SBA-Margin (SIMM) & SBA-Capital (FRTB)

Common and Different Features

Slides presented by Youngsuk Lee
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Contents

- Initial Margin Requirements & SIMM
- SBA-C and SBA-M
- Similarities
  - Structure
  - Calculation
- Differences
  - Overall use case
  - Methodology
  - Data

Backgrounds: Initial & Variation Margins and SIMM

Regulatory Articles

1. Basel: bcbs 261. Margin requirements for non-centrally cleared derivatives
2. US
   - Treasury, Federal Reserve, FDIC, FCA, FHFA: 2015-28671 (final)
   - CFTC: PR7294-15 (final)
3. Europe: JC/CP/2014/03 (consultation paper) - still waiting for the final rule!
4. Japan, Singapore, …

ISDA - SIMM

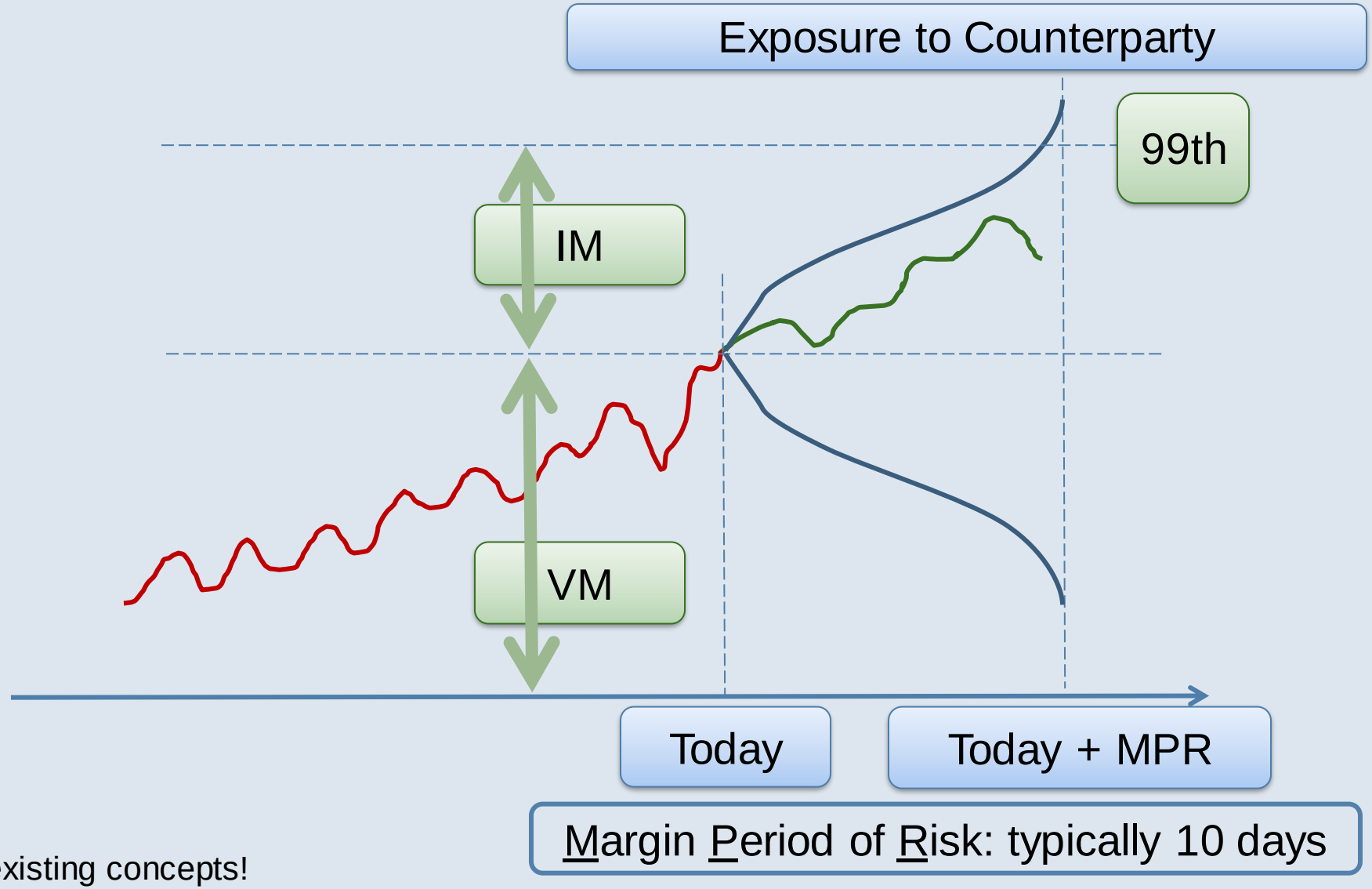
https://www2.isda.org/functional-areas/wgmr-implementation/

