WELLS FARGO

Standard Initial Margin Model Seminar @ UNCC
- A Practitioner's Perspective

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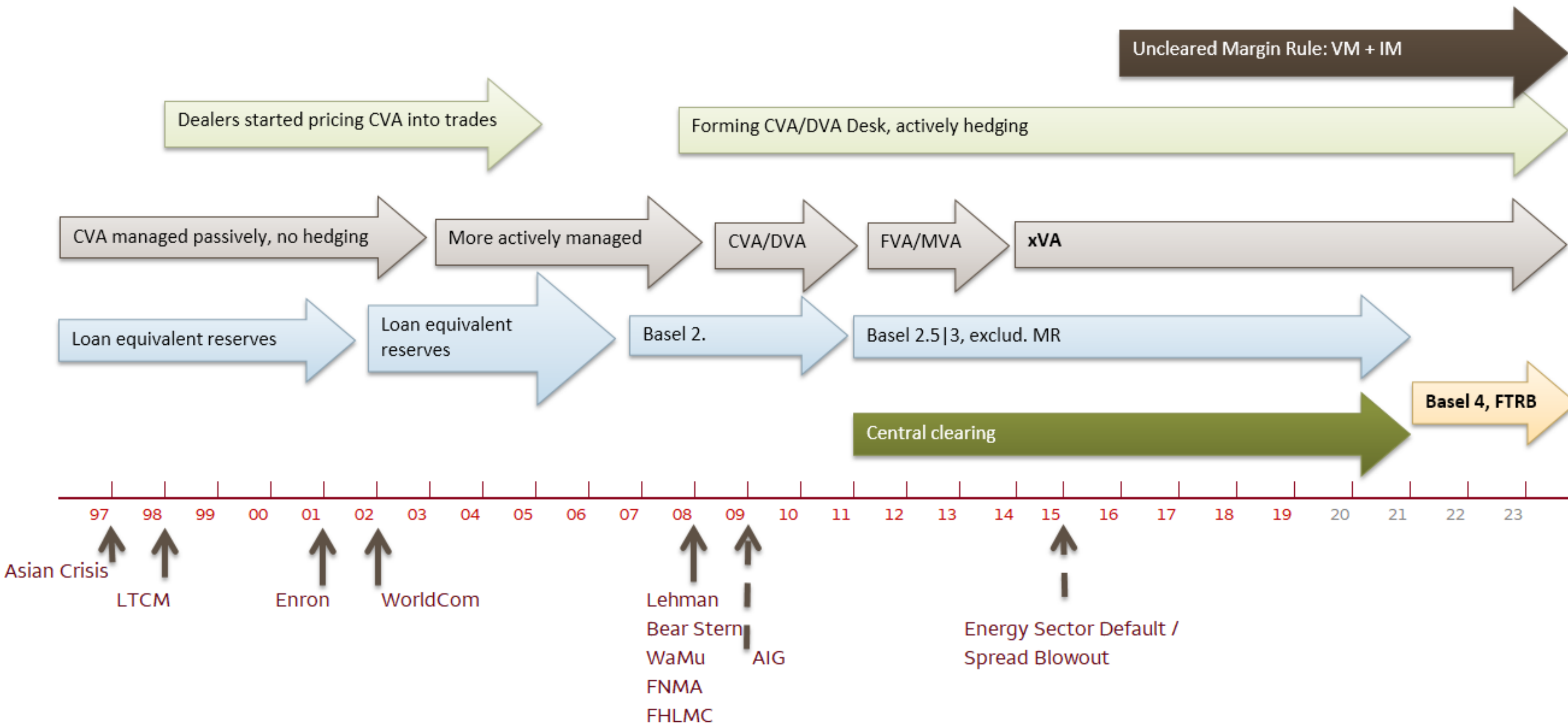
Topics

Disclaimer: The material presented in this deck does not contain any company specific information. All examples and numeric analyses used within are public information for illustration purpose only. The content is intended for educational and knowledge sharing purpose only.

I. Background – Uncleared Margin Rule

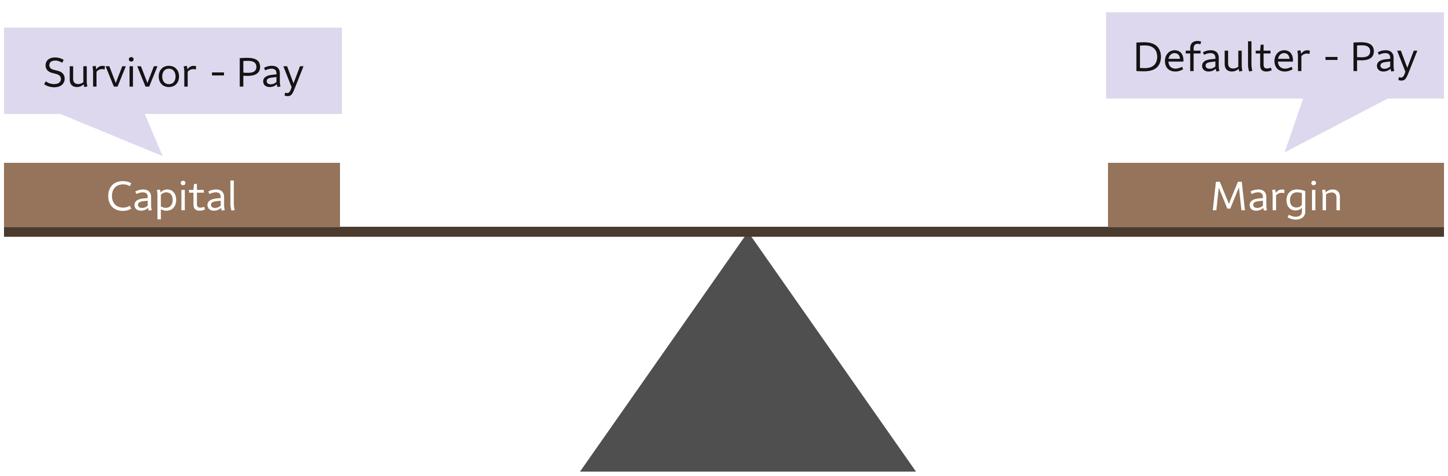
– Below is an oversimplified chart showing the regulatory regime changes in responses to the financial crises.

– CVA reserve, central clearing, and uncleared margin rule are all measures the institutions can take to mitigate the counterparty risk.



I. Background – Capital vs. Margin

- The financial crisis in 2008 raised concerns about the lack of transparency in the over-the-counter (OTC) derivatives market and the resiliency of its market participants. To reduce the systemic risk, global regulators have made the following important changes:
  - Promote Central Clearing – Mandatory Clearing of single currency swaps & CDS in 2013
  - Increase the margining amongst the counterparties (include IM & VM)
  - Increase the capital buffer
- Both capital and margin perform important and complementary risk mitigation functions but are distinct in a number of ways [1].
- Existing capital rules ensure sufficient levels of reserves to act as a buffer in the event of a counterparty default. The intent of margin rules is to harmonize "**survivor-pay**" capital requirements with "**defaulter-pay**" margin rules in order to achieve two regulatory goals:
  - Reduce systemic risk in the derivatives market highlighted by the financial crisis, and
  - Promote central clearing by aligning bilateral margining with the heightened risk observed in bilateral markets.

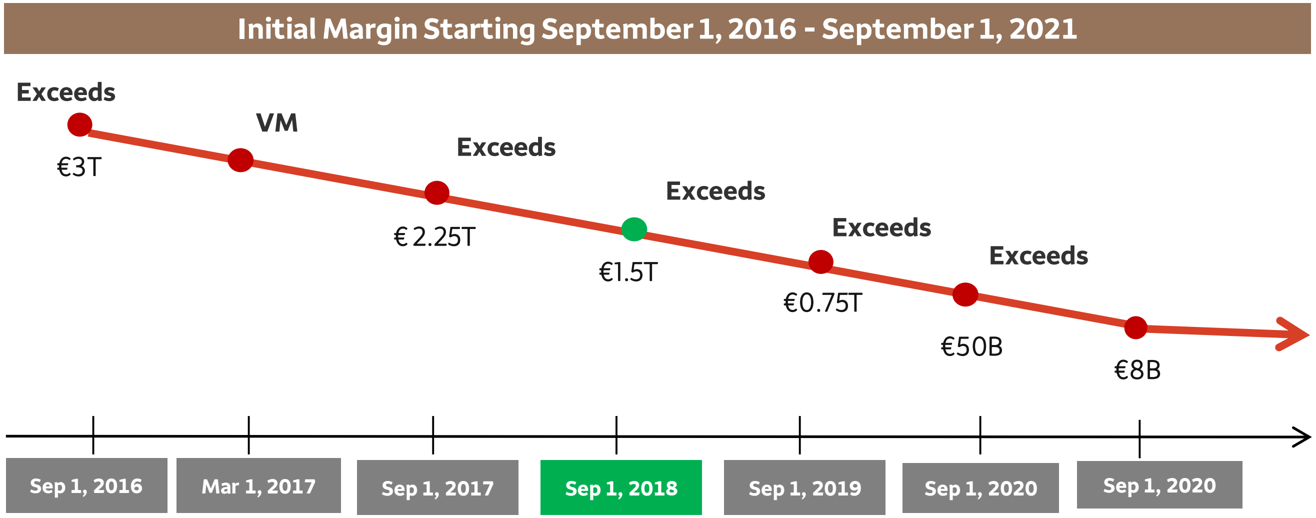


I. Background – ISDA SIMM

- To level the playing field for the OTC bilateral derivative market from the margin perspective, the Group of 20 (G20), Basel Committee of Banking Supervision (BCBS), and the International Organization of Securities Commissions (IOSCO) created the Working Group on Margin Requirements (WGMR) with the goal of establishing a global framework for margin practices of non-cleared over-the-counter derivatives (i.e., bilateral).
- In September 2013, a final policy framework was published by WGMR imposing margin requirements; and global regulatory agencies have since developed local rules that are consistent with the WGMR's framework. This framework establishes two-way (i.e., post and collect) initial margin (IM) for certain covered counterparties and exchange of variation margin (VM) for covered counterparties. It also restricts the forms of eligible collateral to cash and other highly liquid assets, requires mandatory segregation of IM, and requires documentation to govern collateral relationships with a bank's counterparties.
- In December 2013, in order to mitigate differences in IM that banks would calculate by using unique internally developed risk-based models, ISDA proposed an initiative to develop a standardized model for computing IM that would be compliant with the WGMR policy framework and be utilized by industry participants to collect and post IM in accordance with various global margin regimes, including margin rules issued by U.S. prudential regulators.
- Over the course of the 4 years since 2013, ISDA incrementally built out the current Standard Initial Margin specification, publically available from its website, with a large industry working group. Currently the ISDA SIMM is the industry standard and adopted by every in scope SIMM counterparties. ISDA's success in SIMM specification is really rooted on the following 9 objectives it set out to accomplish [2].

