Initial Margin: Standardized Approach

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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 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 $\rightarrow$ risk bucket $\rightarrow$ risk measure $\rightarrow$ risk class $\rightarrow$ product class $\rightarrow$ 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

Sensitivity Calculation

◆ Delta calculation

　◆ Interest rate (PV01): $\qquad s(i, r_t) = V_i(r_t + 1bp, cs_i) - V_i(r_t, cs_t)$
　　where r_t − interest rate; cs_t − credit spread; 1bp − 1 basis point; V_i − market value

　◆ Credit (CS01): $\qquad s(i, cs_t) = V_i(r_{t,}, cs_i + 1bp) - V_i(r_t, cs_t)$

　◆ Equity: $\qquad s_{ik} = V_i(EQ_k + 1\%EQ_k) - V_i(EQ_k)$
　　where EQ_k − spot price of equity k.

　◆ Commodity: $\qquad s_{ik} = V_i(CTY_k + 1\%CTY_k) - V_i(CTY_k)$
　　where CTY_k − spot price of commodity k.

　◆ FX: $\qquad s_{ik} = V_i(FX_k + 1\%FX_k) - V_i(FX_k)$
　　where FX_k − spot exchange rate of base currency k.

Sensitivity Calculation (Cont'd)

◆ Vega calculation

$$VR_{ik} = \sum_j \sigma_{kj} \frac{dV_i}{d\sigma}, \qquad \text{where } \sigma_{ik} - \text{implied volatility}$$

◆ Curvature calculation

$$CVR_{ik} = \sum_j SF(t_{ik}) \sigma_{kj} \frac{dV_i}{d\sigma}$$

where $SF(t) = 0.5 \min(1, \frac{14\,d}{t})$ 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 $\rho_{ki} -$ 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!

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http://www.finpricing.com/paperList.html