Market Risk

2016 Seminar for Senior Bank Supervisors from Emerging Economies
Katharine Seal, Washington, DC
October 17, 2016
Changing Landscape

Pillar 1

Credit risk

Market risk

Operational risk

Internal Models

Standardized

Consultation Mar 2016

Consultation Dec 2015

New Approach Jan 2016

New Approach Jan 2016

Eliminated Jan 2016

Consultation Mar 2016

BIA

IMA

AIRB

IMA

IMA

IMA

IMA
Capital Framework

Capital Adequacy Ratio = \frac{K}{\text{RWA(Credit)} + 12.5 \times \text{Market Risk} + 12.5 \times \text{Op Risk}}
### Evolution of the Capital Accord

<table>
<thead>
<tr>
<th>Basel I</th>
<th>• Minimum risk based capital, definition of capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRA</td>
<td>• Market risk treatment in the trading book; standard and internal model approaches</td>
</tr>
<tr>
<td>Basel II</td>
<td>• Credit Risk, Operational Risk – standard and internal model approaches</td>
</tr>
<tr>
<td></td>
<td>• Pillars 2 and 3</td>
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<tr>
<td>Basel 2.5</td>
<td>• Enhanced Market Risk standards</td>
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<tr>
<td></td>
<td>• Securitisation enhancements</td>
</tr>
<tr>
<td>Basel III</td>
<td>• Definition of capital, Capital buffers: procyclicality and capital conservation; Leverage</td>
</tr>
<tr>
<td></td>
<td>• Enhanced risk coverage; Liquidity framework</td>
</tr>
<tr>
<td>Fundamental Review of the Trading Book</td>
<td>• New Standardised Approach</td>
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<tr>
<td></td>
<td>• New Trading Book Boundary</td>
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<td>• New Standards for Models</td>
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</table>
Why was the Market Risk Amendment designed – true or false?

To reduce capital?

To decompose and assess risk accurately?

To frighten supervisors?
Market Risk Regulatory Time Line

- Market Risk Amendment 1996
- Basel 2.5 2009
- Fundamental Review of the Trading Book 2016
- Fundamental Review of the Trading Book Implementation End 2019
Innovations in the Market Risk Amendment 1996

Trading Book
- Trading intent
- 10 day holding period
- Mark-to-market

Capital Options
- Standard approach
- Value at Risk Models
- Supervisory approval

Tier 3
- 2 year capital
Why important?

- Vast majority of losses were from trading books during the 2008 crisis
- Market risk framework may have been used in other sectors (in particular broker dealers and insurance companies)

Sources: BCBS
Basel 2.5 – the first fix

- Illiquid positions
- Tail Risks
- Complex products
- Arbitrage

✓ Incremental default risk (default and migration)
✓ Stressed Value-at-Risk
✓ Securitisation to have banking book charges
✓ Acknowledgement of procyclicality concerns

✗
Basel 2.5 Overview

Market Risk Measure - Models

- De minimis
- Comprehensive Risk Measure
- Incremental Risk Charge
- Stressed VaR
- Specific Risk Add-On
- General VaR
Findings

- Significant variation in the outputs of MR internal models
- Typically variability increases for more complex trading positions
- Confirms differences in modelling choices are a significant driver of variation in market risk RWAs
Improving public disclosure and collection of regulatory data

Narrow the range of modelling choices for banks

Further harmonise supervisory practices with regard to model approvals
Objectives for the Fundamental Review of the Trading Book

Enhance Risk Measurement

Reduce market RWA variability
What was so fundamental?

- Trading Book Boundary
- Standardised Approach
- Internal Models
Scope of Application of Market Risk

- No de minimis exceptions from market risk
- FX and commodities in the banking book are still subject to market risk

<table>
<thead>
<tr>
<th>Credit (Default)</th>
<th>Credit (Credit Spread)</th>
<th>Interest Rate Risk</th>
<th>Equity Risk</th>
<th>Equity Investment in a fund</th>
<th>FX</th>
<th>Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banking</td>
<td></td>
<td></td>
<td></td>
<td>No look through: e.g. Hedge Funds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trading</td>
<td></td>
<td></td>
<td></td>
<td>Look through</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Trading Book Boundary - Before

Incentive for illiquid assets to migrate to BB to avoid higher capital charge
Trading Book Boundary

- Presumptive list of assets for TB
- National supervisory discretion in setting lists assets
- Boundary based on intent to trade or hold to maturity

