GESTIÓN DE RIESGO DE CRÉDITO EN PORTAFOLIO DE DERIVADOS (CVA, CRM)

19° Congreso de Tesorería
DESAFÍOS
PANORAMA ECONÓMICO
ESTÁNDARES INTERNACIONALES

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Dada la importancia que está teniendo cada día en la gestión de los libros de derivados el CVA *(Credit Value Adjustment)*, en esta sesión se presentarán los lineamientos generales en la gestión y operaciones de cobertura de riesgo de CVA/Riesgo de Contraparte en derivados, así como los retos en gestión de garantías generados en la implementación de Basilea III.

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Agenda

Credit Risk: a 4,000 years leap in History

Why CVA?

CCR *vs* CVA

Obvious Business Impacts

CVA Path and its Analytical Challenge

Not-so-Obvious Impacts

Collateral Management

Coming Soon

Credit Risk: a 3,700 years leap in History

Credit Risk Management at Hamurabi Code (1754 BC)

Law 48

If a free person is in debt and loses a crop because of a natural disaster, the contract shall be changed so that person will not owe the creditor any interest for the year.

Credit Risk Management at Hamurabi Code (1754 BC)

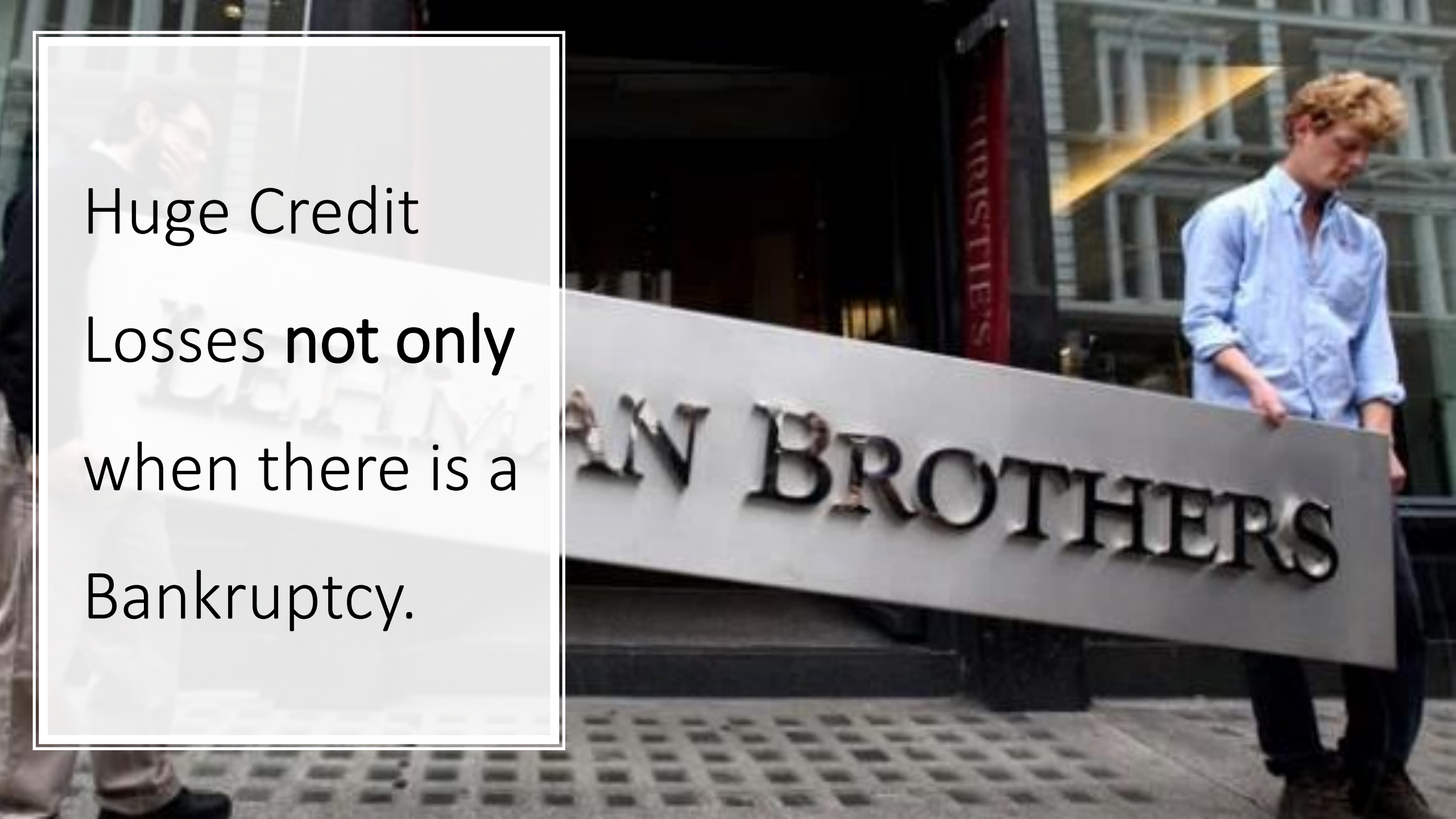
Law 117

If anyone fails to repay a debt, and sell himself, his wife, his son, and daughter for money or give them away to forced labor: they shall work for three years in the house of the man who bought them, or the proprietor, and in the fourth year they shall be set free.

BACK TO THE FUTURE

BACK TO THE FUTURE

3,700 later…



Huge Credit Losses **not only** when there is a Bankruptcy.

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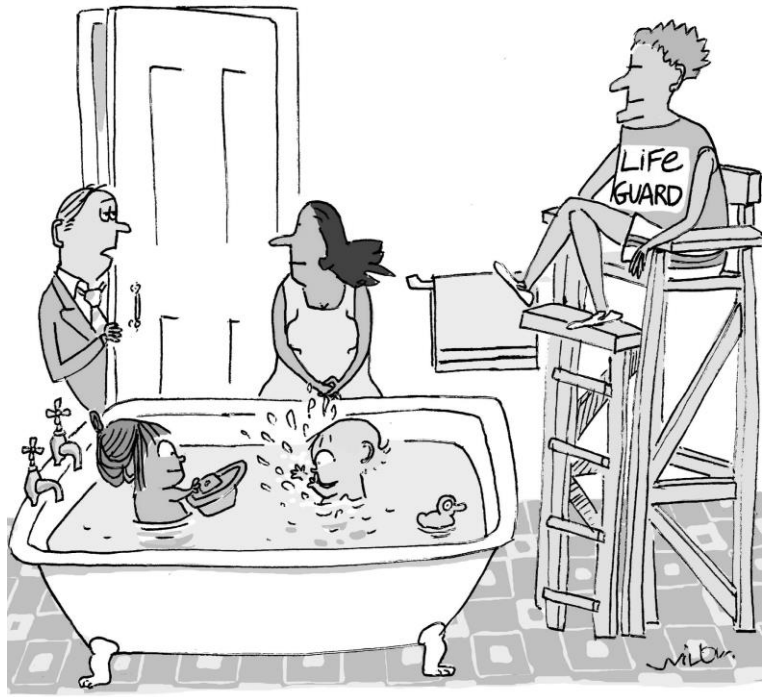
Why CVA?

Why CVA?

Before the Crisis

During the Crisis

After the Crisis



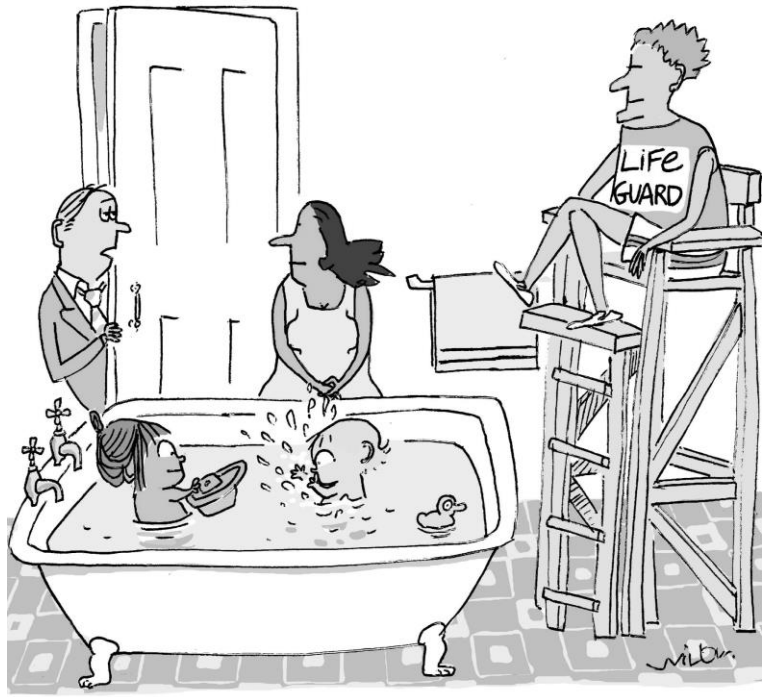
Why CVA?

Before the Crisis

Banks used to compute their exposures against their counterparties by using either simplistic assumptions (static PF calculation) or incipient PFE calculations.

During the Crisis

After the Crisis



Why CVA?

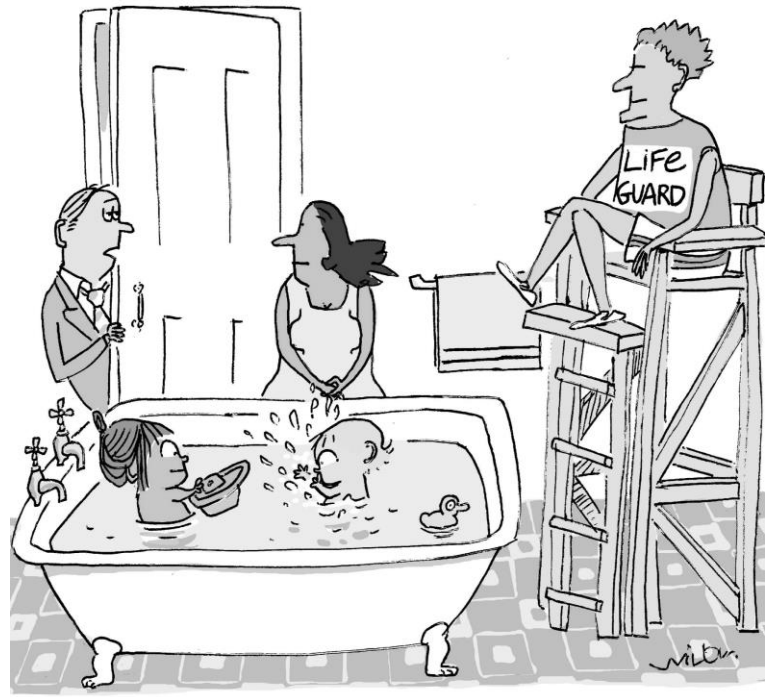
Before the Crisis

During the Crisis

Big banks started calculating simplistic approaches to CVA.

No regulatory pressure at all.

After the Crisis

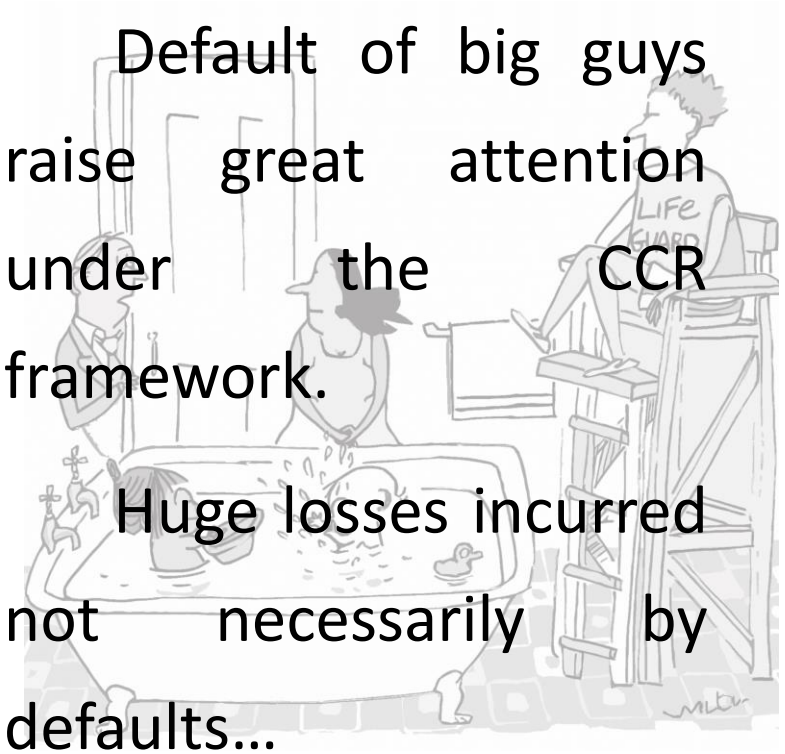


Why CVA?

Before the Crisis

During the Crisis

After the Crisis



Default of big guys raise great attention under the CCR framework.

Huge losses incurred not necessarily by defaults…

Why CVA?

While the Basel II standard covers the risk of a counterparty default, it does not address such CVA risk, which during the financial crisis was a greater source of losses than those arising from outright defaults.

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Credit **C**ounterparty **R**isk

CCR

Potential Future Exposure (PFE) as future VaRs at 97.5% or 99%

Expected Positive Exposure (EPE) being the mean of the positive part of the distribution

PFE historically used as credit limit management

EPE used for RWA and capital purposes.

Credit **V**aluation **A**djustment

CVA

Cost of buying protection on the counterparty in case of default

Expected Positive Exposure (EPE), the expected value under the risk neutral measure

Now it is a considerable part of the PnL concern.

