CVA, Basel III and Wrong-Way Risk

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Regulatory Capital and CVA

“Mark-to-market losses due to credit valuation adjustments (CVA) were not directly capitalised. Roughly two-thirds of CCR losses were due to CVA losses and only one-third were due to actual defaults.”

Basel Committee on Banking Supervision (2009)
Outline

- Introduction
  - CCR, CVA, management of CVA
  - CCR capital and Basel III
  - Wrong-way risk (WWR)
- Computing CVA and CVA VaR
- Wrong-way risk methodology
- Examples
- Concluding remarks

Counterparty Credit Risk Evolution

- Economic capital
  - Default risk
    - Basel II (IRB)
    - EPE and alpha
- Hedging CCR
  - JtD risk and CVA
- CCR valuation: CVA
  - Fundamental vs. Market values (CDS spreads)
  - Unilateral ➔ bilateral
- Economic capital
  - Credit + market risk (CVA)
    - Basel III...

CVA is now an integral part of current accounting rules for P&L, and of the new proposal for banking regulation ("Basel III" rules)
Pricing CCR: Credit Value Adjustment (CVA)

- CVA is the market value of counterparty credit risk
  
  \[ \text{CVA} = \text{Risk-free portfolio value} - \text{true portfolio value accounting for counterparty's default} \]

- CVA is an integral component of the value of derivatives
  
  - Now an integral part of accounting rules, and Basel III
  - Prior to mid-2007, CVA was either ignored by dealers, or too small to be noticed by customers

- CVA is measured at the counterparty level
  
  - Ideally, it should be part of the trade valuation but calculated separately because of portfolio effects
  - In addition to credit spreads (and competition) the CVA charged on a particular trade is affected by:
    - Bank’s existing portfolio of trades and the credit mitigation used in the deal
    - Methodology used to determine exposures

CVA and Risk Management

- Some banks started to price and hedge CVA in the mid 1990s
  
  - More recently, more banks started to price and actively hedge CVA

- Banks currently calculate and manage CVA according to different business models and subject different accounting regimes
  
  - Various large banks already manage CVA risks as part of their Trading Books: daily MtM, active hedging, enforced market risk limits and intent to transfer out the CVA risks
  
  - Some banks have opted for central CVA desk
  
  - Others have opted for CVA desks deployed in their main business units

- CVA desks sell full counterparty credit insurance to the derivatives trading desks
  
  - Manage the risks of the CVA after inception of the trades
  
  - Subject to risk limits and usually do not have a revenue generation budget
Some Definitions

- **Counterparty exposure**: economic loss incurred on all outstanding transactions if counterparty defaults
  - Cost of replacing or hedging the contracts at the time of default
  - Accounts for netting and collateral, but is generally not adjusted by possible recoveries
  - More generally, exposures can also be defined as potential losses on credit migration events such as downgrades (e.g. in CreditMetrics)

- **Potential future exposure (PFE)**: current exposure plus the potential future changes in exposures during the contracts’ lives
  - Accounts for the aging of the portfolio and underlying market factor movements which directly affect contract values at a future times
  - Example: a pay-fix IRS with negative MtM has current exposure = 0.
    - If future rates rise, the contract can have a positive value → potential exposure to holder

Computing CVA

- Value of the CP portfolio at \( t \)
  \[ V(t) = \sum_{i=1}^{N} V_i(t) \]

- Gross CP-level exposure (netting not allowed)
  \[ E(t) = \sum_{i=1}^{N} \max \{0, V_i(t)\} \]

- Netted CP-level exposure (single agreement)
  \[ E(t) = \max \{V(t), 0\} \]

- CP-level (margined) \( E(t) = \max \{V(t) - C(t), 0\} \)
  - Instantaneous collateral
    \[ C(t) = \max \{V(t) - H, 0\} \]
  - Lagged collateral
    \[ C(t) = \max \{V(t - \delta t) - H, 0\} \]

- CP portfolios with multiple netting agreements and trades outside of the agreement can be modeled by a combination of these equations
CCR Credit Risk Model Components

Exposures

Default Migration

Recovery

CCR and Potential Future Exposures (PFEs)