- Regulatory arbitrage targeted:
  - Capital benefit nullified (by a disclosed pillar 1 charge) if instrument transfers
  - Internal risk transfers subject to clearer and more stringent requirements

- Emphasis on active supervision and supervisory powers
  - Increased reporting to supervisors required on policies and practices
Trading Book Boundary
Examples

Trading Book
- Trading assets and liabilities
- Market making instruments
- Look through fund equity investment
- Listed equities

Banking Book
- Unlisted equities
- Securitisation
- Real estate
- Retail and SME
- Non look through equity investment
Trading Book Boundary - After

Banking Book

Trading Book
BCBS Objectives in Revising the Standardised Approach

To provide a fallback if an internal model is inadequate

Must not require sophisticated measurement techniques

To facilitate consistent and comparable reporting
The Standardised Approach for All

- All banks must use the Standardised Approach.
- Even banks with internal model approval must calculate capital based on the standardised approach.
- Securitisation exposures are subject to standardised approach.
Some Features of the Standardised Approach

- A bank’s pricing model used in P&L reporting seen as the appropriate basis for determining regulatory capital requirements
- Capital charges computed at an asset class level
- Diversification not recognized between different asset classes but can be recognized within a single asset class
Standardised Approach: sum the three charges

**Sensitivity Based Risk Charge (SBM)**
- Sensitivity (delta, vega and curvature) $\times$ risk weight

**Default Risk Charge (DRC)**
- Net exposure $\times$ risk weight
- Calibration based on banking book
- Some recognition of hedging but no diversification benefit

**Residual Risk Add-on (RRAO)**
- Gross notional $\times$ risk weight
The 3 Risk Sensitivities

**Delta**
- Change in price resulting from a small price or rate shock to the value of each relevant risk factor.

**Vega**
- Risk due to variations in the volatility for options – computed as the product of the vega of a given option and its implied volatility.

**Curvature**
- Risk due to movement in the delta when the price changes.
Why Risk Sensitivities?

Greater reliance on risk sensitivities as **inputs** into capital charge calculations

**Inputs** that are integral to the pricing and risk management models of trading-active banks.

A common risk data infrastructure can support both the revised internal and standard approaches
Sensitivity Based Method

1. Instruments are mapped to regulatory-prescribed risk factors
   - Shocks are applied to the risk factors to generate capital charge for the risk factors
   - Bank uses sensitivities derived from its pricing models to determine the size of risk positions for each risk factor

2. The risk-weighted sensitivities are aggregated within each bucket
   - The aggregation uses regulator-prescribed correlations applied within a regulator-prescribed aggregation formula

3. The resulting “bucket-level” capital charges are then aggregated to obtain the “risk class level” capital charge
   - The same aggregation technique from step 2 is used in step 3

4. The aggregate capital charge is the sum of each risk-class level capital charge
Sensitivity Based Method – to put it another way

1. Estimate sensitivity (delta and vega) based on bank’s pricing model for each risk factor
   - e.g. 10 year of USD bond

2. Multiply with corresponding risk weights and add up with correlations within the same bucket
   - e.g. the same currency but different tenor

3. Sum of risk with correlation for each of the 7 risk classes
   - e.g. all currencies of general interest rate risk

4. Sum the capital charges of the 7 risk classes
7 Risk Classes

1. General Interest Rate Risk (GIRR)
2. Credit Spread Risk: non-Securitisation
3. Credit Spread Risk: Securitisation (non correlation TP)
4. Credit Spread Risk: Securitisation (correlation TP)
5. Equity Risk
6. Commodity Risk
7. Foreign Exchange
# Sensitivity Based Method

<table>
<thead>
<tr>
<th>Risk Classes</th>
<th>Bucket</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Interest Rate Risk (GIRR)</td>
<td>Each Currency</td>
<td>Tenor (0.25, 0.5 year, 1 year ...., 30 years)</td>
</tr>
<tr>
<td>Credit Spread Risk: non-Securitisation</td>
<td>16 buckets</td>
<td>Name + Basis + Tenor</td>
</tr>
<tr>
<td></td>
<td>Credit quality + Sector</td>
<td></td>
</tr>
<tr>
<td>Credit Spread Risk: Securitisation</td>
<td>25 buckets</td>
<td>Tranche + Basis + Tenors</td>
</tr>
<tr>
<td></td>
<td>Credit quality + Sector</td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>11 buckets</td>
<td>Name + Spot + Repo</td>
</tr>
<tr>
<td></td>
<td>Market Cap + Economy + Sector</td>
<td></td>
</tr>
<tr>
<td>FX</td>
<td>Each Pair of Currencies</td>
<td>Each Pair of Currencies</td>
</tr>
<tr>
<td>Commodity</td>
<td>11 commodity bucket</td>
<td>Grade + Location + Tenor</td>
</tr>
</tbody>
</table>
# Sample Risk Weights