Non-procyclicality	Ease of Replication	Transparency
Quick To Calculate	Extensible	Predictability
Costs	Governance	Margin Appropriateness

I. Background - Global Compliance Date



Phase-in metric for IM:

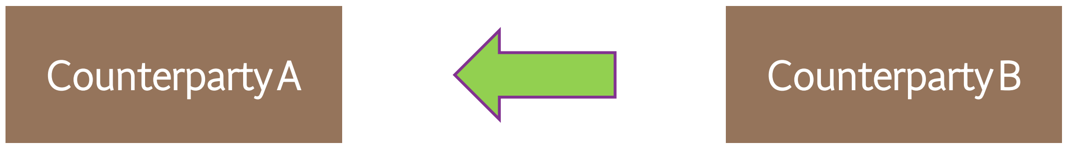
- Revised requirement – Based on aggregate average notional amounts for March, April, and May of a given year when transacting with another covered entity (provided that it also meets that condition).

Threshold	USPR	ESAs	JFSA
MTA	$500 K	€ 500 K	¥70 M
IM Threshold	$50 M	€ 50 M	¥7 B

The threshold value can be different across jurisdictions on the same compliance dates, see the table below:

Country	Sep 1, 2016	Sep 1, 2017	Sep 1, 2018	Sep 1, 2019	Sep 1, 2020	Sep 1, 2021
	IM: $3.0T	$2.25T	**$1.5T**	$0.75T	$50B	$8B
	IM: €3.0T	€2.25T	€1.5T	€0.75T	€50B	€8B
	IM: ¥ 420T	¥ 315T	¥ 210T	¥ 105T	¥ 10T?	¥ 1.1T

I. Background – Bilateral Variation Margin



- Unidirectional posting
- Generally cash in the same currency as the derivative contract
- Generally can be re-hypothecated
- Netting against the IM not allowed
- Usually called daily but can be called intra-day during volatile market
- Reflecting the MTM of the netting sets.
- Usually you are concerned with two numbers:
  - Self calculated MTM
  - Counterparty calculated MTM

I. Background – Bilateral Initial Margin

- Bidirectional posting to a 3rd party custodian
- Usually non-cash securities subject to the mutually accepted haircut schedule
- Generally can not be re-hypothecated
- Netting against the VM not allowed
- Usually called daily
- Reflecting the tail risk of the netting sets
- Intended to cover potential losses in the event of the counterparty defaults
- Usually you are concerned with four numbers:
  - Self calculated Margin to Post (Own Pledgor Amount)
  - Self calculated Margin to Collect (Own Secured Amount)
  - Counterparty calculated Margin to Post (Counterparty Pledgor Amount)
  - Counterparty calculated Margin to Collect (Counterparty Secured Amount)

II. SIMM Scope - Counterparties

– Below are SIMM in scope counterparties for the first 4 waves.

– The in scope company is required to collect IM from its inter-affiliates.

Phase 1 (>$3T) 2016	Phase 2 (>$2.25T) 2017	Phase 3 (>$1.5T) 2018	Phase 4 (>$750B) 2019	Phase 5 (>$50B) 2020	Phase 6 (>$8B) 2021
Bank of America Corporation	ANZ Group	Wells Fargo Group	Banca IMI S.p.A.	500+ Financial End Users	1000+ Financial End Users
Barclays Group	Danske Bank Group	ING GROUP	Banco Bilbao Vizcaya Argentaria, S.A.		
BNP Paribas	Grupo Santander	The Toronto-Dominion Bank	Bank of Montreal		
Citigroup Inc.	ING (For US AANA Only)	Commonwealth Bank of Australia	BBVA Bancomer		
Credit Suisse	Nordea Bank AB (publ)	National Australia Bank Group	BSMA Ltd		
Deutsche Bank Group	RBC(Phase 2 for Canada and Japanese rules)	UniCredit Group	Canadian Imperial Bank of Commerce		
GOLDMAN SACHS GROUP, INC.	Sumitomo Mitsui Financial Group	Santander Group	Citadel Global Fixed Income Master Fund Ltd.		
HSBC Holdings Plc		BBVA BANCO FRANCES, S.A.	Compass Bank		
JPMorgan Chase		State Street Corporation	Cooperatieve Rabobank U.A., "Rabobank"		
Mitsubishi UFJ Financial Group		Commerzbank	DBS Bank Ltd		
Mizuho Financial Group		Brevan Howard Investment	GIC Private Limited		
NATIXIS			Intesa Sanpaolo S.p.A		
Nomura Holdings, Inc.			Lloyds Bank Corporate Markets plc		
Morgan Stanley			Lloyds Bank plc		
RBC Financial Group (For US and EMIR)			Milennium CMM, Ltd.		
RBS Group			Milennium Fixed Income Ltd.		
Société Generale Group			Millennium Partners LP		
Standard Chartered PLC			Nordea Bank Abp		
UBS Group			Riverview Group LLC		
			Skandinaviska Enskilda Banken AB		
			The Bank of Nova Scotia		
			Westpac Banking Corporation		

II. SIMM Scope – Product Types

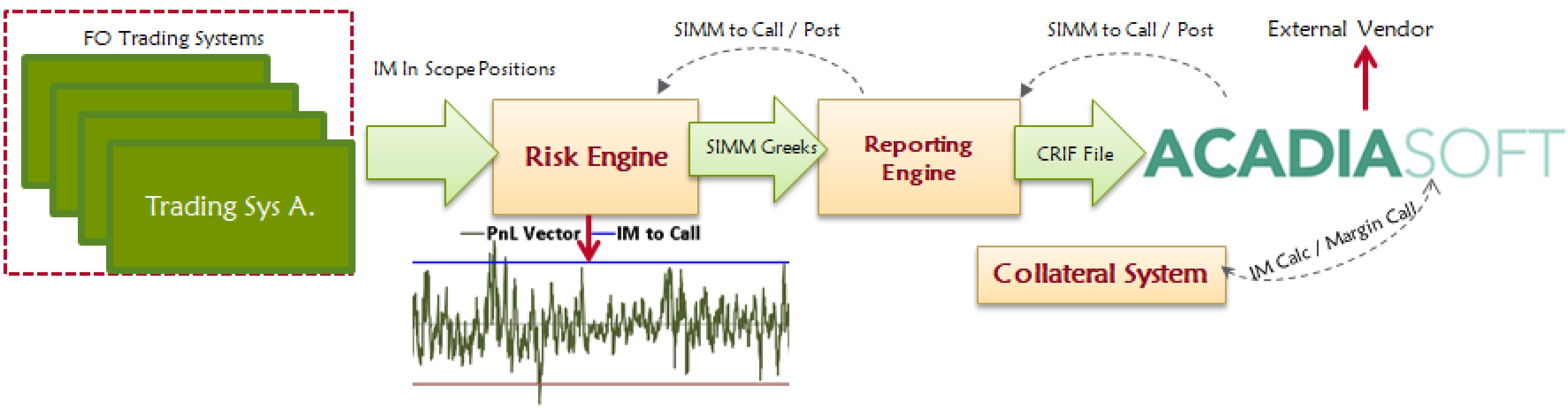
– The Initial Margin rule impacts most of the un-cleared derivative transactions in Rates, FX, Equity, Commodities and Credit against all counterparties phased in according to the UMR compliance schedule.

– BCBS exempts the physically settled FX forward and swaps for the Margin Rule. As the known principle exchanges for a cross currency swap is economically equivalent to the FX Forward \ Swaps, all known principle exchanges for cross currency swaps are exempted as well.

Example Product Scope				
Rates	FX	Commodities	Equities	Credit
Cap	Non deliverable Forward	Commodity	Equity Swap	CDS ABS Index
Cancellable Swap	Window Forwards	Commodity Option	Cliquet	CDS Index
Cross Currency Swap	FX Option	Commodity Swap	Variance Swap	CDS Structuews Prod
Digital Cap		Com Swaption	TRS	CDX Index Option
Digital Floor		Power		CDS
Floor		Swap		Risk Partici. Swap
Forward Starting Swap				TRS
Inflation Cap				
Inflation Floor				
Inflation Swap				
Swap				
Swaption				
Treasury Lock				

III. SIMM Implementation - Typical High Level Architecture

– Below is a high level system diagram how the SIMM solution could be implemented by an in scope company:
  - FO Trading Systemswould produce the SIMM specific Greeks as well as other position level static attributes including Notinoal
  - FO Trading Systems are also responsible for accurately tagging the in scope trades for sensitivity calculations (in scope SIMM flag)
  - Risk Engine functions as the SIMM sensitivity processing / aggregation engine.
  - A Common Risk Interface File (CRIF) is produced by Reporting Engine and uploaded to AcadiaSoft [9]
  - AcadiaSoft produces the SIMM / Schedule IM numbers and provides a common hub for exposure sharing and margin reconciliations.