1. Methodology
2. Crowd sourcing

Timing

1. Phased approach
2. Sep 2016 for major financial institutions - systemically important firms first..

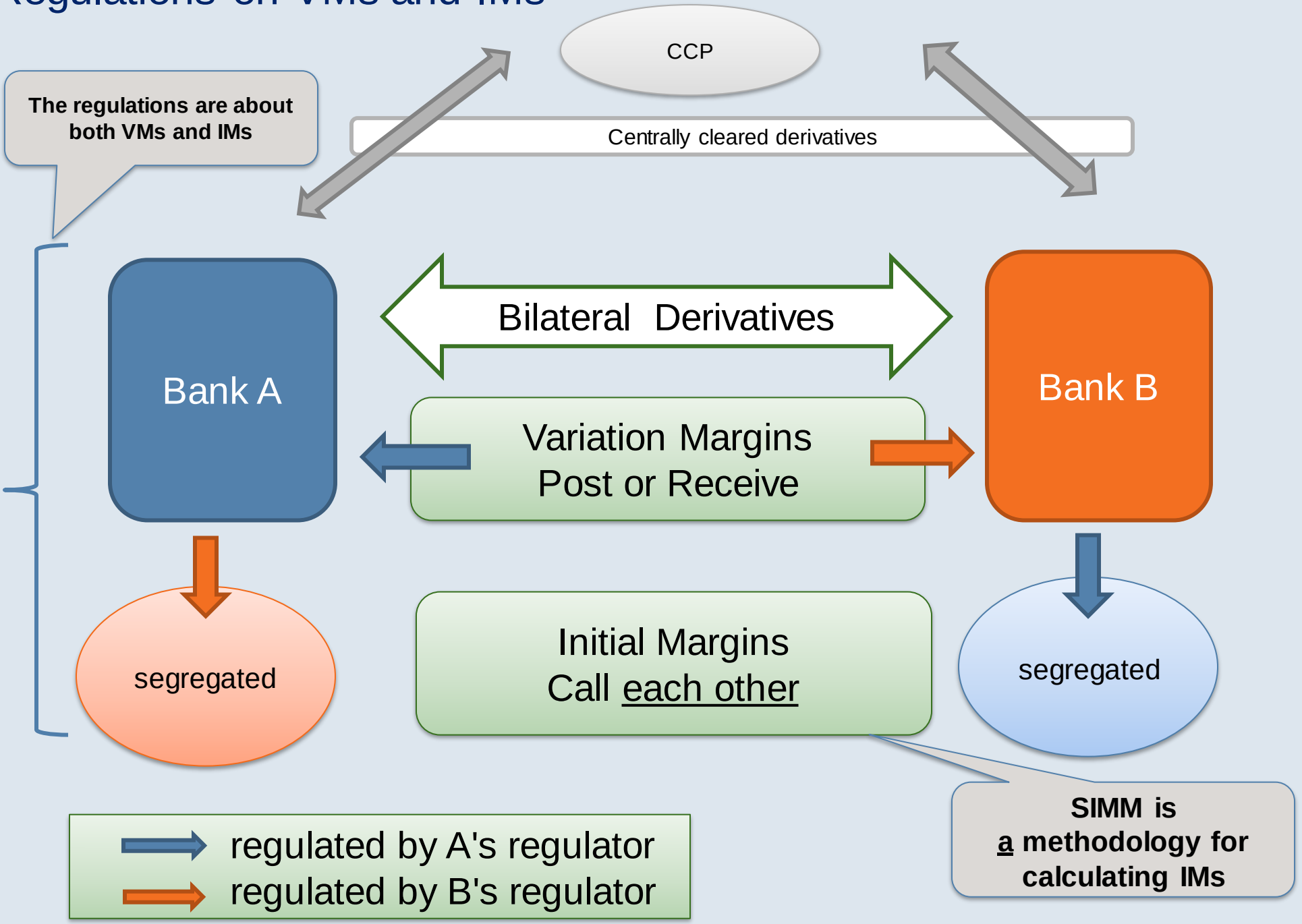
Variation Margin and Initial Margin



Already existing concepts!

– Firms are already posting/receiving VMs and IMs.

Regulations on VMs and IMs



Regulations on Initial Margins

Initial Margins

1. Now regulated. So, we must do it.
2. How To?
   - Standardised Method approach:
     - Expensive…
       - Notional schedule-based
       - Crude treatment for netting
     - Almost 'copy/paste' of the standardised method for counterparty credit risk capitalisation
   - Initial Margin Models (IMM) approach:
     - Internal models, i.e. each bank to develop their own model
     - A set of guidelines
       - Similar to the guidelines for market risk VaRs
       - 10-day liquidity horizon, 99th percentile (upper not lower)
     - Has to be approved by our local regulator

Challenge...

