# Euronext Clearing Internal Model Validation

Risk Policy Team

EURONEXT CLEARING

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# Background

- As part of the focus on CCPs in the wake of the Lehman's Default, European and Worldwide Financial Authorities have requested CCPs to include a Model Validation Framework in their Risk Management processes

- Model Validation is a key Model Risk mitigant, i.e. the risk that a model:
  - is not providing accurate output;
  - is being used inappropriately

- In order to meet these regulatory requirements, Euronext Clearing has set up the Risk Policy Dept. that is also in charge of Validation of Risk Models



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# Model Validation Features

- Risk Policy performs an independent review of all the components of Risk Models, using an internally developed web based tool (MoVE) that allows both to replicate the existing margining methodologies on the main asset classes and to run a wide set of Benchmark Models
- Euronext Clearing Internal Model Validation:
  - Is based on a configurable web-based graphical interface (as opposed to Excel-based validations), released in 2016
  - Allows a full recalculation of risk algorithms (as opposed to qualitative validations)
  - Creates a parallel environment for risk calculations
- Benchmark Models:
  - Evaluate models performance by using market best practices, thus allowing a comparison with Euronext Clearing's peers
  - May represent a strategic decision facilitator since they provide indication on the efficiency of various margin algorithms
  - have been validated by Global Valuation Ltd, led by an eminent Professor at King's College, so that their consistency and adequacy are ensured



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# Model Validation Process

**1 Framework Soundness**

- Assessment of conceptual adequacy of the Risk Model
- Assessment of Regulatory Adequacy

**2 Model Replica**

- Replica of Risk Models via programs in all their components (input, calculation, output)

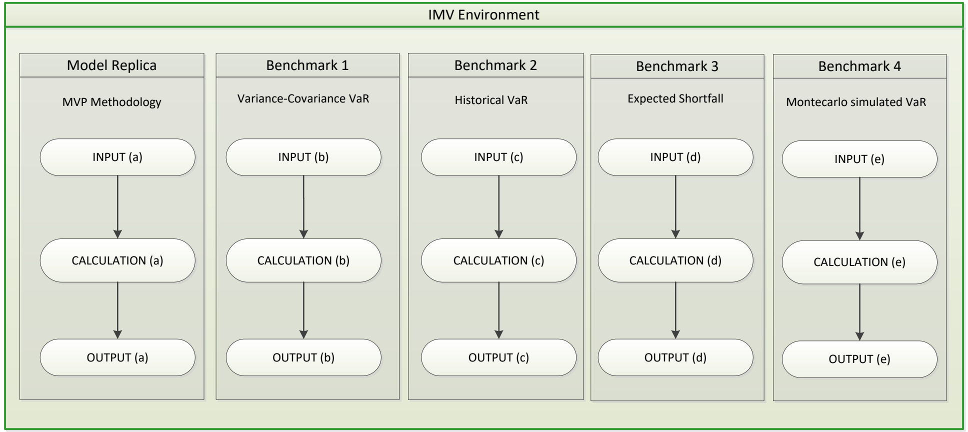
**3 Model Benchmarking**

- Assessment of model performance against market best practices
- VaR-based models

# Model Benchmarking

- Four “Value at Risk” (VaR) Benchmark Models have been selected, classified into two groups:
  - **Local-valuation methods (Var Cov):** value the portfolio once, at the initial position, and use local derivatives to infer possible movements
  - **Full-valuation methods**: fully re-price portfolio over a wide range of scenarios. Historical VaR, Expected Shortfall, Monte Carlo Simulated VaR belong to this family

