An Enhanced Initial Margin Methodology to Manage Tail Credit Risk

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Agenda

Disclaimer

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Contents

Background knowledge: Counterparty Risk and Initial Margin

- Before the 2008 crisis, the focus was on Market Risk (i.e. the risk derived from movement in economic varibles). However, after the crisis, there is a new focus on Counterparty Risk, this is the risk from a counterparty defaulting on its obligations.

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    - Variation Margin - Exchange of MtM
    - Initial Margin - should be thought as an "independent amount"

The Role of Variation and Initial Margin

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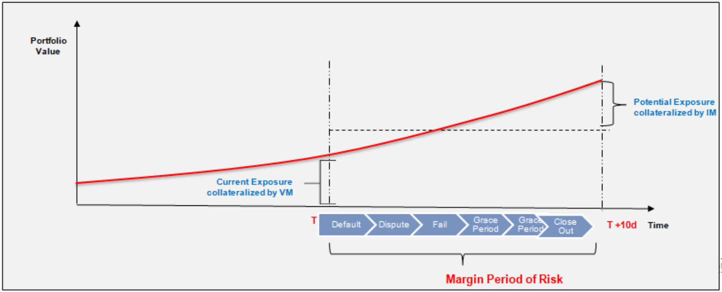
- **Initial Margin** – In the event of a default, the surviving firm could face losses resulting from an increase in replacement costs from the time of default to the time when the positions are unwound or replaced (i.e. the "MPoR").



How is Initial Margin calculated?

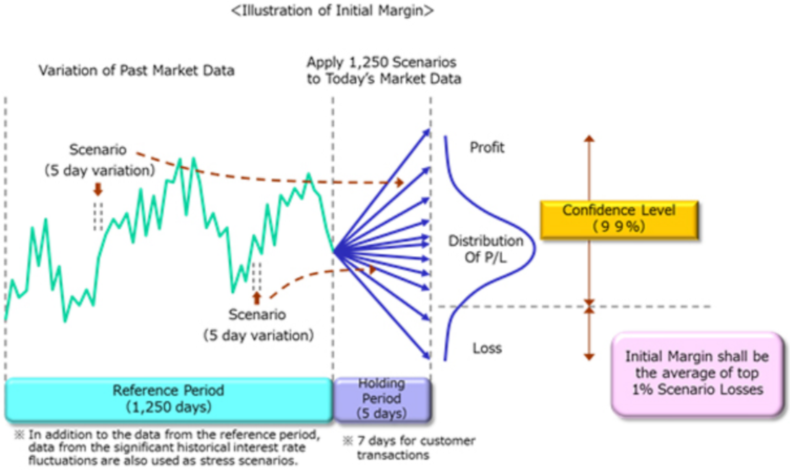


Figure: Pic courtesy of the Tokyo Stock Exchange

Contents

Initial Margin Before UMR

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- An example would look like this:

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1	Solid rating - big firms	0
2	Smaller firms	VaR + spread (firm view)
3	C-rated/unrated	Max loss on the portfolio

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- How do we calculate the spread for Tier 2?

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Table: CVA for different collateralization schemes for an at-the-money swap.

Rating	Prob default (basis points)	Notional	Uncollateralised CVA	Collateralised CVA (VM)	Collateralised CVA (VM-IM)
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Table: Figures in US dollars

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- What are the incentives to trade with smaller counterparties, then?

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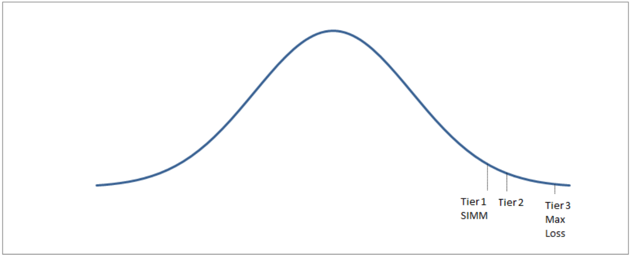
- UMR rules allow firms to request an IM greater than SIMM. But how is this IM amount calculated?
- The rationale is to cover the PnL tail-risk. The percentile chosen should compensate for the Default Probability together with the risk appetite on that counterparty.



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A Methodology to Improve Initial Margin

- We define an add-on to the current IM that compensates for the credit risk of counterparty j.

$$IM^j_{specific} = IM_{general} + IM^j_{add-on} \tag{3}$$

where $IM_{general}$ accounts for the gap risk without any consideration on the credit quality of the counterparty (e.g. SIMM), and IM^j_{add-on} is the add-on that is specific to the counterparty's $j$credit spread.

