Wrong-Way Risk, Collateral and Central Clearing

Jon Gregory, Partner
Wrong-Way Risk, Collateral and Central Clearing

i) CVA for collateralised counterparties

ii) General and specific wrong-way risk

iii) The impact of collateral on wrong-way risk

iv) Central counterparties

v) Overall impact of collateral on counterparty risk
Calculating Exposure with 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

**Obvious problems**
- Imperfect collateral parameters (can’t ask for enough)
- Time to receive collateral
- Volatility of collateral
- Need to post collateral ourselves
Margin Period of Risk

• Margin period of risk is the actual time delay when receiving collateral
  – Pre-default (posting frequency, operational delays, disputes, settlement, grace period)
  – Post-default (closeout, liquidation and rehedging / replacing trades)

• Must assume that collateral will always arrive late
  – For example, Basel II defines 10 business days for OTC derivatives
Receiving Collateral Reduces Risk

- **Residual risk is due to**
  - Margin period of risk (20-days in this example as can be required under Basel III)
  - Non-perfect collateral parameters (minimum transfer amount)
  - (In this case we assume zero threshold and cash collateral)
Example 1
Impact of Margin Period of Risk on CVA

- Base case IRS, CSA with zero threshold
CVA with Independent Amount / Threshold

![Graph showing CVA with Independent Amount/Threshold](image-url)
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Wrong-Way Risk

- It is typical to assume independence between
  - Default probability of counterparty
  - Exposure at default

- But in reality this is often wrong
  - Buying out of the money put options
  - Buying CDS protection
  - FX products involving local currencies

- Types of wrong-way risk
  - General (driven by macroeconomic co-dependencies)
  - Specific (driven structurally due to counterparty and trade type)
Empirical Evidence of Wrong-Way Risk

- **Interest rate products**
  - Duffee [1996] shows a clustering of corporate defaults during low interest rates periods
  - But institutions may be more likely to default when interest rates increase significantly?
  - Note: correlation and dependency are not the same thing

- **Currency products**
  - Levy and Levin [1999] show a devaluation of currencies linked to sovereign default
  - The devaluation is most severe for high credit quality entities
  - Loss in Asian crisis of 1997 (e.g. Thai Baht US dollar cross currency swap with a Thai bank)

- **Credit derivatives**
  - Very clear relationship between exposure (credit spreads) and counterparty default

<table>
<thead>
<tr>
<th>Rating</th>
<th>Devaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>83%</td>
</tr>
<tr>
<td>AA</td>
<td>83%</td>
</tr>
<tr>
<td>A</td>
<td>78%</td>
</tr>
<tr>
<td>BBB</td>
<td>73%</td>
</tr>
<tr>
<td>BB</td>
<td>59%</td>
</tr>
<tr>
<td>B</td>
<td>38%</td>
</tr>
<tr>
<td>CCC</td>
<td>38%</td>
</tr>
</tbody>
</table>

Source: JP Morgan 1999
One way to interpret wrong way risk is to look at the unconditional default probability and the conditional exposure.

\[ CVA(t) = LGD \int_{t}^{T} EE(u) dPD_c(u) \]

- \( CVA(t) \): Conditional Expected Exposure at time \( t \)
- \( LGD \): Loss Given Default
- \( EE(u) \): Expected Exposure at time \( u \)
- \( dPD_c(u) \): Probability of Default Conditional on Default at time \( u \)

The diagram shows the expected exposure over time for different scenarios:

- **EE**: Expected Exposure
- **EE (wrong-way risk)**
- **EE (right-way risk)**

The graph visualizes the expected exposure over a 10-year period, illustrating how the expected exposure changes under different risk scenarios.
Interest Rate Swap

- Negative correlation between default rate and IR
  - Conditionally on default interest rates paths tend to decrease
  - Receiver swap exposure is higher and vice versa

Impact of correlation between default rates and interest rates on CVA
FX Devaluation Approach

- **FX wrong way risk**
  - Devaluation of currency linked to sovereign default
  - CDS market can only be explained via a jump effect

**Italy CDS Market, May 2011**

<table>
<thead>
<tr>
<th>Maturity</th>
<th>USD</th>
<th>EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Y</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>2Y</td>
<td>73</td>
<td>57</td>
</tr>
<tr>
<td>3Y</td>
<td>96</td>
<td>63</td>
</tr>
<tr>
<td>4Y</td>
<td>118</td>
<td>78</td>
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<tr>
<td>5Y</td>
<td>131</td>
<td>91</td>
</tr>
<tr>
<td>7Y</td>
<td>137</td>
<td>97</td>
</tr>
<tr>
<td>10Y</td>
<td>146</td>
<td>103</td>
</tr>
</tbody>
</table>

*Implied RVs in June 2010: Greece (91%), Italy (83%), Spain (80%) and Germany (75%)*
CDS Counterparty Risk Example

- Bad example, counterparty at 240 bps, reference at 120 bps with recovery rate at 10% (Lehman recovery)
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Wrong-Way Risk and Collateral

- **Correlation approach for IRS**
  - Collateral works well because it is a continuous model

- **Devaluation approach for FX**
  - Works badly as cannot take collateral against jump

So we need to know how quickly default occurs and/or exposure jumps at default

Collateral didn’t help much in case of buying Lehman CDS protection
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Central Clearing Overview

Bilateral market

CCP market

A
B
C
D
E
F

A
B
C
D
E
F

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

CCP capital charges
- Trade level (initial margin)
- Reserve fund related

Exposure to a CCP
- Something like a second loss on a financial basket

If initial margin is not sufficient then there is real risk as a CCP member

CCP Loss Waterfall

<table>
<thead>
<tr>
<th>Initial margin (member)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve fund (member)</td>
</tr>
<tr>
<td>CCP equity</td>
</tr>
<tr>
<td>Reserve Fund (non-defaulting members)</td>
</tr>
<tr>
<td>Additional capital contribution from CCP</td>
</tr>
<tr>
<td>CCP Capital</td>
</tr>
<tr>
<td>Liquidity Support or CCP Fails</td>
</tr>
</tbody>
</table>

At risk if CCP defaults
At risk if CCP member defaults
Defaulter pays
Moral hazard
• **Initial margin**
  
  – Cover the cost of a member defaulting (to a confidence level over a pre-defined period)
  – Also significantly drives the cost of central clearing
  – To a large extent independent of the credit quality of the member
  – Not great in the case of wrong-way risk (likely jump in exposure when member defaults)
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The Impact of Counterparty Risk Reduction

- Collateral (or lack of it) also creates funding costs (FVA)
- What is the combined impact of CVA and funding costs?

![Diagram showing the impact of counterparty risk reduction]

- Institution
  - No Collateral
  - CSA (legacy)
  - SCSA (new)
  - Central cleared trades
    - CCP1
    - CCP2
    - CCP3
    - CCP4
    - ...

- Counterparty
  - Reduce Counterparty Risk
  - CSA
  - SCSA
  - Centrally Cleared

- Increase Funding Risk
  - No CSA
  - CSA
  - SCSA

Collateral (or lack of it) also creates funding costs (FVA). What is the combined impact of CVA and funding costs?
CVA, DVA and FCA

\[ CVA + FCA(DVA) + FBA \]

Funding cost of initial margin

Assume no CVA to a CCP (they are risk-free)
Overall Effect

Push to central clearing

Two-way CSA with low threshold

Trade with risk-free CCP but with very small initial margin

CVA + FCA + FBA (GBP)

Independent amount / Threshold (GBP millions)