Big Data in Risk Analytics

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Big Data & Analytics

Counterparty Credit Risk Management
Challenges for the Counterparty Credit Risk Manager

- Regulatory Capital
- Default Risks
- Increased business demands
- Data Quality
- Intra-day Credit Risk Management
- High IT Costs
- Compliance and regulatory reporting
- Increased business demands
Credit Risk – Post Crisis

The 2007/08 ‘credit crisis’ demonstrated that approaches in place to manage Credit Risk are relatively inadequate compared to most Market Risk management approaches used by banks today. Credit Risk requires far more advanced solutions.

Example risk factors

- Interest Rates
- Spreads
- Equity values
- Foreign exchange rates
- Commodity prices

Market Risk simulation through time

Value Mark-to-Future

Credit Risk simulation through time

Exposure Mark-to-Future

Market valuations impact Credit risks

Value Mark-to-Future

Netting and collateral

Credit risks can be mitigated by factors such as netting and collateral.
### Big Data in Risk Analytics

<table>
<thead>
<tr>
<th>Prepare</th>
<th>Exposures</th>
<th>Limits</th>
<th>Capital</th>
<th>Stress</th>
<th>Document</th>
<th>Hedge</th>
<th>Report</th>
<th>Evolve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gather data about positions, markets, cptys</td>
<td>Estimate potential exposures</td>
<td>Compare aggregated exposures against limits</td>
<td>Determine capital and provisions</td>
<td>Stress testing and Scenario Analysis</td>
<td>Legal risk mitigation</td>
<td>Limit the damage</td>
<td>Inform stakeholders</td>
<td>Keep up with changing markets, products, regulations</td>
</tr>
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#### BIG challenges

<table>
<thead>
<tr>
<th>Historical Data</th>
<th>Need for Speed</th>
<th>Too much Data</th>
<th>Minimize the Costs</th>
<th>So many What ifs?</th>
<th>Info Mgmt</th>
<th>Timely Response</th>
<th>Good enough?</th>
<th>Never ending game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too much data, too fast changing, too much variety</td>
<td>Very fast and very large Monte Carlo reqs. or PFE</td>
<td>Information coming from multiple locations, trading desks</td>
<td>Optimization of reg capital</td>
<td>Multiple scenarios, Ad hoc analyses</td>
<td>Managing Cpty and collateral documents</td>
<td>Quality of Credit Data</td>
<td>Consistency and transparency</td>
<td>Ever more complex data and IT needs</td>
</tr>
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#### Requiring Big Data

- **Data Quality:** Master Data Management for Counterparty legal entities. MDM, Data Stage
- **Massive Analytics:** 10-100x faster than traditional systems – Critical for Potential Future Exposure calculations. E.g., PureData
- **Real time Analytics:** Streams functionality
- **Risk Apps:** Industry leading Cpty credit Risk, Market Risk and Collateral apps: e.g., Algorithmics Integrated Market and Credit, Collateral,
- **Optimization tools:** for Capital, liquidity and collateral. E.g., iLog
- **Operational and Adhoc Reporting and Search tools:** e.g., Cognos, Data Explorer
- **Scalability:** Peta-scale user data capacity essential for large OTC portfolios
Big Data in Risk Analytics

Provide a more comprehensive view of Counterparty Credit Risk with Big Data

Calculate Potential Future Exposures and Credit Valuation Adjustments for complex portfolios

Pre deal calculation of exposures against CCR Limits

Improve Data Quality by instigating master data management of Counterparty data

Reduce Regulatory Capital Costs associated with CVA and IMM

Optimize OTC derivatives restructuring

Support CCR stress testing and estimation of Wrong Way Risk

Support intra day liquidity risk management

Estimation of DVA

More closely align front office and middle office valuation models and thereby reduce discrepancies

Optimize Collateral Management
Big Data in Risk Analytics

What does a Big Data platform do?