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- We express IM^{j}_{add-on} as a proportion of the $IM_{general}$ giving us

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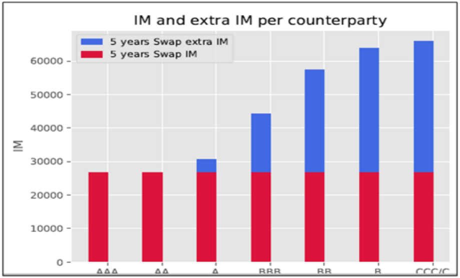
- As an example, an AAA-rated counterparty will always have to post $IM_{general}$ (i.e. SIMM), while the rest will have to post $IM_{general} + \alpha^j IM_{general}$

The IM Add-on

- The graph below shows the proposed IM components: a "base" IM as given by for example SIMM, and the proposed add-on, given by the credit rating differentials.
- This is a simplified example with a single Swap on the netting set
- We can see that the proposed add-on is significant. This means, that the tail risk not considered in SIMM is material for lower-rated counterparties.



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Model Calibration

- The total IM requested to a party should compensate for 2 risks:
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- The values of α^j are computed by equating the CVA of the counterparty in question (say CCC) with the CVA of the AAA-counterparty. We solve for the α^j such that:

$$CVA^{AAA}(PD_{AAA}) = CVA^{CCC}(PD_{ccc}, \alpha^J) \tag{6}$$

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- In this way, each counterparty will be equivalent to a AAA one from a credit-risk worthiness.

Model Calibration - continued

- In practice, we solve numerically for α^j in the following equation:

$$\mathbb{E}\left[\int_0^T (V_t - VM_t - IM_t)^+ LGD_t PD_t^{AAA} DF_t dt\right] - \mathbb{E}\left[\int_0^T \left(V_t - VM_t - IM_t - \alpha^j IM_t\right)^+ LGD_t PD_t^j DF_t dt\right] = 0 \quad (7)$$

- The value α^j that solves Equation 7 is used in Equation 6 (reproduced below) to determine $IM^j_{\text{add-on}}$ for Counterparty j and compute today's IM^j_{specific} .

$$IM^j_{\text{specific}} = IM_{\text{general}} + \alpha^j IM_{\text{general}} \quad (8)$$

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	AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
As dollar amount	0	0	3,859	17,547	30,615	36,924	39,108
As % over SIMM	0%	0%	14%	66%	114%	138%	146%

Table: IM ADD-ON values per rating and maturity

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- The table below shows the Total IM amount to post: SIMM + Add-on

	AAA	AA	A	BBB	BB	B	CCC
As dollar amount	26,789	26,789	30,648	44,336	57,404	63,713	65,897
As % over SIMM	0%	0%	14%	66%	114%	138%	146%

Table: Specific Initial Margin = General IM + Add-On

Numerical Example - 5Y Swap - Continued

The table below shows the approx bps equivalent to the Total IM amount. If SIMM's IM is obtained by applying a 50bps shock, the IM for a CCC is equivalent to applying 123bps to the position.

AAA (SIMM)	AA	A	BBB	BB	B	CCC
51	51	57	83	107	119	123

Table: IM ADD-ON values per rating and maturity

For comparison Below are SIMM's risk weights for *regular currencies*

2w	1m	3m	6m	1y	2y	3y	5y	10y	15y	20y	30y
114	115	102	71	61	52	50	51	51	51	54	62

Numerical Example - Portfolio of Swaps

Below we present an example of the method for a portfolio of Libor Swaps
The portfolio composition is as follows:

Swap maturity	Notional
3Y	1 Million
5Y	1 Million
7Y	1 Million
10Y	1 Million

IM ADD-ON values per rating and maturity

	AAA	AA	A	BBB	BB	B	CCC
As dollar amount	0	1,064	10,398	23,436	36,956	41,046	43,924
As % over SIMM	0%	3%	28%	62%	98%	109%	116%

The table below shows the Total IM amount to post: SIMM + Add-on

	AAA	AA	A	BBB	BB	B	CCC
As dollar amount	37,802	38,866	48,200	61,238	74,758	78,848	81,726
As % over SIMM	0%	3%	28%	62%	98%	109%	116%

Numerical Example - Method Stability

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	AAA SIMM	AA	A	BBB	BB	B	CCC
As dollar amount	28,449	29,301	33,179	44,747	55,389	60,502	62,746
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- We can see that the changes on the IM per credit cohort are in line with changes in SIMM. The method does not present big jumps in IM.

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- The new Specific Initial Margin is composed of two quantities: the IM as computed today in the industry (e.g. SIMM) plus an add-on, which depends on the counterparties' credit rating. This second component is computed so that under a CVA framework, the CVA of the corresponding netting set is reduced to that of a AAA-rated counterparty .
- As opposed to the current CVA amounts which are negligible, we have shown that the extra IM required is significant specially for the lowest rated counterparties.

Contents

Questions ?

Contents

Insights on the Quant Profession

- Which are the skills required?
  - Skills to get the interview
  - Skills to get the job
  - Skills to get promoted
- Areas where quant skills are required.
  - Pricing Analysts, Risk Analyst, Traders, Quantitative Developer, Data Scientist, among others.
  - We'll describe them further on the next slide

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