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Delta RW</th>
<th>Curvature RW</th>
<th>Vega RW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy - Liquid</td>
<td>35 %</td>
<td>35 %</td>
<td></td>
</tr>
<tr>
<td>Precious Metal</td>
<td>20 %</td>
<td>20%</td>
<td>100 %</td>
</tr>
<tr>
<td>Grains &amp; oilseeds</td>
<td>35 %</td>
<td>35 %</td>
<td></td>
</tr>
</tbody>
</table>
## Sample Risk Weights

### General Interest Rate

<table>
<thead>
<tr>
<th></th>
<th>Delta RW</th>
<th>Curvature RW</th>
<th>Vega RW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Bond – Investment Grade &amp; 5 year</td>
<td>1.06 %</td>
<td>1.70 %</td>
<td>100%</td>
</tr>
</tbody>
</table>

1. If the bond is denominated in certain currencies (USD, EUR, GBP, AUD, JPY, SEK, CAD or the domestic reporting currency of a bank) the Delta RW may be divided by the square root of 2.
2. If there is no optionality in the bond then there will be no RW for Curvature or Vega

### Credit Spread Risk

<table>
<thead>
<tr>
<th></th>
<th>Delta RW</th>
<th>Curvature RW</th>
<th>Vega RW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Bond – Investment Grade, Energy sector, 5 year</td>
<td>3 %</td>
<td>3 %</td>
<td>100%</td>
</tr>
</tbody>
</table>
Default Risk Charge

To capture stress events in the tail of the default distribution which may not be captured by credit spread shocks in mark-to-market risk.

Calibrated to BB credit risk treatment. Positions allocated to default risk bucket categories (e.g. corporates, sovereigns etc)

National discretion permits zero default risk weight for sovereigns, PSEs and MDBs

Offsetting and hedging only allowed within risk buckets
Default Risk Charge

1. Estimate Jump to Default (JTD) for each instrument
   - JTD is a function of notional amount and market value and prescribed LGD

2. Offset long and short positions to the same obligor to derive net JTD

3. Net JTD are allocated to buckets and multiplied by prescribed risk weights
   - Risk weight for non securitisation positions is set by credit quality rating

4. DRC is sum of bucket level default risks
Residual Risk Add On

- Not all market risks can be captured in the standardised approach.
- Not all market risks can be modelled.
- Examples include: gap risk, correlation risk and behavioural risk.
Residual Risk Add On

• Simple sum of gross notional amount multiplied by a risk weight for instruments bearing residual risk

• Risk weight is 1% for instruments with exotic underlying: such as longevity, weather derivatives, natural disasters, future realized volatility

• Risk weight is 0.1% for other instruments

• Exemption for transactions exactly matched with a third-party transaction
• Exemption for instruments eligible for central clearing
# Simple Comparison of Capital Charges

<table>
<thead>
<tr>
<th>Book</th>
<th>Banking Book</th>
<th>Trading Book *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Credit Risk</td>
</tr>
<tr>
<td>Corporate Bond BBB 5 Year</td>
<td>100 %</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

<sup>1</sup> As corporate bond sector is unspecified, a range of Delta CSR could apply.

<table>
<thead>
<tr>
<th>Book</th>
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<th>Trading Book *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Credit Risk</td>
</tr>
<tr>
<td>Equity – Small BBB Emerging Market</td>
<td>250 %</td>
<td>70 %</td>
</tr>
</tbody>
</table>

* Netting and Diversification Benefits will reduce the effective risk weights of the trading book significantly, depending on the other positions in the trading book.
Internal Models Approach

- Regulatory scrutiny: much higher
- Tail Risk: Expected Shortfall replaces VaR and SVaR
- Liquidity horizons: varying, more granular
- Non-modellable Risk Factors
- Data: more data, stronger data analysis in banks
Internal Models Approach: sum the three charges

- **Global Expected Shortfall (ES)**
  - Stressed Expected Shortfall (97.5% for 10-120 days)

- **Default Risk Charge (DRC)**
  - Credit VaR (99.9% for 1 year)
  - Same PD/LGD as in IRB approaches

- **Stressed Capital Add-On (SES)**
  - Stressed scenario at least as prudent as ES
  - No diversification is allowed between other non-modellable risk factors
Market Risk – VaR vs ES

The P&L Distribution

- VaR is the likely loss of market value for a given portfolio over a predetermined confidence level and holding period, e.g. max 1 day loss at a 99% confidence level.
- There is a fixed probability that any losses suffered over the holding period will be less or greater than the VaR amount.
- VaR does not say anything about how bad the losses could actually be, and it does not specify the worst possible loss.

