

Stress Testing Challenges

*International Workshop on Stress Test and
Risk Management : Round Table
May 2019*



AGENDA

Model uncertainty and challenges

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Scenario generation and data science

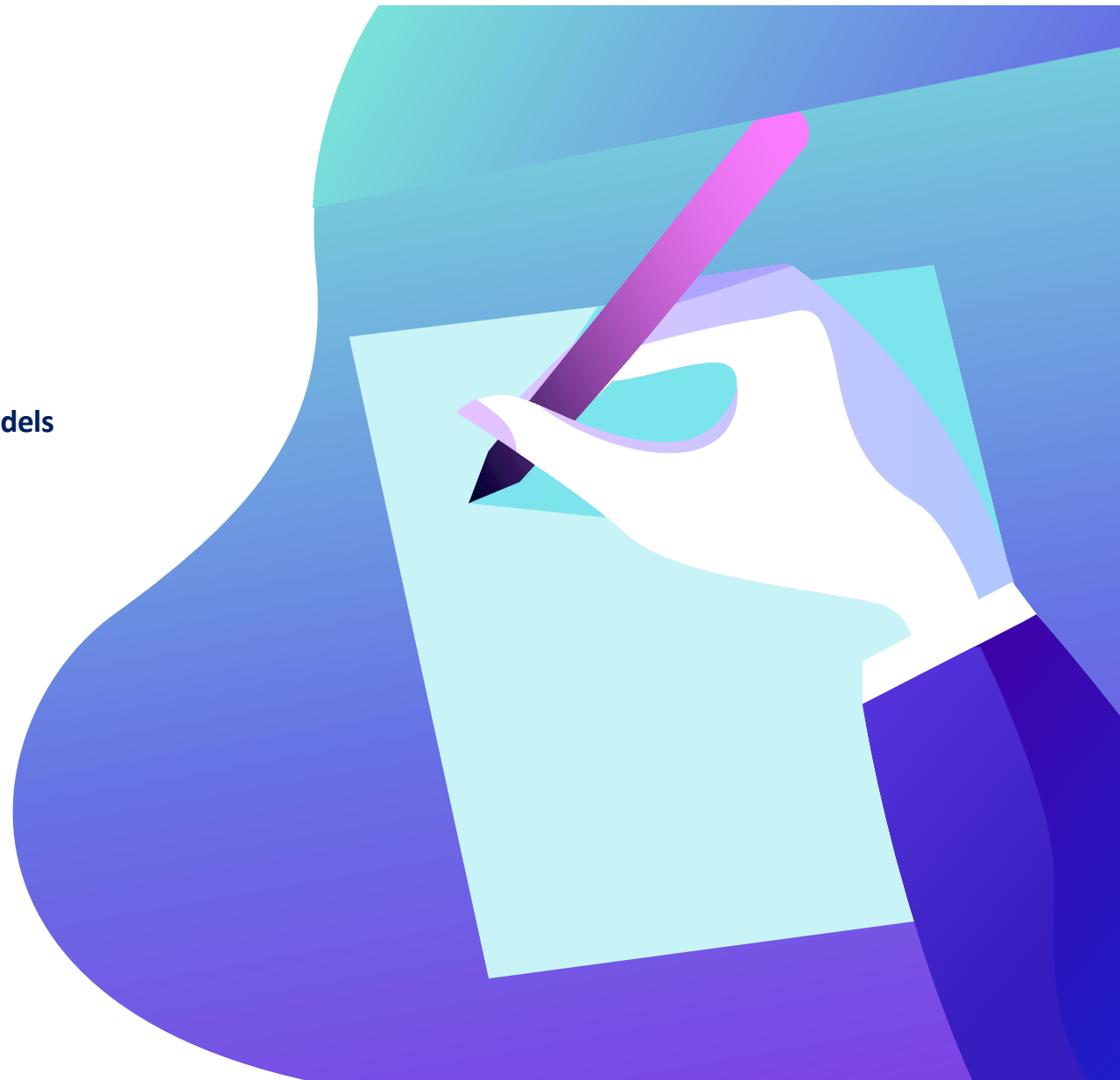
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Head of Risk and capital Modeling