Source: de Prisco and Rosen (2005)
Credit Losses and CVA

- **Unilateral CP-level CVA** – the bank’s discounted loss due to the CP default (recovers a fraction $R$ of the exposure)
  \[ L = 1_{\{\tau \leq T\}}(1 - R) E(\tau) D(\tau) \]

- CVA obtained by discounting losses and applying the expectation
  \[ \text{CVA} = (1 - R) \int_0^\tau dP(t) \hat{\epsilon}^*(t) \]
  where
  \[ \hat{\epsilon}^*(t) = \mathbb{E}_\tau [D(t) E(t)] \equiv \mathbb{E}[D(t) E(t) | \tau = t] \]
  is the risk-neutral discounted expected exposure (EE) at $t$, conditional on the CPs default at $t$

(everything is under the risk-neutral measure)

Calculating Exposures and CVA by Simulation

- Banks use Monte Carlo simulation in practice to obtain the distribution of counterparty-level exposures
- The calculation of CVA and CVA contributions can be easily incorporated to the Monte Carlo simulation of the counterparty-level exposure
- In general, exposures are simulated separately – implicitly assume that they are independent of counterparties’ credit quality
  - Conditional expectations in the CVA formulae can be replaced by the unconditional ones
- Dependence of exposure on the counterparty’s credit quality can be incorporated in the CVA calculation, if the trade values and credit quality of the bank’s counterparties are simulated jointly (both right/wrong-way risk and exposure-limiting agreements)
  - E.g. using a joint process with stochastic intensities, or a copula methodology as in Garcia cespedes et al
- Need to make model computationally efficient
Calculating CVA – Simulation

Unilateral CVA – Independent market and credit risk

$$\text{CVA} = (1 - R) \sum_{k} e^*(t_k)[P(t_k) - P(t_{k-1})]$$

$$e^*(t_k) = \frac{1}{M} \sum_{j=1}^{M} D^{(j)}(t_k) E^{(j)}(t_k)$$

Analytical CVA (Normal Approx.)

- It is useful in practice to estimate EE, CVA
- It is useful to estimate EE, CVA contributions quickly outside of the simulation system
- Analytical expressions can be derived for EE and CVA contributions, for the case when trade values are normally distributed

$$V_i(t) = \mu_i(t) + \sigma_i(t) X_i$$

$$\hat{e}^*(t) = \hat{E}[D(t)E(t)] = E\left[D(t)E(t) \mid \tau = t\right]$$

$$e(t) = \mu(t) \Phi \left( \frac{\mu(t)}{\sigma(t)} \right) + \sigma(t) \phi \left( \frac{\mu(t) - H}{\sigma(t)} \right)$$

$$e(t) = \mu(t) \left[ \Phi \left( \frac{\mu(t)}{\sigma(t)} \right) - \Phi \left( \frac{\mu(t) - H}{\sigma(t)} \right) \right]$$

$$+ \sigma(t) \left[ \phi \left( \frac{\mu(t)}{\sigma(t)} \right) - \phi \left( \frac{\mu(t) - H}{\sigma(t)} \right) \right] + H \Phi \left( \frac{\mu(t) - H}{\sigma(t)} \right)$$
CCR and CVA Capital Charges in Basel III

- Basel III introduces a new charge for MtM losses (CVA – spread risk): associated with a deterioration in the credit worthiness (greater source of losses than outright defaults)
- The total CCR charges aim to cover default, migration and spread risks

Total CCR capital = CCR (default) capital + CVA risk capital

- Revision of Internal Model Method (IMM) for measuring exposures based on Effective EPE with stressed parameters – address wrong-way risk
  - Default risk capital charge: greater of
    - Portfolio capital charge based on Eff EPE using current market data
    - Portfolio capital charge based on Eff EPE using stressed calibration

CCR Capital Charge (Basel II)

\[
\text{Basel Capital} = \sum_{j=1}^{N} \text{LGD}_j \cdot \text{EAD}_j \cdot \left( N^{-1}(PD) \cdot \sqrt{\rho_j N^{-1}(0.001)} \right)^{-PD_j} \cdot MF(M_j, PD_j)
\]

\[
\text{EAD}_j = \text{Eff EPE}_j \cdot \alpha
\]

\[
\alpha = \frac{EC(L^EPE)}{EC(L^EPE)}
\]