Extract insights from a large volume of data, including a wide variety of types, with high velocity

Analyze a Variety of Information
- Novel analytics on a broad set of mixed information that could not be analyzed before
- Multiple relational & non-relational data types and schemas

Analyze Information in Motion
- Streaming data analysis
- Large volume data bursts & ad-hoc analysis

Analyze Extreme Volumes of Information
- Cost-efficiently process and analyze petabytes of information
- Manage & analyze high volumes of structured, relational data

Discover & Experiment
- Ad-hoc analytics, data discovery & experimentation

Manage & Plan
- Enforce data structure, integrity and control to ensure consistency for repeatable queries
Big Data in Risk Analytics

The IBM Big Data and Analytics Platform advantage – complete and integrated

The platform enables starting small & growing without throwing away work

Integration between components lowers deployment cost, time & risk

Key points of leverage

• Pre-built integrations between Dynamic Risk Management, Agile, Multi-Tenant Shared Infrastructure and Hadoop System components

• Pre-built integrations between Hadoop System, Stream Computing & Data Warehouse – to turn unstructured data into structured data

• Common metadata, integration design & governance that provides the glue between existing landscape & the new components

• Common analytic engines across components (i.e. write-once text analytics that run in both batch & real-time)
IBM approach and technology

The scenario based approach and architecture is uniquely suited for executing fast and accurate measures of market and credit risk.

**Software Services**

- **Scenario**: Market risk scenario generation
  - Instruments modelled within each scenario define a single plane
  - Mark-To-Future (MtF) Cube
- **Simulation**: Position valuation over time
  - Time Steps
  - Instrument valuations for all scenarios at each step in time
- **Aggregation**: Apply aggregation & netting nodes
  - Collateral Adjustment
    - Revaluation across all scenarios and time steps
    - Account for bilateral calls and lag periods
  - Exposure metrics
    - PFE
    - CVA
    - EE
- **Decision**: Exposure profiles
  - Map exposure profiles for each scenario

**IBM Foundation**

- Data Services
- Infrastructure
- Process Management
Active CCR management builds innovations upon current approaches

## Approaches to Counterparty Credit Risk (CCR) management – methods for exposures and pricing

<table>
<thead>
<tr>
<th>Analysis Depth</th>
<th>Analysis Methods and Results</th>
<th>Supporting Requirements</th>
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| **Calculate Credit Exposure**| • Potential Future Exposure (PFE) @x%  
• Expected Positive Exposure (EPE)  
• Effective EPE  
• Netting and collateral  
• Stress testing | • Terms & Conditions of all trades  
• Market data across all asset classes  
• Historical Market Data  
• Credit Data – netting and CSA  
• Parameters, Counterparty hierarchies  
• Significant Validation |
| **Calculate CVA**            | • Calculation of unilateral & bilateral CVA / DVA  
• Wrong-way risk measurement                                                                 | • Risk neutral Probabilities of Default (PDs), and Losses Given Default (LGDs)  
• Validation of risk neutral scenario generation and CVA calculation |
| **Pre-Deal, CVA Exposure**   | • Incremental exposure and CVA  
• Utilize same batch process methodology  
• Fast Simulators (SLIMs)  
• Add-ons approach                                                                                                                                |
| **Pre-Deal Limits**          | • Compare exposure measures to limits  
• Monitor trade restrictions  
• Excess management                                                                 | • Delivery of trades on a real-time basis  
(No additional validation required) |

(No additional data required)  
(No additional validation required)
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What are the market needs?

Most firms are not benefiting from advanced approaches to CVA

Of the banks that have already adopted CVA, most use simple add-ons, or apply CVA in a way that does not offer netting benefits. This puts them at a competitive disadvantage on pricing trades versus firms using more advanced approaches.

How do banks achieve intra-day calculation of pre-deal CVA?

- Simple add-ons, look up tables or formulas
- Full Monte Carlo system incorporating netting
- On a product by product basis ignoring netting
- Including a charge for unexpected losses

Source: Credit Value Adjustment: and the changing environment for pricing and managing counterparty risk, Algorithmics, December 2009
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What IBM offer – accuracy matters

**Accuracy matters**, because the analysis that is used to adjust the pricing of highly valuable trades can be a competitive advantage.

By performing a pre-deal check on potential trades with a what-if simulations of incremental CVA, a trader that can determine if a trade is risk-reducing or risk-increasing, and price the trade accordingly.

This analysis requires an incremental Monte Carlo simulation that accurately assesses the incremental impact of the new trade within the entire portfolio.
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Further Information

Integrated Market and Credit Risk

Credit Valuation Adjustment

Big Data
http://www-01.ibm.com/software/data/bigdata/
Thank You