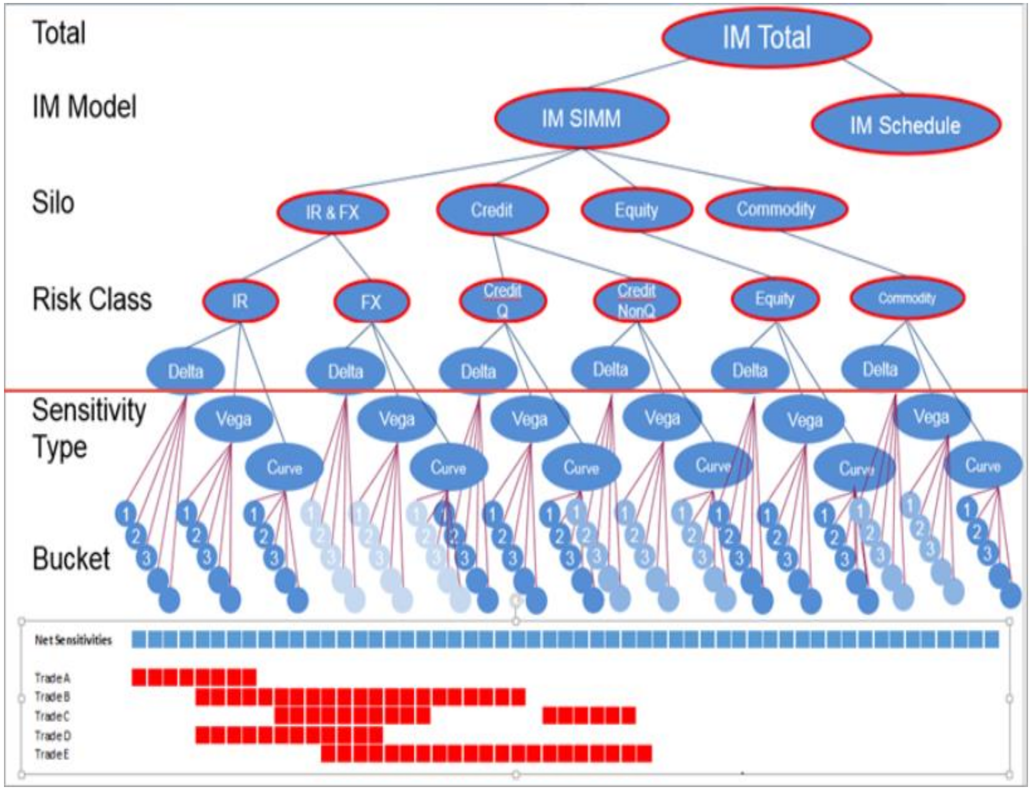


IV. AcadiaSoft – the Company

- AcadiaSoft, Inc. is the leading industry provider of risk and collateral management services for the non-cleared derivatives community.
- Owned and backed by the investment of 17 major industry participants and infrastructures, the AcadiaSoft community has grown to more than 650 client firms exchanging approximately $400B of collateral on daily basis.
- Based in Township of Norwell, MA
- **{Q}** How many Employees of the company?
  - Population of Norwell: 10,506
  - Number of employees: 50 - 200

IV. AcadiaSoft – Calculation Overview

- If AcadiaSoft is used for IM margin hub, SIMM-sensitivities are submitted to AcadiaSoft via Common Risk Input File (CRIF) [9].
- The CRIF files are produced and submitted to the vendor at T + 0.
- AcadiaSoft's IM Exposure Manager provides tools for counterparty reconciliation and investigation of IM calculation differences among counterparties as required by UMR regulations and ISDA documentation.



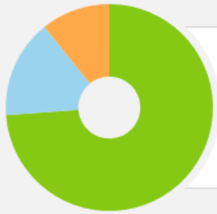
- Trade level sensitivities are calculated by participating firms and submitted to AcadiaSoft Risk Data Manager

- AcadiaSoft nets trade level sensitivities and aggregates by Bucket, Sensitivity Type, Risk Class, Silo, Model and Total.

- The same process is used to calculate two different calculation trees:
    - Pledgor (you pay)
    - Secured Party (you receive)

- For portfolios containing primarily linear products, IM secured will approximate IM pledger. Introduction of optionality can cause IM pledger and IM secured to diverge dramatically.

IV. AcadiaSoft – IM Exposure Manager



65 agreements

- Complete 48
- Own data only 10
- CP data only 7

Show all

ROLE	OWN	CP	DIFF (%)	ABS DIFF (%)	CURRENCY
Pledgor					USD
Secured					USD

(Differences are based on complete agreements)

IM Exposure by Counterparty Group

Export CSV

A

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ROLE	OWN	CP	DIFF (%)	ABS DIFF (%)
Pledgor	-9 M	8 M	-0 M (-3.4%)	0 M (+3.4%)
Secured	10 M	-9 M	0 M (+4.9%)	0 M (+4.9%)

B

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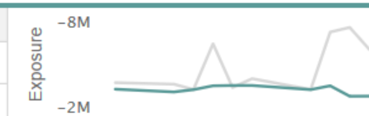
ROLE	OWN	CP	DIFF (%)	ABS DIFF (%)
Pledgor	-2 M	6 M	3 M (+148.5%)	3 M (+148.5%)
Secured	2 M	-5 M	-3 M (-166.2%)	3 M (+166.2%)



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ROLE	OWN	CP	DIFF (%)	ABS DIFF (%)
Pledgor	-74 M	74 M	-0 M (-0.4%)	0 M (+0.4%)
Secured	78 M	-76 M	2 M (+3.0%)	2 M (+3.0%)

D

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ROLE	OWN	CP	DIFF (%)	ABS DIFF (%)
Pledgor	-202 M	195 M	-7 M (-3.4%)	7 M (+3.4%)
Secured	215 M	-209 M	6 M (+2.9%)	6 M (+2.9%)

E

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ROLE	OWN	CP	DIFF (%)	ABS DIFF (%)
Pledgor	-4 M	4 M	0 M (+9.1%)	1 M (+21.3%)
Secured	4 M	-4 M	0 M (+0.8%)	0 M (+10.4%)

IV. Schedule IM

– Schedule IM can be thought as the simplified notional based IM exposure calculation approach.
– It can be a proper approach for smaller firms especially phase 4 or 5 companies to become compliant with the UMR without outlandish infrastructure investments.

Standardized Initial Margin Schedule		
Asset Class	**Maturity**	**Initial Margin Requirement (% of Notional)**
Credit	0 - 2 year duration	2
	2 - 5 year duration	5
	5+ year duration	10
Commodity		15
Equity		15
FX		6
Interest Rates	0 - 2 year duration	1
	2 - 5 year duration	2
	5+ year duration	4
Other		15

** Prescribed by BCBS & IOSCO*

– Consider the above schedule, we had a **long** discussion in the initial implementation phase on should we classify the Risk Participation Swap as interest rate instrument or credit instrument. **{Q}** Why?
– **{Q}** Can you think of a situation a bank would rather use the schedule IM as opposed to the SIMM modeling approach?

V. Schedule IM

– Consider below live trade for example:

Trade Example 1	
positionId	31535209
businessDate	3/29/2019
maturityDate	5/14/2020
securityId	31535209
productType	FRA
productDescription	FRA/05/14/2020/P:USD/CMM30-FNMA/1D /R:USD 4.08700
currency	USD
notional	5000000000
counterparty	Counterparty X

– **{Q}** What's the schedule IM?
– **{Q}**How much is produced by AcadiaSoft?

	Match ID	IM match type	Trade ID	Trade ID2	IM model	Product class	Regulations	End date	Trade ID	Trade date	triResolve status	Diff category	Own	CP	Diff (%)
☐	1389344374	M	CAL315352092 0181114	CalypsoWFC#3 1535209#0	Schedule	Rates	USPR / CFTC	2020-05-14	CAL315352092 0181114_VM	2018-11-14	Matched	End date	-50,000,000	50,000,000	0 (0.0%)

V. Schedule IM

– Consider another live trade for example:

Trade Example 2	
positionId	32029141
businessDate	4/25/2019
maturityDate	12/24/2020
productType	RiskParticipationSwap
productDescription	RiskParticipationSwap/First Data Corporation/32029140/CappedSwap/P:USD/LIBOR/1M /R:USD 2.62800
currency	USD
unadjustedNotional	4750000000
riskParticipation%	15
Counterparty	Counterparty Y

– **{Q}** What's the schedule IM?

– **{Q}** How much is produced by AcadiaSoft?

Match ID	Silo	Risk class	Sensitivity type	Match status	Trade ID	Regulations (Own)	Qualifier	Bucket	Label 1	Label 2	AMOUNT (USD) Own	CP	Diff (%)	Risk weight	Own
1454063000	Credit		Notional	MD	CAL3202914120181227	USPR				0-2y / ⚠	712,500,000	NS	712,500,000	0.02	-14,250,000
	Credit		PV	UM	CAL3202914120181227	USPR					-3,597		-3,597	1.00	

V. Schedule IM

–{Q} Any potential problems?

- Lack of netting benefit
- Overly punitive
  - A comparative study done by AcadiaSoft for a diversified portfolio could produce 7x schedule IM vs. SIMM model. [3]
- Challenge of calculating notional for certain types of derivatives
  - Step up structures
  - Balance guarantee structures
  - Accreting
  - Amortizing
- Tenor classification can also present practical difficulties
  - Callable
  - Extensible

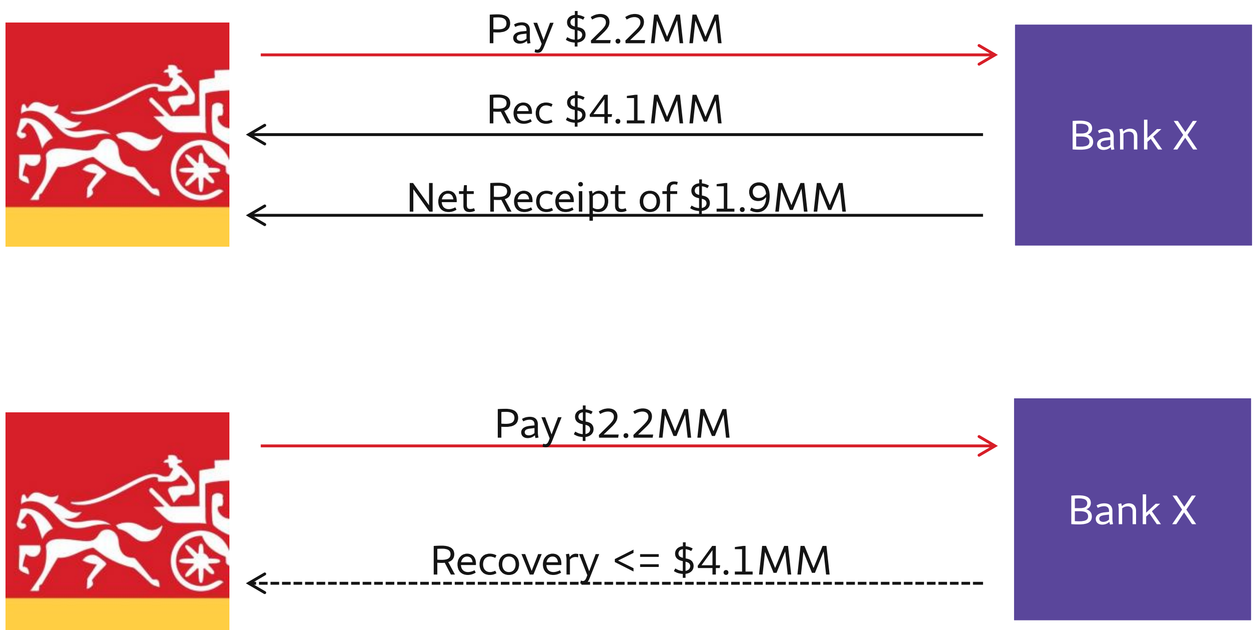
V. Schedule IM – Net to gross ratio

- In order to address the “lack of the netting benefit” issue, the BCBS introduced a workaround – net to gross ratio (NGR). [1]
- NGR aimes to adjust the Gross Initial Margin Amount in the **legally enforceable netting set**. **{Q}** Why legal enforceability so important ?