- Eff EPE = effective EPE (expected positive exposure)
- Alpha: measures the effect of using deterministic exposures (EPE) instead of stochastic exposures – ratio of
  - EC from a joint simulation of market and credit risk factors
  - EC when CP exposures are constant and equal to EPE
- Eff EPE and M (maturity) based on bank’s internal model
- Supervisory alpha = 1.4 – allow for own estimate, subject to floor = 1.2
CVA Risk Capital Charge

- CVA capital charge calculation depends on bank’s approved methods for CCR and specific interest rate risk
  - Historical simulation, Monte Carlos simulation, etc.
  - Full re-pricing, sensitivities to specific tenors, sensitivities to parallel shifts (CS01), second order sensitivities, etc.
- Advanced CVA capital charge
  - Impact of changes in the counterparties’ credit spreads on the CVAs of all OTC derivative counterparties, together with eligible CVA hedges
  - Using the bank’s VaR model for bonds – restricted to changes in credit spreads, and does not model the sensitivity of CVA to other factors
- CVA capital charge includes general and specific credit spread risk
  - Includes stressed VaR but excludes IRC
  - VaR = non-stressed VaR + stressed VaR

CVA VaR: Market Risk Capital and VaR

- From a market risk perspective, CVA is just essentially another price risk
- Standard techniques to measure market VaR
  - Full simulation
  - Sensitivities
  - Very expensive re-pricing
    - Simple approximations sought
  - Regulatory Basel III focuses only on spread risk

\[
\text{CVA} = (1 - R) \int_0^T dP(t) \hat{e}^*(t)
\]

\[
\hat{e}^*(t) = \hat{E}_{t} \left[ D(t) E(t) \right] = E \left[ D(t) E(t) | \tau = t \right]
\]
CVA Calculation and Basel III Formula

\[ CVA_{WWR} = (1 - R) \sum (\hat{\epsilon}(t_k) \left[ P(t_k) - P(t_{k-1}) \right]) \]

- Regulatory CVA formula

\[ CVA = \left( \frac{LGD_{MTT}}{R} \right) \sum_{k} \max \left( 0, \exp \left( \frac{s_{1-k} - s_{k}}{LGD_{MTT}} \right) - \exp \left( \frac{s_{1-k} - s_{k}}{LGD_{MTT}} \right) \right) \left( EE_{LMT} \cdot D_{MT} + EE \cdot D_{h} \right) \]

- Calibration
  - Spreads
    - For individual CPs where available, otherwise proxy by rating, industry, region
  - For stressed VaR using the most severe one-year period in the exposure stressed calibration
  - EE
    - Non-stressed VaR – EE with current parameter calibration of exposures
    - Stressed VaR – EE according to stressed exposure calibration

CVA Risk Capital Charge

- Standardized CVA capital charge

\[ K = 2.33 \cdot \sqrt{h} \left( \sum_{i=1}^{n} 0.5 \cdot w_i \left( \sum_{i=1}^{m} \left( M_i \cdot EAD_i \cdot B_i^\text{MED} \right) - \sum_{i=1}^{n} \left( M_i \cdot B_i \right)^2 \right) + \sum_{i=1}^{m} 0.75 \cdot w_i \left( \sum_{i=1}^{m} \left( M_i \cdot EAD_i \cdot B_i^\text{ME} \right) - \sum_{i=1}^{n} \left( M_i \cdot B_i \right)^2 \right) \right) \]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Weight w_i</th>
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<tbody>
<tr>
<td>AAA</td>
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</tr>
<tr>
<td>AA</td>
<td>0.7%</td>
</tr>
<tr>
<td>A</td>
<td>0.9%</td>
</tr>
<tr>
<td>BBB</td>
<td>1.0%</td>
</tr>
<tr>
<td>BB</td>
<td>2.0%</td>
</tr>
<tr>
<td>B</td>
<td>3.0%</td>
</tr>
<tr>
<td>CCC</td>
<td>18.0%</td>
</tr>
</tbody>
</table>

- \( h = 1 \) (one-year horizon)
- Bi and Bind denote the hedging positions in single-name and indices