Challenge with adopting <u>any</u> IMM

- Our bank calculates the initial margin amount using our own methodology.
  - crucial difference from regulatory capital model
- But… the counterparty might not agree with our numbers!

methodology	IM: A to B	IM: B to A
Firm A	**IM(A, A to B)**	IM(A, B to A)
Firm B	IM(B, A to B)	**IM(B, B to A)**

Red: actual call amount & Blue: expected amount

- Dispute: increase in MPR and increase in IM..
- <u>BAD SOLUTION</u>: Use each bank's internal VaR model.

ISDA SIMM

ISDA SIMM Project

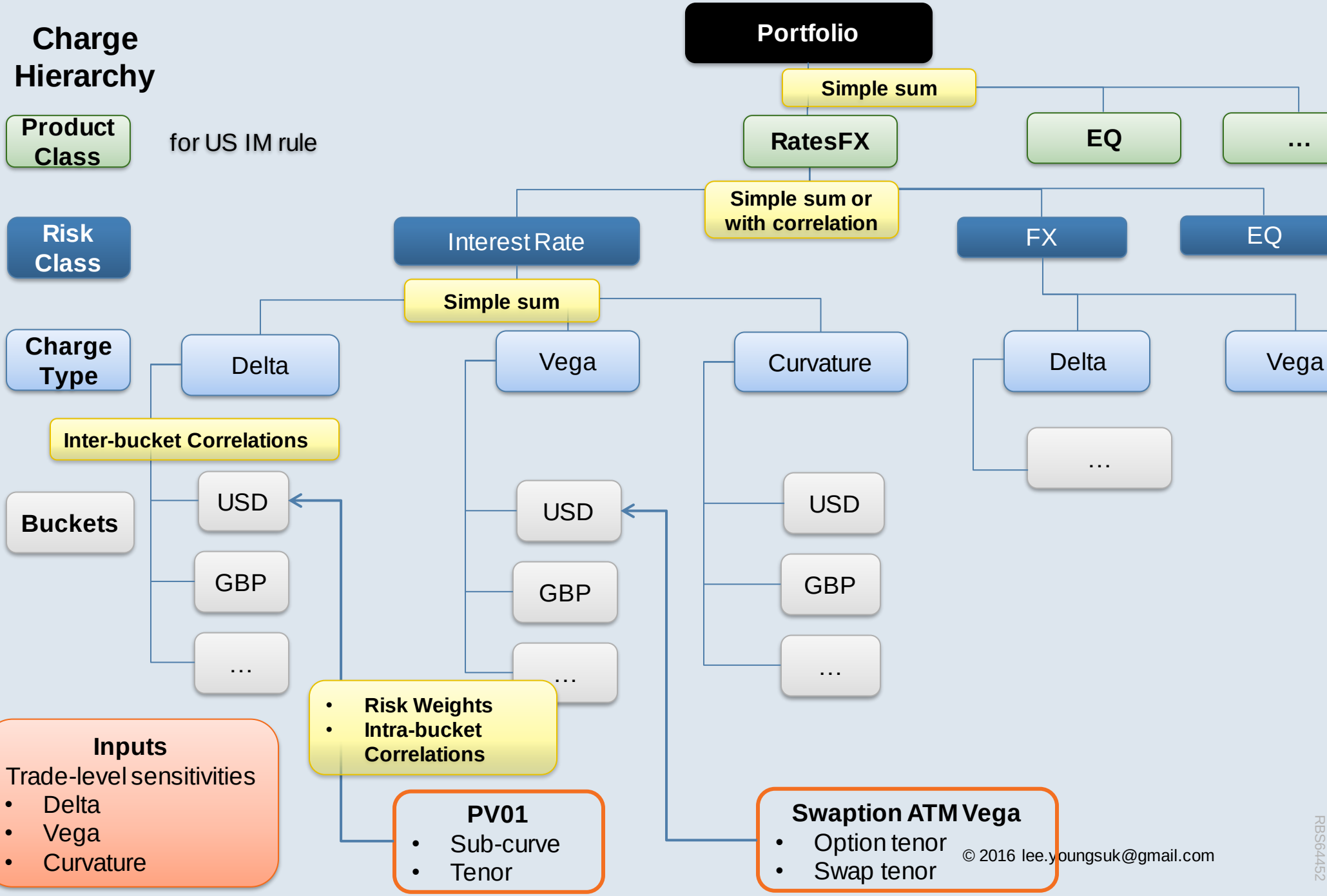
- To develop an initial margin calculation model jointly by industry members (ISDA)
  - Standard model that could be widely adopted as their own initial margin model
  - Risk sensitive
  - Simple and transparent
  - Easy calculations and reconciliations
- Based on SBA in FRTB!
- To distinguish one from another…
  SBA-M & SBA-C

Regulatory Perspective

approach	Market Risk Capital (FRTB)	Initial Margin
Standardised	• non-defaults: **SBA**-C • default charge methods • residual risk add-ons	notional based
Model-based	• ES • DRC • NMRF	• SIMM (**SBA**-M) • potentially different models for some counterparties

Model Approval Required!