positionid	baseNPV	Gross NPV
Rates Trade 1	(1,122,718.50)	
Rates Trade 2	(339,636.93)	
Rates Trade 3	(296,755.81)	
Rates Trade 4	(247,805.21)	(2,173,039.49)
Rates Trade 5	(76,097.31)	
Rates Trade 6	(52,133.06)	
Rates Trade 7	(37,892.66)	
Rates Trade 8	34,920.27	
Rates Trade 9	67,130.16	
Rates Trade 10	72,693.66	
Rates Trade 11	144,549.90	
Rates Trade 12	258,370.50	4,097,125.99
Rates Trade 13	285,450.03	
Rates Trade 14	497,653.46	
Rates Trade 15	1,232,544.06	
Rates Trade 16	1,503,813.94	

V. Schedule IM – Net to gross ratio

- Without the legal enforceability, a financial institution’s current credit exposure to the counterparty equals to its gross positive MTM. [4]
- During the close out if the netting is not legally enforceable, you still need to pay your counterparty negative MTM while trying to recover your positive MTM.



Disclaimer*: Example given above is based on fictitious exposure vs. Bank X for illustrative purpose only.*

V. Schedule IM – Net to gross ratio

- BCBS recognizes the important non-negligible offsets would have been ignored if the gross schedule IM were to be implemented without considering the netting benefit.
- BCBS proposes the following formula for calculating the schedule IM by taking into the consideration of net to gross ratio (NGR) [1].

$$Net\ IM = 0.4 \times Gross\ IM + 0.6 \times NGR \times Gross\ IM$$

- NGR is defined as the level of the net replacement **cost** over the level of the gross replacement **cost** for all in scope transactions in the legally enforceable netting set.
- Adjust 60% of Gross IM by NGR.
- **{Q}** What's NGR from Wells Fargo point of view ?
- **{Q}** What's NGR from Bank X point of view?

Counterparty	Net Cost	Gross Cost	Ratio
Wells Fargo	-	2,173,039.49	0%
Bank X	1,924,086.50	4,097,125.99	47%

VI. Mean and Variance of Portfolio Return

- ISDA SIMM model is developed with the shortcomings of the schedule IM in mind. It has achieved the universal acceptance in as short as 2.5 years. There's no other viable SIMM model outside the ISDA one.
- The key design principle of the ISDA SIMM is rooted in the classic portfolio return and variance theory.
- **Memory refresher 1**: {Q} what's the portfolio return assuming the portfolio comprises two assets returning r(1) and r(2) and with w(1) and w(2) weighting?
- **Memory refresher 2**: {Q} what's the portfolio variance assuming the portfolio comprises two assets having standard deviation of return σ(1) and σ(2) and with w(1) and w(2) weighting?

$$R = w_1 \times r_1 + w_2 \times r_2$$

$$Var = w_1^2 \times \sigma_1^2 + w_2^2 \times \sigma_2^2 + 2 \times w_1 \times w_2 \times \rho \times \sigma_1 \times \sigma_2$$

VI. Mean and Variance of Portfolio Return

- More importantly in general
  - Assume we have a portfolio with n assets each return r(i)
  - Each asset has a standard deviation of σ (i)
  - And the weighting of each asset is w(i)
- The following define the expected return and the variance of the portfolio [5].

$$R = \sum_{i=1}^{n} w_i \times r_i$$

$$Var = \sum_{i=1}^{n} w_i^2 \times \sigma_i^2 + \sum_{i=1}^{n} \sum_{i \neq j}^{n} w_i \times w_j \times \rho_{i,j} \times \sigma_i \times \sigma_j$$

VI. Mean and Variance of Portfolio Return - example

– Assume we have a portfolio with 2 equal investments in Walmart & Target.
– Walmart returns 3% and Target returns 2%.
– Walmart's standard deviation of return is 9% while Target is 7%.
– The correlation of the returns is 80%.
– **{Q}** What's the portfolio return and risk?

	J	K	L	M	N
1	**Portfolio**	**Weight**	**Return**	**Standard Deviation**	**Correlation**
2	Walmart	0.50	3%	9%	80%
3	Target	0.50	2%	7%	
4					
5	Portfolio Return	2.5%	<--=K2*L2+K3*L3		
6	Portfolio Risk	7.6%	<--=SQRT(K2^2*M2^2+K3^2*M3^2+2*K2*K3*M2*M3*N2)		

VII. Zero, Forward, and Par Rates

– It's very important for us to understand the differences between 3 most important rates we work with from time to time:

- **Zero Rate:** The interest rate that would be earned on a bond that provides no coupons [6]. This rate is the point estimate of the yield of the instrument at maturity time t and has sufficient information to calculate the base NPV of the instrument.

- **Forward Rate:** Rate of interest for a period of time **<u>in the future</u>** implied by today's zero rate [6]. E.g., risk driver *IR_RATE_VAR_USD_**LIBSWPM03CME**_FWD_BASE_**Y05_Y10*** has a value of 0.027851418 at EOD 4/23, **{Q}** what does it really mean?

- **Par Rate:** The coupon (fixed rate) on the bond (vanilla fix – float swap) that makes its price (MTM) equal to the principle (zero).

VII. Zero, Forward, and Par Rates

– **Zero Rate:** The interest rate that would be earned on a bond that provides no coupons [6]. This rate is the point estimate of the yield of the instrument at maturity time t and has sufficient information to calculate the base NPV of the instrument.

B 0 04/23/20 (912796SM2)

Discount	2.32375	Settle	04/29/19
Price	97.6762500	Issue	04/25/2019
Days to Maturity	360	Maturity	04/23/2020
			Taxed @
Yield Calculations			28.00 %
US Treasury Convention		2.404471	1.734060
US Govt Bond Equivalent		2.404703	1.734181
Simple Interest (Act/360)		2.379033	1.712904
Medium Term CD (Act/360)		2.365053	1.705633
US Treasury with Leap Year		2.404471	1.734060
Risk			
Duration			0.984
Modified Duration			0.972
Risk			0.950
Convexity			0.014
DV 01 on 1MM			94.95
YV 0.01	Dscnt		0.01053

Source: Bloomberg

– The T-bill on the left is trading at discount of 2.32375 implying a market price of 97.67625.

– The yield of this bond using simple interest is 2.379% while the continual compounded yield is approximately 2.35%.

$$y = 100 \times ln \frac{100}{97.67625}$$

VII. Zero, **Forward**, and Par Rates

- **Forward Rate:** Rate of interest for a period of time **<u>in the future</u>** implied by today's zero rate [6]

$$R_F = \frac{R_2 T_2 - R_1 T_1}{T_2 - T_1} \qquad\qquad R_F = \frac{DF_1}{DF_2} - 1$$

- If you know the zero rate at the beginning and the end of the future period, you can easily derive the forward rate.
- The forecast curve in the trading system such as the LIBOR 3M, LIBOR 1M, EURIOR 3M, and EURIBOR 6M, contains such information so the expected future cash flows on a derivative contracts can be easily computed.
- **{Q}** How much is forward rate between December 18, 2019 and March 18, 2010?

Reset	Fwd Begin	Fwd End	Pmt Begin	Pmt End	Idx Term	Interp	Period	Proj Amt	PV Disc	Pmt Dt	Interest Amt	Manual Amt	Fwd Rate
06/14/2019	06/18/2019	09/18/2019	06/18/2019	09/18/2019	3M	☐	0.25555556	1,069,329.43	1,058,353.04	09/18/2019	1,069,329.43	☐	2.5843300
09/16/2019	09/18/2019	12/18/2019	09/18/2019	12/18/2019	3M	☐	0.25277778	1,048,213.96	1,031,348.19	12/18/2019	1,048,213.96	☐	2.5467800
12/16/2019	12/18/2019	03/18/2020	12/18/2019	03/18/2020	3M	☐	0.25277778	1,050,731.37	1,027,889.76	03/18/2020	1,050,731.37	☐	2.5567400
03/16/2020	03/18/2020	06/18/2020	03/18/2020	06/18/2020	3M	☐	0.25555556	1,038,901.72	1,010,555.30	06/18/2020	1,038,901.72	☐	2.4652700
06/16/2020	06/18/2020	09/18/2020	06/18/2020	09/18/2020	3M	☐	0.25555556	1,020,823.50	987,517.66	09/18/2020	1,020,823.50	☐	2.3945300

0LIBOR3M_FIX_OIS | CLOSE | Date 04/16/2019 | 3:17:01 PM | ☐ Current

ition | Underlying | Resets | Points | Graph

Insert

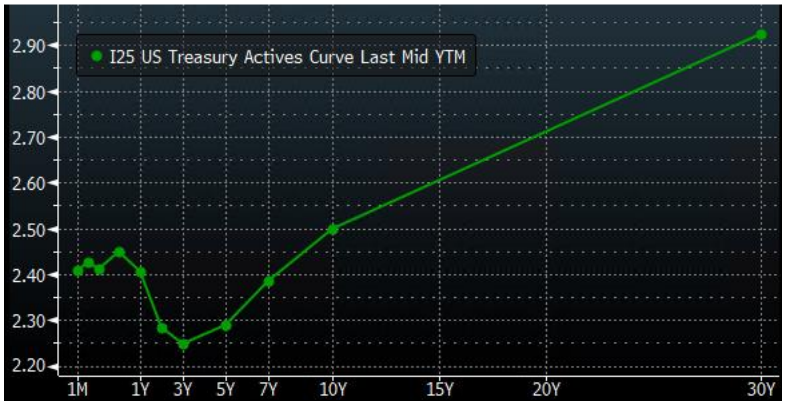
Append

Date	Offset	Res Bid	Res Mid	Res Ask	Spr Bid(bp)	Spr Mid(bp)	Spr Ask(bp)	Base Bid	Base Mid	Base Ask	Df Bid
12/18/2019	246	2.62044	2.62044	2.62044	9,826.0667	9,826.0667	9,826.0667	0.00000	0.00000	0.00000	0.98260667
01/21/2020	280	2.61800	2.61800	2.61800	9,802.4475	9,802.4475	9,802.4475	0.00000	0.00000	0.00000	0.98024475
03/18/2020	337	2.61510	2.61510	2.61510	9,762.9699	9,762.9699	9,762.9699	0.00000	0.00000	0.00000	0.97629699

$$F_{(Dec\ 18\ 2019, to\ Mar\ 18\ 2020)} = \left(\frac{0.98260667}{0.97629699} - 1\right) \times \frac{360}{91} = 0.025567396$$

VII. Zero, Forward, and **Par** Rates

– **Par Rate:** The coupon (fixed rate) on the bond (fixed – float swap) that makes its price (MTM) equal to the principle (zero).