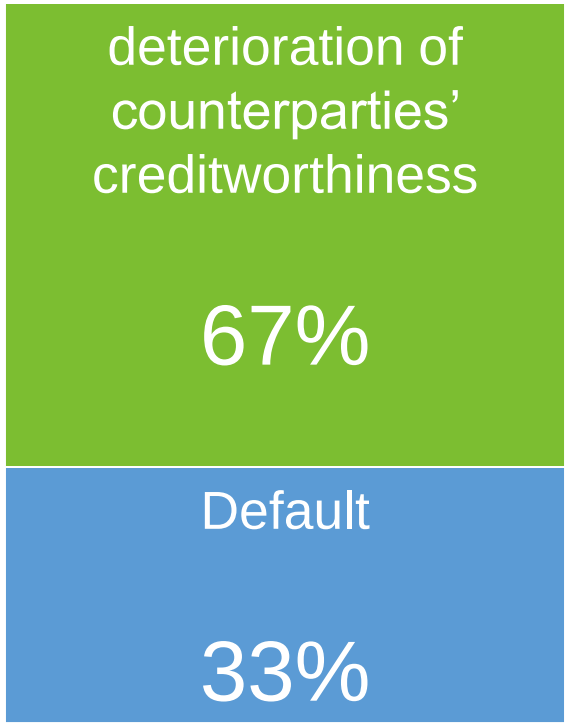
CVA needs to be hedged

CCR *vs* CVA

Basel 2.0

Risk associated to the losses due to the **probability of default of the counterparties** on OTC transactions.

During 2007/2008 crisis



Basel 3.0

Risk associated to the losses due to the **deterioration of counterparties' creditworthiness** on OTC transactions.

CCR *vs* CVA

Categorisation by product type/asset class	TB ($bn)	BB ($bn)	Total ($bn)
Super Senior CDOs with ABS underliers	53	34	87
CVA counterparty losses on monoline insurers	28	9	37
ABS assets (failed securitisations, SIVs, conduits etc)	16	35	51
Leveraged loans	4	14	18
Corporate credit derivatives (index and bespoke)	11		11
Counterparty defaults	6	2	8
Other CVA losses (incl. Credit Derivative Product Companies)	6		6
Equity derivatives	4	1	5
Hedge Fund derivatives and financing	3		3
IR derivatives	3		3
Vanilla credit derivatives	3		3
Emerging markets	2		2
Corporate bond trading	2		2
FX trading	1		1
Government bond trading	0.5	0.5	1
Commodities trading	0.5		0.5
Total	**144**	**96**	**240**

Source: https://goo.gl/Ew9h4Q

CCR *vs* CVA

CCR Basel 3.0

=

Default Risk + CVA Risk

Credit VaR	VaR of the Price of Credit Counterparty Risk

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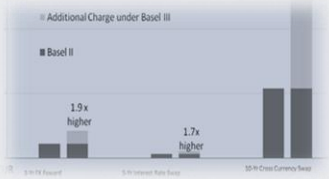
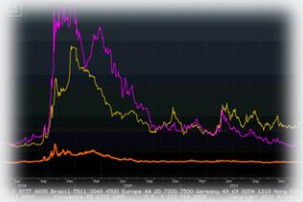


Higher CCR Risk Charge

Higher usage of Collateral

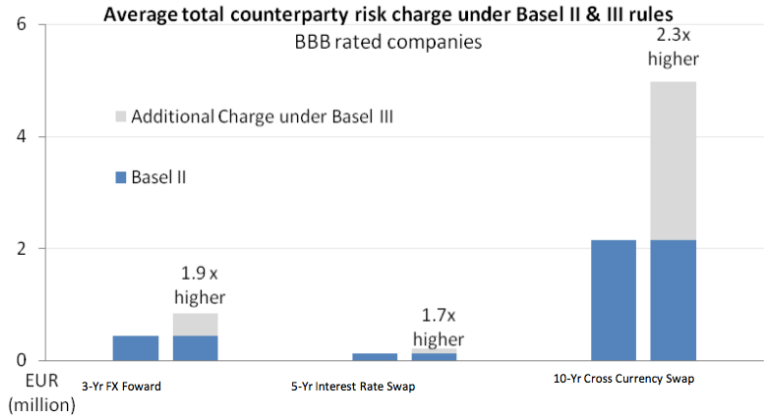
Higher Trading Costs



Need to Hedge the CVA

Higher CCR Risk Charge

Banks will be subject to a **capital charge** for potential **mark-to-market losses** (i.e. credit valuation adjustment – **CVA** – risk) associated with a deterioration in the credit worthiness of a counterparty.



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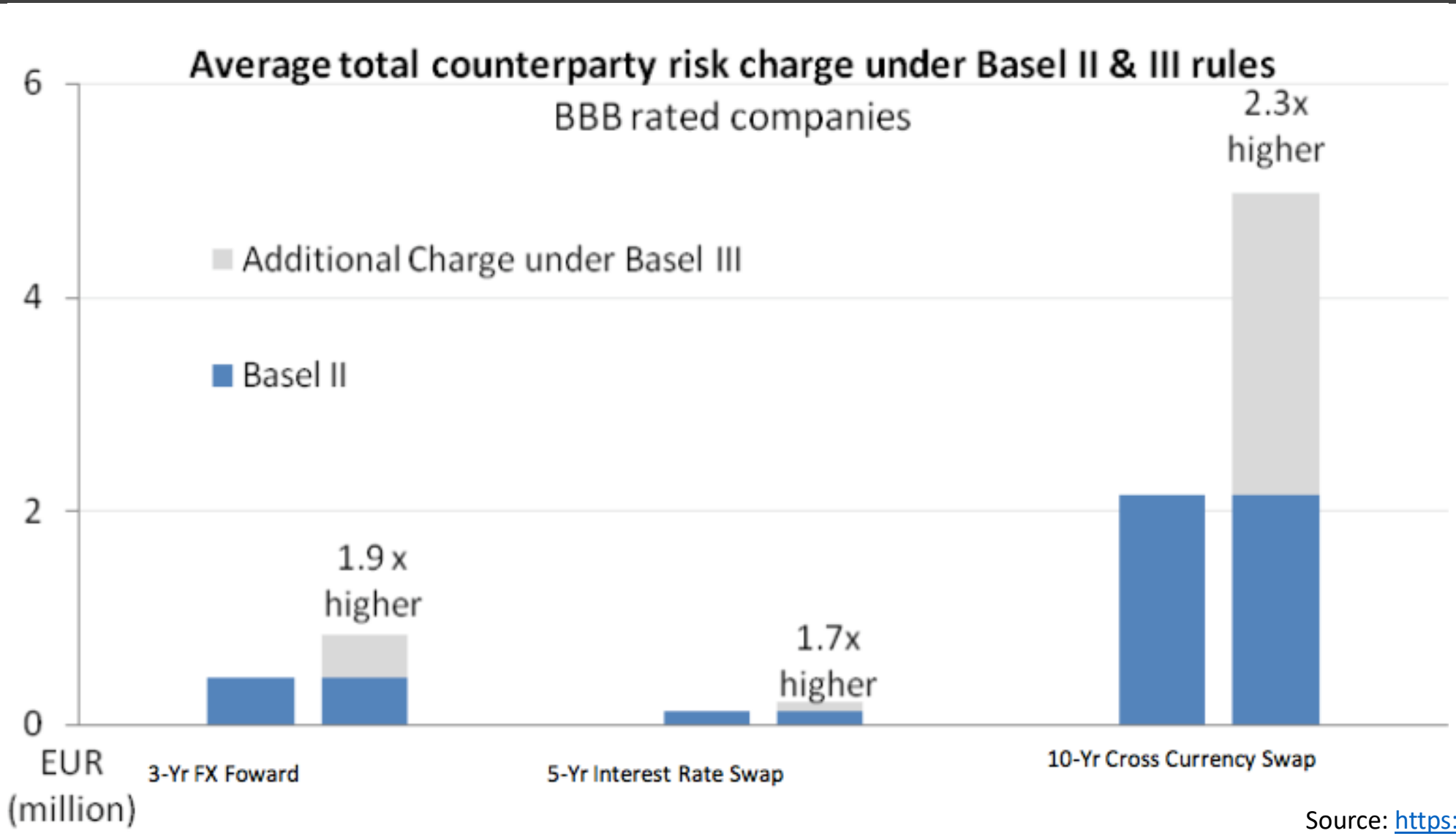
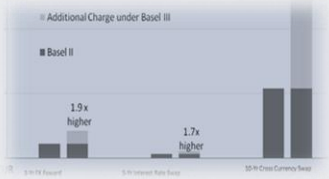


Source: https://goo.gl/GHIFjr

Obvious Business Impacts



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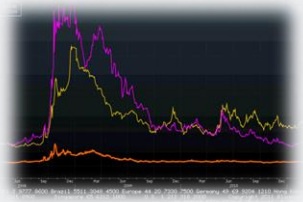


Need to Hedge the CVA

Higher usage of Collateral

Increase the efficiency of collateral agreements,

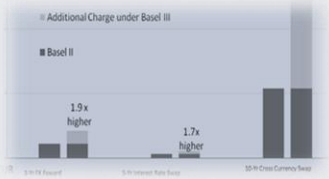
Recognize more mitigating effects in the regulatory exposure measures,

Re-negotiation the terms of current collateral agreements,

Banks may fund their collateral needs via **short-term loans**.

Source: https://goo.gl/GHIFjr

Obvious Business Impacts



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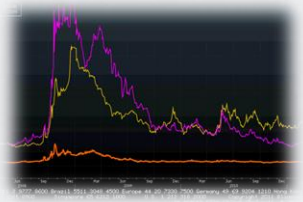


Need to Hedge the CVA

Higher Trading Cost to the Clients

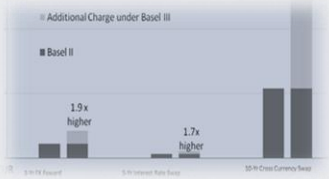
Obvious consequence in case there is no change in the current CSA.

Shift of the credit counterparty risk costs from Risk to front-office.

Not all banks in LatAm have their front-offices aware of such new responsibility.

Source: https://goo.gl/GHIFjr

Obvious Business Impacts



Higher CCR Risk Charge

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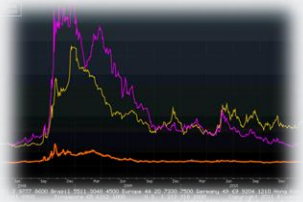