How reliable are model based stress tests results

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Global Head of Models and Portfolio Risks

Climate risk stress testing

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Head of Credit and Non-Financial Risks
Modeling



***Model uncertainty and
challenges***



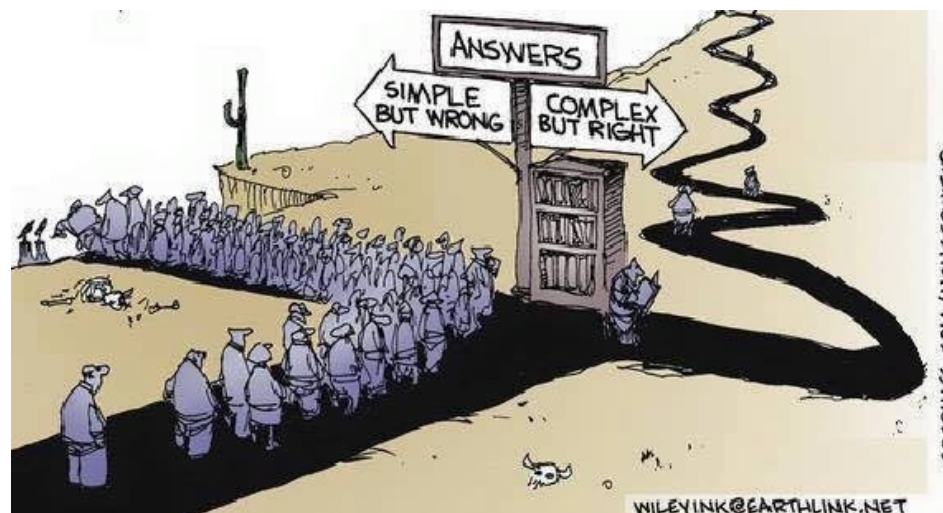
How reliable are model based stress tests results

Simple...

- Easy to design / explain
- Transparent & Conservative

But « wrong »

- Poor information
- Limited sensitivity to risks
- Unfair comparison between banks

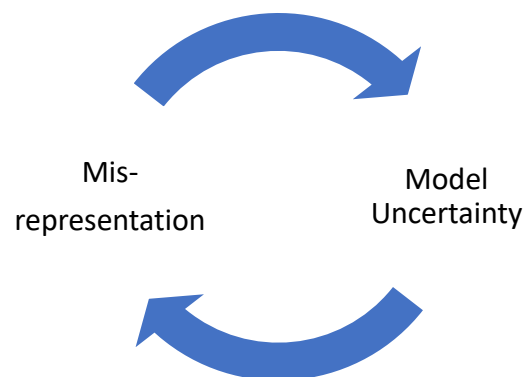


Complex...

- Difficult to design / control
- Hard to explain

But « right »

- More risk sensitive
- Informative
- Reflect the risk profile of each bank



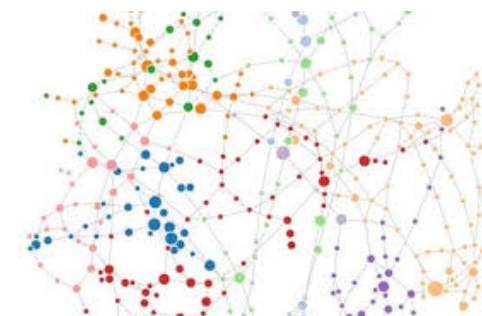
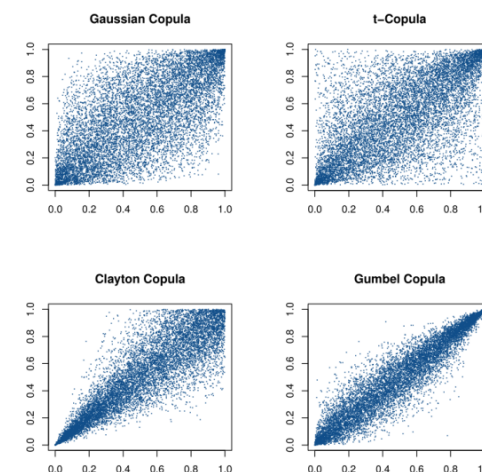
Some examples of challenges