SBA: Risk-based hierarchy



SBA Calculation: Cascading

Delta & Vega

- Organise all risk factors into the bucketing structure for each risk class
- For each risk factor k, calculate the net sensitivity s_k across all trades
- Weight the net sensitivity by the risk weight RW_b (defined per bucket)

$$WS_k = RW_b \cdot s_k$$

- **Bucket-level charge**: Calculate charges K_b and net positions S_b

$$K_b = \sqrt{\sum_k WS_k^2 + \sum_{k \neq l} \rho_{kl} WS_k WS_l}$$

- **Risk class-level charge**: Aggregate across buckets

$$\text{Charge} = \sqrt{\sum_b K_b^2 + \sum_{b \neq c} \gamma_{kl} S_k S_l} \quad \text{where} \quad S_b = \begin{cases} \sum_k WS_k & \text{SBA} - \text{C} \\ \min(K_b, \max(-K_b, \sum_k WS_k)) & \text{SBA} - \text{M} \end{cases}$$

Curvature: Different formula for SBA-C and SBA-M

Cascading, aka nest approach

- Small-sized correlation matrices
- Easier operations
- Easy to drill-down
- Easy to reconciliation between firms (SBA-C)

Common Requirements

Inputs

- Widely used sensitivities
  - PV01, FX Delta, CR01, etc
  - Vegas (IR, FX, etc)

Static data

- Credit/EQ/Commodity: bucketing
- Risk class classification

Calculation Methodology

- Index decompositions
- Both are variations of the classical Variance calculation
  - Minor differences for Delta & Vega charges
- But… noticeable differences for Curvature charge

- Firm-wide consistent sensitivities
- Common calculation library

curvature	SBA-C	SBA-M
trade level curvature	full-revaluations with stressed shocks	approximation through Vega ~ vega * implied vol / time
aggregation	$\sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c \psi(S_b, S_c)}$	$max\left(\sum_{b,k} CVR_{b,k} + \lambda \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc}^2 S_b S_c}, 0\right)$

SBA Components

	SBA-C	SBA-M
risk classes	GIRR FX CSR (non-sec) CSR (sec - non-CTP) CSR (sec - CTP) Equity Commodity	GIRR/FX CSR (qualifying) CSR (non-Q) Equity Commodity
charge types	Delta Vega Curvature (on stressed shocks)	Delta Vega Curvature (based on Vega)
aggregation	2-tier cascading Variance calculation	2-tier cascading Variance calculation

Bucket Structures

	SBA-C	SBA-M
GIRR	currency	currency
FX	currency currency pair	currency currency pair

Credit	by credit quality/sector
	• credit quality: IG / HY
	• sector
	  • sovereign
	  • local government
	  • financials
	  • …
		same but
		• based on the old FRTB buckets
		• crowd-sourcing for reconciliation

Equity	by market cap/economy/sector
	• large/small cap
	• advance/emerging markets
	• sector
	  • consumer goods
	  • telecommunications
	  • …
		similar
		• with index bucket
		• crowd-sourcing for reconciliation

Commodity	coal, crude, electricity, freight…	coal, crude, light ends, middle distillates, ….

