Calculating Counterparty Exposures for CVA

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Credit Exposure and Definitions

Methodology for Quantifying Exposure

The Impact of Netting and Collateral

Example Results
Potential Future Exposure

Only positive outcomes result in credit exposure

\[ = \max(\ , 0) = \]
Potential Future Exposure (PFE) and Expected Exposure (EE)
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Example Results
Exposure Simulation Methodology (I)

1. Factor choice
   - Choose a model for each risk factor
   - The model must provide a reasonable distribution of the possible risks of the transactions and thus account for a large fraction of the future plausible scenarios - risk manager view – PFE mainly AND/OR
   - Model must calibrate to (match) today’s market variables (for example, yield curves, FX rates, commodity prices) – trader view – CVA mainly

2. Scenario generation
   - Each scenario is a joint realisation of risk factors at various points in time
   - It must be reasonably easy to simulate risk factors within a Monte Carlo simulation
   - Risk factors need also to be correlated
Exposure Simulation Methodology (II)

3. Revaluation
   - Revalue individual positions at each point in time in the future
   - E.g. 250 counterparties, average 40 trades with each counterparty, 100 simulation steps, 10,000 scenarios - total number of instrument revaluations will be 10 billion

4. Aggregation
   - After revaluation, there will be a matrix of values with respect to scenario and time point. Now aggregate these values up to the netting set (or counterparty) level.

5. Post processing
   - Treatment of collateral (discussed later)
   - Go through exposure and account for collateral according to thresholds etc

6. Extraction
   - Extraction of statistics such as EE, EPE and PFE
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Example Results
Calculating Incremental Exposure

• Simply the exposure after adding a new deal minus the exposure before adding the new deal
• Used for many years in pre-trade approvals with credit lines

\[ EE'_i(u) = EE_{NS+i}(u) - EE_{NS}(u) \]

- Incremental expected exposure for trade \( i \)
- Expected exposure of netting set with new trade \( i \)
- Expected exposure of netting set before new trade
Incremental Expected Exposure

Incremental Expected Exposure

![Graph showing incremental expected exposure over time](image-url)
## Impact of Collateral

<table>
<thead>
<tr>
<th></th>
<th>Party A</th>
<th>Party B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Amount</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Threshold</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Minimum Transfer Amount</td>
<td>0.25%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Rounding</td>
<td>0.05%</td>
<td>0.05%</td>
</tr>
</tbody>
</table>

10-day remargin period assumed
Credit Exposure and Definitions

Methodology for Quantifying Exposure

The Impact of Netting and Collateral

Example Results
Base Case - IRS

- 5-year interest rate swap, 500 bps counterparty

- Simple calculation – $0.47\% \times 500 = 2.36$ bps

- Accurate calculation – 2.34 bps or 0.085% of notional up-front
Base Case - CCY

- 5-year cross-currency swap, 500 bps counterparty

- Simple calculation – $1.50\% \times 500 = 7.50 \text{ bps}$

- Accurate calculation – $6.99 \text{ bps}$ or $0.255\%$ of notional up-front
Incremental CVA

- Base case IRS, existing trade is a CCY swap

- Simple calculation – $0.24\% \times 500 = 1.19$ bps

- Accurate calculation – 1.19 bps or 0.043% of notional up-front
CSA Counterparty

- Base case IRS, CSA with threshold

- Simple calculation – $0.34\% \times 500 = 1.71$ bps

- Accurate calculation – $1.75$ bps or $0.064\%$ of notional up-front
DVA

• Base case IRS with DVA (own credit at 250 bps)

- Simple calculation – 0.47% × 500 – 0.37% × 250 = 1.44 bps
- Accurate calculation – 1.37 bps or 0.047% of notional up-front
Funding Costs – no CSA

- Different IRS, assume risk-free cashflows priced on OIS curve
- Assume our funding spread is 250 bps (symmetric)

Calculation – $2.22\% \times 250 - 1.78\% \times 250 = 1.09 \text{ bps} = 0.44\% \times 250$

- CVA with a 500 bps counterparty (less DVA) = 6.63 bps
Funding Costs – CSA no Threshold

- Assume risk-free cashflows priced on OIS curve, cash collateral
- 10-day remargin period (10-days to receive, post collateral immediately)

- Calculation – $0.37\% \times 250 = 0.93 \text{ bps}$
- CVA with a 500 bps counterparty = $1.85 \text{ bps (11.1 bps without CSA)}$