Performance Analysis



# Benchmark Models

| | Variance-Covariance | Historical | Expected Shortfall | Monte Carlo |
|---|---|---|---|---|
| **Description** | For each portfolio, determines the amount of potential loss (VaR) that can occur with probability 1-CL over HP days | For each portfolio, determines the amount of potential loss (VaR) that can occur with probability 1-CL over HP days, by ranking historical returns from lowest to highest | Given a quantile-level q, calculates the expected loss of the portfolio given that a loss is occurring at or below the q-quantile | Estimates VaR by simulating random scenarios, revaluing instruments in the portfolio and selecting the CL-percentile of simulated values |
| **What's Inside** | **Cash-flow mapping:** Map every instrument (principal and coupon amounts) of the portfolio in the appropriate nodes based on Duration<br><br>**VaR calculation:** Given the present value of x of the future cash payments and the portfolio variance-covariance matrix Σ, $VaR = \alpha\sqrt{x'\Sigma x}$, where α is the normal distribution quantile | All yield input data are converted into prices p<br>For each node j=1,…,n and t=1,…,m day of the time series, given the current price $p_{curr}$, the following price variations are computed<br>$p_{curr}^{j}\,\frac{p_t^j}{p_{t-hp}^j}$<br>The portfolio is fully re-evaluated by multiplying the notional amount allocated to each node by the related price scenario and then selecting the CL-percentile | Same assumptions as Historical VaR<br>Given the loss function X, ES is given by:<br>$E(X \mid X < q) = \frac{\int_{-\infty}^{q} x f(x)dx}{\int_{-\infty}^{q} f(x)dx}$ | ▪ Select a stochastic process for yields: $y_t = f(t) + \varepsilon_t$<br>▪ Compute yields at T+1 for $N_{sim}$ times (Nelson Siegel Model)<br>▪ VaR is the CL-percentile of the $N_{sim}$ portfolio value variations |
| **Advantages** | ▪ Fast and simple to calculate<br>▪ Needs only correlations of risk factors as input | ▪ No assumptions on distribution | ▪ More conservative than Historical VaR<br>▪ Coherent risk measure | ▪ Converges to the solution<br>▪ Future can behave differently from the past |
| **Disadvantages** | • Normality assumption on portfolio returns | • No distribution to help determine future returns<br>• Assumes future will behave like the past | • No distribution to help determine future returns<br>• Assumes future will behave like the past | • High computational effort<br>• Needed calibration of parameters |



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# Appendix

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# Regulatory Framework

- **EMIR, Article 49 (1) (Review of models, stress testing and back testing):**
  "A CCP shall regularly review the models and parameters adopted to calculate its margin requirements, default fund contributions, collateral requirements and other risk control mechanisms. It shall subject the models to rigorous and frequent stress tests to assess their resilience in extreme but plausible market conditions and shall perform back tests to assess the reliability of the methodology adopted. The CCP shall obtain independent validation, shall inform its competent authority and ESMA of the results of the tests performed and shall obtain their validation before adopting any significant change to the models and parameters."

- **ESMA RTS No. 153/2013, Section 1 (Models and Programmes), Article 47 (1) (Model Validation):**
  "A CCP shall conduct a comprehensive validation of its models, their methodologies and the liquidity risk management framework used to quantify, aggregate, and manage its risks. Any material revisions or adjustments to its models, their methodologies and the liquidity risk management framework shall be subject to appropriate governance, including seeking advice from the risk committee, and validated by a qualified and independent party prior to application ."

- **CPMI-IOSCO Principles for Financial Market Infrastructures (2012), Principle (3.2.16):**
  "The board should ensure that there is adequate governance surrounding the adoption and use of models, such as for credit, collateral, margining, and liquidity risk-management systems. An FMI should validate, on an ongoing basis, the models and their methodologies used to quantify, aggregate, and manage the FMI's risks. The validation process should be independent of the development, implementation, and operation of the models and their methodologies, and the validation process should be subjected to an independent review of its adequacy and effectiveness. Validation should include (a) an evaluation of the conceptual soundness of (including developmental evidence supporting) the models, (b) an ongoing monitoring process that includes verification of processes and benchmarking, and (c) an analysis of outcomes that includes backtesting."


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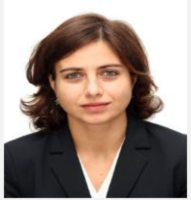

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