Differences - Operation

	SBA-C	SBA-M
go-live	• 2019/20?	• Sep 2016
department	• risk	• FO

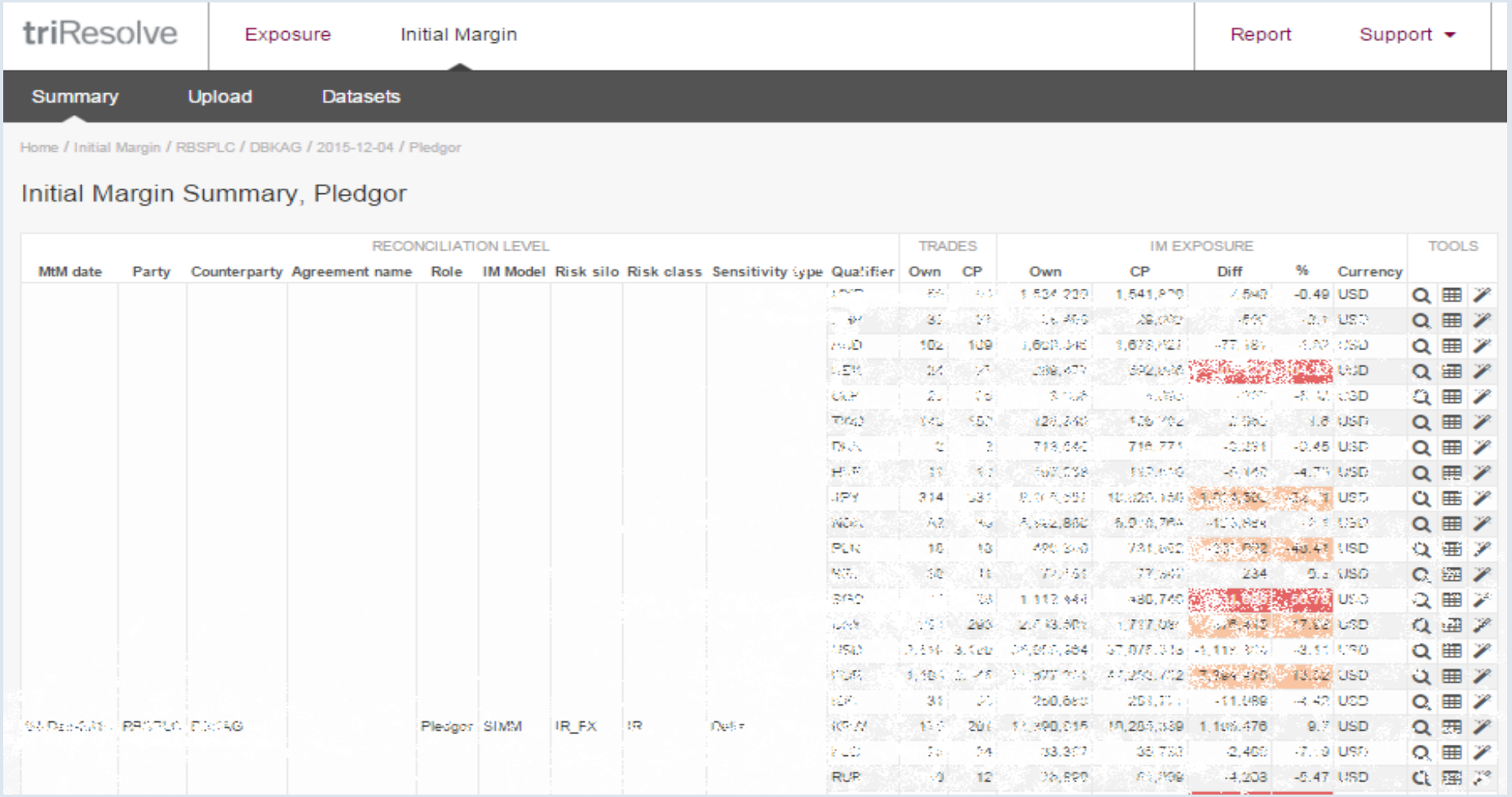
model approval	• not required
	• standardised approach by regulators
	• back-testing not required
		• required
		• it is a model!
		  • developed jointly by industry members
		  • adopted as an internal model by firm
		• back-testing, governance and monitoring
		  • industry-wide
		  • firm-level

model parameter calibrations
• risk weights
• correlations
	• passive
	• at the mercy of regulators
		• active
		• calibrated/revisited on regular basis
		  • jointly by industry members
		  • satisfy the regulatory guideline

reconciliation	• not required • banks to report the capitals	• required - part of daily operation • banks to agree/dispute margin amounts • missing trades • different pricing/classifications
frequency & timing	• infrequent reporting • can be delayed	• daily margin • next day
scope	• trading book • slicing/dicing by desk/book	• by counterparty/netting set • non-cleared OTC • excluded products

Helping Reconciliations for SIMM

Tri-Resolve



Differences - Methodology

	SBA-C	SBA-M
Liquidity Horizon	• varying horizons	• baseline: 10-day • scaled according to concentration risk
Diversification	• offsetting/diversification allowed within risk class / charge type	• EU rule: allowed (to be seen) within risk class / charge type • US rule: only within the same product class
Curvature	• at stressed shock • aggregation method	• vega-based • aggregation different from SBA-C
Basis Risk	• across all risk classes	• only for GIRR
GIRR	• the exact set of sub-curves are not specified • inflation • xccy-basis	• sub-curves: ois, 1m, 3m, 6m, 12m • inflation • no xccy-basis
others	• CDS vs bonds • commodity maturity/grade/etc • …	• none…
Correlation risk	• three scenarios (L/M/H)	• a single set of correlations
currency	• bank's reporting currency	• agreed per counterparty

