Regulation and the Difference Guises of CVA

Counterparty Credit Risk Capital Charges

Analysis of the CVA Capital Charge

Impact of Central Clearing
# CVA and Accounting Rules

## IFRS 13 (1st January 2013)

- “The entity shall include the effect of the entity’s net exposure to the credit risk of that counterparty or the counterparty’s net exposure to the credit risk of the entity in the fair value measurement when market participants would take into account any existing arrangements that mitigate credit risk exposure in the event of default” (CVA)

- Non-performance risk includes, but may not be limited to, an entity's own credit risk” (DVA)

## Exit price concept

- Explicit that own credit must be incorporated into the fair value measurement based on the concept of “exit price”

- Exit price implies the use of risk-neutral default probabilities
CVA and Basel III capital requirements

- **BCBS Consultative document (December 2009)**
  - Two-thirds of CCR losses due to CVA and only about one-third were due to actual defaults

- **BCBS Basel III text**
  - “Banks will be subject to a capital charge for potential mark-to-market losses (i.e. CVA) associated with a deterioration in the credit worthiness of a counterparty.”

\[
CVA = LGD_{mkt} \sum_{i=1}^{T} \max \left( 0; \exp \left( - \frac{s_{i-1} t_{i-1}}{LGD_{mkt}} \right) - \exp \left( - \frac{s_i t_i}{LGD_{mkt}} \right) \right) \left( \frac{EE_{i-1} B_{i-1} + EE_i B_i}{2} \right)
\]

- **BCBS “Application of own credit risk adjustments to derivatives”**
  - “...... all DVAs for derivatives should be fully deducted....”

- **Exemptions in Europe under CRD IV**
  - Sovereigns / non-financials
## The Different Guises of CVA

<table>
<thead>
<tr>
<th>Accounting</th>
<th>Default Probability</th>
<th>Exposure</th>
<th>DVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>If CVA is seen as a reserve then real world parameters are used</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Historical (or blended) default probabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Historical volatilities and correlations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If CVA is seen as a market price then risk-neutral parameters are used</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Credit spread implied default probabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Market implied volatilities and correlations (where available)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current accounting rules (IAS 39 / FAS 157) do not give clear direction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IFRS 13 requirements over exit price imply a risk-neutral approach (particularly relevant for the calculation of default probabilities)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front-office (for pricing)</td>
<td>Typically risk-neutral (spread based) even if bank’s accounting CVA is defined historically</td>
<td>Typically risk-neutral exposure</td>
<td>Typical price will include some (but not all) of the DVA (not with real world default probs)</td>
</tr>
<tr>
<td></td>
<td>May charge based on historical (or blended) but then ignore DVA</td>
<td>• Real world simulation if used will probably be a facet of using older PFE type systems for CVA calculations</td>
<td></td>
</tr>
<tr>
<td>Regulatory (CVA VAR)</td>
<td>Risk-neutral (Basel III clearly defines CVA with respect to credit spreads)</td>
<td>Real world parameters for simulation (IMM), or implicitly in other methods (e.g. CEM)</td>
<td>Not allowed (no DVA offset in calculation of CVA VAR)</td>
</tr>
<tr>
<td></td>
<td>Mapping methods are important</td>
<td>• Risk-neutral approach consideration for IMM banks to get better alignment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Additional of stressed VAR component creates misalignment</td>
<td></td>
</tr>
</tbody>
</table>
Real World or Risk-Neutral Parametrisation

<table>
<thead>
<tr>
<th></th>
<th>Real world</th>
<th>Risk-neutral</th>
<th>Market practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default probability</td>
<td>Historical (rating based)</td>
<td>CDS, bonds, proxies and indices</td>
<td>Risk-neutral</td>
</tr>
<tr>
<td>Drift</td>
<td>Forecasting</td>
<td>Forward rates</td>
<td>Risk-neutral</td>
</tr>
<tr>
<td>Volatility</td>
<td>Historical time series</td>
<td>Implied volatility surface</td>
<td>Mainly risk-neutral</td>
</tr>
<tr>
<td>Correlation</td>
<td>Historical time series</td>
<td>Spread options, quantos, baskets</td>
<td>Mainly real world</td>
</tr>
</tbody>
</table>
• **Using credit spreads (compared to historical default probabilities)**
  
