabourin  
Christopher Lotz



# Tour de table

## Questions Réponses

## ORGANISATION ET GOUVERNANCE

Comment est organisée la fonction Model Risk Management au sein de votre établissement ?  
Reporte-t-elle au CRO ?

## GESTION DU CYCLE DE VIE DES MODÈLES

Selon-vous, quels types de modèles sont dans le périmètre MRM ? disposez-vous d'inventaires de ces modèles et d'une méthode de classification de ces modèles ?

## VALIDATION DES MODÈLES

Seriez-vous prêts à envisager d'externaliser vos fonctions de validation de modèles ? sinon pourquoi ?

## QUANTIFICATION DU RISQUE DE MODÈLE

Comment définissez-vous la quantification du risque de modèle ?

## PROCESS

Comment est envisagé le projet de définition d'un dispositif MRM dans votre établissement ?

## IMPACT SUR LA PROFITABILITÉ DE LA BANQUE

Pensez-vous que l'absence d'une gestion du risque de modèle puisse avoir un impact négatif sur la profitabilité de la banque, avez-vous des retours d'expérience



# Conclusion

Hervé Phaure 



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