Differences - Data

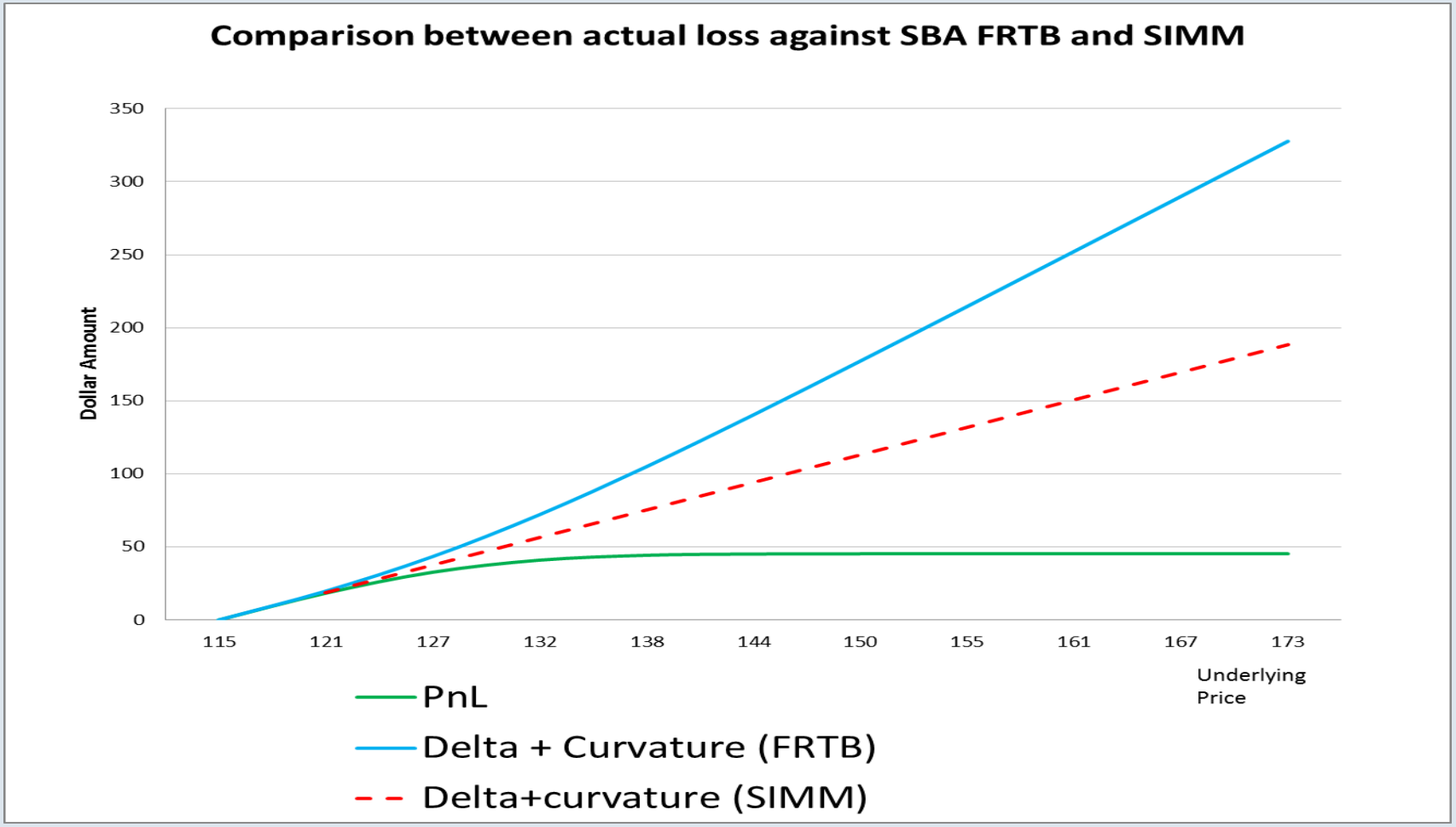
	SBA-C	SBA-M

Credit & Equity bucketing	• bank's own view	• through crowd sourcing
		  • firms to send their view to a central location
		  • receive back the industry view

Commodities	quite different bucket structure	
Market Data	• volatilities for all risk classes (where Vega is required)	• only for GIRR and credit
Common Risk Interchange Format (CRIF)	• not available	• plays an important role

Comparing SBA-C and SBA-M

Case Study with Digital Options



In-Closing

Leveraging…

- SBA-C and SBA-M have many common features/requirements
  - Almost the same kinds of sensitivities (except curvatures)
  - Similar kinds of static data (for bucketing)
  - Methodology based on variance calculation

Different as well..

