



FinPricing®

# Initial Margin: Standardized Approach

# Initial Margin

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# 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.
- ◆  $\text{Margin Balance} = \text{Asset value} - \text{Borrowed fund}$
- ◆ Margin Call: if  $(\text{Margin balance}) < (\text{Maintenance margin})$ , 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

## 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

## 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

## 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):  $s(i, r_t) = V_i(r_t + 1bp, cs_i) - V_i(r_t, cs_t)$   
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.



# Initial Margin

## 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

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

where  $SF(t) = 0.5 \min(1, \frac{14d}{t})$  is a scaling factor and  $t_{kj}$  is the expiry date.

# Initial Margin

## 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

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

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

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

- ◆ Initial margin for a risk class

$$IM_x = DeltaMargin_x + VegaMargin_x + CurvatureMargin_x$$

# Initial Margin

## 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/IrCurveIntroduction.html>