Diversification

- Central risk management topic, core to the business model of banks
- But difficult to introduce in scenario based stress testing (requires multiple scenarios)
- Not recognized by regulators for internal capital requirements
- Advanced approaches exist through scenario generation involving copula methods or Bayesian networks

What if analysis

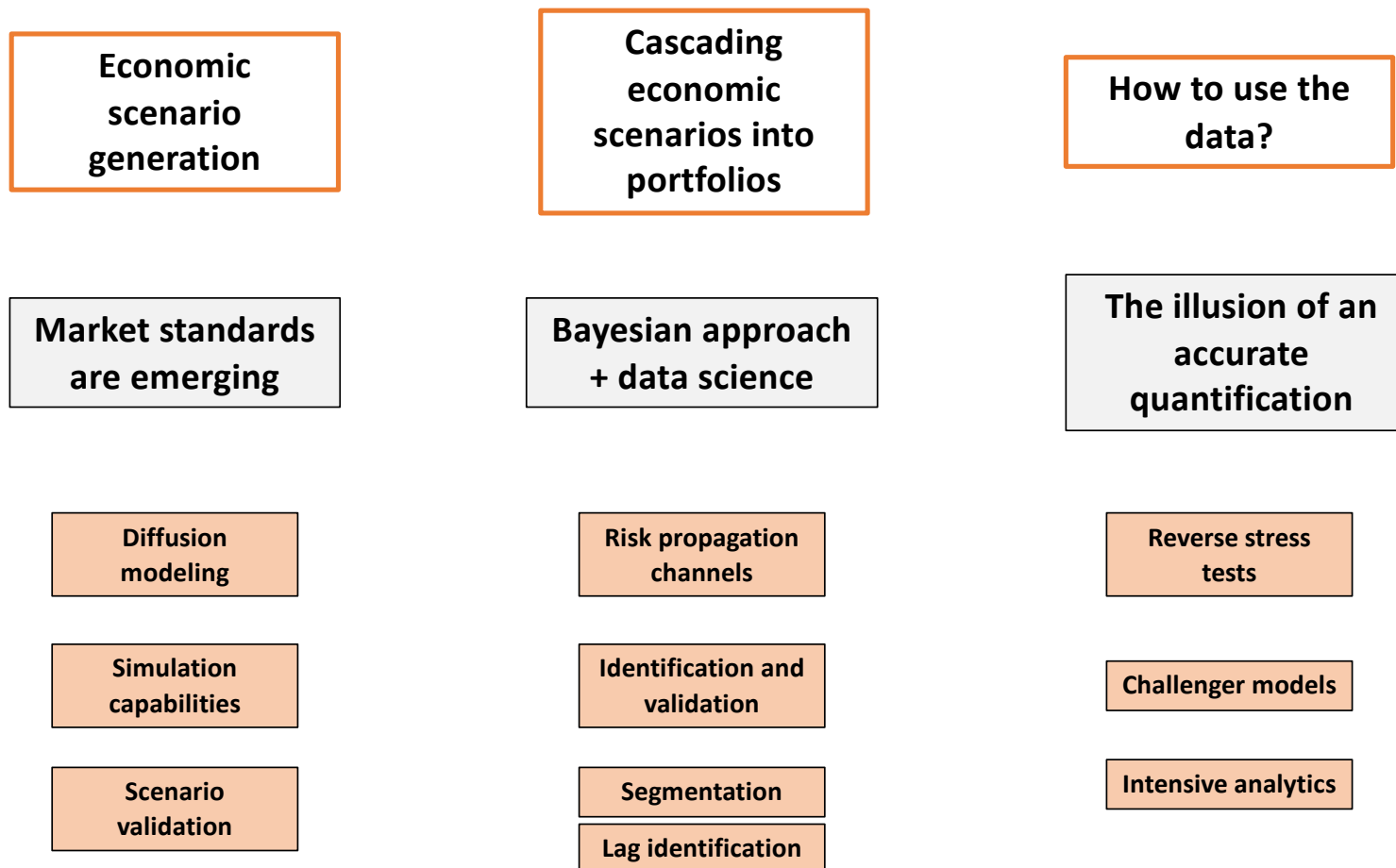
- Current stress testing frameworks well-adapted to scenarios that show similarities with 2009 financial crisis.
- In some cases, it can be difficult to assess the impact of relatively simple scenarios:
 - Interest rate hike (impact on credit, fees...)
 - Energy transition
- Modelling the revenues / balance sheet of clients and interactions between them (agent based modelling) leveraging large data sets and high computing capabilities