- Day-to-day use cases with different objectives in mind
  - SBA-C: standardised approach for capital
  - SBA-M: internal model approach for initial margin
- The devil is in details - differences in data/methodology specifications

Appendix

SBA – How It Works

PV01's

V(x + 0.5bp) - V(x-0.5bp)

e.g. 1*bp* increase in GBP 1Y
- Trade 1: 20 profit
- Trade 3: 15 loss

Example of GIRR Delta Charges

Inputs: Risk sensitivities by currency bucket

Define a set of risk factors

Bucket	Mat
£	1Y
	5Y
$	1Y
	5Y

Calculate sensitivities for each trade

T1	T2	T3
+20		-15
+15		-20
	-20	+30
	-30	+15

Net sensitivities across trades

Net
+5
-5
+10
-15

In practice, over 10 maturities

Capital calculation: Aggregate netted risk sensitivities across risk factors. But **HOW?**

SBA Risk Aggregation – Risk Weight

Risk Weighted Sensitivities

- For each risk factor k, a risk weight RW_k is assigned
- Represents the 97.5% expected shortfall over a stressed period

Risk weight Calibration
- SBA-C: regulators
- SBA-M: industry

Net Sensitivities across trades

Bucket	Mat	Net
£	1Y	+5
	5Y	-5
$	1Y	+10
	5Y	-15

k	1Y	5Y
RW_k	150 (bps)	100 (bps)

Multiply

Weighted Sensitivities

WS_k
+750
-500
+1500
-1500

- The individual capital charge for each position would be the risk weighted sensitivity itself (e.g. £ 1Y: 750, $ 5Y: 1500)
- How to aggregate across all positions for the portfolio-level capital?

Risk Aggregation – Correlations

Correlation Specification

- Specify a correlation for each pair of risk factors
  - ρ_{jk}: **intra-bucket** correlations
  - $\gamma_{£\$}$: **inter-bucket** correlations

		WS_k
£	1Y	+750
	5Y	-500
$	1Y	+1500
	5Y	-1500

	£		$	
	1Y	5Y	1Y	5Y
£	1	0.75	0.5	
	0.75	1		
$	0.5		1	0.75
			0.75	1

Correlation Calibration
- SBA-C: regulators
- SBA-M: industry

Charge Calculation

- Variance Calculation

$$\text{Delta Charge} = \sqrt{\sum_{k,l} \text{Corr}_{k,l} \cdot WS_k \cdot WS_l}$$

$$= \sqrt{\sum_{k} WS_k^2 + \sum_{k \neq l} \sum_{l} \text{Corr}_{k,l} \cdot WS_k \cdot WS_l}$$

- Nothing but.. Classic parametric VaR model
  - $k \sim N(0, RW_k^2)$
  - $corr(k, l) = \text{Corr}_{kl}$

Risk Aggregation via 2-Tier Cascade

Equivalent Variance Calculation via 2-Tiers Cascading

- Modularised into simpler calculations
- Drilling down into buckets
- Single correlation specification between buckets

		WS_k
£	1Y	+750
	5Y	-500
$	1Y	+1500
	5Y	-1500

	£		$	
	1Y	5Y	1Y	5Y
	+750	-500	+1500	-1500
£ 1Y	1	0.75	0.5	
£ 5Y	0.75	1		
$ 1Y	0.5		1	0.75
$ 5Y			0.75	1

Step 1: Aggregate **within** each currency **bucket**

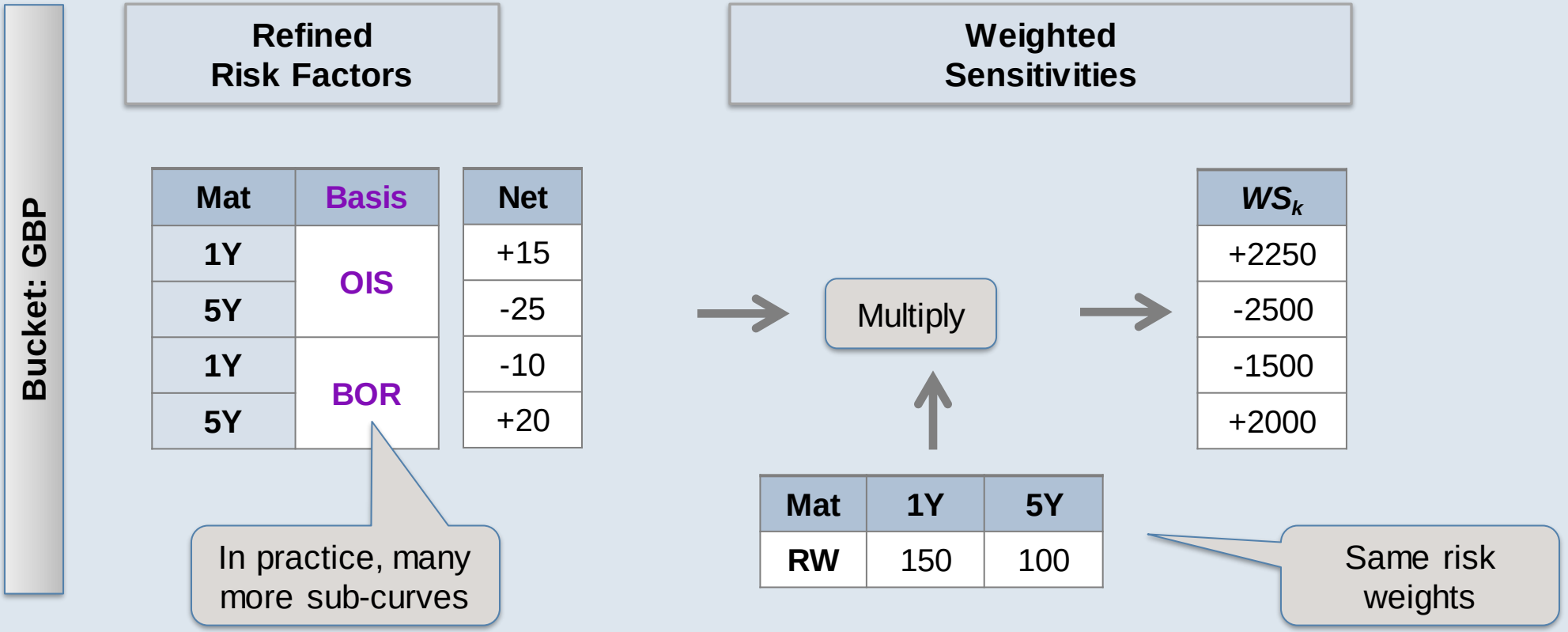
Bucket Charges	Net Positions
$K_{£} = \sqrt{\sum_k WS_{£,k}^2 + \sum_{k \neq l} \rho_{kl} \cdot WS_{£,k} \cdot WS_{£,l}}$	$S_{£} = \sum_k WS_{£,k}$
$K_{\$} = \sqrt{\sum_k WS_{\$,k}^2 + \sum_{k \neq l} \rho_{kl} \cdot WS_{\$,k} \cdot WS_{\$,l}}$	$S_{\$} = \sum_k WS_{\$,k}$

