Measuring and Managing Credit Risk
Volatility – a practitioner’s view

New York University Stern School of Business

Passion to Perform

Wilfried Paus, Global Head of Risk Analytics & Living Wills
26. April 2013
Deutsche Bank’s Risk Management Framework
Sound principles and processes compliant with Basel 2.5/3 Pillar II

Four key principles underpin our risk management framework:

- Risk is taken within the defined risk appetite
- Every risk taken must be approved within the risk management framework
- DB should be adequately compensated for the risk taken
- Risk should be continuously monitored

- Risk Appetite: Integrated strategic planning process resulting in Risk & Capital Plan; monitoring in place
- Use Test: Evidence of strong risk culture and robust governance framework which manages on-going risk profile
- Risk Assessment: Independent function identifies, assesses, manages and reports material risks
- Regulatory and Internal capital adequacy quantified by risk type
- Top-down comprehensive limits
- Regular, appropriate stress testing
- Skilled and dedicated teams
- Models regularly validated
- Tools adapted to entity requirements

Pillar II – A Compliant ICAAP framework

- Appropriate risk management processes operating
- Clear roles and responsibilities for managing all risk inventories
- Processes and tools for identification of risk concentrations
- Established infrastructure and operational support
- Principles, policies and procedures in place
- Relevant top-down MI monitors risk exposures and process
- Risk governance and strategy
- Risk management processes
- Risk and capital methods – Analytics and modeling
- Risk infrastructure, policies and documentations

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In line with MaRisk\(^{(1)}\) and Basel II requirements, the key instruments to ensure adequate capitalization on an ongoing and forward looking basis for the Group are:

- A strategic planning process which sets defined capital threshold and risk appetite limit aligned to business objectives
- Translation of Risk appetite to measurable thresholds
- A continuous monitoring process of actual risk profile against approved limits and thresholds

(1) Minimum Requirements for Risk Management for Banks set by the German Federal Financial Supervisory Authority (BaFin)
Expected Loss (EL) is the average loss over a given period (commonly one year)
Economic Capital (EC) is the amount of capital needed to cover additional unexpected losses (at 99.98% confidence)
Calculated via simulation models:
Economic Capital is Deutsche Bank’s Risk Currency

DB calculates Economic Capital for…
- Credit Risk
- Market Risk
- Operational Risk
- Business Risk

… and uses it to …
- Assess capital adequacy & plan capital demand
- Measure performance (RoE, RAROC)
- Distribute compensation
- Perform stress tests
- Meet Basel II regulatory requirements
  - Internal Capital Adequacy Assessment Process
  - Modelling alpha and the Incremental Risk Charge
  - “Use test” for ratings, derivatives methodology etc.

1) As per CEBS CP03R definition. Market liquidity of assets is considered in EC.
# Economic Capital by Risk Type

## Risk Type Diversification via t-Copula

### Credit Risk
- **Counterparty Defaults**
- Simulation of portfolio loss distribution
  - DB's 45 factor model
- Risk Drivers:
  - EAD, PD, LGD, R2, Collateral
  - Industry/Country weights

### Market Risk
- **Market Movements**
- Scaled sVaR simulation supplemented by bespoke stress tests
  - "Hectic correlation" aggregation
    - Reflecting market stress
- Risk Drivers:
  - FX, IR, Credit, Equity
  - Transaction size, structure, hedging, basis

### Operational Risk
- **Adverse Operational Events**
- Simulation of loss events and their impact
- Risk Drivers:
  - Potential Loss Sizes
  - Loss Frequencies
  - Business structure and organization

### Business Risk
- **P&L Volatility**
- Simulation of future revenues / tax legislation impact
- Scenarios based on historic revenue volatility and input from business & risk managers
- Risk Drivers:
  - Revenues, Costs (actual vs. planned)
  - Tax events
Base Model: Calculating Credit Risk Economic Capital

In a nutshell

Joint EC calculation for counterparty, transfer, settlement & traded default risk