Tenor	Description	Price	Yield
1M	B 0 05/28/19 Govt	2.365	2.409
2M	B 0 06/25/19 Govt	2.378	2.426
3M	B 0 07/25/19 Govt	2.366	2.413
6M	B 0 10/24/19 Govt	2.380	2.448
1Y	B 0 04/23/20 Govt	2.324	2.404
2Y	T 2 ¼ 04/30/21 Govt	99-30	2.283
3Y	T 2 ¼ 04/15/22 Govt	100-00⅛	2.248
5Y	T 2 ¼ 04/30/24 Govt	99-26⅛	2.289
7Y	T 2 ⅜ 04/30/26 Govt	99-29¾	2.386
10Y	T 2 ⅝ 02/15/29 Govt	101-02¾	2.499
30Y	T 3 02/15/49 Govt	101-16¼	2.924

– Assuming you want to auction a precise par bond with 2 year maturity. **{Q}** How do you determine the par coupon?

$$100 = \frac{c}{2}e^{-0.02448\times0.5} + \frac{c}{2}e^{-0.02404\times1} + \frac{c}{2}e^{-0.02348\times1.5} + \left(\frac{c}{2} + 100\right)e^{-0.02283\times2}$$

$$c = 2.298\%$$

VIII. SIMM Model

- SIMM uses sensitivities as inputs. Risk factors and sensitivities are clearly defined by ISDA and consistently used by all counterparties [7].
- SIMM sensitivities are used as inputs to aggregation formulae which are intended to recognize:
  - Hedging
  - Diversification benefits
- SIMM sensitivities are coupled with the "**Risk Weights**" and aggregated with each other using "**Correlation Matrices**"
- There are 6 risk classes

Interest Rates	Equity	FX	Commodity	Credit Qualifying	Credit Non-Qualifying

- There are 4 resultant margin outputs for each of the 6 risk classes described above.

$$IM_x = DeltaMargin_x + VegaMargin_x + CvxMargin_x + CorrMargin_x$$

VIII. SIMM Model

- There are 4 product classes.

Rates FX | Equity | Commodities | Credit

- The total margin for that product class is aggregated for its containing risk classes.

$$SIMM_{product} = \sqrt{\sum_r IM_r^2 + \sum_r \sum_{s \neq r} \psi_{rs} IM_r IM_s}$$

- The total SIMM is the sum of the above defined product classes.

$$\text{SIMM} = SIMM_{RatesFX} + SIMM_{Equity} + SIMM_{Commods} + SIMM_{Credit}$$

- Please note there's no diversification benefits across product classes.

VIII. SIMM Model – Aggregate Across Risk Classes

Interest Rates	Equity	FX	Commodity	Credit Qualifying	Credit Non-Qualifying

– Assume your IR risk class pledgor IM = -12,227,022 and FX risk class pledger IM = -2,879,051. IR and FX has $\psi_{ir,fx}$ = 26%. **{Q}** How much is the SIMM for RatesFX product class?

$$SIMM_{product} = \sqrt{\sum_r IM_r^2 + \sum_r \sum_{s \neq r} \psi_{rs} IM_r IM_s}$$

$$SIMM_{product} = \sqrt{12227022^2 + 2879051^2 + 2 \times 0.26 \times 12227022 \times 287905} = 13270048$$

LEVELS					TRADE COUNT		IM EXPOSURE			TOOLS
IM model	Silo	Risk class	Sensitivity type	Bucket	Own	CP	Own	CP	Diff (%)	Sharing
SIMM					73	66	-13,270,048	13,622,718	352,671 (+2.7%)	
	RatesFX				73	66	-13,270,048	13,622,718	352,671 (+2.7%)	
		IR			73	57	-12,227,022	12,589,087	362,064 (+3.0%)	
		FX			40	66	-2,879,051	2,875,573	-3,478 (-0.1%)	

IX. SIMM – Delta Margin for Interest Rate

$$IM_{IR} = DeltaMargin_{IR} + VegaMargin_{IR} + CvxMargin_{IR}$$

– Following steps are used to calculate the delta margin for interest rates

1. Obtain weighted sensitivities on par rate IR01 for each index i and tenor k at **net level**

Tenor	Regular	Low-Vol	Hi-Vol
2w	114	33	91
1m	115	20	91
3m	102	10	95
6m	71	11	88
1y	61	14	99
2y	52	20	101
3y	50	22	101
5y	51	20	99
10y	51	20	108
15y	51	21	100
20y	54	23	101
30y	62	27	101

$$WS_{k,i} = \boldsymbol{RW_k} \times s_{k,i} \times CR_b$$

$s_{k,i}$ is the par rate dv01 for index i at tenor k.
Example: USD 3mL 10yr <u>par</u> rate dv01

Ccy	Type	Ordinal	Concentration Type	Concentration Threshold
AUD	Regular	2	Regular -	28,000,000
CAD	Regular	2	Regular -	28,000,000
CHF	Regular	2	Regular -	28,000,000
CNH	Hi-Vol	4	Hi-Vol	8,000,000
CNY	Hi-Vol	4	Hi-Vol	8,000,000
EUR	Regular	2	Regular +	230,000,000
GBP	Regular	2	Regular +	230,000,000
HKD	Regular	2	Regular -	28,000,000
INR	Hi-Vol	4	Hi-Vol	8,000,000
JPY	Lo-Vol	3	Lo-Vol	82,000,000
KRW	Regular	2	Regular -	28,000,000
MXN	Hi-Vol	4	Hi-Vol	8,000,000
NOK	Regular	2	Regular -	28,000,000
NZD	Regular	2	Regular -	28,000,000
PEN	Hi-Vol	4	Hi-Vol	8,000,000
PLN	Hi-Vol	4	Hi-Vol	8,000,000
SEK	Regular	2	Regular -	28,000,000
SGD	Regular	2	Regular -	28,000,000
TRY	Hi-Vol	4	Hi-Vol	8,000,000
TWD	Regular	2	Regular -	28,000,000
USD	Regular	2	Regular +	230,000,000
ZAR	Hi-Vol	4	Hi-Vol	8,000,000

IX. SIMM – Delta Margin for Interest Rate

$$IM_{IR} = DeltaMargin_{IR} + VegaMargin_{IR} + CvxMargin_{IR}$$

2. Obtain delta margins for each currency by aggregating weighted sensitivities across indices and tenors within each currency via specified correlations

$$K = \sqrt{\sum_{i,k} WS_{k,i}^2 + \sum_{i,k} \sum_{(j,l)\neq(i,k)} \varphi_{i,j} \rho_{k,l} WS_{k,i} WS_{l,j}}$$

98% is the correlation b/w any 2 sub-curves intra-Ccy, e.g, USD 3mL vs. 1mL

T/T	2w	1m	3m	6m	1y	2y	3y	5y	10y	15y	20y	30y
2w	0.00	0.63	0.59	0.47	0.31	0.22	0.18	0.14	0.09	0.06	0.04	0.05
1m	0.63	0.00	0.79	0.67	0.52	0.42	0.37	0.30	0.23	0.18	0.15	0.13
3m	0.59	0.79	0.00	0.84	0.68	0.56	0.50	0.42	0.32	0.26	0.24	0.21
6m	0.47	0.67	0.84	0.00	0.86	0.76	0.69	0.60	0.48	0.42	0.38	0.33
1y	0.31	0.52	0.68	0.86	0.00	0.94	0.89	0.80	0.67	0.60	0.57	0.53
2y	0.22	0.42	0.56	0.76	0.94	0.00	0.98	0.91	0.79	0.73	0.70	0.66
3y	0.18	0.37	0.50	0.69	0.89	0.98	0.00	0.96	0.87	0.81	0.78	0.74
5y	0.14	0.30	0.42	0.60	0.80	0.91	0.96	0.00	0.95	0.91	0.88	0.84
10y	0.09	0.23	0.32	0.48	0.67	0.79	0.87	0.95	0.00	0.98	0.97	0.94
15y	0.06	0.18	0.26	0.42	0.60	0.73	0.81	0.91	0.98	0.00	0.99	0.97
20y	0.04	0.15	0.24	0.38	0.57	0.70	0.78	0.88	0.97	0.99	0.00	0.99
30y	0.05	0.13	0.21	0.33	0.53	0.66	0.74	0.84	0.94	0.97	0.99	0.00

IX. SIMM – Delta Margin for Interest Rate

IM_{IR} = $DeltaMargin_{IR}$ + $VegaMargin_{IR}$ + $CvxMargin_{IR}$

{Q} Assume we have a positive weighted sensitivity for 2y of 100K and a negative weighted sensitivity of 3yr of -100K all on 3mL; what's our IM?

$$K = \sqrt{\sum_{i,k} WS_{k,i}^2 + \sum_{i,k} \sum_{(j,l)\neq(i,k)} \varphi_{i,j}\rho_{k,l} WS_{k,i} WS_{l,j}}$$

98% *between 2 sub-curves intra-Ccy, e.g, 3mL vs. 1mL,* ***100%*** *if same curve*

98% *is the correlation b/w 2yr and 3yr par rate sensitivities*

$$K = \sqrt{100^2 + (-100)^2 + 100\% \times 98\% \times 100 \times (-100) \times 2} = \sqrt{2 \times 100 \times (100 - 98)} = 20K$$

{Q} Assume we have a positive weighted sensitivity for 2y of 100K on 3mL and a negative weighted sensitivity of 3yr of -100K on 1mL; what's our IM?

$$K = \sqrt{100^2 + (-100)^2 + 98\% \times 98\% \times 100 \times (-100) \times 2} = \sqrt{2 \times (100^2 - 98^2)} = 2 \times \sqrt{198} = 28.14K$$