***Scenario generation
and data science***



Scenario generation and data science

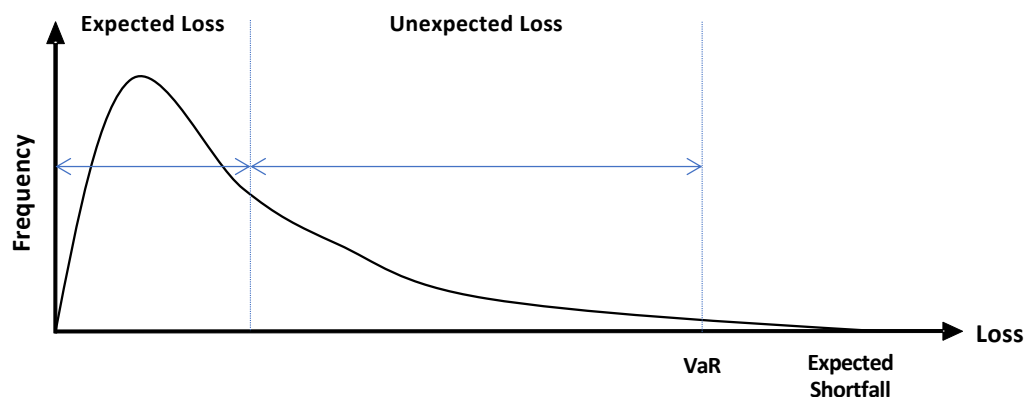


***The Loss Distribution
Challenges***



The Loss Distribution Challenges

Why is calculating the loss distribution critical for Risk Management ?



1. Accounting provisions calculation
2. Risk appetite setting and internal estimation of capital requirements
3. Profitability measurement at asset level
4. Reverse stress testing and RRP scenario identification

➔ The framework's consistency promotes its usage in the day-to-day risk management journey

Modeling issues

Coherent diffusion of several parameters :
macroeconomic variables, ratings, LGD, collateral values, credit spreads, default correlations, etc.