Input
- Client & Product
  - EAD
  - LGD
  - PD
  - R²
- Factor model
  - Countries
  - Industries

Simulation
- Client 1
- Client 2

Loss Distribution
- How often?
- How much?
- EL

Allocation
- Group EC
- Expected Shortfall

Group EC
Model Extension: Multi-State Asset Value Simulation
Incorporating duration and rating migration

Two State
- Event = defaulted / not defaulted
- Loss value depends only on EAD and LGD

Multi-State
- Event = Rating change at horizon
- Value in rating class at horizon by cash flow valuation: additional dependence on maturity, default curve, interest rates

Natural choice to model assets subject to fair value accounting
Model Extension: Multi-period Simulation
Joint Economic Capital calculation for Traded Default Risk and Credit Risk

Multi-period extension of credit portfolio model
- Appropriate framework for a joint EC calculation for portfolios with different liquidity horizons
- Multi-period simulation of underlying risk factors captures dependence between sub-portfolios with different liquidity profiles

Joint EC calculation for Traded Default Risk and Credit Risk
- Determination of the liquidity horizon
  - Credit Risk: 12m
  - Traded Default Risk: 6m
- Joint EC calculation for TDR and Credit Risk provides correct diversification effects down to transaction level
- Extendable to “Constant Level of Risk” model used for Incremental Risk Charge

Multi-period simulation of underlying risk factors
- \( X^{(i)} \): increment of risk factors in month \( i \)
- \( H_j \): loss function of subportfolio with \( j \) months liquidity horizon

\[
\sum H_b(X^{(1)} + X^{(2)} + \ldots + X^{(6)})
\]

\[
H_{12}(X^{(1)} + X^{(2)} + \ldots + X^{(6)} + X^{(7)} + \ldots + X^{(12)})
\]
Model Extension: Reflection of Wrong-way Risk
Incorporation of alpha factor

Regulatory alpha parameter is a joint product of DB’s credit portfolio model (dbCDE) and derivatives exposure engine (MATRIX)

- $\alpha$ captures “wrong-way” risk through a joint simulation of credit and market risk
  
  $\alpha = \frac{\text{EC based on joint simulation of CR and MR drivers}}{\text{EC based on Average Expected Exposure}}$

- This makes it a natural component also for EC

Approximative implementation in Deutsche Bank’s EC methodology

- Monthly calibration of $\alpha$
- Scale exposure for derivatives and securities financing transactions
  
  - EAD=AEE * $\alpha$
  
  - by latest $\alpha$ (i.e. previous month’s)
Credit Risk Volatility – How Relevant is It?
DB favours PD-based over spread-based Economic Capital modelling

Market-driven credit spreads combine pure credit risk with other aspects
— Overweight of systemic drivers
— Market sentiment
— Liquidity

True threat for a bank’s P&L and capital is driven by other criteria
— Credit risk type
  — Default
  — Transfer
— Accounting treatment (e.g. fair value vs. hold to maturity)
— Time horizon (e.g. default vs. settlement risk)

But regulators push for comprehensive credit-spread based capital demand modelling
## Dual Processing of Assets Subject to Spread Risk

Risk considerations prevail over accounting and regulatory treatment

### Table: Risk Considerations

<table>
<thead>
<tr>
<th>Pillar I (Global)</th>
<th>Pillar II (Global)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR (AIRB)</td>
<td>CR (AIRB)</td>
</tr>
<tr>
<td>MR (VaR)</td>
<td>TMR</td>
</tr>
<tr>
<td>IRC in 12/2011</td>
<td>TDR</td>
</tr>
<tr>
<td>CR (AIRB)</td>
<td>NTMR</td>
</tr>
<tr>
<td>CR (AIRB)</td>
<td>CR/TDR</td>
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### Diagram:
- **Regulatory Trading Book?**
  - Yes: CR (AIRB), MR (VaR), IRC in 12/2011
  - No1): FX, Comm., IR Risk2(3)