The level and reasonableness of the standardised CVA risk capital charge, including a comparison to the advanced approach, is subject to a final impact assessment targeted for completion in the first quarter of 2011.
Wrong-Way Risk in Basel III

- Banks must identify exposures that give rise to general WWR
  - Stress testing and scenario analyses to identify risk factors positively correlated with credit worthiness – including severe shocks occurring when relationships between risk factors have changed
  - Monitor general wrong way risk by product, by region, by industry, etc.
  - Reports provided to senior management and Board on a regular basis
- Explicit Pillar I charge for identified specific WWR – higher EAD
  - Explicit procedure for identifying, monitoring and controlling specific WWR
  - Instruments for which there is a legal connection between CP and underlying issuer and for which specific WWR has been identified are to be taken out of netting set with other transactions
    - CDSs: use expected loss assuming underlying in liquidation (LGD for swap = 100%)
    - Equity, bond, securities financing: EAD = value of transaction under JtD

Analytical CVA and Contributions (Normal Approx.)

Analytical expressions

\[ V_i(t) = \mu_i(t) + \sigma_i(t)X_i \]

- Contributions – including wrong-way risk
  - Need to modify the approach to obtain the contributions \( Y = \Phi^{-1}[P(\tau)] \) to the CP EE conditional on the CP defaulting
  - For this purpose, we define a Normal copula
  - Same results – but instead of the unconditional expectations, standard deviations and correlations of the trade values, we now use the conditional ones

\[
\hat{\mu}(t) = \text{E}[V_i(t) | \tau = t] = \mu_i(t) + \sigma_i(t)b_i\Phi^{-1}[P(t)] \\
\hat{\sigma}(t) = \text{StDev}[V_i(t) | \tau = t] = \sigma_i(t)\sqrt{1-b_i^2} \\
\hat{\rho}(t) = \frac{\rho_i(t) - b_i\beta(t)}{\sqrt{(1-b_i^2)(1-\beta^2(t))}}
\]
CCR Capital and Alpha Methodology
(Garcia et al)

- Framework defined by two key components:
  - Non-parametric sampling of exposures from pre-computed PFEs (unconditional)
  - Direct modelling of codependence of exposures and systematic credit factors
    (non-parametric exposures sampling also from joint market-credit factor scenarios)
- Computationally efficient – fully leverages pre-computed PFE profiles
  - Minimizes work during the most computationally intensive step
  - Multiple capital calculations – model validation, sensitivities, stress testing
- Model can be applied within general integrated market-credit risk models
- Stress testing
  - Wrong-way risk and transparency of counterparty concentrations and factors driving exposures
  - Market-credit correlations – contrast to industry studies, conservative assumptions, or from a previously estimated market-credit risk model

Wrong-Way Risk – Correlated Market-Credit

General market-credit codependence framework

CP exposures
(Simulated from market factors)

Credit factors $\rightarrow$ defaults

Copula
Correlation parameters: $\rho$

Capital
WWR Model at the Portfolio Level

Integrated market and credit portfolio model
Simulated jointly for entire portfolio

Copula \((X, Z)\)
Codependence of exposures and credit events

Exposures (market scenarios)
\[ E_j = f(X) \]

Credit events
\[ Y_i = \sqrt{\rho} Z + \sqrt{1-\rho} \varepsilon_i \]
\[ P(D|Z) = N \left( \frac{\rho D - \sqrt{\rho} Z}{\sqrt{1-\rho}} \right) \]

Syst. factor \(X\)
Syst. factor \(Z\)
Idiosyncratic CP factors

Calculating CVA with Wrong-Way Risk

CVA with WWR
\[
CVA_{WWR} = (1 - R) \sum_i \sum_j^M D^i(t_k) \cdot E^i(t_k) \cdot P(\omega_j, t_{k-1} < \tau < t_k)
\]
\[
CVA_{WWR} = (1 - R) \sum_i \hat{e}^i(t_k) \cdot [P(t_k) - P(t_{k-1})]
\]

Expected exposure conditional on default
\[
\hat{e}^i(t_k) = \sum_j^M D^i(t_k) \cdot E^i(t_k) \cdot \frac{P(\omega_j, t_{k-1} < \tau < t_k)}{P(t_k) - P(t_{k-1})}
\]