Validation issues

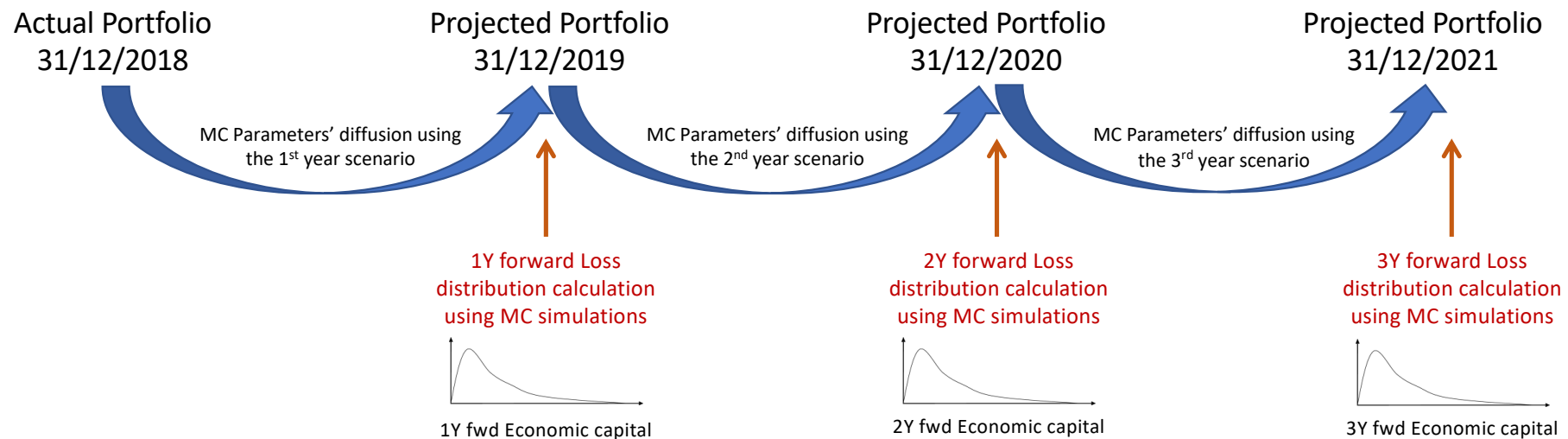
Default events are scarce.
Imaginative solutions need to be developed in order to ensure consistent loss measures at high percentiles

Computation time issues

Several sets of monte carlo simulations are needed to perform the calculation of all the measures at the required granularity (asset level)

The computational challenge of stress testing the loss distribution

- A typical stress testing exercise is conducted on a 3Y forward period (e.g. for a Medium-Term Plan simulation purposes)
- Scenario-based risk parameters are first projected before simulating the 1Y loss distribution



- The computational burden could be waived through a combination of :
 - Credit VaR closed-form formula (Taylor expansion)
 - Markov assumption for some parameters (rating migrations matrix)
 - Multi-core distributed computation (coupled with GPU if need be)