  – Resulting CVA will be many times higher (although DVA reduces this)
  
  – But most credit spreads cannot be easily obtained
  
  – Mapping rules required and hedging not obvious

<table>
<thead>
<tr>
<th>Credit Spread</th>
<th>Risk premium</th>
<th>Risk-neutral default loss</th>
<th>Real-world default loss (bps)</th>
<th>Risk neutral loss (bps)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>4</td>
<td>67</td>
<td>16.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aa</td>
<td>6</td>
<td>78</td>
<td>13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>128</td>
<td>9.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baa</td>
<td>47</td>
<td>238</td>
<td>5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ba</td>
<td>240</td>
<td>507</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>749</td>
<td>902</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caa</td>
<td>1690</td>
<td>2130</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hull, J., M. Predescu and A. White, 2004
### Example categorisation for European counterparties

<table>
<thead>
<tr>
<th>CDS Index Proxy</th>
<th>Counterparty</th>
<th>Rating</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single name CDS proxy</td>
<td>Corporates</td>
<td>BBB &amp; better</td>
<td>iTraxx EUR Non-Financials</td>
</tr>
<tr>
<td></td>
<td>Financials</td>
<td>BBB and below</td>
<td>iTraxx EUR crossover</td>
</tr>
<tr>
<td></td>
<td>Sovereigns</td>
<td></td>
<td>iTraxx EUR Financials</td>
</tr>
</tbody>
</table>

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Example Marking Methodology

- **Direct mapping**
  - Single name CDS
  - Names with liquid bond/loan spreads (but then there is a basis issue)

- **Proxies**
  - Sovereign mapping (e.g. states, cities, banks, names with explicit or implicit sovereign guarantees)
  - Other direct link to similar credit
  - But no capital relief!

- **Remaining generic names**
  - Stratify names into rating/region/industry categories
  - Mark to relevant index
  - Perform regression periodically
"... given the relative illiquidity of sovereign CDS markets a sharp increase in demand from active investors can bid up the cost of sovereign CDS protection. CVA desks have come to account for a large proportion of trading in the sovereign CDS market and so their hedging activity has reportedly been a factor pushing prices away from levels solely reflecting the underlying probability of sovereign default."

Bank of England Q2

- **CVA desks with similar hedging requirements**
  - Extreme moves in a single variable (e.g. spread blowout)
  - Sudden change in co-dependency between variables (creating cross gamma issues)
  - At this point do we stop hedging bear the pain?
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## Overview of counterparty risk related capital charges

<table>
<thead>
<tr>
<th>IMM approval</th>
<th>Default risk capital charge</th>
<th>CVA capital charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMM method</td>
<td><strong>Advanced method:</strong></td>
<td></td>
</tr>
<tr>
<td>• Higher of IMM capital charge based on EAD calculated with both standard and stressed calibrations</td>
<td>• Uses banks VAR model for bonds to model spread</td>
<td></td>
</tr>
<tr>
<td>• If approval exists for collateralised trades, then future collateral can be modelled.</td>
<td>• Eligible hedges (single-name and index CDS) can be included</td>
<td></td>
</tr>
<tr>
<td>IMM approval only</td>
<td></td>
<td>Sum of normal and stressed VAR</td>
</tr>
<tr>
<td>Simple methods</td>
<td><strong>Standardised method:</strong></td>
<td>Hedges included but limited relief from indices</td>
</tr>
<tr>
<td>• Current exposure method</td>
<td>• Simple variance formula driven by EAD</td>
<td></td>
</tr>
<tr>
<td>• Standardised method</td>
<td>• EAD defined according to default risk approval (CEM, IMM etc)</td>
<td></td>
</tr>
<tr>
<td>• Shortcut method (collateralized trades)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No approvals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comparison Between CEM and IMM