- Analytical formula for EPE | default
- Explicit formula for the joint probability... But very expensive
  - (large number of bi-Normal distributions)
  - Requires numerical evaluation
  - Depends on the joint market-credit model and the correlation parameters
Methods for Calculating CVA with WWR

- Conditioning on the default interval is computationally infeasible. Requires approximations:
  - Fixed expected exposure at default (can be shown to be conservative)
  - Linear Approximation:
    - When simulating new PD scenarios, calculate CVA using a linear approximation (in PD) to the REP formula:

\[
CVA_{New} = CVA_{Old} + (PD_{New} - PD_{Old}) \cdot \frac{\partial CVA}{\partial PD} (PD_{Old})
\]

Calculating CVA with WWR

- Based on explicit computations of the derivatives, the linear approximation algorithm is quite fast
- One can show that (from the analytical formulas for the derivatives) that fixing the expected exposure at default will be conservative (aggressive) in the presence of wrong-way risk (right-way risk).
Methods for Calculating CVA with WWR

- Conditioning on the default interval is computationally infeasible
- Conditioning directly on default exactly at time $t_k$ is faster:
  \[
  CVA_j = (1 - R_i) \cdot \int_0^\tau \hat{e}^* (t) dP_j(t)
  \]
  \[
  \hat{e}^* (t) = E[D(t)E(t) \mid \tau = t]
  \]
  - Avoids computation of cumulative bivariate normal distributions.
  - Still requires significant computation (inverse normal distributions for each time, counterparty and simulation scenario)
  - Accuracy could be a consideration if the time points are far apart

Example: trapezoid Rule (conditioning on exact default time):

\[
CVA \approx (1 - R_i) \sum_{k=1}^{K} \frac{\hat{e}^* (t_k) + \hat{e}^* (t_{k-1})}{2} \cdot (P(t_k) - P(t_{k-1}))
\]
\[
\hat{e}^* (t_k) = \sum_j D^j (t_k) \cdot E^j (t_k) \cdot P(\omega_j \mid \tau_i = t_k)
\]

Remarks on WWR at the Portfolio Level

- Integrated market and credit portfolio model
- While the CVA is the sum of CP CVAs, we must use the same model and correlation parameters to compute CVA at the portfolio level
- Under a given model (market factor and correlation levels) not all CPs will simultaneously have WWR
- Stress testing of individual CPs can be done with different set of parameters
Case Study

- Sample portfolio: 70 counterparties
  - Transactions: FI, FX, equity and credit derivatives (multiple currencies)
- PFE profiles - simulated over 30 years using 2,000 market scenarios and 21 time steps (MtF)
  - Calibrated using historical data
    - mean reversion for relevant parameters

Portfolio – Exposures

Portfolio Exposure Summary: Regulatory Capital

One-Year Equivalent Exposures

One-Year Equivalent Mean Exposures

<table>
<thead>
<tr>
<th>Counterparty</th>
<th>Top 10 Exposures ('000 Euros)</th>
<th>Portfolio Size Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>95th Percentile</td>
</tr>
<tr>
<td>1</td>
<td>158,032</td>
<td>199,954</td>
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<tr>
<td>2</td>
<td>94,691</td>
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</tr>
<tr>
<td>20</td>
<td>50,491</td>
<td>110,390</td>
</tr>
</tbody>
</table>
Counterparty Level Exposures

CCR Capital (Independent Market-Credit)
CCR Capital WWR – Correlated Market-Credit

Alpha - Total (99.9%)

Alpha - Systematic (99.9%)

- Alpha <1.2 → correlations ~ 75% (Basel II)
- Negative correlations → “right-way exposures” (alpha < 1.0)
- Systematic alpha more sensitive to market-credit correlation (no idiosyncratic risk)

ERC Capital WWR – Correlated Market-Credit

Market factor” correlated to defaults
- Important to understand “why?”
- Portfolio may have right-way or wrong-way exposures? – may change over time
- In practice, can find “smile effect” – some CPs are positively correlated and some negatively correlated
- Exposure factors include PCs, EL

Total exposure (TE is generally the most conservative)
CCR Regulatory Capital – Internal Model