IX. SIMM Model – Delta Margin for Interest Rate

IM_{IR} = $DeltaMargin_{IR}$ + $VegaMargin_{IR}$ + $CvxMargin_{IR}$

3. Obtain delta margin by aggregate across currencies with specified correlations

$$Delta\ Margin = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{b,c} g_{b,c} S_b S_c}$$

Accounting for risk offset cross currencies but limited by the correlation

21% *should be used for aggregating across different currencies.*

$$S_b = \max(\min(\sum_{i,k} WS_{k,i}, K_b), -K_b)$$

$\boldsymbol{K_b}$ *is always non-negative*
$\boldsymbol{-K_b}$ *is always non-positive*
$\boldsymbol{WS_{k,i}}$ *Could be positive or negative or zero*
$\boldsymbol{S_b}$ *preserves the signage of the exposure, hence ensuring the netting benefit*

IX. SIMM Model – Delta Margin for Interest Rate

IM_{IR} = $DeltaMargin_{IR}$ + $VegaMargin_{IR}$ + $CvxMargin_{IR}$

{Q} Assume we have a short USD 3yr **3mL PV01 =2K** and a long **EUR 3yr 3mE -2K**; what's our IM?

$$Delta\ Margin = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{b,c} g_{b,c} S_b S_c}$$

21% *should be used for aggregating across different currencies.*

$$S_b = \max(\min(\sum_{i,k} WS_{k,i}, K_b), -K_b)$$

$\boldsymbol{K_b}$ *is always non-negative*
$\boldsymbol{-K_b}$ *is always non-positive*
$\boldsymbol{WS_{k,i}}$ *Could be positive or negative or zero*
$\boldsymbol{S_b}$ *preserves the signage of the exposure, hence ensuring the netting benefit*

$$K_{USD} = 2 \times 50 = 100K; K_{EUR} = -2 \times 50 = -100K$$

$$S_{USD} = 100K; S_{EUR} = -100K$$

$$Delta\ Margin = \sqrt{100^2 + (-100)^2 + 2 \times 21\% \times 1 \times 100 \times (-100)} = \sqrt{2 \times 100 \times (100 - 21)} = 125.69K$$

X. SIMM – Curious Case of Interest Rate Vega

$$\boldsymbol{IM_{IR}} = \boldsymbol{DeltaMargin_{IR}} + \boldsymbol{VegaMargin_{IR}} + \boldsymbol{CvxMargin_{IR}}$$

$$VR_{ik} = \sum_j \sigma_{kj} \frac{\partial V_i}{\partial \sigma}$$

Vega for the corresponding vol grid point

Implied volatility for tenor k and expiry j

- Interesting to see ISDA spec requires the implied volatility level to be used as the operand to multiply with the vega. Why ?
- AcadiaSoft requires the submission of vega risk to be the product of vega and the ATM Vol as well.
- It turns out it solves the vega risk representation issue elegantly. Different banks may have implemented different vega risk metrics. Some may produce black (a.k.a. lognormal) vega; some may instead produce normal vega.
- By asking for the vega X ATM Vol, ISDA SIMM achieves the vega risk submission invariance. **{Q}** Why this will give us vega risk invariance?

X. SIMM – Curious Case of Interest Rate Vega

IM_{IR} = $DeltaMargin_{IR}$ + $VegaMargin_{IR}$ + $CvxMargin_{IR}$

$$VR_{ik} = \sum_j \sigma_{kj} \frac{\partial V_i}{\partial \sigma}$$

Vega for the corresponding vol grid point

Implied volatility for tenor k and expiry j

– To see this mathematically (black vega x black vol ≃ normal vega x normal vol)

$$\sigma_N = F \times \sigma_B$$

$$\frac{\partial \sigma_N}{\partial \sigma_B} = F$$

$$\frac{\partial V}{\partial \sigma_B} \times \sigma_B = \frac{\partial V}{\partial \sigma_N} \times \frac{\partial \sigma_N}{\partial \sigma_B} \times \sigma_B$$

$$\frac{\partial V}{\partial \sigma_B} \times \sigma_B = \frac{\partial V}{\partial \sigma_N} \times F \times \sigma_B$$

$$\frac{\partial V}{\partial \sigma_B} \times \sigma_B = \frac{\partial V}{\partial \sigma_N} \times \sigma_N$$

X. SIMM – Curious Case of Interest Rate Vega

$$IM_{IR} = DeltaMargin_{IR} + VegaMargin_{IR} + CvxMargin_{IR}$$

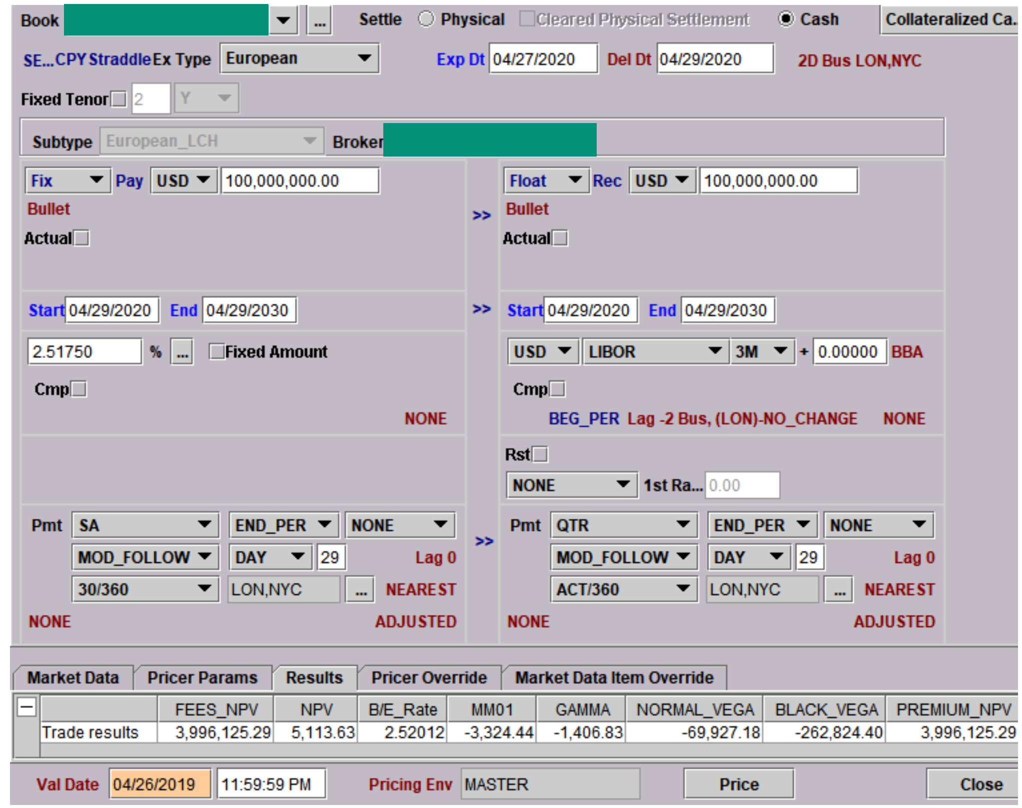
$$VR_{ik} = \sum_j \sigma_{kj} \frac{\partial V_i}{\partial \sigma}$$

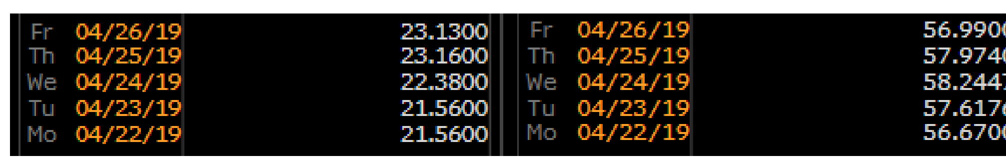
– Is it empirically true ?

Type	ATM Vol	Vega	Product
Black	23.13	262,824.40	6,079,128.37
Normal	56.99	69,927.18	3,985,149.99

– Appears to be very different for the 1y10y ATM swaption

– **{Q}** Why?





X. SIMM – Curious Case of Interest Rate Vega

$$IM_{IR} = DeltaMargin_{IR} + VegaMargin_{IR} + CvxMargin_{IR}$$

- This turns out partially explainable due to our shifted SABR model.
- We pushes up the forward rates by 125bps which impacts the black vega # and ATM log normal volatility.

LOGNORMAL	0.25	1	2	3	4	5	7	10	15	20	25	30	40
5/3/2019	0.0474	0.0971	0.1635	0.1731	0.1741	0.1737	0.1663	0.1552	0.1459	0.1388	0.1344	0.1296	0.1302
5/10/2019	0.0449	0.0920	0.1549	0.1640	0.1648	0.1644	0.1574	0.1469	0.1380	0.1313	0.1272	0.1227	0.1232
5/28/2019	0.0403	0.0827	0.1392	0.1487	0.1497	0.1474	0.1407	0.1316	0.1239	0.1177	0.1136	0.1099	0.1104
6/26/2019	0.0643	0.0978	0.1462	0.1555	0.1556	0.1532	0.1465	0.1368	0.1283	0.1227	0.1189	0.1149	0.1154
7/26/2019	0.0885	0.1116	0.1500	0.1587	0.1579	0.1555	0.1489	0.1388	0.1294	0.1242	0.1212	0.1174	0.1179
10/28/2019	0.1142	0.1391	0.1649	0.1709	0.1681	0.1650	0.1582	0.1468	0.1362	0.1297	0.1273	0.1245	0.1251
1/27/2020	0.1336	0.1598	0.1754	0.1766	0.1729	0.1688	0.1612	0.1498	0.1390	0.1323	0.1298	0.1274	0.1280
4/27/2020	0.1529	0.1755	0.1845	0.1805	0.1760	0.1710	0.1626	0.1515	0.1406	0.1339	0.1311	0.1292	0.1299
10/26/2020	0.1762	0.1920	0.1928	0.1856	0.1798	0.1737	0.1653	0.1542	0.1429	0.1364	0.1338	0.1318	0.1327
4/26/2021	0.1863	0.1970	0.1938	0.1852	0.1797	0.1740	0.1658	0.1550	0.1435	0.1370	0.1345	0.1325	0.1334
4/26/2022	0.1885	0.1940	0.1893	0.1830	0.1771	0.1710	0.1631	0.1535	0.1426	0.1363	0.1341	0.1323	0.1335
4/26/2023	0.1853	0.1879	0.1835	0.1786	0.1742	0.1680	0.1611	0.1523	0.1420	0.1360	0.1341	0.1329	0.1343
4/26/2024	0.1802	0.1813	0.1780	0.1737	0.1694	0.1651	0.1588	0.1510	0.1414	0.1358	0.1343	0.1332	0.1347
4/28/2025	0.1747	0.1752	0.1717	0.1678	0.1642	0.1607	0.1553	0.1486	0.1398	0.1346	0.1333	0.1326	0.1343
4/27/2026	0.1702	0.1697	0.1665	0.1630	0.1601	0.1573	0.1529	0.1469	0.1387	0.1338	0.1327	0.1323	0.1340
4/26/2027	0.1640	0.1628	0.1601	0.1574	0.1552	0.1531	0.1494	0.1442	0.1365	0.1321	0.1311	0.1311	0.1329
4/26/2028	0.1587	0.1575	0.1555	0.1533	0.1517	0.1502	0.1470	0.1424	0.1350	0.1309	0.1302	0.1304	0.1323
4/26/2029	0.1549	0.1538	0.1522	0.1504	0.1494	0.1484	0.1454	0.1412	0.1340	0.1301	0.1296	0.1301	0.1319
4/26/2034	0.1451	0.1446	0.1439	0.1433	0.1427	0.1422	0.1401	0.1364	0.1316	0.1296	0.1300	0.1308	0.1325
4/26/2039	0.1411	0.1392	0.1380	0.1377	0.1371	0.1364	0.1345	0.1312	0.1283	0.1279	0.1287	0.1297	0.1310
4/26/2044	0.1336	0.1324	0.1317	0.1310	0.1306	0.1304	0.1296	0.1283	0.1276	0.1279	0.1288	0.1297	0.1306
4/26/2049	0.1272	0.1270	0.1274	0.1275	0.1275	0.1276	0.1278	0.1280	0.1285	0.1294	0.1303	0.1310	0.1316
4/28/2059	0.1238	0.1242	0.1257	0.1266	0.1264	0.1261	0.1268	0.1279	0.1301	0.1315	0.1322	0.1329	0.1330

