Initial Margin: Standardized Approach
Summary

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- Initial Margin Calculation
Margin Introduction

- Margin is collateral that one party needs to deposit with a broker or an exchange to cover some or all of the credit risk.
- Initial Margin is the amount of collateral required to open a position.
- Maintenance Margin is the minimum amount of collateral required to keep the position open after inception.
- Margin Balance = Asset value – Borrowed fund
- Margin Call: if (Margin balance) < (Maintenance margin), the broker issues a margin call that requires the investor to bring the margin balance back to initial margin.
Initial Margin

Initial Margin Scope

- Initial margin calculation is counterparty-portfolio-based.
- Initial margin calculation in a bank contains non-cleared OTC derivatives only as cleared products are already covered by Exchanges.
- Derivative trades belonging to a counterparty will be divided into a cleared portfolio and a non-cleared portfolio. The initial margin is computed for the non-cleared portfolio.
Initial Margin Calculation hierarchy

- Calculation is conducted from the lowest level to the highest one:
  - risk factor → risk bucket → risk measure → risk class → product class → final initial margin
- Define 4 product classes
  - Interest Rates and Foreign Exchange Product (RatesFX)
  - Credit Product
  - Equity Product
  - Commodity Product
Define 6 risk classes
◆ Interest Rate
◆ Credit (Qualifying): non-securitization and simple securitization
◆ Credit (Non-Qualifying): complex securitization
◆ Equity
◆ Commodity
◆ FX

Define 3 risk measures
◆ Delta
◆ Vega
◆ Curvature
Initial Margin Calculation hierarchy (Cont’d)

◆ Define risk buckets
  ◆ Interest rate bucket: based on currency (USD, EUR, CAD, …)
  ◆ Credit bucket: based on credit quality (sovereign, financial, technology, …)
  ◆ Equity bucket: based on sector (financial, industrial, …)
  ◆ Commodity bucket: based on commodity type (crude, gas, …)
  ◆ FX: each FX rate is a bucket

◆ Define risk factors
  ◆ Interest rate curve: 12 yields per curve
  ◆ Credit curve: 5 spreads per credit curve
  ◆ Equity: spot price
  ◆ Commodity: spot price
  ◆ FX: spot exchange rate
Sensitivity Calculation

**Delta calculation**

- **Interest rate (PV01):**
  \[ s(i, r_t) = V_i(r_t + 1bp, cs_i) - V_i(r_t, cs_t) \]
  where \( r_t \) – interest rate; \( cs_t \) – credit spread; 1bp – 1 basis point; \( V_i \) – market value

- **Credit (CS01):**
  \[ s(i, cs_t) = V_i(r_t, cs_i + 1bp) - V_i(r_t, cs_t) \]

- **Equity:**
  \[ s_{ik} = V_i(EQ_k + 1%EQ_k) - V_i(EQ_k) \]
  where \( EQ_k \) – spot price of equity k.

- **Commodity:**
  \[ s_{ik} = V_i(CTY_k + 1%CTY_k) - V_i(CTY_k) \]
  where \( CTY_k \) – spot price of commodity k.

- **FX:**
  \[ s_{ik} = V_i(FX_k + 1%FX_k) - V_i(FX_k) \]
  where \( FX_k \) – spot exchange rate of base currency k.
Sensitivity Calculation (Cont’d)

- **Vega calculation**
  \[ VR_{ik} = \sum_j \sigma_{kj} \frac{dV_i}{d\sigma}, \quad \text{where } \sigma_{ik} \text{ – implied volatility} \]

- **Curvature calculation**
  \[ CVR_{ik} = \sum_j SF(t_{ik})\sigma_{kj} \frac{dV_i}{d\sigma} \]
  
  where \( SF(t) = 0.5 \min(1, \frac{14d}{t}) \) is a scaling factor and \( t_{kj} \) is the expiry date.
Initial Margin Calculation

- A risk weight is defined for each risk factor.
- A correlation is specified for each risk factor pair.
- Within a product class, calculate initial margin for each risk class
  - Net all sensitivities for each risk factor $k \rightarrow s_k$
  - Compute risk weighted sensitivity $WS_k = RW_k s_k CR_k$
    where $WS_k$ – risk weight and $CR_k$ – concentration risk factor
  - Aggregate weighted sensitivities within each bucket

\[
K = \sqrt{\sum_{k} WS_k^2 + \sum_{k} \sum_{i \neq k} \rho_{ki} f_{ki} WS_k WS_i}
\]

where $\rho_{ki}$ – correlation and $f_{ki}$ – correlation adjustment
Initial Margin

Initial Margin Calculation (Cont’d)

- Aggregate buckets to obtain a sensitivity initial margin
  \[
  \text{DeltaMargin} = \sqrt{\sum_b K_b^2 + \sum_b \sum_{b\neq c} \gamma_{bc} S_b S_c} + K_{\text{residual}}
  \]
  \[
  \text{VegaMargin} = \sqrt{\sum_b K_b^2 + \sum_b \sum_{b\neq c} \gamma_{bc} \delta_{bc} S_b S_c + K_{\text{residual}}}
  \]
  \[
  \text{CurvatureMargin} = \max \left( \sum_{b,k} CVR_{b,k} + \lambda \sqrt{\sum_b K_b^2 + \sum_b \sum_{b\neq c} \gamma_{bc}^2 S_b S_c} \right) + \theta_{\text{residual}}
  \]

- Initial margin for a risk class
  \[
  IM_x = \text{DeltaMargin}_x + \text{VegaMargin}_x + \text{CurvatureMargin}_x
  \]
Initial Margin Calculation (Cont’d)

- Initial margin for the product class
  \[ IM_p = \sqrt{\sum_r IM_r^2 + \sum_r \sum_{s \neq r} \psi_{rs} IM_r IM_s} \]

- Final initial margin
  \[ IM = IM_{RateFX} + IM_{Credit} + IM_{Equity} + IM_{Commodity} \]
Thanks!

You can find more online presentations at https://finpricing.com/lib/EqVariance.html