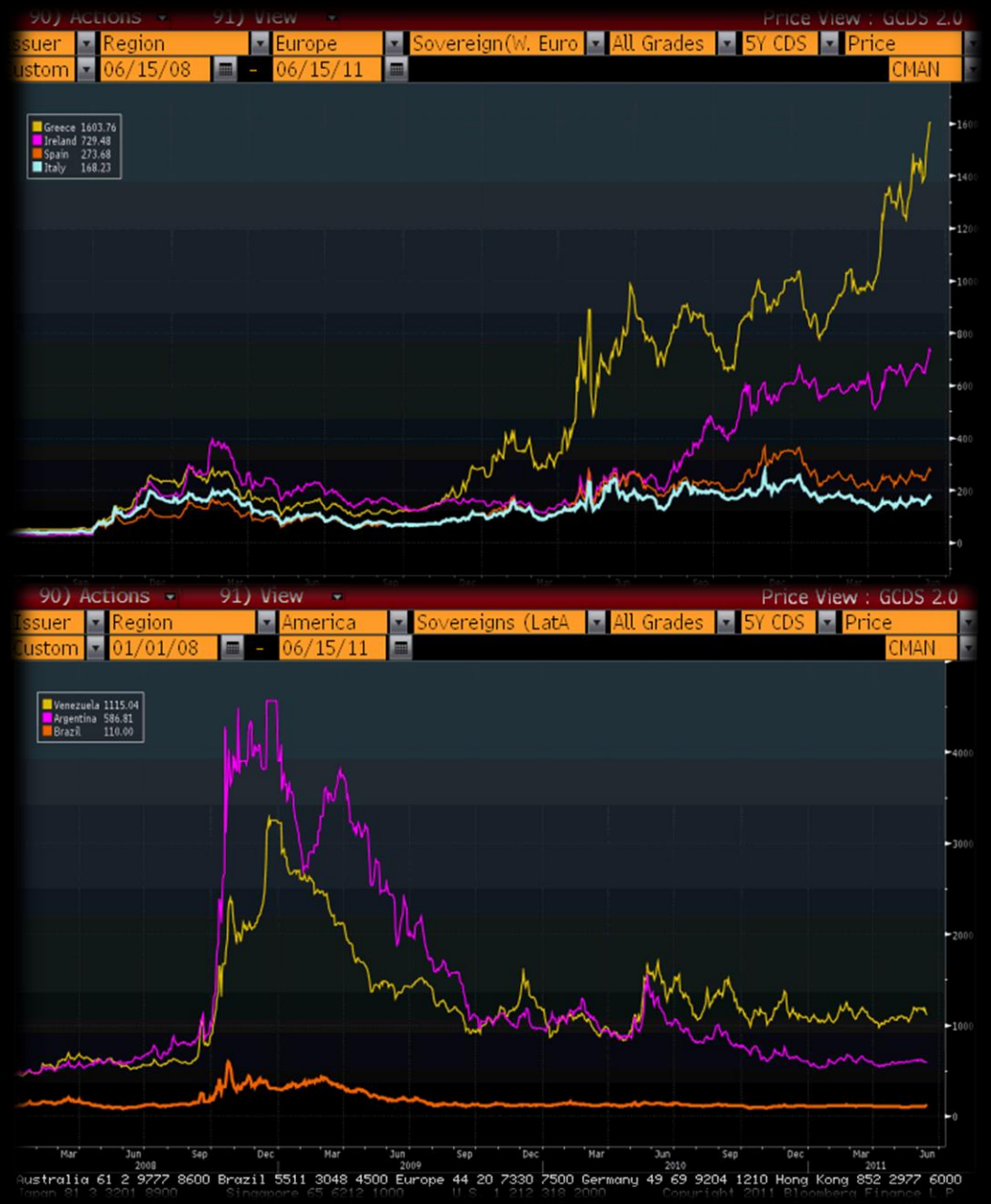
Need to Hedge the CVA

Need to Hedge the CVA

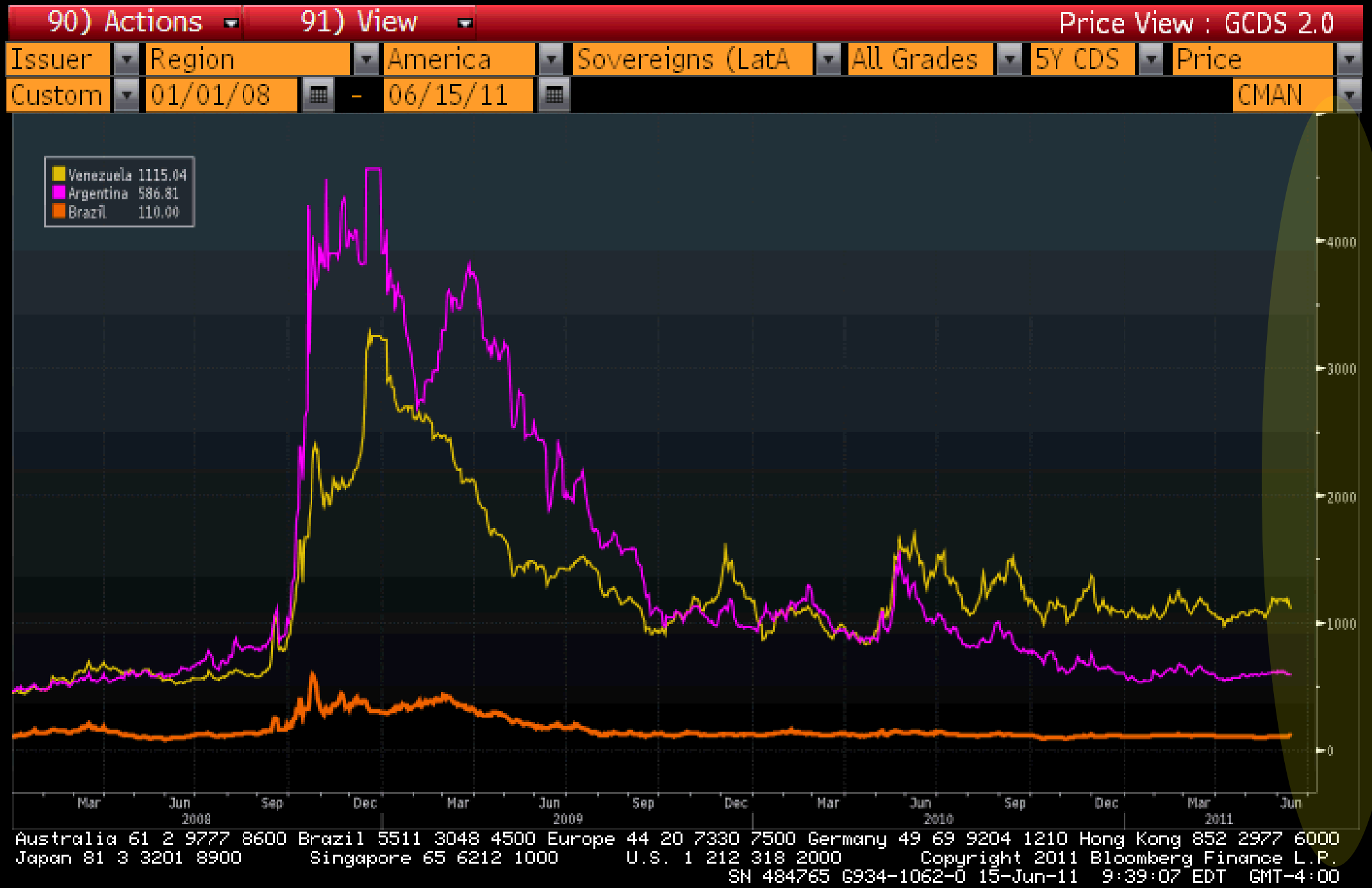
CDS as the typical hedging instrument.

Lack of liquidity or non-existence.

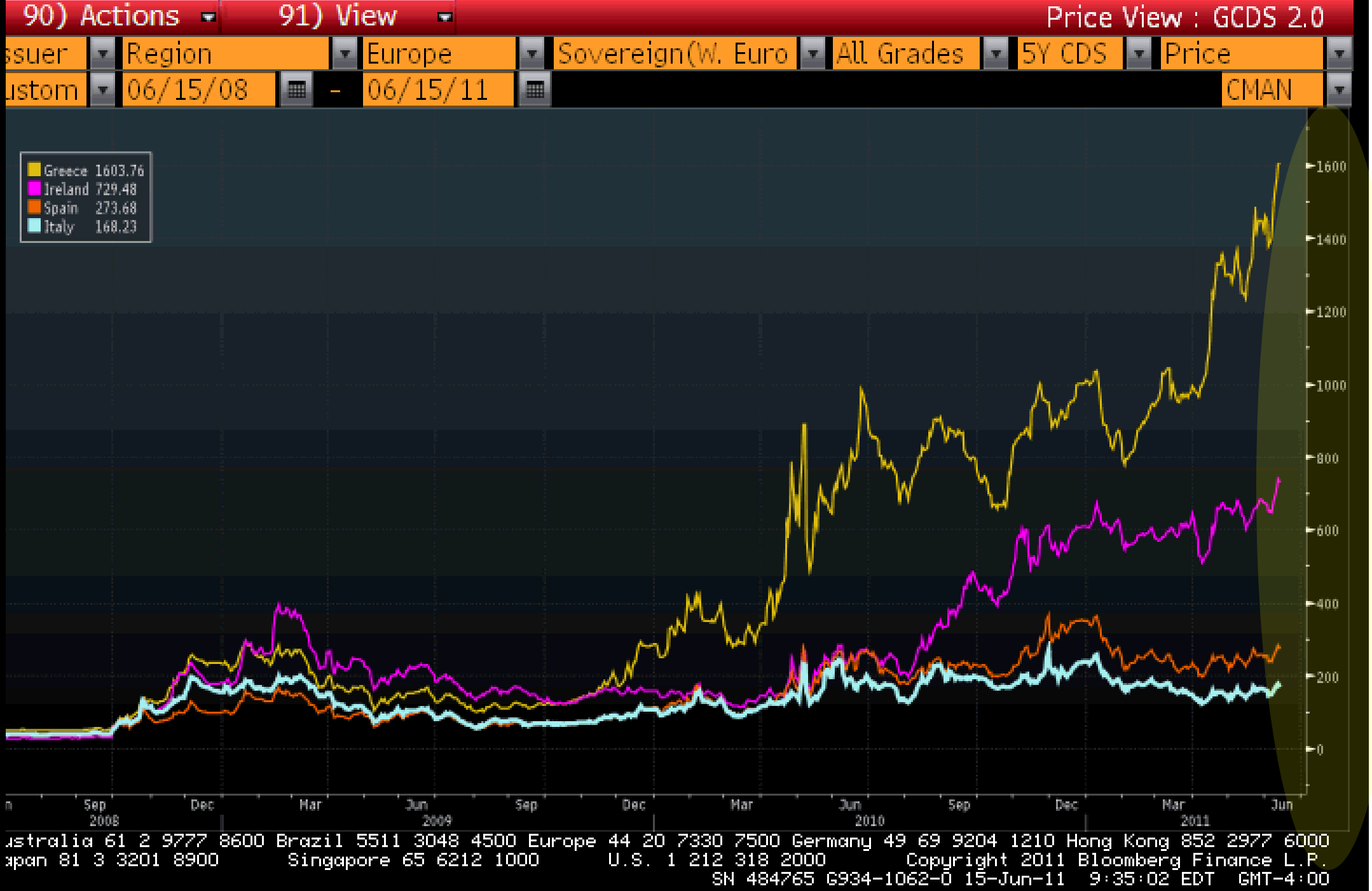
During financial distress hedge strategies may go completely skewed.



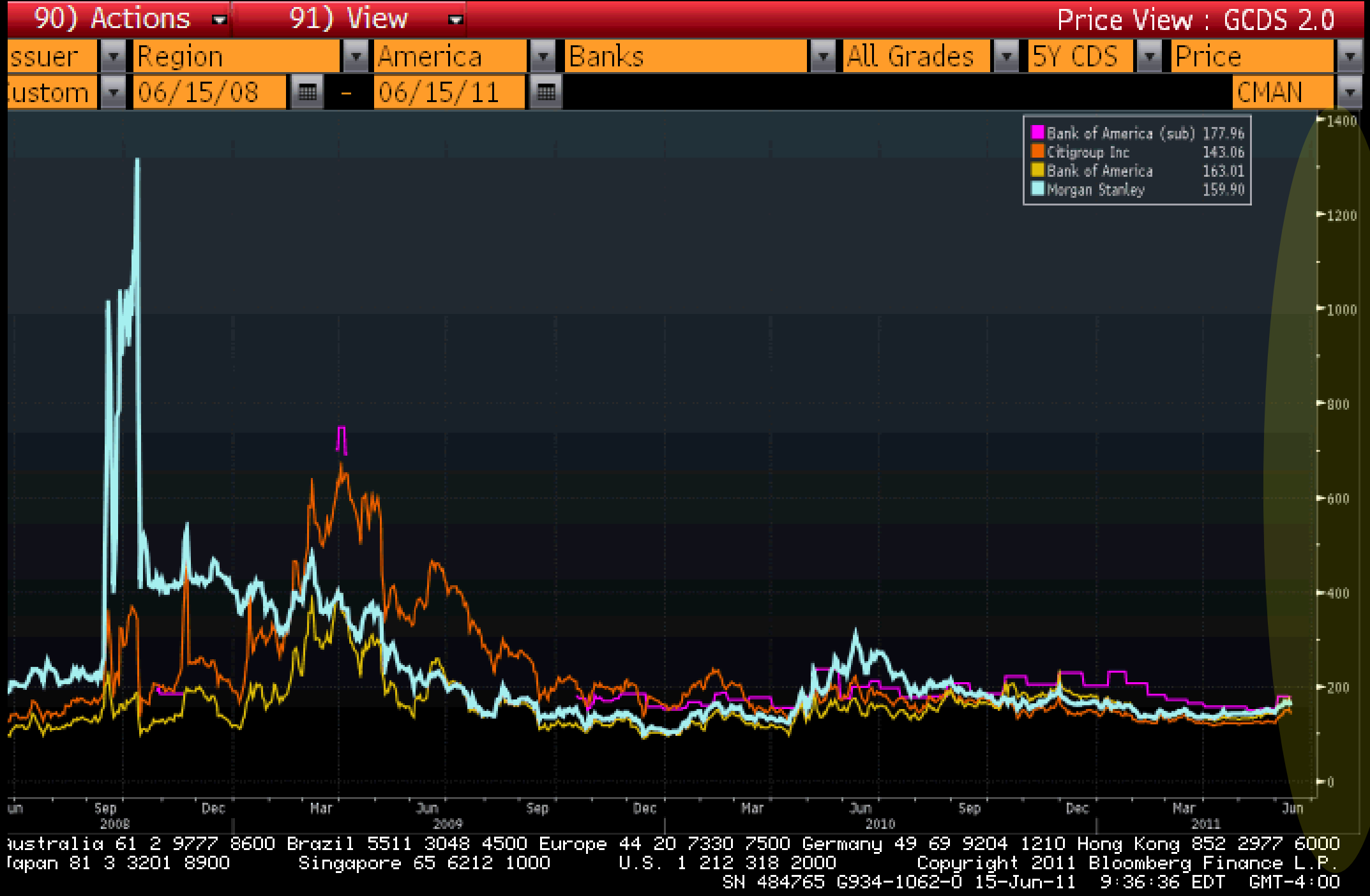
Latam CDS during 2008 crisis



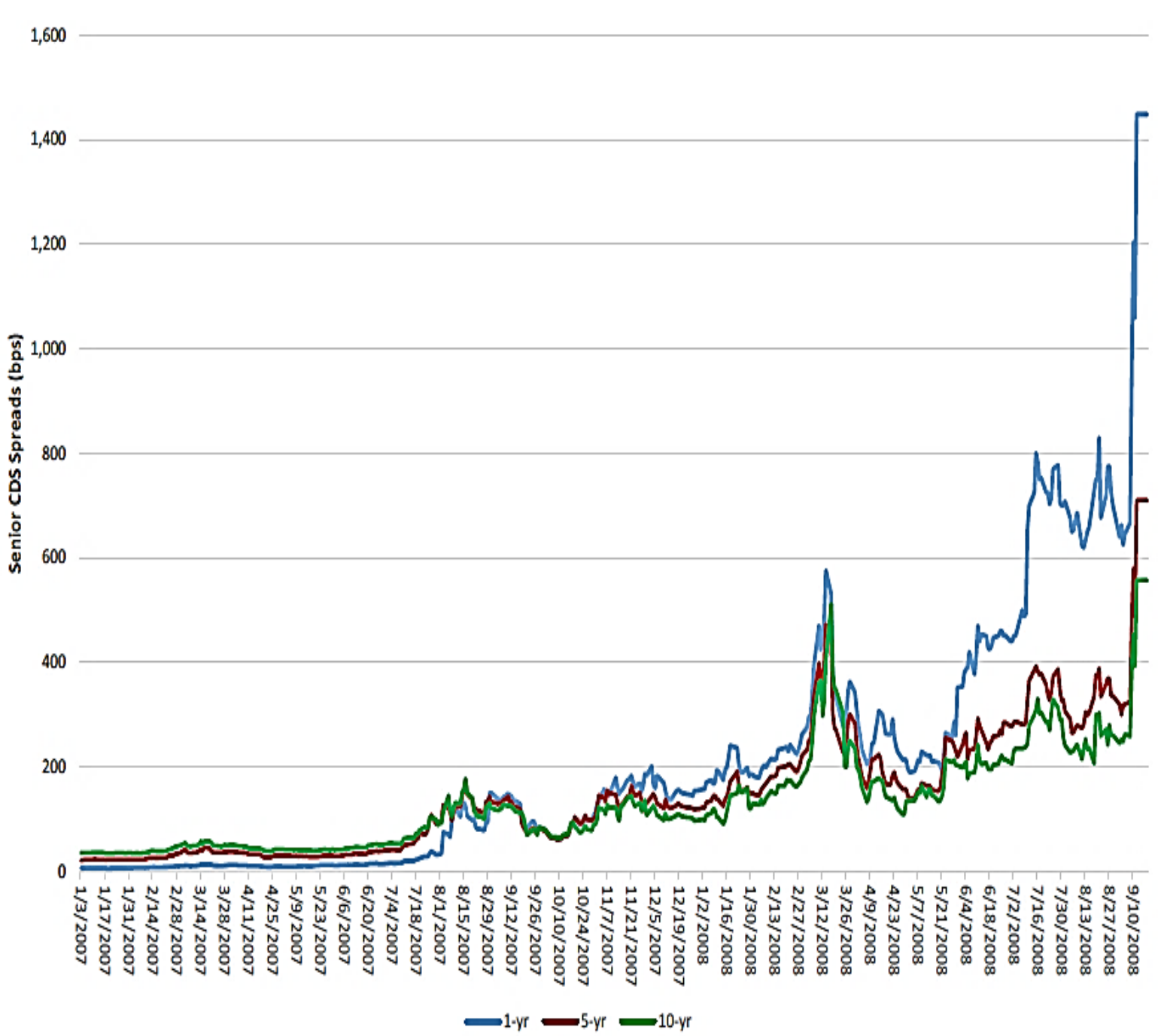
Euro zone CDS during 2008 crisis



Banking Industry CDS during 2008 crisis



Lehman Brother's CDS brief history



Source: [Single-name Credit Default Swaps: A Review of the Empirical Academic Literature]

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CVA Path and its Analytical Challenge

Not-so-Obvious Impacts

Coming Soon

CVA Path and its Analytical Challenge

The Building Blocks

Exposure $V(t;s_t)$ – Value of the trade (portfolio) at time *t* given state s_t

The state (underlying or risk factor) vector is critical input for pricing.