### 1) Incl. “held for sale” and securitization assets in the ramp up phase if they cannot be sold within 180 days

### 2) Interest rate, commodity and foreign exchange risk is transferred to the trading book

### 3) Some retail subsidiaries have their own limits for Interest Rate risk and don’t transfer it to the trading book.

### 4) Credit Risk for derivatives in AEE, EPE, PFE (average expected exposure, expected potential exposure, potential future exposure)

### 5) Spread and basis risk

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*CR* credit risk

*TMR* trading market risk

*NTMR* non-trading market risk

*TDR* traded default risk

*AIRB* Advanced Internal Ratings Based

*IMM* Internal Model Method

*IRRBB* Interest Rate Risk Banking Book

*IRC* Incremental Risk Charge
Managing Credit Risk Volatility
Additional tools to mitigate credit risk loss potential

Single-name concentration hedging
Dedicated loan pricing and hedging function established in 2003
Scope: Large Corporates & MidCap

Centralised dynamic hedging
Derivatives exposure
Traded default risk

Central counterparts
An additional (partially mandatory) option – but not risk free!

Loan Exposure Management Framework

- **Avoid concentration risk**
  - Ratings based exposure limit for each credit
  - Exposures above thresholds are sold or hedged

- **Active hedging**
  - Hedging begins when loan is booked, not when trouble arises
  - Full use of capital markets toolbox: loan sales, CDS, securitisation....

- **Fair value election**
  - Mark-to-market dynamic provides “early warning” on problem credits
  - Loss recognition drives better decision making in distressed scenarios

- **Conservative modelling assumptions**
  - Facilities fully drawn in default
  - Loan vs. bond recovery differential assumed small
Exposure Profiles for Derivatives
Integration of market risk drivers into credit risk EC

Exposure calculation for derivatives
– Current MtM does not reflect value change potential over time horizon
– Requires simulation of market factors and revaluation of derivatives over time

Various exposure measures
– Average Expected Exposure (for EC)
– Expected Positive Exposure (for RC)
– Potential Future Exposure (for limit monitoring)

alpha-factor
– Internal Models Method under Basel II: \( EAD = EPE \times \alpha \)
– \( \alpha \) is a scaling factor for “wrong-way risk”, ranging from 1.2 (regulatory floor) to 1.4 (standard)
– Consideration for RC (floored) and EC (plain)
### Basel II vs. Economic Capital Model

**Fundamental Conceptual Differences**

<table>
<thead>
<tr>
<th>Credit Risk</th>
<th>EC Framework</th>
<th>Basel II Framework</th>
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<tbody>
<tr>
<td>LGD, PD, etc. calibrated and validated on same data</td>
<td>Process-driven netting set split</td>
<td></td>
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<tr>
<td>In most cases identical</td>
<td></td>
<td></td>
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<tr>
<td>Use of best estimate for EAD</td>
<td>99.98% quantile</td>
<td></td>
</tr>
<tr>
<td>99.98% quantile</td>
<td>99.90% quantile</td>
<td></td>
</tr>
<tr>
<td>Portfolio context considered, i.e. concentration risk</td>
<td>Capital calculated &amp; allocated in isolation – “one size fits all”</td>
<td></td>
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<tr>
<td>Full diversification through country/industry correlation</td>
<td>“Asset correlation” is counterparty specific</td>
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### Comparability
- Improved

### No concentration risk under Basel II
- Potential systemic risk

### Baseline II/2.5 building block approach
- No risk type diversification

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<thead>
<tr>
<th>OR</th>
<th>Identical loss distribution</th>
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<td>99.98%-ile</td>
<td>99.90%-ile</td>
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<th>Scaled sVar</th>
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<td>99.98%-ile for Tr. Default Risk</td>
<td>99%-ile for VaR+sVar; MRSA 99.90%-ile for IRC &amp; CompRM</td>
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<th>Earnings simulation</th>
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