Example 2: Stressed Exposures

Alpha (99.9%): Base Case vs. Stressed Exposures

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Base Case</th>
<th>Stressed Exposures</th>
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<tr>
<td>-1</td>
<td>0.81</td>
<td>0.95</td>
</tr>
<tr>
<td>-0.75</td>
<td>0.88</td>
<td>0.95</td>
</tr>
<tr>
<td>-0.5</td>
<td>0.86</td>
<td>0.96</td>
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<tr>
<td>0</td>
<td>1.04</td>
<td>1.04</td>
</tr>
<tr>
<td>0.25</td>
<td>1.12</td>
<td>1.12</td>
</tr>
<tr>
<td>0.5</td>
<td>1.21</td>
<td>1.21</td>
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<tr>
<td>0.75</td>
<td>1.30</td>
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<tr>
<td>1</td>
<td>1.42</td>
<td>1.42</td>
</tr>
</tbody>
</table>
Empirical Market-Credit Correlations

Historical time series: market index, implied credit driver and default rates (S&P data)

Correlation between all ratings and investment only
- Default rates = 78%
- Implied Credit factors = 70%

Correlation between credit factor and market index
- All ratings = 23%
- Investment grade = 29% *

CVA – Some Assumptions for CVA

- For simplicity, use same exposures as for CCR capital (not risk-neutral)
- Credit model
  - Constant risk-neutral HR – per rating (real PDs also per rating and higher than we have used in the past at BBVA)
  - LGDs from spread pricing
  - Asset correlation – Basel II
- Base market-credit correlation = 25%
- Market risk factors – hazard rates (and not the spreads)
  - Daily volatility returns 3-5%
  - Flat market factor correlations 40%
- Stand-alone VaR computed analytically, and simulation for portfolio VaR
Portfolio CVA

Portfolio Summary (€ million):
- No of CPs: 70
- Market-to-Market: €2,291
- Actual Exposure: €3,882
- EPIC: €2,176
- CVA: €75.80
- Bilateral Capital: €55.53
- CVA VaR: €13.44

CVA Summary (€ million):
- Total CVA: €75.80
- Mean: 1.08
- Median: 0.39
- STD: 2.57
- Skew: 5.95
- Kurtosis: 41.22
- Largest 10%: 1.46
- Smallest 10%: 0.10

CVA Statistics (€ million):
- Mean: 1.08
- Median: 0.39
- STD: 2.57
- Skew: 5.95
- Kurtosis: 41.22
- Maximum: 19.76
- Largest 10%: 1.46
- Smallest 10%: 0.10
- Minimum: 0.004

CVA by Counterparty

Counterparty Exposure, CVA, and WWR
CVA Market VaR

Portfolio CVA Market VaR

Contribution by Sector

Contribution by Rating

Base Case Results

- Independent market and credit risk.
Stress Testing WWR

- 1-Day VaR at 99% confidence level, for various assumed levels of market-credit correlation.

![Graph showing stress testing results]

Capital Charges

- Standardized Capital Charge: 184.56m

\[ K = 2.33 \cdot \sqrt{\sum w_i \cdot (M_i - \text{EAD}) - \sum w_i \cdot M_i \cdot B_i} + \frac{1}{\sqrt{2}} \sum \frac{w_i}{\sqrt{w_i}} \cdot (M_i - \text{EAD}) \]  

- Internal model charges (millions) for different correlation levels:

<table>
<thead>
<tr>
<th>Correlation</th>
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<th>-0.75</th>
<th>-0.5</th>
<th>-0.25</th>
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<th>0.5</th>
<th>0.75</th>
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<tbody>
<tr>
<td>Base Case</td>
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<td>88.11</td>
<td>88.76</td>
<td>89.43</td>
<td>90.13</td>
<td>90.85</td>
<td>91.58</td>
<td>92.32</td>
<td>93.08</td>
</tr>
<tr>
<td>Stress Case</td>
<td>109.35</td>
<td>110.14</td>
<td>110.95</td>
<td>111.78</td>
<td>112.66</td>
<td>113.56</td>
<td>114.47</td>
<td>115.41</td>
<td>116.35</td>
</tr>
</tbody>
</table>