**Single IRS**

**Portfolio of two IRS**

**Single IRS (off market)**
Modelling Collateralised Exposures

- Shortcut method can be rather conservative
- IMM method requires modelling
  - Threshold / minimum transfer amount
  - Time to receive collateral
  - Volatility of collateral
  - Need to post collateral

\[ E_t = \max(V_t - C_{t-k}, 0) \]

Positive exposure at time \( t \)
Future value at time \( t \)
Total collateral account \( k \) days ago
- IMM impact of margin period of risk of 20-days (zero threshold)

- Imperfect receipt of collateral

- Need to post collateral

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Impact of Collateral on Exposure

**Zero threshold CSA**

**Threshold CSA**

**One-way CSA (against)**

**Initial margin**
CVA with Independent Amount / Threshold

Zero threshold, 10 (business)-day margin period of risk

Independent amount
Threshold

Law of diminishing returns

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Regulation and the Difference Guises of CVA

Counterparty Credit Risk Capital Charges

Analysis of the CVA Capital Charge

Impact of Central Clearing
Standardised Approach (I)

- **Normal distribution VAR approach based on the standard deviation of CVA**
  - 99% confidence level, 1-year time horizon
  - Included single-name and index hedges

- **Start with exposure to each counterparty (hedged with single name CDS)**

\[ N_i = M_i EAD_i^{total} - M_i^{hedge} B_i \]

  - Single name hedged notional
  - Effective maturities
  - Notional of single-name hedge

- **EAD may be defined by**
  - Current exposure method (MtM + add-on)
  - Standardised method
  - Shortcut method (collateralised trades)
  - IMM method (EEPE × alpha) – maximum of normal and stressed scenarios
Standardised Approach (II)

- Index hedges (systematic risk) driven by a standard normal variable $V_{ind}$ and each counterparty position is driven by another normal variable $V_i$:

$$V_i = \rho V_{ind} + \sqrt{1 - \rho^2} \varepsilon_i$$

**Note:** this implies counterparty-counterparty spread correlation of $\rho^2$

- The standard deviation of the portfolio would then lead to:

$$K_i = 2.33\sqrt{h} \left( \rho \sum_i w_i N_i - \sum_i w_{ind} M_{ind} B_{ind} \right)^2 + (1 - \rho^2) \sum_{ind} w_i^2 N_i^2$$

- Volatility (credit) represented by weights ($w$) via rating (or average rating for index hedges)

AAA = 0.7%, AA = 0.7%, A = 0.8%, BBB = 1%, BB = 2%, B = 3%, CCC = 10%

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Bank can model the VAR with their own models with CVA defined by:

\[
CVA = LGD_{mkt} \sum_{i=1}^{T} \max\left(0; \exp\left(-\frac{s_{i-1}t_{i-1}}{LGD_{mkt}}\right) - \exp\left(-\frac{s_it_i}{LGD_{mkt}}\right)\right) \left(\frac{EE_{i-1}B_{i-1} + EE_iB_i}{2}\right)
\]

- **Exposure profile is held fixed for simplicity**
  - Only credit spreads are simulated
  - Ignores other market factors (interest rates, FX, commodity, .......)

- **Other points to note**
  - Separate to normal VAR calculations
  - Capital defined as sum of normal and stressed (wrt credit spreads) calculations
  - 10-day period, 99% confidence level, usual VAR multiplier of 3
Advanced Approach (II)

Recalculated CVA values

Simulate credit spreads (and hedges)

CVA VAR

$$LGD_{mkt} \sum_{i=1}^{T} \max \left( 0; \exp \left(- \frac{s_{i-1} t_{i-1}}{LGD_{mkt}} \right) - \exp \left(- \frac{s_{i} t_{i}}{LGD_{mkt}} \right) \right) \left( \frac{EE_{i-1} B_{i-1} + EE_{i} B_{i}}{2} \right)$$

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Capital Treatment of Hedges

- Single name CDS
  - Standardised approach - offset according to EAD and maturity adjustment
  - Advanced approach - offset calculated within VAR simulation (delta neutral?)
  - No relief for single-name proxy hedges

- Index CDS
  - Standardised approach – as above but according to assumed 50% correlation
  - Advanced approach – correlation can be modelled although “If the basis is not reflected to the satisfaction of the supervisor, then the bank must reflect only 50% of the notional amount of index hedges in the VaR”

- Structured credit
  - No benefit from other credit derivatives (tranches, nth to default structures)
  - Securitisations?