States are model dependent.

Potential Future Exposure (PFE) $= inf\{v; P(V(T) \leq v) \geq \alpha\}$

Expected **E**xposure **(EE) = E{ V(t) }**

Expected **P**ositive **E**xposure **(EPE) = E{ $V^+(t)$}**

Expected **N**egative **E**xposure **(ENE) = E{ $V^-(t)$}**

CVA Path and its Analytical Challenge

The Building Blocks

CVA as an adjustment on price given the expected loss of a counterparty.

$$CVA = E[L]$$

$$L(t) = \underbrace{(1 - R) \cdot E(t)}_{\text{Future Value of the Amount that can be lost}} \cdot \underbrace{PD(t)}_{\text{Probability of Default}} \cdot \underbrace{DF(t)}_{\text{Discount Factor}}$$

$$E[L(t)] = E[(1 - R) \cdot E(t) \cdot PD(t) \cdot DF(t)]$$

CVA Path and its Analytical Challenge

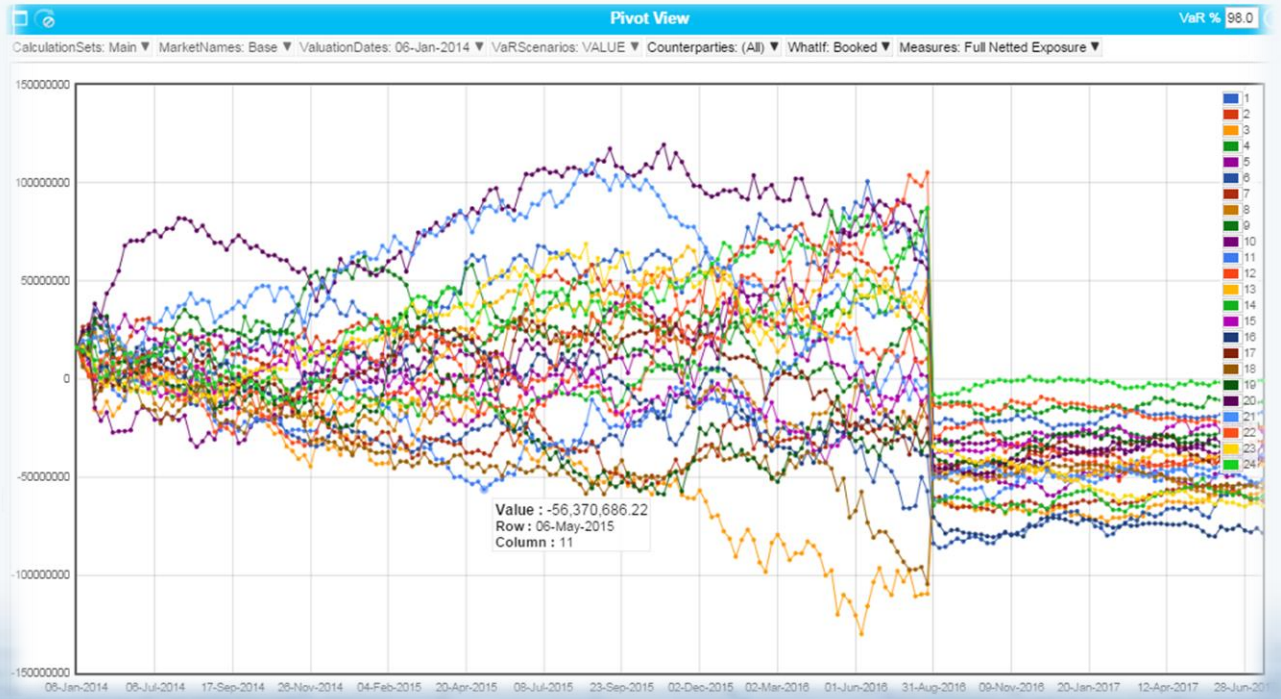
The Building Blocks

CVA can be seen as an adjustment on the price given the expected loss of a counterparty - entire portfolio.

$$CVA = \int_0^T (1 - R) \cdot E(t) \cdot DF(t) \cdot dPD(t)$$

CVA Path and its Analytical Challenge
In practice

Simulating the Prices

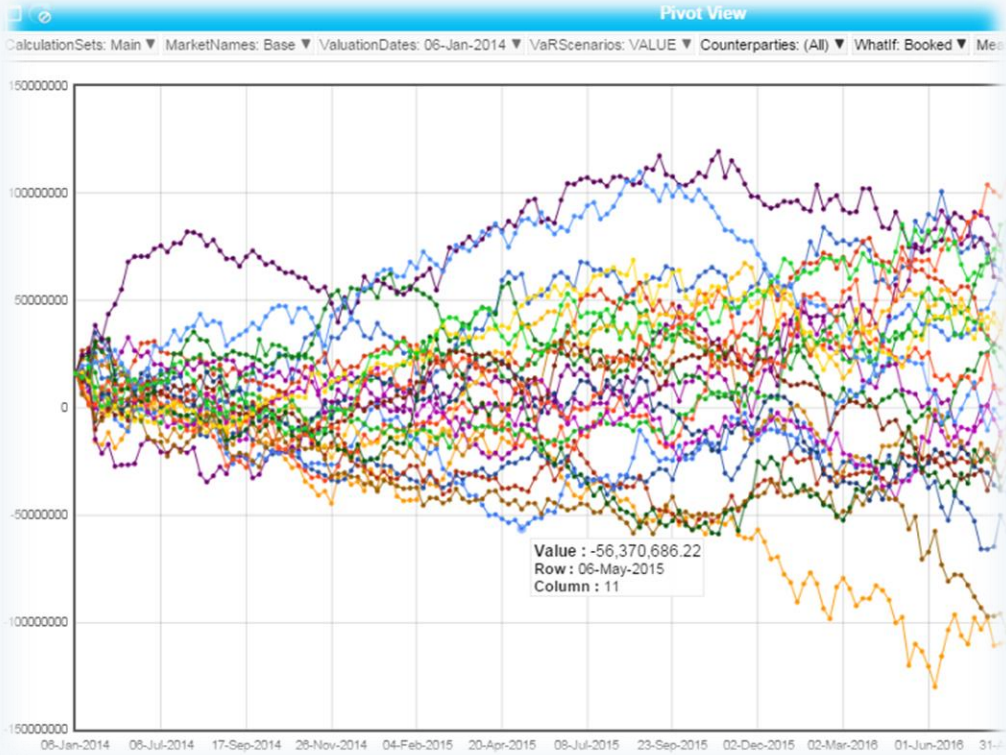


CVA Path and its Analytical Challenge

In practice

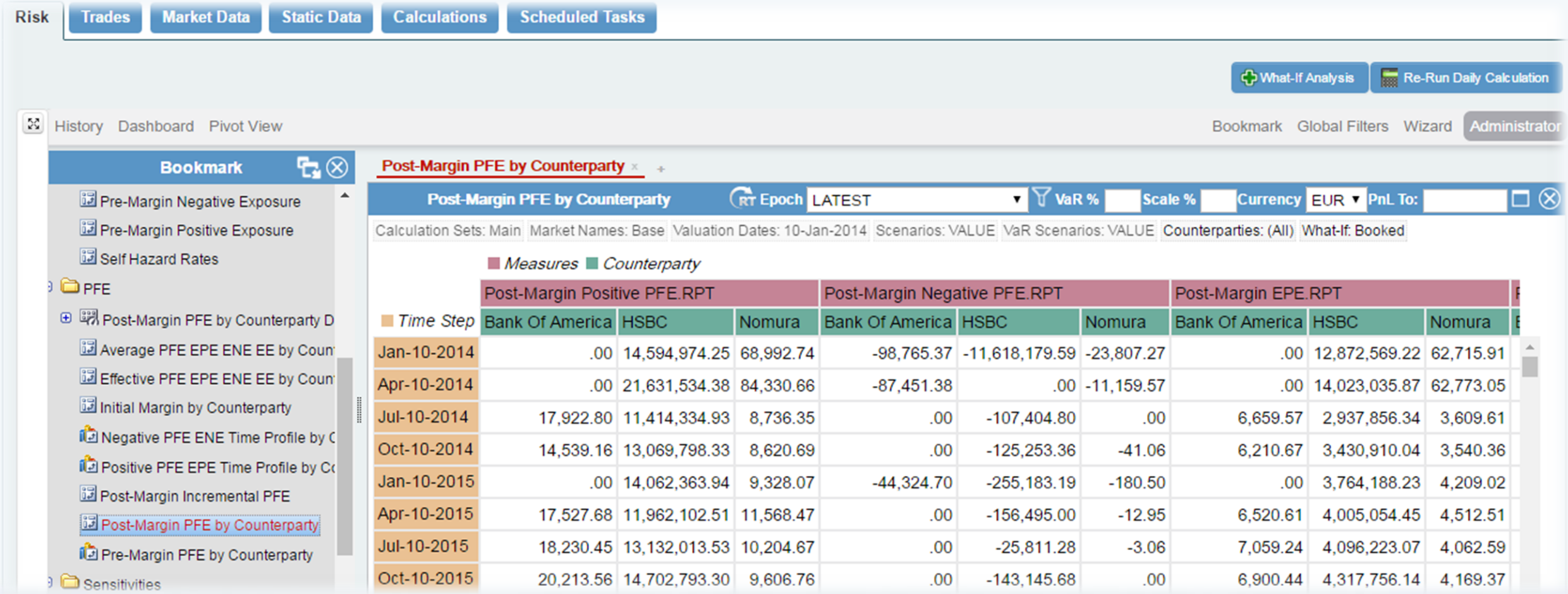
Measures ■ Scenario

Time Step	Full Netted Exposure.RPT			
	1	2	3	4
Jan-10-2014	-9,680,895.38	-9,680,895.38	-9,680,895.38	-9,680,895.38
Jan-17-2014	-6,366,339.00	-9,080,772.24	-10,361,434.72	-13,042,025.44
Jan-24-2014	-9,094,793.25	-2,258,594.18	-12,480,769.29	-11,590,167.80
Apr-10-2014	1,893,694.56	-1,431,669.28	992,710.69	-29,181,009.32
Apr-17-2014	-1,665,408.58	-4,015,586.97	1,017,246.40	-28,068,129.37
Apr-24-2014	1,501,143.96	-14,088,293.69	-8,636,315.74	-27,075,830.09
May-21-2014	-9,215,414.04	-5,367,235.32	-12,142,723.12	-30,233,659.80
May-28-2014	-11,291,754.83	-8,741,550.52	-1,924,642.52	-39,068,058.00
Jun-04-2014	-4,440,200.82	-2,650,549.57	1,559,748.53	-43,482,224.76



Simulating the Prices

CVA Path and its Analytical Challenge
In practice



Time Step	Post-Margin Positive PFE.RPT			Post-Margin Negative PFE.RPT			Post-Margin EPE.RPT		
	Bank Of America	HSBC	Nomura	Bank Of America	HSBC	Nomura	Bank Of America	HSBC	Nomura
Jan-10-2014	.00	14,594,974.25	68,992.74	-98,765.37	-11,618,179.59	-23,807.27	.00	12,872,569.22	62,715.91
Apr-10-2014	.00	21,631,534.38	84,330.66	-87,451.38	.00	-11,159.57	.00	14,023,035.87	62,773.05
Jul-10-2014	17,922.80	11,414,334.93	8,736.35	.00	-107,404.80	.00	6,659.57	2,937,856.34	3,609.61
Oct-10-2014	14,539.16	13,069,798.33	8,620.69	.00	-125,253.36	-41.06	6,210.67	3,430,910.04	3,540.36
Jan-10-2015	.00	14,062,363.94	9,328.07	-44,324.70	-255,183.19	-180.50	.00	3,764,188.23	4,209.02
Apr-10-2015	17,527.68	11,962,102.51	11,568.47	.00	-156,495.00	-12.95	6,520.61	4,005,054.45	4,512.51
Jul-10-2015	18,230.45	13,132,013.53	10,204.67	.00	-25,811.28	-3.06	7,059.24	4,096,223.07	4,062.59
Oct-10-2015	20,213.56	14,702,793.30	9,606.76	.00	-143,145.68	.00	6,900.44	4,317,756.14	4,169.37

Computing the Exposures on the Counterparty Level

CVA Path and its Analytical Challenge

In practice

Finally, computing the XVAs

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CVA and its not so obvious Impacts

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Transformation of the modeling Culture

CVA and its not so obvious Impacts

CVA deals on portfolio level.

CVA requires a consistent/robust way to handle multiple asset classes.