NORMAL	0.25	1	2	3	4	5	7	10	15	20	25	30	40
5/3/2019	0.0019	0.0037	0.0059	0.0062	0.0062	0.0062	0.0060	0.0058	0.0056	0.0054	0.0053	0.0051	0.0051
5/10/2019	0.0018	0.0035	0.0056	0.0058	0.0058	0.0059	0.0057	0.0055	0.0053	0.0051	0.0050	0.0048	0.0048
5/28/2019	0.0016	0.0031	0.0050	0.0053	0.0053	0.0053	0.0051	0.0049	0.0048	0.0046	0.0045	0.0043	0.0043
6/26/2019	0.0025	0.0037	0.0053	0.0055	0.0055	0.0055	0.0053	0.0051	0.0049	0.0048	0.0047	0.0045	0.0045
7/26/2019	0.0034	0.0041	0.0054	0.0056	0.0056	0.0055	0.0054	0.0052	0.0050	0.0049	0.0048	0.0046	0.0046
10/28/2019	0.0043	0.0050	0.0058	0.0060	0.0059	0.0059	0.0057	0.0055	0.0053	0.0051	0.0050	0.0049	0.0049
1/27/2020	0.0049	0.0057	0.0061	0.0061	0.0061	0.0060	0.0059	0.0056	0.0054	0.0052	0.0051	0.0050	0.0050
4/27/2020	0.0055	0.0061	0.0064	0.0063	0.0062	0.0061	0.0059	0.0057	0.0054	0.0052	0.0052	0.0051	0.0051
10/26/2020	0.0061	0.0066	0.0066	0.0064	0.0063	0.0062	0.0061	0.0058	0.0056	0.0054	0.0053	0.0052	0.0052
4/26/2021	0.0063	0.0067	0.0067	0.0065	0.0064	0.0063	0.0061	0.0059	0.0056	0.0054	0.0053	0.0052	0.0052
4/26/2022	0.0065	0.0068	0.0067	0.0066	0.0065	0.0063	0.0062	0.0060	0.0056	0.0054	0.0053	0.0053	0.0053
4/26/2023	0.0066	0.0068	0.0067	0.0066	0.0065	0.0064	0.0062	0.0060	0.0057	0.0055	0.0054	0.0053	0.0053
4/26/2024	0.0066	0.0067	0.0067	0.0066	0.0065	0.0064	0.0063	0.0060	0.0057	0.0055	0.0054	0.0053	0.0053
4/28/2025	0.0066	0.0067	0.0066	0.0065	0.0065	0.0064	0.0062	0.0060	0.0057	0.0054	0.0054	0.0053	0.0053
4/27/2026	0.0065	0.0066	0.0065	0.0065	0.0064	0.0063	0.0062	0.0060	0.0056	0.0054	0.0054	0.0053	0.0053
4/26/2027	0.0064	0.0065	0.0064	0.0063	0.0063	0.0062	0.0061	0.0059	0.0056	0.0054	0.0053	0.0053	0.0053
4/26/2028	0.0064	0.0064	0.0063	0.0063	0.0062	0.0062	0.0060	0.0058	0.0055	0.0053	0.0052	0.0052	0.0052
4/26/2029	0.0063	0.0063	0.0062	0.0062	0.0061	0.0061	0.0060	0.0058	0.0055	0.0053	0.0052	0.0052	0.0052
4/26/2034	0.0059	0.0059	0.0059	0.0058	0.0058	0.0058	0.0057	0.0055	0.0053	0.0051	0.0051	0.0051	0.0051
4/26/2039	0.0056	0.0056	0.0055	0.0055	0.0054	0.0054	0.0053	0.0052	0.0050	0.0050	0.0049	0.0049	0.0049
4/26/2044	0.0052	0.0052	0.0051	0.0051	0.0051	0.0051	0.0050	0.0050	0.0049	0.0048	0.0048	0.0048	0.0048
4/26/2049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048
4/28/2059	0.0045	0.0045	0.0045	0.0046	0.0045	0.0045	0.0045	0.0046	0.0046	0.0047	0.0047	0.0047	0.0047

- If you use our internal shifted SABR produced lognormal volatility, you can see the vega invariance roughly holds:

  black vega x black vol ≃ normal vega x normal vol

1y10y	ATM Vol	Vega	Product
Black	15.15	(262,824)	(3,981,790)
Normal	56.99	(69,927)	(3,985,150)

X. SIMM – Curious Case of Interest Rate Vega

$$IM_{IR} = DeltaMargin_{IR} + VegaMargin_{IR} + CvxMargin_{IR}$$

– The industry model validation on ISDA SIMM reported an issue on the “Invariance” of vega sensitivity under normal vs. lognormal.

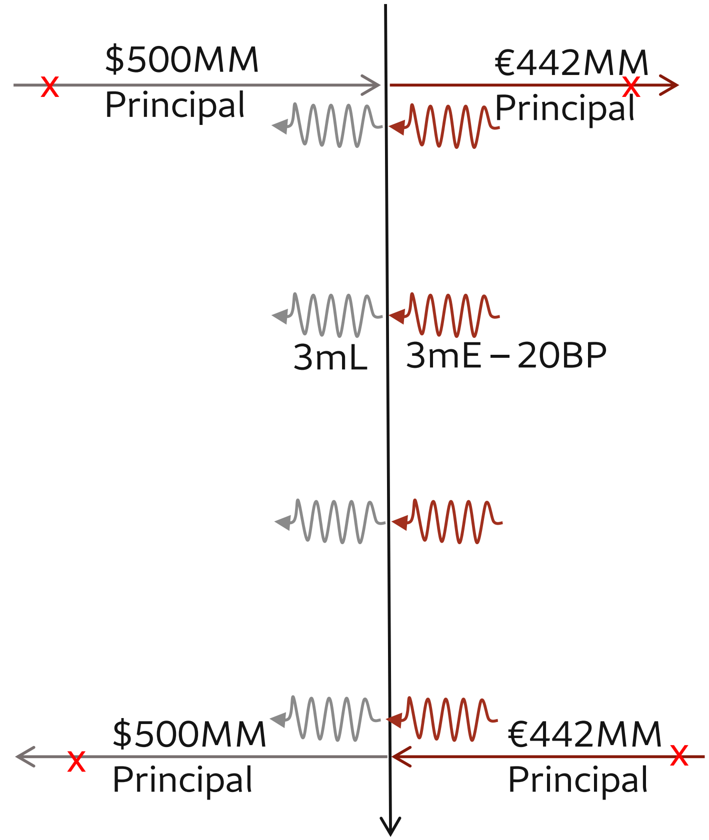
$$\sigma_N = F\sigma_B\left(1 - \frac{\sigma_B T}{24}\right)$$

– The model validation concluded “As the time to maturity becomes longer, this approximation deviates more significantly” [8].

10y10y	ATM Vol	Vega	Product
Black	14.12	(707,464)	(9,989,390)
Normal	57.84	(175,422)	(10,146,403)
Diff			(157,013)
% Diff			1.55%
1y10y	**ATM Vol**	**Vega**	**Product**
Black	15.15	(262,824)	(3,981,790)
Normal	56.99	(69,927)	(3,985,150)
Diff			(3,360)
% Diff			0.08%
3m10y	**ATM Vol**	**Vega**	**Product**
Black	13.68	(132,557)	(1,813,378)
Normal	51.86	(35,409)	(1,836,300)
Diff			(22,922)
% Diff			1.25%

XI. SIMM – Cross Currency Swaps

- SIMM treatment on Cross Currency Swaps ushered in controversial feedbacks.
- Due to Basel Rule explicitly exempt FX forward and swaps for the Initial Margin Rule [1], the physical principal exchanges which are economically equivalent to FX forward and swaps are also excluded [1, 7].
- All fixed notional cross currency swaps' principle exchanges are excluded [10]
  - Constant Notional
  - Amortizing
  - Accreting
- Notional resettable cross currency swaps
  - Only the principle changes associated with the current period can be ignored for margin calculation [10].