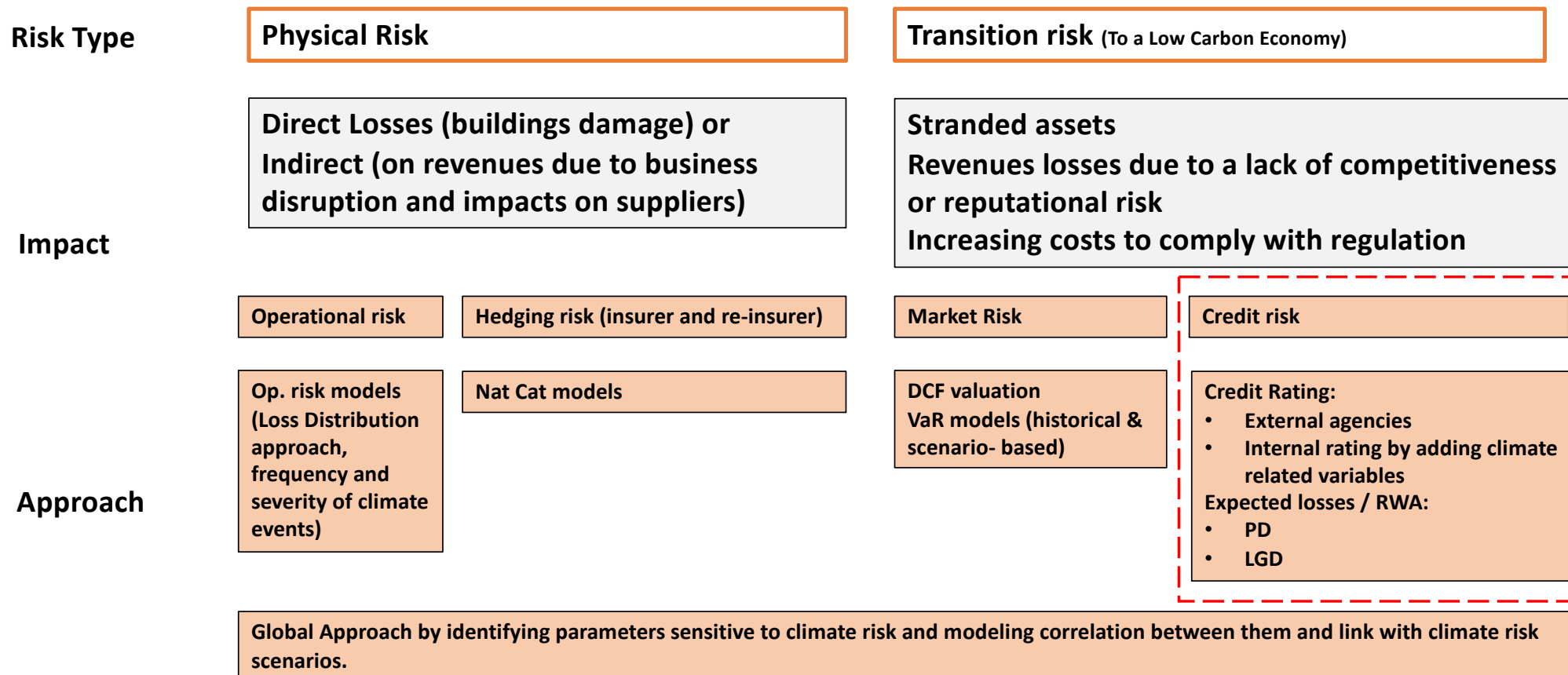
***Climate risk stress
testing***



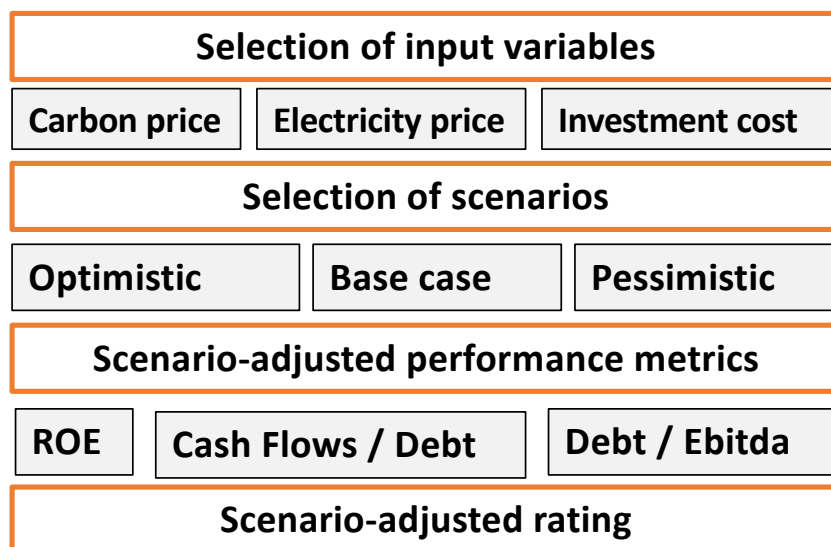
Climate Risk : Outline

- Banks run various stress tests to model the impact of a rise in unemployment, or a jump in interest rates. But what if the temperature of the earth rose a full 2 degrees Celsius, or more?
- Growing awareness of climate risks' implications on prices and financial stability (Carney 2015...Draghi 2017)
- To date, no comprehensive regulatory stress testing exists. Yet, there are some notable examples of a growing interest for climate stress testing.
 - California Insurer commissioner conducted in 2018 a climate scenario analysis on insurance companies
 - Bank of England is planning to include the impact of climate change in its UK bank stress tests in 2019. Previously, it has conducted analysis on its insurance companies
 - 2020 EBA stress tests are likely to include a climate stress test scenario
- But lack of standardized climate risks/impact metrics