- Market risk hedges
  - Split hedge issue - must be included in standard VAR calculation (unlike eligible hedges) and therefore may increase capital!
Examples – Standardised vs. Advanced Capital Charges

5-year swap. CEM approach gives relatively small exposure and much lower capital charge.

Single counterparty examples

5-year + 7-year swap. Off market and strong netting benefit. CEM approach gives relatively small exposure and much lower capital charge.
- Pricing required to cover CVA and achieve a return on capital (RoC) for swaps as a function of maturity (DVA ignored)

\[
RoC = \frac{(Price - CVA)}{0.5 \times Regulatory\ Capital \times Maturity}
\]

Approximately the same for 6-year swap. Advanced approach gives higher costs for longer maturities
Impact of Single Name Hedges

6-year swap (CVA VAR for standardised and advanced approximately the same)

**Standardised approach**

*Delta hedge too small as EAD is relatively large under CEM approach. Capital relief very misaligned with CVA hedging.*

**Advanced approach**

*Delta hedge slightly too small due to need to use stressed data in EEPE calculation (assume all other components are aligned)*
Impact of Index Hedges

6-year swap (CVA VAR for standardised and advanced approximately the same)

**Standardised approach**

Capital relief poor due to misaligned delta and 50% correlation assumption.

**Advanced approach**

Delta hedge quite good giving almost 50% capital relief (80% correlation assumed).
**Impact of Portfolio Effect**

**Standardised approach**

Significant portfolio effect. Hedging improves with size of portfolio. Idiosyncratic risk diversifies and systemic risk can be hedged.

**Advanced approach**

Portfolio effect poor with high correlation of 80% assumed (more systemic risk). Not clear if high correlation is beneficial or not for large portfolios.
Advanced Approach - Portfolio Effect with Index Hedging

- High index-counterparty correlation likely to be assumed
  - This allows better hedging efficiency and capital relief
  - However, it also implies less diversifiable idiosyncratic risk as counterparty – counterparty spread correlation must also be high
Regulation and the Difference Guises of CVA

Counterparty Credit Risk Capital Charges

Analysis of the CVA Capital Charge

Impact of Central Clearing
Central Clearing Overview

Bilateral market

CCP market

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• Allocation of losses after CCP has closed out trades and liquidated variation margin

Initial margin (member)
Reserve fund (member)
CCP equity
Reserve Fund (non-defaulting members)
Additional capital contribution from CCP
CCP Capital
Liquidity Support or CCP Fails
The Impact of Counterparty Risk Reduction

Central cleared trades

- CCP1
- CCP2
- CCP3
- CCP4
- ...
- ...

No Collateral

- CSA (Legacy)
- SCSA (New)

Reduce Counterparty Risk

Increase Funding Risk

No CSA ➔ CSA ➔ SCSA ➔ Centrally Cleared

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Overall Impact of CVA, DVA and Funding Costs

CVA + FCA + FBA (GBP)

Independent amount / Threshold (GBP millions)

Push to central clearing

Two-way CSA with low threshold
CVA capital charge is flawed

- Need to map huge universe of illiquid counterparties
- Even when counterparty is liquid, single-name hedging can create “doom loop” and regulators are clearly aware of this (exemptions / no capital relief for single-name proxies)
- Standardised vs. advanced approach are very different and not obvious which is favourable
- Not clear on the incentive or benefit when hedging with indices

Exemptions

- Within the context of the CVA capital charge, no economic rationale to exempt the very obvious CVA components (sovereigns, corporates.....)

Impact of collateral

- More focus on CVA for collateralised transactions
- Assessment of opaque risk to central counterparties is very difficult
- Central clearing is extremely expensive due to the law of diminishing returns in reducing CVA