Step 2: Aggregate **across** buckets

$$\text{Delta Charge} = \sqrt{K_{£}^2 + K_{\$}^2 + 2 \cdot \gamma_{£\$} \cdot S_{£} \cdot S_{\$}}$$

$$= \sqrt{\sum_b K_b^2 + \sum_{b \neq c} \sum_c \gamma_{bc} \cdot S_b \cdot S_c} \quad b, c = £, \$$$

Basis Risk and Correlation Scaling Method



Procedure

- Start with refined risk factors
- Calculate weighted sensitivities at each refined risk factor

Basis Risk and Correlation Scaling Method (cont'd)

Aggregation through Correlation Scaling

			1Y	5Y	1Y	5Y
			OIS		BOR	
		WS_k	+2250	-2500	-1500	+2000
1Y	OIS	+2250	C		ϕ C	
5Y		-2500				
1Y	BOR	-1500	ϕ C		C	
5Y		+2000				

C =

	1Y	5Y
1Y	1	0.75
5Y	0.75	1

Procedure (cont'd)

- Aggregation via Variance
  - Specify correlations using main attributes
  - Correlation between basis risk factors: scaled down by ϕ

$$(K_{£})^2 = \sum_k WS_k^2 + \sum_{k \neq l} \rho_{kl} \cdot WS_k \cdot WS_l$$

$$= \sum_m WS_{OIS,m}^2 + \sum_{m \neq n} c_{mn} \cdot WS_{OIS,m} \cdot WS_{OIS,n} \quad \text{OIS}$$

$$+ \sum_m WS_{BOR,m}^2 + \sum_{m \neq n} c_{mn} \cdot WS_{BOR,m} \cdot WS_{6M,n} \quad \text{BOR}$$

$$+ 2 \cdot \phi \cdot \left[\sum_m WS_{BOR,m} \cdot WS_{OIS,m} + \sum_{m \neq n} c_{mn} \cdot WS_{BOR,m} \cdot WS_{OIS,n} \right] \quad \text{OIS v BOR}$$

Product- vs Risk- Based

Risk-based Calculation

- Potential interpretation of EU rule (consultation stage)
- Across all trades, calculate the margins at each risk class
  - GIRR: based on IR risks (e.g. PV01s, etc) across all trades in the netting set
  - FX: based on FX risks (e.g. FX deltas, etc) across all trades in the netting set
  - CSR (Q): based on CSR (Q) (e.g. CR01s, etc) across all trades in the netting set
  - …
- Final charge: sum across all risk classes.

Product-based Calculation

- US rule (final). No cross-product hedging/diversification benefits (more expensive)
- First, partition all trades into GIRR/FX, CSR (Q), CSR(NQ), EQ and CM product classes
- Within each product class, perform the risk-based calculation
  - For example, the margin for EQ product class includes the charge due to PV01s, FX deltas as well as EQ deltas
- Final change: sum across all product-class charges

Note: Likely, all US counterparties will be subject to the US rule. So, we shall apply the US rule as well!