- Expected Shortfall considers both the size and likelihood of losses above a certain confidence level.
- Expected Shortfall captures tail risk
- Expected Shortfall must be calibrated to a period of significant financial market stress
Approval Process for Internal Models

Step 1
Overall assessment of the banks’ firm-wide internal risk capital model

Step 2(i)
Banks nominate which trading desks are in-scope for model approval and which are out-of-scope

Step 2(ii)
Assessment of trading desk-level model performance against quantitative criteria: Clear thresholds for breaches of P&L attribution and backtesting procedures

Step 3
Individual risk factor analysis
- Risk factors must be based on real, verifiable prices
- Frequency of observable prices

Global Expected Shortfall (ES):
Equal weighted average of diversified ES and non-diversified partial ES capital charges for specified risk classes.

Default Risk Charge (DRC):
Captures default risk of credit and equity trading book exposures with no diversification effects allowed with other market risks (including credit spread risk).

Stressed capital add-on (SES):
Aggregate regulatory capital measure for non-modellable risk factors in model-eligible desks.

Securitisation exposures in the trading book are fully out of scope of internal models and capitalised in the revised standardised approach.

Standardised approach for entire trading book

Out of scope

Standardised approach for specific trading desks

Fail

Pass

Pass

Non-modellable

Modellable
Illiquid Positions

Guidance on prudent valuation for positions accounted at fair value:

- TB or BB

Valuation methodologies:

- Marking to market, marking to model, independent price verification

Adjustment to the current valuation of less liquid positions for regulatory capital purposes
## Three eras of Basel on Market Risk

<table>
<thead>
<tr>
<th>Era</th>
<th>Key Features</th>
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<tbody>
<tr>
<td>Market Risk Amendment (1996)</td>
<td>✓ A different analysis of risk from Basel I</td>
</tr>
<tr>
<td></td>
<td>✓ Calibration produced insufficient capital to withstand the global market stress</td>
</tr>
<tr>
<td>Basel 2.5 (2009)</td>
<td>✓ Significant increase of capital charges with stressed VaR</td>
</tr>
<tr>
<td></td>
<td>✓ Incremental Risk Charge (IRC) to capture risks from rating migration</td>
</tr>
<tr>
<td></td>
<td>✓ Securitisation capital charge consistent with that of banking book</td>
</tr>
<tr>
<td>Fundamental Review of Trading Book (2016)</td>
<td>✓ Boundary between banking and trading books with strong disincentive for arbitrage</td>
</tr>
<tr>
<td></td>
<td>✓ Tail risk captured through expected shortfall (ES)</td>
</tr>
<tr>
<td></td>
<td>✓ Standardized approach recalibrated to make more consistent with internal models</td>
</tr>
</tbody>
</table>
Impact of Regulatory Changes
Impact of Regulatory Changes

- Capital charges of market risks have been increased substantially after two regulatory reforms.
- Basel 2.5 mainly increased capital charges for internal models approach (by 223% on average).
- Recent fundamental review mainly addressed standardized approach (by 128% on average).
Impact

“The changes that must be made to banks’ infrastructures to implement the FRTB standards are transformational.”

“The standardised approach requirements to use granular risk factor sensitivities will also require an overhaul of current market risk capital calculations and processes”

“Changes should allow banks to thoroughly consider the business strategy and implementation implications”
Impact

Is the new framework too complex? What about the BCBS commitment to simplicity?

Credible alternative to models is needed. This means more parameters, more granularity.

Conclusion – no, it is not simple for non-experts, but risk sensitivity is the priority and this implies a degree of complexity.
Questions for Discussion

• Should the new Market Risk Capital Charge be a priority?
  ➢ Still Early?
  ➢ Too complex to implement?
  ➢ No substantial trading activities?
  ➢ Aren't FX and Commodities exposures relatively large at some groups?
Thank You!

http://www.bis.org/bcbs/publ/d352.htm