Climate risk at a glance



Transition risk & credit risk : rating based approach



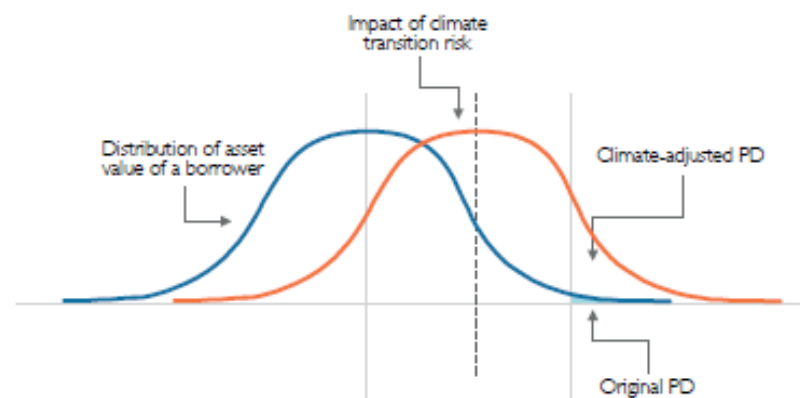
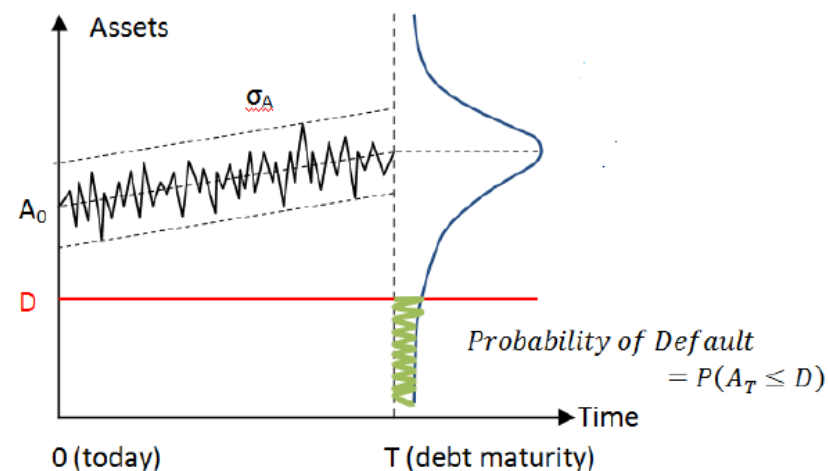
- Borrower-level calibration
- Relies heavily on expert judgment
- Pro-forma analysis of the company's balance sheet and income statement

Transition risk & credit risk : PD based approach

- Adaptation of the Merton framework : relates PD to the likelihood that the firm's future asset values could fall below a threshold value (Debt)
- The introduction of additional systemic risk factors related to transition risk assumes a shift in asset values

$$PD_i|c^* = \Phi[\Phi^{-1}(PD_i, TTC) - \frac{1}{\alpha_k} \cdot \sum_r (s_{j,k}^r \cdot f_k^r)]$$

Source : UNEP Finance Initiative – Oliver Wyman



Transition risk & credit risk : LGD based approach

- The assessment of LGD is largely driven by the type and value of collateral provided.
- Stress tests may be performed by determining collateral haircuts (expert-based haircuts, cash-flow models for project financing or Reserves-Based Lending...).
- Another approach uses the relationship between PD and LGD (e.g. Frye Jacob relationship)