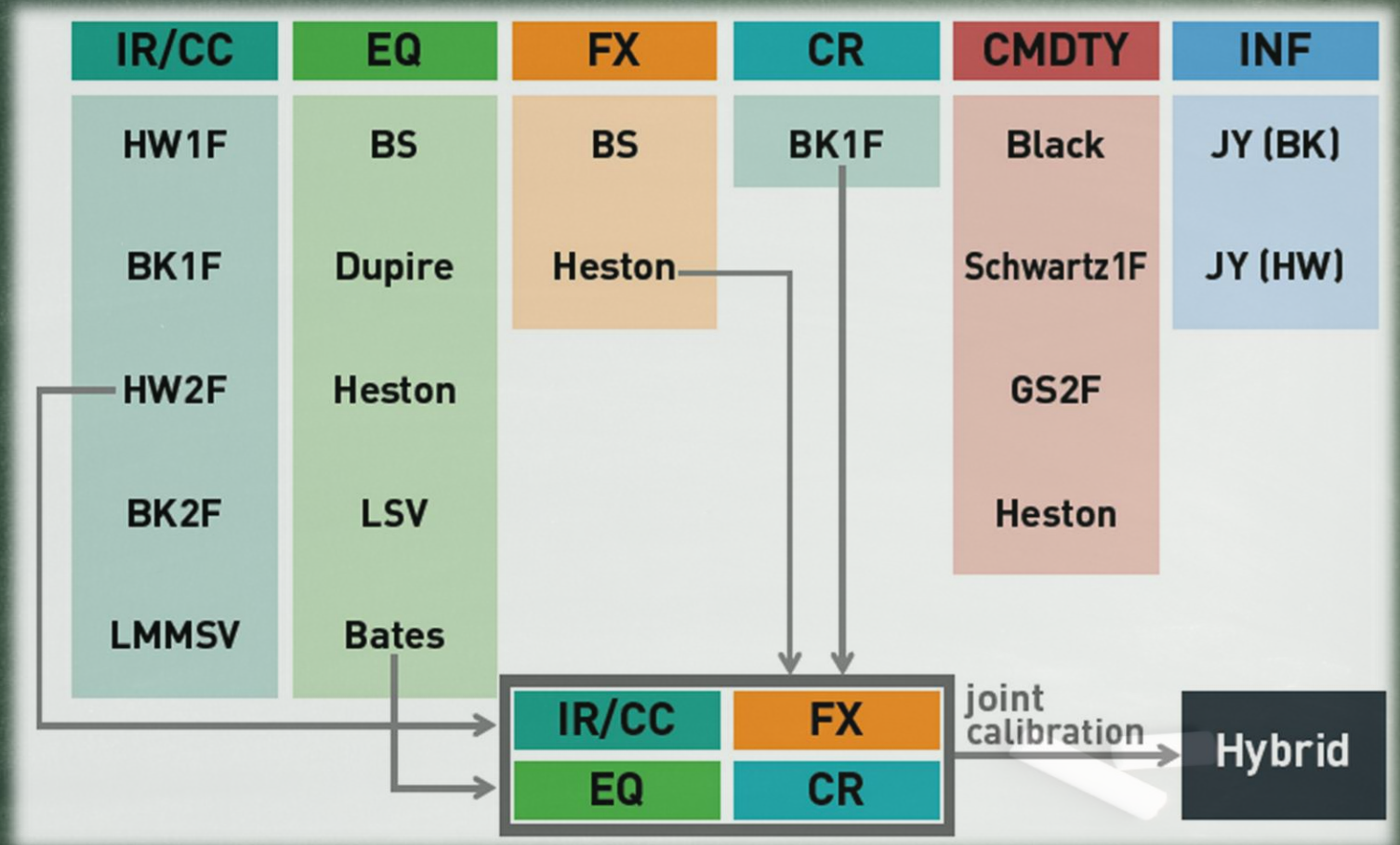
Exposure should handle correlation structure.

All these suggest a Hybrid model…

Transformation of the modeling Culture

CVA and its not so obvious Impacts

Universal Hybrid Model Framework across multi-asset classes / models with generic n-factor fast Monte Carlo (See Antonov and Issakov and Mechkov 2011)



Transformation of the modeling Culture

CVA and its not so obvious Impacts

Instrument	Pricing	VaR, PFE	CVA	BCVA
IRS	Det	IR	IR + CR	IR + CR + CR_self
FX Fwd	Det	FX	FX + CR	FX + CR + CR_self
IRS + FX Fwd	Det	IR + FX	IR + FX + CR	IR + FX + CR + CR_self

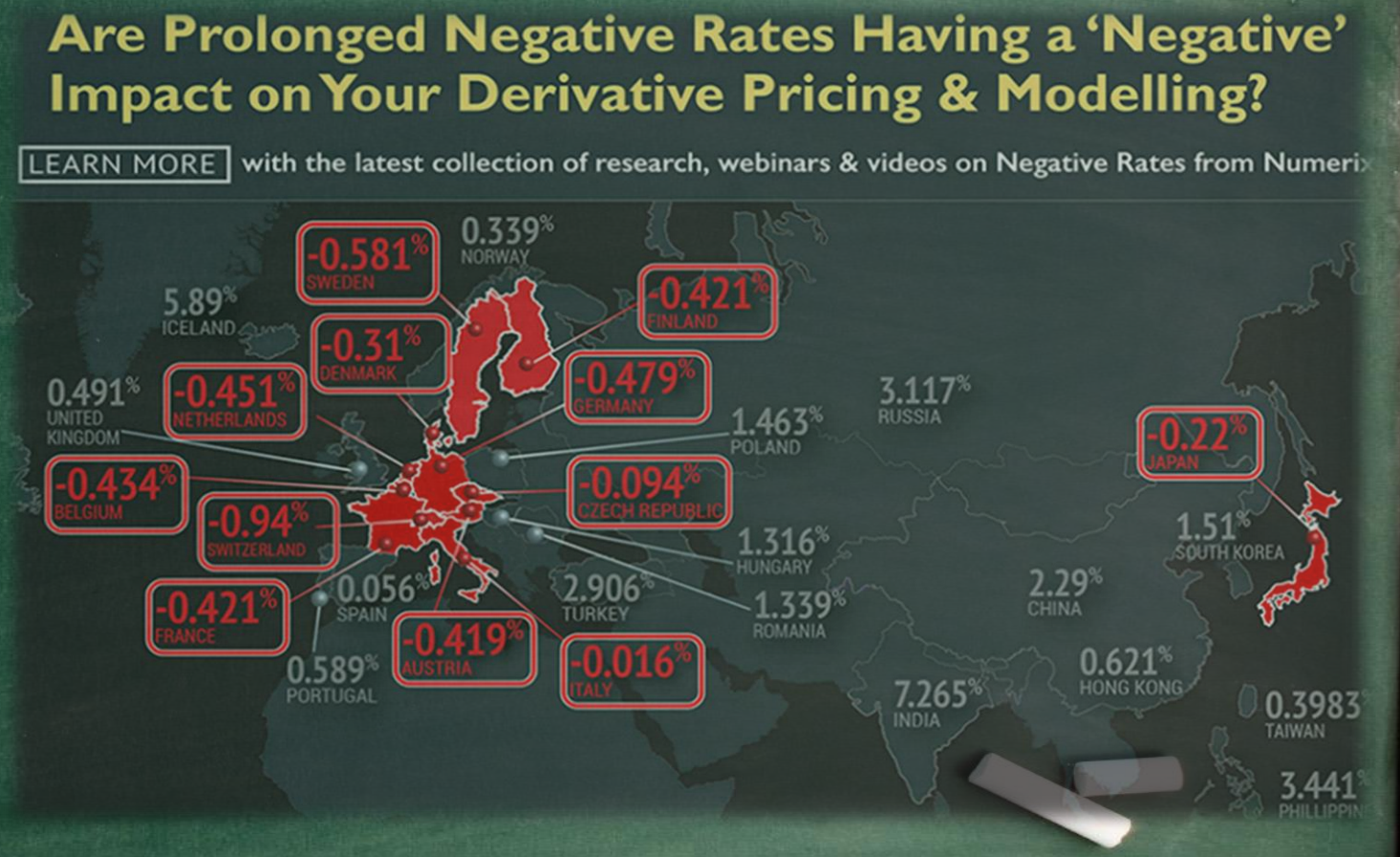
Transformation of the modeling Culture

CVA and its not so obvious Impacts

Additionally….

Negative rates have been a tremendous modelling challenge both from a **pricing** and **risk management** perspective.

That might seem so far away (LatAm standards) but, if you trade offshore this is huge issue.



Source: Are Negative Res Having a 'Negative' Impact on Your Derivative Pricing and Modelling?

http://www.numerix.com/info-graphic/negative-rates-trends-continue-2016#

Transformation of the modeling Culture

CVA and its not so obvious Impacts

NOTABLE RESEARCH

In *The Free Boundary SABR: Natural Extension to Negative Rates*, published in September 2015 Risk—Antonov, along with colleagues Michael Konikov & Michael Spector, revolutionize negative rates modeling. Unlike other models, the ground-breaking feature of the free boundary SABR model is that you don't decide in advance how negative the rates could become.

In the Risk Cutting Edge research article, *FVA for General Instruments*, published in November 2015, Drs Alexandre Antonov, Marco Bianchetti & Ion Mihai develop a universal and efficient approach to numerical FVA calculation for portfolios of general instruments with multiple stochastic assets and funding sources.

In January 2015, Dr. Antonov and his colleagues, Drs. Serguei Mechkov & Serguei Issakov, published *Backward Induction for Future Values*, which offers an exposure calculation methodology for exotics that pares not only the computational effort, but also the time taken to write the code.

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AWARDS

Quant of the year: Alexandre Antonov

Numerix quant revolutionises negative rates modelling

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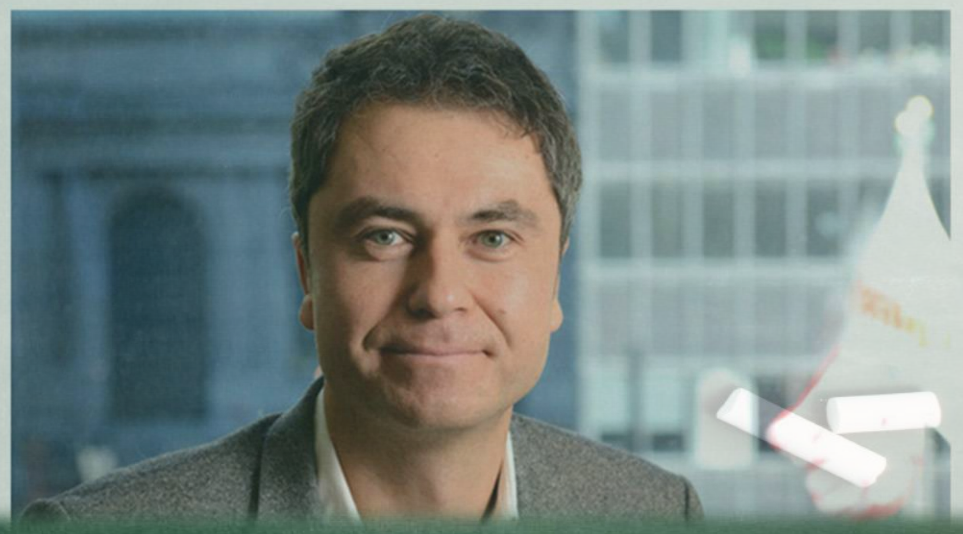
27 January 2016



Transformation of the modeling Culture

CVA and its not so obvious Impacts

Good Practices with the Algorithmic Exposure

Extension of the backward induction in the American Monte Carlo;

Scenarios generated by arbitrage free model ;

Applies uniformly to all instruments

Computationally efficient for complex instruments;

Exposures are calculated in one pass;

Prices and exposures are generated on the same path.

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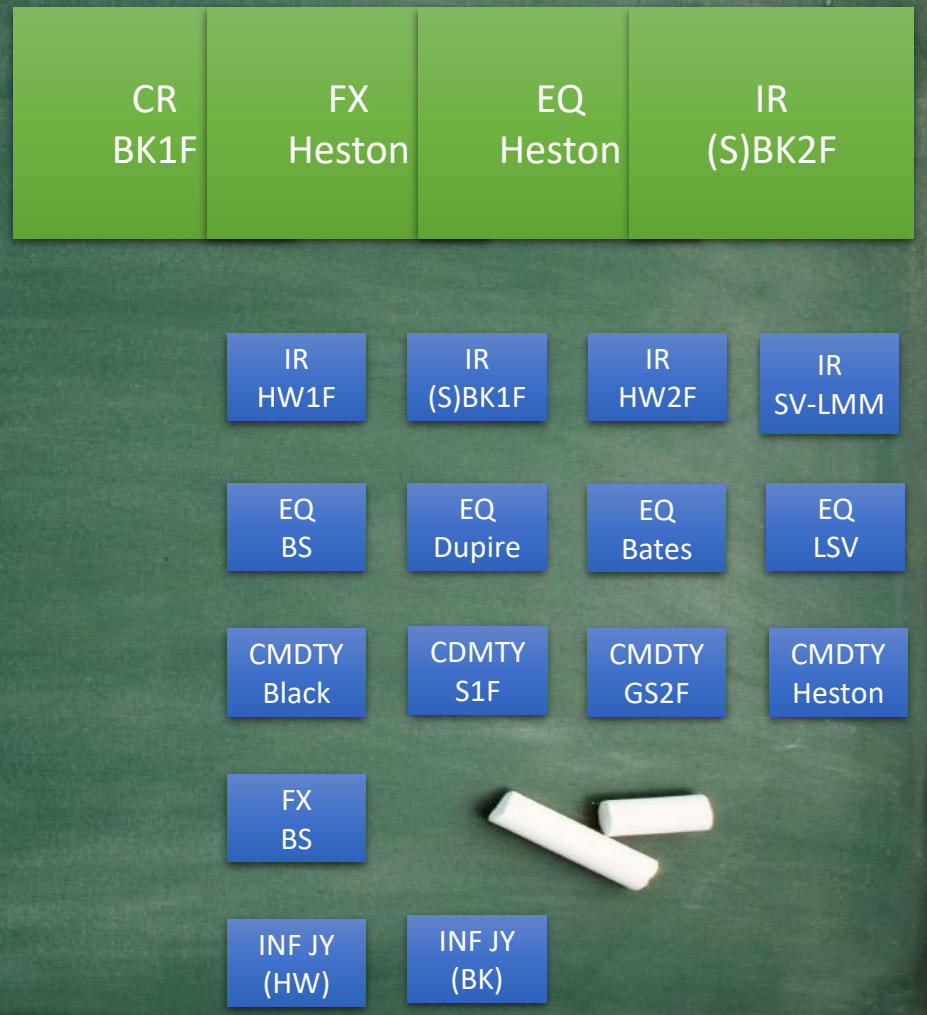


CVA and its not so obvious Impacts

Collateral Management

CVA and its not so obvious Impacts

Netting Sets:

Exposure with Netting

$$V(t) = \Sigma V_i(t)$$

Exposure without Netting

$$V(t) = \Sigma \max\{V_i(t), 0\}$$

The effectiveness of netting depends on the number of trades, correlations and volatilities

Perfect CSAs

Under perfect CSA: Collateral C(t) = V(t) at all times

Collateral fully removes CP risk

Often understood as:

- Daily collateral calls
- Zero threshold
- Zero margins
- No settlement risk
- No close-out risk

Collateral Management

CVA and its not so obvious Impacts

Schedule of Margin Calls

How often collateral is requested?