Base Case: \( SVaR = VaR \)
Stress Case: \( SVaR = 1.5 \times VaR \)
Concluding Remarks

CVA and Wrong Way Risk

- CVA must be priced for derivatives portfolios – the crisis showed its practical role and impact
  - Conceptually simple, but complex problem in practice
  - Consequences now reflected in accounting and capital rules
  - We are just starting to understand its modelling and its financial, regulatory and management requirements and impacts

- Wrong-way risk is important
  - Portfolio effects may reduce its systematic impacts (general WWR)
  - Specific WWR needs to be analyzed with stress testing and individual counterparty analysis

- Basel III regulation is not yet fully aligned with some of the best practices, but will likely move there over time
CVA and Model Risk

- CVA is pricing – do we want to achieve “pricing-level accuracy”
  - Marginal contributions, real time, securitization of CVA...
- But… how accurate can we…. Or will we do it in the near future?
- This is probably the Most complex “instrument” we have ever priced!
- Complex risks
  - Modelling CCR and CVA requires integrated market-credit models:
  - 10s or 100s of market factors driving exposures over very long horizons
  - Wrong-way risk
- Credit risk of portfolios of very complex and varied derivatives
  - Mitigation: netting, collateral, margin calls….
- We cant price very well yet synthetic CDOs!
  - Simple portfolios, standardized instruments, 125 credits….

Final Lessons

Model risk framework…

- Acknowledge the “heroic” assumptions in our models and the limitation of the information which we can reasonably extract from the market and quoted prices
- Effectively incorporate fundamental credit information, historical data and expert judgment into the valuation process
- Develop explicit model risk and stress testing approaches which can help us understand better
  - The behaviour of instruments and portfolios,
  - “Knightean” uncertainties we could be facing.
Bio – Dan Rosen

Dan Rosen is the CEO and co-founder of R² Financial Technologies and an adjunct professor of Mathematical Finance at the University of Toronto.

Dr. Rosen lectures extensively around the world on financial engineering, enterprise risk and capital management, credit risk and market risk. He has authored several patents and numerous papers on quantitative methods in risk management, applied mathematics, operations research, and has coauthored two books and various chapters in risk management books (including two chapters of PRMIA’s Professional Risk Manger Handbook). In addition, Dr. Rosen is a member of the Industrial Advisory Boards of the Fields Institute and the Center for Advanced Financial Studies at the University of Waterloo; the Academic Advisory Board of Fitch; the Advisory Board of the IAFE; a founder former Regional Director and current steering committee member of PRMA in Toronto; and a member of the Oliver Wyman Institute. He is also one of the founders of RiskLab, an international network of research centers in Financial Engineering and Risk Management. Dr. Rosen was inducted in 2010 as a fellow of the Fields Institute for Research in Mathematical Sciences, for his ‘outstanding contributions to the Fields Institute, its programs, and to the Canadian mathematical community’.

Prior to co-founding R², Dr. Rosen had a successful ten-year career at Algorithmics Inc., where he held senior management roles in research and financial engineering, strategy and business development, and product marketing. In these roles, he was responsible for setting strategic direction, new initiatives and alliances; the design and positioning of credit risk and capital management solutions, market risk tools, operational risk, and advanced simulation and optimization, as well as their application to industrial settings. He holds an M.A.Sc. and Ph.D. in Chemical Engineering from the University of Toronto.

Selected Recent Publications

- Nedeljkovic, J., Rosen D. and Saunders D. 2010, Pricing and Hedging CLOs with Implied Factor Models, Journal of Credit Risk, fall issue
- Rosen D. and Saunders D. 2009, Valuing CDOs of Bespoke Portfolios with Implied Multi-Factor Models, Journal of Credit Risk, Fall Issue
- Rosen D. and Saunders D. 2011, Wrong-Way CVA and CVA VaR, working paper
- Rosen D. and Saunders D. 2010, Computing and Stress Testing Counterparty Credit Risk Capital, in Counterparty Credit Risk Modelling, (ed. E. Canabarro), Risk Books
- De Prisco B., Rosen D., 2005, Modelling Stochastic Counterparty Credit Exposures for Derivatives Portfolios, Counterparty Credit Risk (M. Pykhtin, Editor), Risk Books
Selected Recent Publications