XI. SIMM – Cross Currency Swaps

IR Delta

FX Delta

Match ID	Silo	Risk class	Sensitivity type	Match status	Trade ID	Regulations (Own)	Qualifier	Bucket	Label 1	Label 2	AMOUNT (USD) Own	CP	Diff (%)	Risk weight	EXPOSURE (USD) Own	CP	Diff (%)
1304245077	RatesFX	FX	Delta	UM		USPR	EUR				2,791,936		2,791,936	8.20	-22,893,873		-22,893,873
	RatesFX	IR	Delta	UM		USPR	USD		2w	Ois	-310		-310	113.00	-69,884,230		-69,884,230
				UM		USPR	EUR		2w	Ois	310		310	113.00			
				UM		USPR	USD		1m		14,667		14,667	113.00			
				UM		USPR	EUR		1m	Ois	-0		-0	113.00			
				UM		USPR	USD		3m		1,093		1,093	98.00			
				UM		USPR	EUR		3m		-43,353		-43,353	98.00			
				UM		USPR	USD		6m		1,010		1,010	69.00			
				UM		USPR	EUR		6m		-3,789		-3,789	69.00			
				UM		USPR	USD		1y		3,946		3,946	56.00			
				UM		USPR	EUR		1y		-911		-911	56.00			
				UM		USPR	USD		2y		15,951		15,951	52.00			
				UM		USPR	EUR		2y		-6,211		-6,211	52.00			
				UM		USPR	USD		3y		29,936		29,936	51.00			
				UM		USPR	EUR		3y		-17,499		-17,499	51.00			
				UM		USPR	USD		5y		-244,508		-244,508	51.00			
				UM		USPR	EUR		5y		319,074		319,074	51.00			
				UM		USPR	USD		10y		-798,286		-798,286	51.00			
				UM		USPR	EUR		10y		930,837		930,837	51.00			
				UM		USPR	EUR		XCcyBasis		-137,279		-137,279	20.00			

Delta Margin

Risk Weight

XCCy Basis

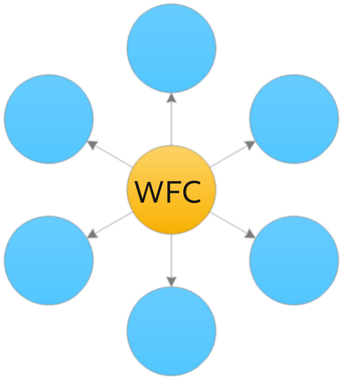
XI. SIMM – Cross Currency Swaps

Silo	Risk class	Sensitivity type	Match status	Trade ID	Regulations (Own)	Qualifier	Bucket	Label 1	Label 2	AMOUNT (USD) Own	CP	Diff (%)	Risk weight	EXPOSURE (USD) Own	CP	Diff (%)
RatesFX	FX	Delta	M	CAL3311760520190322	USPR	EUR				-482	NS	-482	8.10	-3,901		-3,901
			UMCP	0000002379744011069L							NS		0.00			
RatesFX	IR	Delta	M	CAL3311760520190322	USPR	USD				-2	NS	-2 (-100.0%)	115.00	-990,953	819,401	-171,551 (-17.3%)
			M	CAL3311760520190322	USPR	EUR		1m		-13	NS	-13 (-100.0%)	115.00			
			M	CAL3311760520190322	USPR	USD		3m		-12	NS	-12 (-100.0%)	102.00			
			M	CAL3311760520190322	USPR	EUR		3m		55	NS	55 (+100.0%)	102.00			
			M	CAL3311760520190322	USPR	USD		6m		6	NS	6 (+100.0%)	71.00			
			M	CAL3311760520190322	USPR	EUR		6m		-30	NS	-30 (-100.0%)	71.00			
			M	CAL3311760520190322	USPR	USD		1y		1	NS	1 (+100.0%)	61.00			
			M	CAL3311760520190322	USPR	EUR		1y		-5	NS	-5 (-100.0%)	61.00			
			M	CAL3311760520190322	USPR	USD		2y		35	NS	35 (+100.0%)	52.00			
			M	CAL3311760520190322	USPR	EUR		2y		-16	NS	-16 (-100.0%)	52.00			
			M	CAL3311760520190322	USPR	USD		3y		16	NS	16 (+100.0%)	50.00			
			M	CAL3311760520190322	USPR	EUR		3y		75	NS	75 (+100.0%)	50.00			
			M	CAL3311760520190322	USPR	USD		5y		38	NS	38 (+100.0%)	51.00			
			M	CAL3311760520190322	USPR	EUR		5y		174	NS	174 (+100.0%)	51.00			
			M	CAL3311760520190322	USPR	USD		10y		-101	NS	-101 (-100.0%)	51.00			
			M	CAL3311760520190322	USPR	EUR		10y		260	NS	260 (+100.0%)	51.00			
			M	CAL3311760520190322	USPR	USD		2w		-0	NS	-0 (-100.0%)	114.00			
			M	CAL3311760520190322	USPR	EUR		2w		-0	NS	-0 (-100.0%)	114.00			
			M	CAL3311760520190322	USPR	EUR		XCcyBasis		38,924	NS	38,924	21.00			

FX Delta
IR Delta
Delta Margin
Risk Weight
XCCy Basis

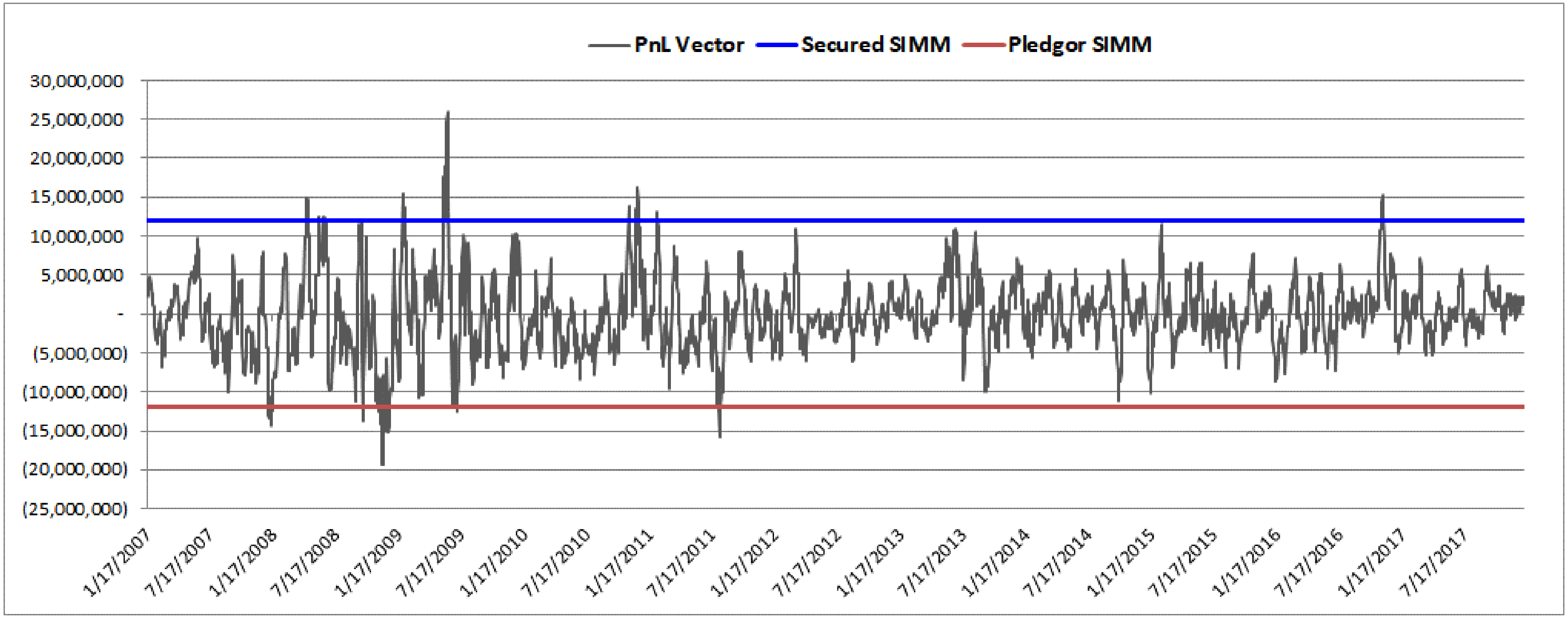
XII. SIMM – Benchmarking & Back-testing

- U.S. and European final rules require monitoring and assessment of controls, validation and operational process and procedures surrounding margin model [11].
- Regulators require ongoing **portfolio level** SIMM monitoring for IM sufficiency thru benchmarking and back-testing[11]. The back-testing results are to be shared with the ISDA on **quarterly** basis.
- The idea is to identify if we have IM shortfalls based on the current in force SIMM methodology using the classic back-testing tool. Statistically the portfolio level monitoring seeks to verify the secured (pledgor) IM based on the SIMM methodology ensures the firm (counterparty) will not suffer losses for a **10-day horizon at 99% confidence** level.
- Conducting the back-testing at netting set level at the regular interval is an onerous exercise. We have some relief that it's technically not required on the portfolios with SIMM margin < €50MM.
- The firms are expected to report to ISDA the margin coverage shortfalls.
- Unidirectional monitoring is allowable to reduce the burden on the smaller firms.



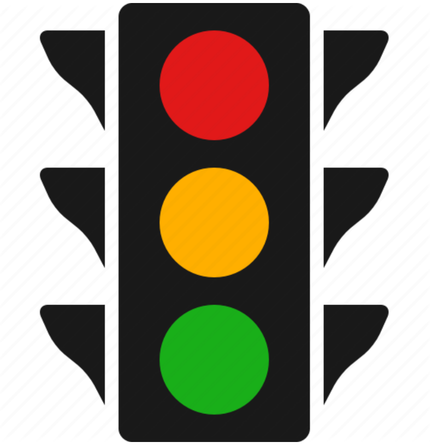
XII. SIMM – Benchmarking & Back-testing

– **SIMM shortfall** amount is defined as the “smallest incremental margin amount that would give Green Traffic light signal from a back-testing using the 99% confidence level” [11].
  - 1+3 back-testing
  - Comparison of actual portfolio “1-day Clean P&L” vs. “1-day SIMM”



XII. SIMM – Benchmarking & Back-testing

- The number of exceedances in "1+3" period is categorized in "Red", "Amber" and "Green" zone based on modified Basel traffic light approach [12]. Below is an illustration of how the threshold will look like assuming 1000 observations.



> 44 Exceedances

> 21 Exceedances but <= 44 Exceedances

<= 21 Exceedances

- In addition to the back-testing mentioned above, Risk Analytics team also conducts the **Benchmark testing** based on the ratio of 10-day SIMM over 10-day VaR to assess potential underestimation of SIMM.

XV. Question & Answers

– If there are follow up questions, please email: jonathan.wu@wellsfargo.com

XVI. References

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