If there are no extra conditions:

Collateral C*(t) = V(t) on margin dates

Settlement lag: collateral posted at t will be

received at t+h_s (e.g. t+2bd)

Thresholds = uncollateralised amount

Collateral with Threshold H_s, H_c on margin dates

$C^*(t) = Max(V(t) – H_s, 0)$ if $V(t)>0$

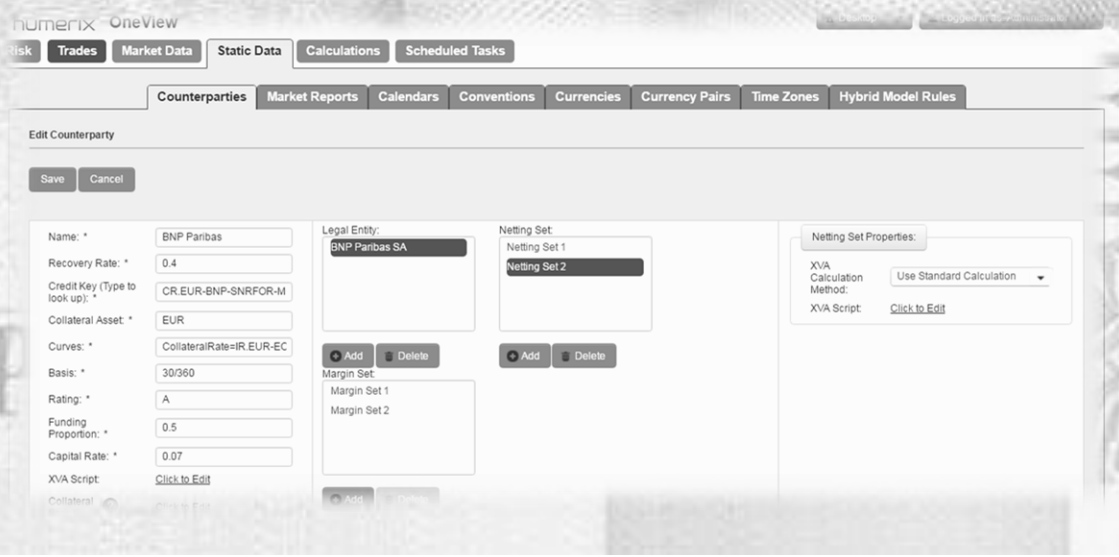
$C^*(t) = - Max(- V(t) + H_c, 0)$ if $V(t)<0$

MTA = the smallest uncollateralised exposure resulting in a collateral transfer on margin date

Collateral with MTA: M_s, M_c on margin dates

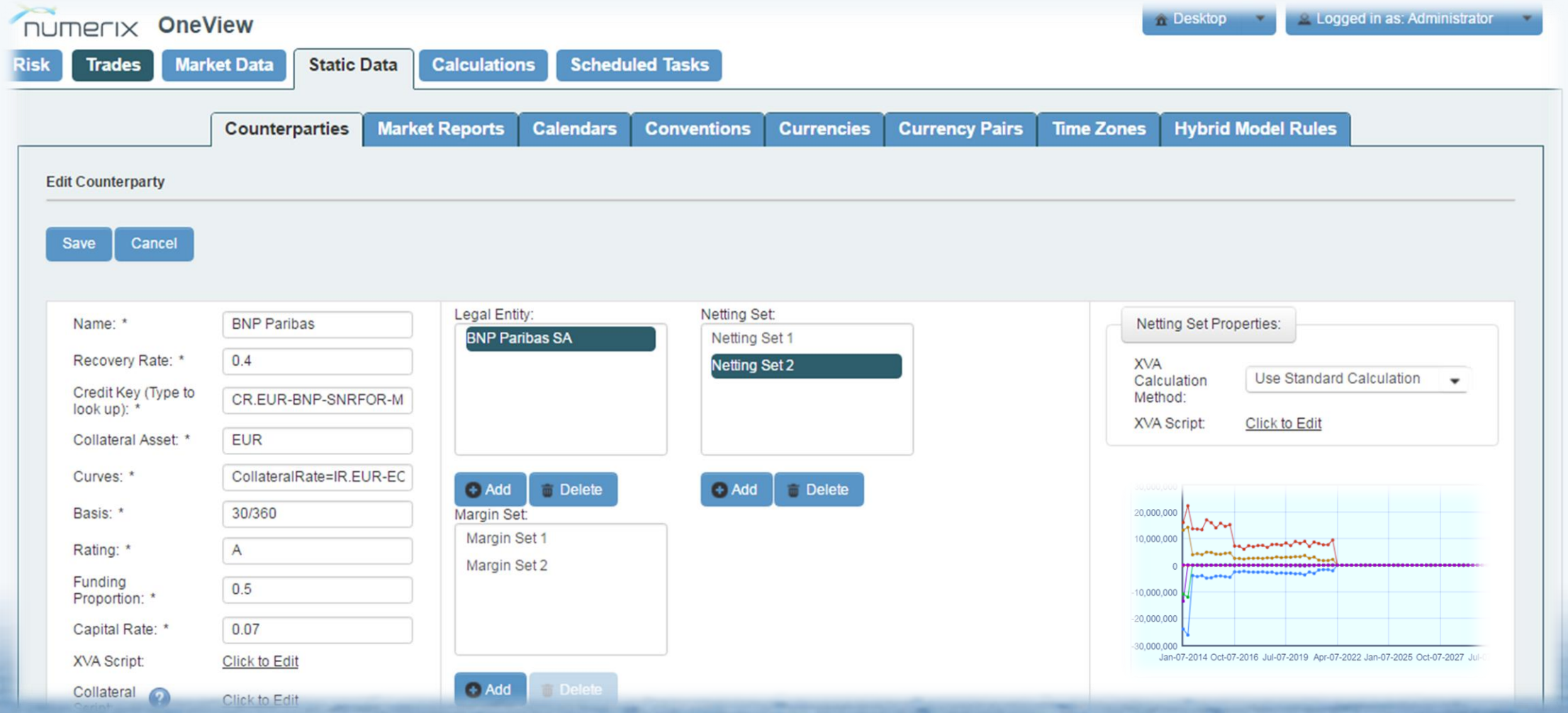
$C^*(t) = V(t)$ if $V(t)>C(t)$, $V(t) – C(t) > M_s$

$C^*(t) = V(t)$ if $V(t)<C(t)$, $C(t) - V(t) > M_c$



Collateral Management

CVA and its not so obvious Impacts

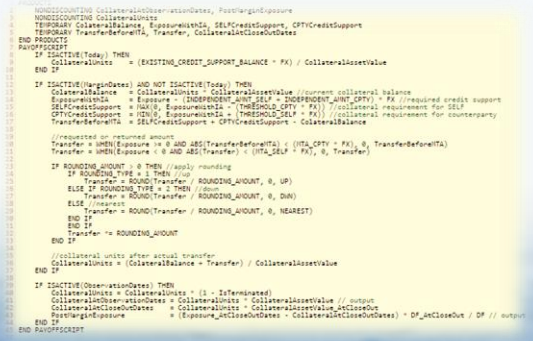


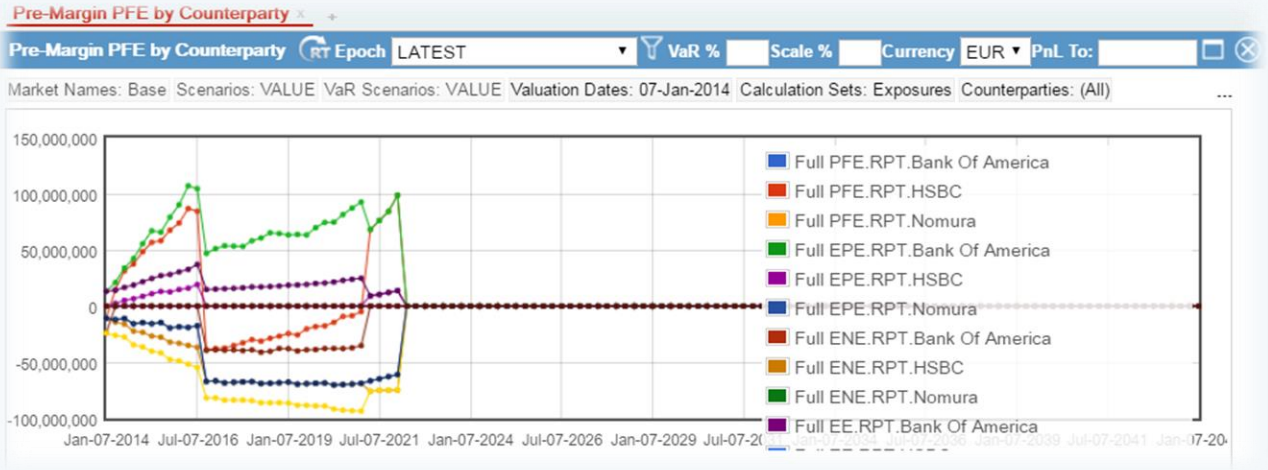
Customizing a CSA

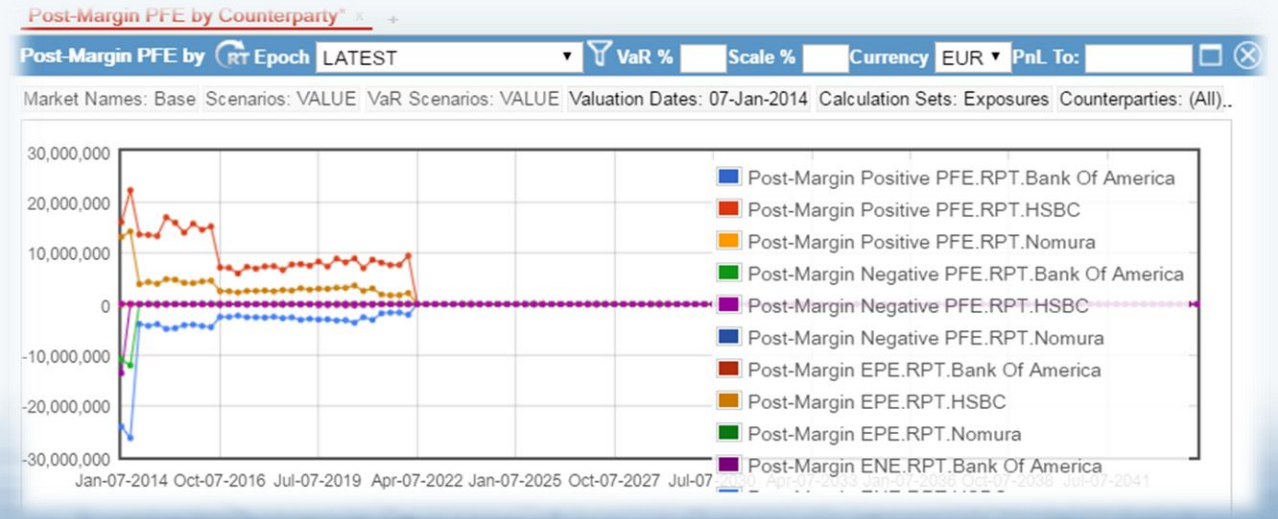
Collateral Management

CVA and its not so obvious Impacts

CVA platform requires a robust collateral management system once it is as a crucial tool to check the effectiveness of the bank's CVA strategy.







