FinPricing®

Initial Margin: Standardized Approach

Initial Margin

Summary

- Margin Introduction
- Initial Margin Scope
- Initial Margin Calculation hierarchy
- Sensitivity Calculation
- Initial Margin Calculation

Initial Margin

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 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 coverred 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

Initial Margin Calculation hierarchy (Cont'd)

- 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 cuve
  - Equity: spot price
  - Commodity: spot price
  - FX: spot exchange rate

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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.

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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 $SF(t) = 0.5 \min(1, \frac{14}{t})$ 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 → 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 ρ_{ki} – correlation and f_{ki} – correlation adjustment

Initial Margin Calculation (Cont'd)

- Aggregate buckets to obtain a sensitivity initial margin

$$DeltaMargin = \sqrt{\sum_b K_b^2 + \sum_b \sum_{b \neq c} \gamma_{bc} S_b S_c} + K_{residual}$$

$$VegaMargin = \sqrt{\sum_b K_b^2 + \sum_b \sum_{b \neq c} \gamma_{bc} \delta_{bc} S_b S_c} + K_{residual}$$

$$CurvatureMargin = max\left(\sum_{b,k} CVR_{b,k} + \lambda \sqrt{\sum_b K_b^2 + \sum_b \sum_{b \neq c} \gamma_{bc}^2 S_b S_c}\right) + \theta_{residual}$$

- Initial margin for a risk class

$$IM_x = DeltaMargin_x + VegaMargin_x + CurvatureMargin_x$$

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/CdCreditSpreadCurve.html