Testing the CSA effectiveness: Pre and Post-Margin

Collateral Management

CVA and its not so obvious Impacts

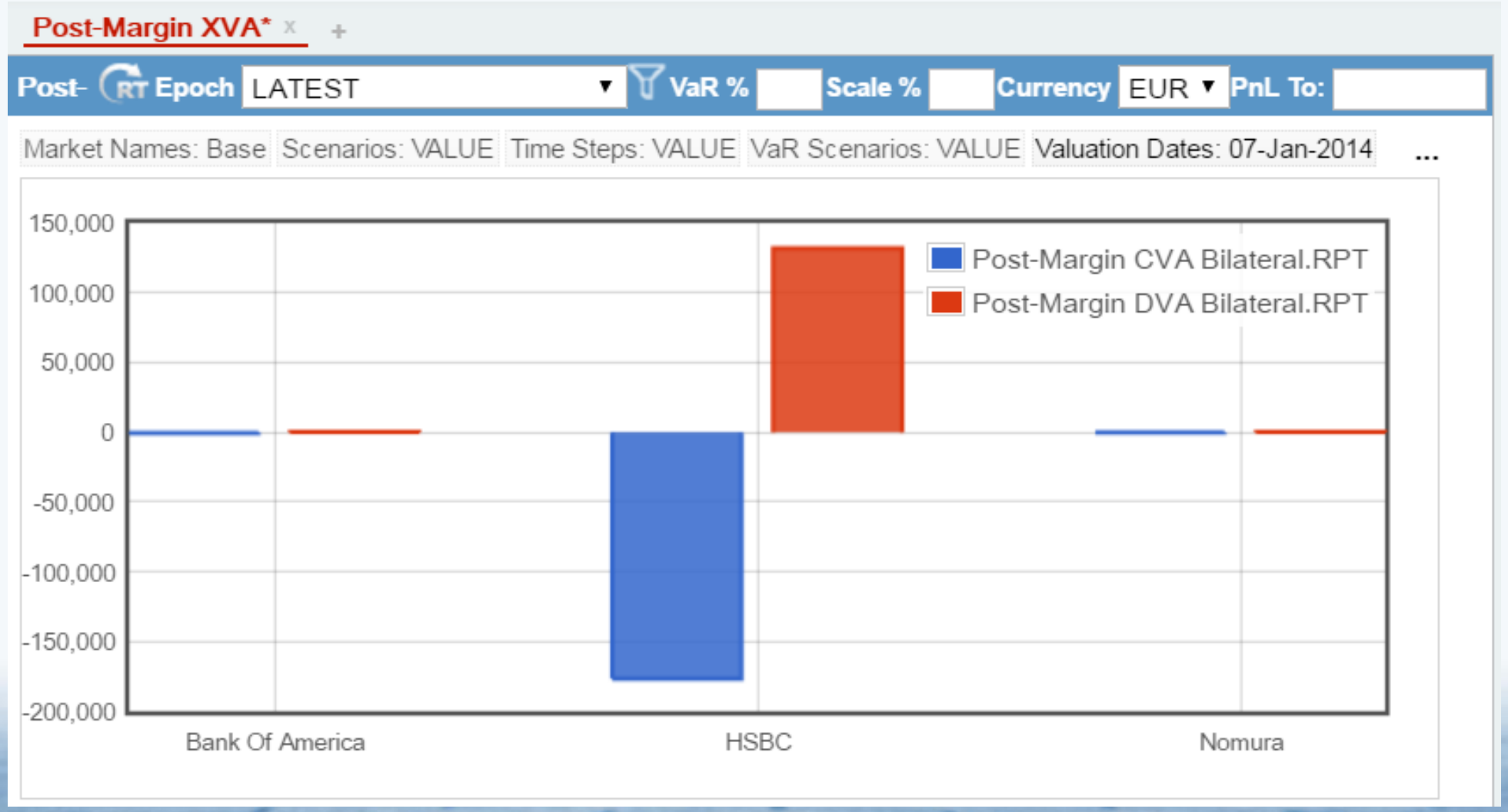
The collateral management logic should be the most **transparent** and **flexible** as possible so the Risk Managers can try different approaches as well as different CSA arrangements.

```
PRODUCTS
    NONDISCOUNTING CollateralAtObservationDates, PostMarginExposure
    NONDISCOUNTING CollateralUnits
    TEMPORARY ColateralBalance, ExposureWithIA, SELFCreditSupport, CPTYCreditSupport
    TEMPORARY TransferBeforeMTA, Transfer, CollateralAtCloseOutDates
END PRODUCTS
PAYOFFSCRIPT
    IF ISACTIVE(Today) THEN
        CollateralUnits    = (EXISTING_CREDIT_SUPPORT_BALANCE * FX) / CollateralAssetValue
    END IF

    IF ISACTIVE(MarginDates) AND NOT ISACTIVE(Today) THEN
        ColateralBalance   = CollateralUnits * CollateralAssetValue //current collateral balance
        ExposureWithIA     = Exposure - (INDEPENDENT_AMNT_SELF + INDEPENDENT_AMNT_CPTY) * FX //required credit support
        SELFCreditSupport  = MAX(0, ExposureWithIA - (THRESHOLD_CPTY * FX)) //collateral requirement for SELF
        CPTYCreditSupport  = MIN(0, ExposureWithIA + (THRESHOLD_SELF * FX)) //collateral requirement for counterparty
        TransferBeforeMTA  = SELFCreditSupport + CPTYCreditSupport - ColateralBalance

        //requested or returned amount
        Transfer = WHEN(Exposure >= 0 AND ABS(TransferBeforeMTA) < (MTA_CPTY * FX), 0, TransferBeforeMTA)
        Transfer = WHEN(Exposure < 0 AND ABS(Transfer) < (MTA_SELF * FX), 0, Transfer)

        IF ROUNDING_AMOUNT > 0 THEN //apply rounding
            IF ROUNDING_TYPE = 1 THEN //up
                Transfer = ROUND(Transfer / ROUNDING_AMOUNT, 0, UP)
            ELSE IF ROUNDING_TYPE = 2 THEN //down
                Transfer = ROUND(Transfer / ROUNDING_AMOUNT, 0, DWN)
            ELSE //nearest
                Transfer = ROUND(Transfer / ROUNDING_AMOUNT, 0, NEAREST)
            END IF
            END IF
            Transfer *= ROUNDING_AMOUNT
        END IF

        //collateral units after actual transfer
        CollateralUnits = (ColateralBalance + Transfer) / CollateralAssetValue
    END IF

    IF ISACTIVE(ObservationDates) THEN
        CollateralUnits = CollateralUnits * (1 - IsTerminated)
        CollateralAtObservationDates = CollateralUnits * CollateralAssetValue // output
        CollateralAtCloseOutDates    = CollateralUnits * CollateralAssetValue_AtCloseOut
        PostMarginExposure           = (Exposure_AtCloseOutDates - CollateralAtCloseOutDates) * DF_AtCloseOut / DF // output
    END IF
END PAYOFFSCRIPT

```

Transparency on the Collateral Management Business Logic

Collateral Management

CVA and its not so obvious Impacts

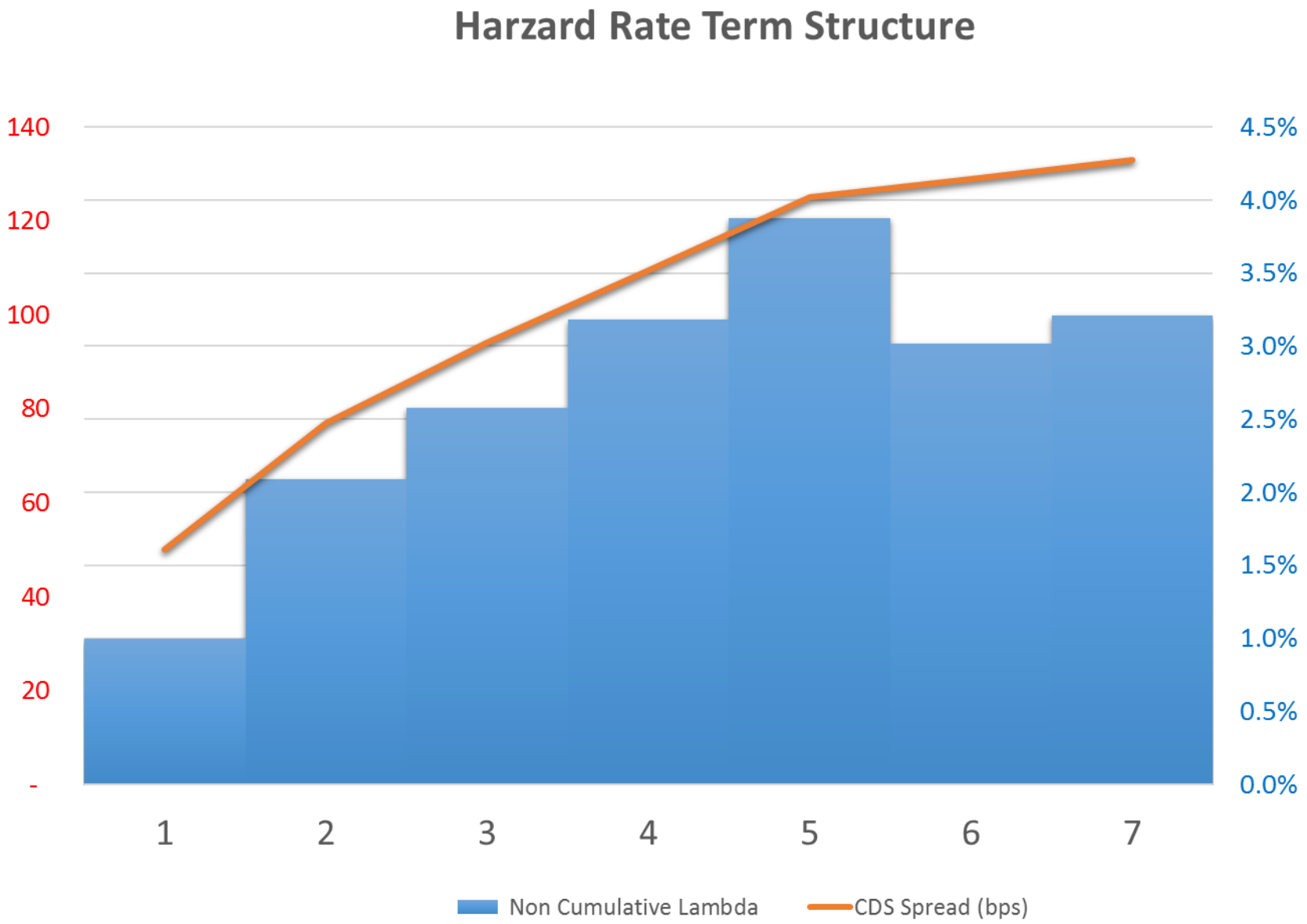


Bringing all pieces together

CVA and its not so obvious Impacts

Market Data Alternatives (or new modeling challenges)

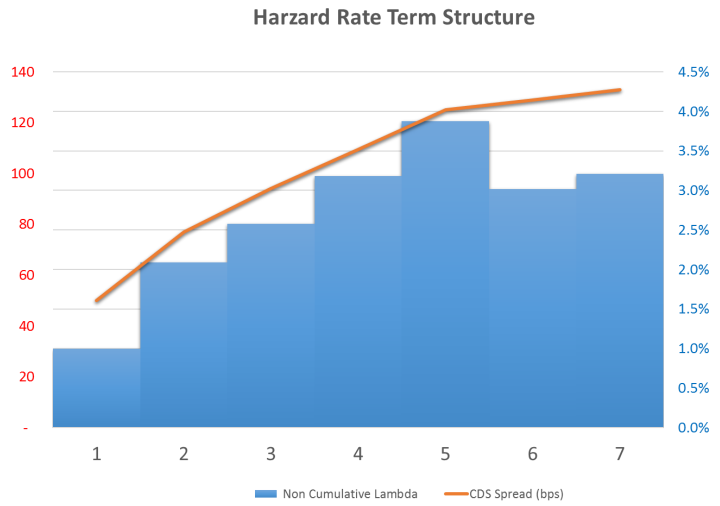
CVA and its not so obvious Impacts



Bootstrapping Probability of Default from CDS curves is not always possible due to the lack of liquidity (or even inexistence) of such market in LatAm.

Market Data Alternatives (or new modeling challenges)

CVA and its not so obvious Impacts



Bootstrapping of Probability of Default from CDS curves is not always possible due to the lack of liquidity (or even inexistence) of such market in LatAm.

Alternatives	
Prices of Bonds or any other Credit Instrument	$PD = \frac{1 - e^{-s.T}}{(1 - R)}$
Data Mining: Logistic Models for PDs	$\text{logit}(p_i) = \ln\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 x_{1,i} + \cdots + \beta_m x_{m,i}$
Third Party Providers: Credit Bureau or Local Rating Agency	Credit Score / Credit Rating

Market Data Alternatives (or new modeling challenges)

CVA and its not so obvious Impacts

[PDF] Approach to the assessment of credit risk for non-financial ...

www.bis.org/ifc/publ/ifcb41q.pdf ▾

by N Nehrebecka - Related articles

Dec 15, 2015 - **Approach to the assessment of credit risk for non-financial corporations**. ... corporations in **Poland**, developed on the basis of individual data from .... categorized variables transformed using the weight of **evidence approach**.

Method	Authors
Weight-Of-Evidence measure	Bailey, 2001; Banasik et al., 2003; Siddiqi, 2006; Abdou, 2009
Regression analysis	Lucas, 1992; Henley, 1995; Hand, Henley, 1997; Hand, Jacka, 1998
Discriminant analysis	Altman, 1968; Desai et al., 1996; Hand, Henley, 1997; Caouette et al., 1998; Hand et al., 1998; Sarlija et al., 2004; Abdou, Pointon, 2009; Wiginton, 1980; Crone, Finlay, 2012
Probit analysis	Finney, 1952; Grablowsky, Talley, 1981
Logistic regression	Lenard et al., 1995; Desai et al., 1996; Lee and Jung, 2000; Baesens et al., 2003; Crook et al., 2007; Abdou et al., 2008; Wiginton, 1980; Yap, Ong, Husain, 2011; Kočenda, Vojtek, 2009; Stepanova, Thomas, 2002; Thanh Dinh oraz Kleimer, 2007; Crone, Finlay, 2012
Linear programming	Yang, Wang, Bai, Zhang, 2004
Cox's proportional hazard model	Stepanova, Thomas, 2002
Support Vector Machines	Deschaine, Francone, 2008
Decision trees	Baesens et al., 2003; Stefanowski, Wilk, 2001; Thomas, 2000; Fritz, Hosemann, 2000; Hand, Jacka 1998; Henley, Hand, 1996; Coffman, 1986; Paleologo et al., 2010; Yap, Ong, Husain, 2011; Kočenda, Vojtek, 2009; Frydman, Altman, Kao,1985; Novak, LaDue, 1999; Thomas, Bijak, 2012; Crone, Finlay, 2012
Neural Networks	Amari, 2002; Al Amari, 2002; Gately, 1996; Irwin et al., 1995; Masters, 1995; Palisade Corporation, 2005; Desai, Conwey, Crook, Overstreet,1996; Crone, Finlay, 2012
Genetic algorithms and genetic programming	Goldberg, 1989; Koza, 1992; McKee and Lensberg, 2002; Etemadi et al., 2009; Huang et al., 2006; Huang et al., 2007
Markov switching model and Bayesian estimation	Chuang, Kuan, 2011; Frydman, Schuermann, 2008; Jacobs, Kiefer, 2011; Tasche, 2013

CVA and its not so obvious Impacts

Integration of Market/Credit Risk departments and Front-Office

CVA and its not so obvious Impacts

Market Risk (MR)

Credit Counterparty Risk (CCR)

Front-Office

Integration of Market/Credit Risk departments and Front-Office

CVA and its not so obvious Impacts

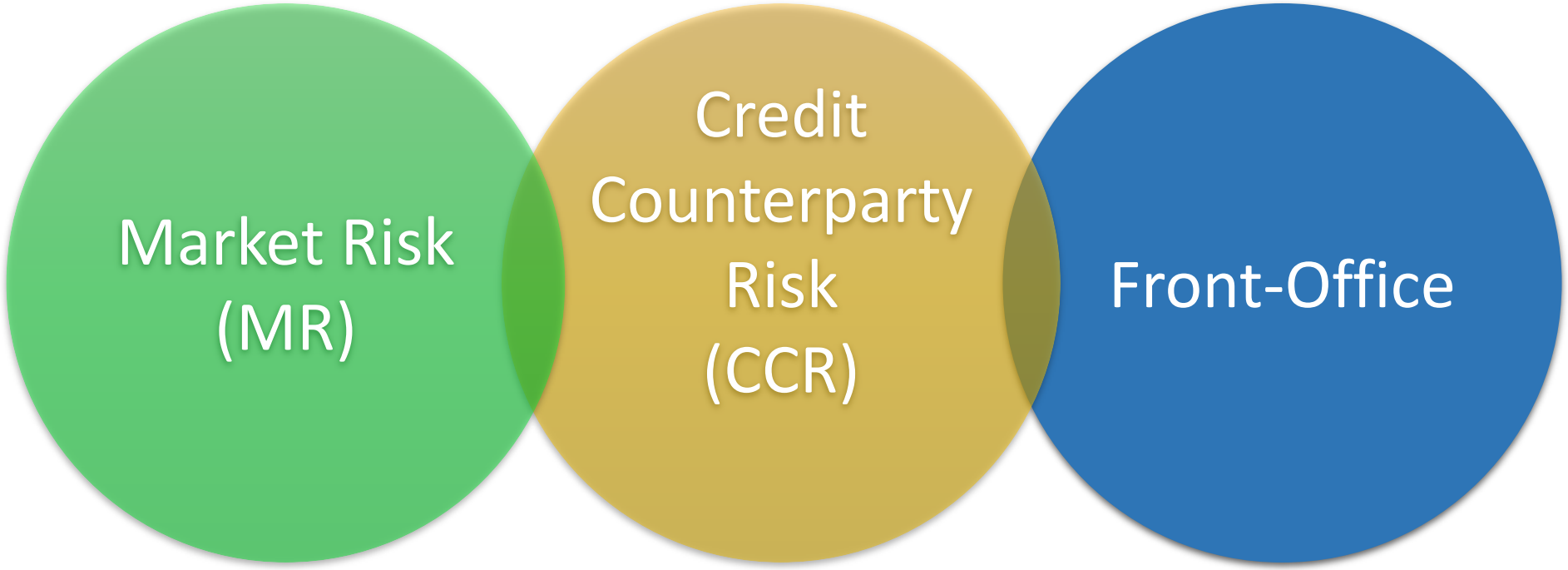
Consistency between the Credit and Market Risk scenarios generation. **Centralized Model Engine**.

Relationship between **MC PFE profile** and **MC VaR**.

Consistency between **PD Models** when there is a gap on CDS liquidity.

Integration of Market/Credit Risk departments and Front-Office

CVA and its not so obvious Impacts



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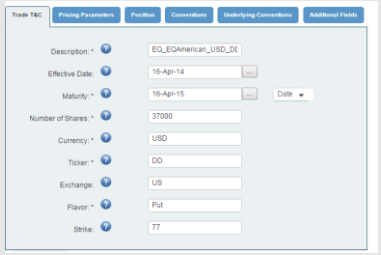
Robust Exposure Engine for a accurate Pre-trading analysis (What-if Analytics): PFE, VaR, XVAs.



Integration of Market/Credit Risk departments and Front-Office

CVA and its not so obvious Impacts

Counterparties

Counterparty	Legal Entity	Netting Set	Margin Set
▾ Bank Of America			
Bank Of Ameri	Bank Of America US	Netting Set 1	Margin Set 1
Bank Of Ameri	Bank Of America US	Netting Set 1	Margin Set 2
Bank Of Ameri	Bank Of America US	Netting Set 2	Margin Set 1
Bank Of Ameri	Bank Of America US	Netting Set 2	Margin Set 2
▾ HSBC			
HSBC	HSBC Bank PLC	Netting Set 1	Margin Set 1
HSBC	HSBC Bank PLC	Netting Set 1	Margin Set 2
HSBC	HSBC Bank PLC	Netting Set 2	Margin Set 1
HSBC	HSBC Bank PLC	Netting Set 2	Margin Set 2
▸ Nomura			

Clear Selected

Back Submit

Trade T&C | Pricing Parameters | Position | Conventions | Underlying Conventions | Additional Fields

Description: * EQ_EQAmerican_USD_D[

Effective Date: * 16-Apr-14 ...

Maturity: * 16-Apr-15 ... Date

Number of Shares: * 37000

Currency: * USD

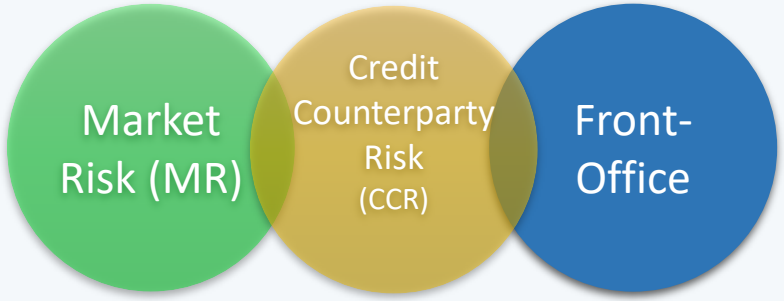
Post-Margin XVA × Pivot View ×

Pivot View — RT Epoch LATEST

Calculation Sets: Main Market Names: Base Scenarios: VALUE Time Steps: VALUE VaR Scenarios: VALUE Valuation

Measures

	Trade ID	Counterparty	Legal Entity	Margin Set	Netting Set	Counterparty Post-Margin CVA Bilateral RPT
1		Bank Of America	Bank Of America US	Margin Set 1	Netting Set 2	-525.4
6		HSBC	HSBC Bank PLC	Margin Set 1	Netting Set 1	-178,397.5
7		HSBC	HSBC Bank PLC	Margin Set 1	Netting Set 1	-178,397.5
8		HSBC	HSBC Bank PLC	Margin Set 1	Netting Set 2	-178,397.5
9		UBS	UBS AG	Margin Set 1	Netting Set 1	-8,920.3
10		UBS	UBS AG	Margin Set 1	Netting Set 1	-8,920.3



Pre-trading analysis for all XVAs in order to Optimize bank's CCR strategy.

Integration of Market/Credit Risk departments and Front-Office

CVA and its not so obvious Impacts

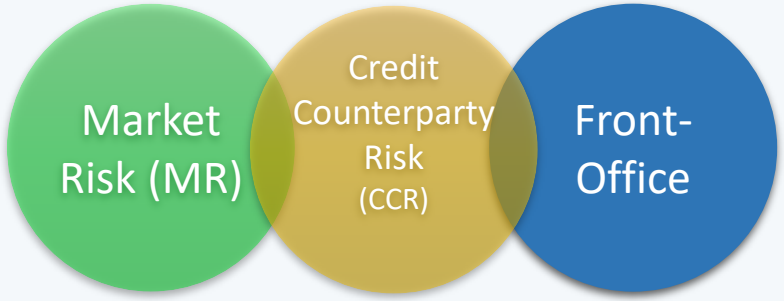
istory Dashboard Pivot View

Post-Margin XVA × Pivot View × +

Pivot View | Epoch LATEST | VaR % | Scale % | Currency EUR | PnL To:

Calculation Sets: Main | Market Names: Base | Scenarios: VALUE | Time Steps: VALUE | VaR Scenarios: VALUE | Valuation Dates: 06-Jan-2014 | Trade IDs: (All) | What-If: (All)

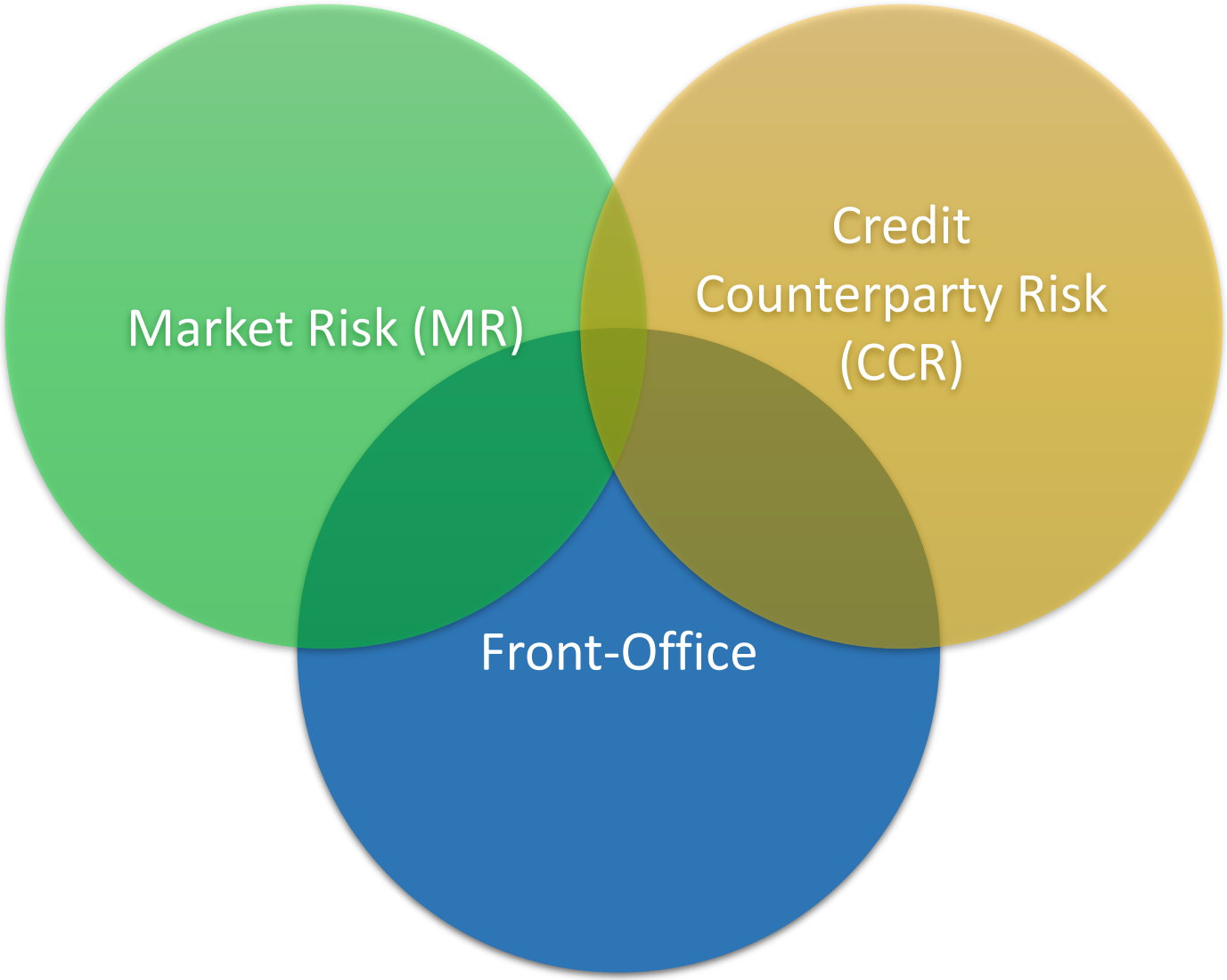
	Trade ID	Counterparty	Legal Entity	Margin Set	Netting Set	Counterparty Post-Margin CVA Bilateral.RPT	Post-Margin CVA Bilateral.RPT	Post-Margin CVA Bilateral Contribution.RPT
						Measures		
1	Bank Of America	Bank Of America US	Margin Set 1	Netting Set 2		-525.41	-388.16	-388.16
6	HSBC	HSBC Bank PLC	Margin Set 1	Netting Set 1		-178,397.51	-26,560.44	-13,743.04
7	HSBC	HSBC Bank PLC	Margin Set 1	Netting Set 1		-178,397.51	-106,896.26	-94,078.86
8	HSBC	HSBC Bank PLC	Margin Set 1	Netting Set 2		-178,397.51	-57,758.21	-57,758.21
9	UBS	UBS AG	Margin Set 1	Netting Set 1		-8,920.38	-1,849.10	-3,044.75
10	UBS	UBS AG	Margin Set 1	Netting Set 1		-8,920.38	-5,875.63	-7,071.29
205	Bank Of America	Bank Of America US	Margin Set 2	Netting Set 1		-525.41	-137.25	-137.25



Near Real Time results of a pre-trading What-if Analysis

Integration of Market/Credit Risk departments and Front-Office

CVA and its not so obvious Impacts



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Robust **Exposure Generation Risk Engine** for a accurate Pre-trading analysis (**What-if Analytics**): PFE, VaR, XVAs.

Ability to Analyze **Pre** and **Post-margin** CCR risk measures.

Fully Customizable Reporting Layer.

Agenda

Credit Risk: a 4,000 years leap in History

Why CVA?

CCR *vs* CVA

Obvious Business Impacts

CVA Path and its Analytical Challenge

Not-so-Obvious Impacts

Coming Soon

Coming soon

XVA Main components

Adjustment	Description
CVA (2002+)	Impact of counterparty credit risk
DVA (2002+)	Benefit a bank derives in the event of its own default (the 'other side' of CVA)
COLVA (2010+)	Cost of funding a collateralised derivative position, at new 'risk free' rate
FVA (2011+)	Captures the funding cost of uncollateralised derivatives above the 'risk free rate'
KVA (2015+)	Cost of holding regulatory capital as a result of the derivative position
MVA (2015+)	Cost of posting 'initial margin' against a derivative position

New initial margin rules (effective September 1, 2016 for larger banks in the US)

$$MVA = \mathbb{E}\left[\int_0^T DF(t)\, s_{IM}(s)\, IM(s)\, ds\right]$$

Recent articles in RISK magazine

- ✓ "Banks warn prime brokerage clients of 'material' MVA costs", 27 September 2016
- ✓ "MVA: swaps scale new heights in complexity", 29 July 2016
- ✓ "Dealers wake up to MVA impact of new funding rules", 18 July 2016
- ✓ "Time to gear up for MVA", 04 July 2016

MVA with ISDA SIMM

ISDA Safe, Efficient Markets

Final Document
Appendix 1

ISDA SIMM™,1 Methodology, version R1.0 (same as v3.15: 7 April 2016)
Effective Date: September 1, 2016

$$MVA = \mathbb{E}\left[\int_0^T DF(t)\, s_{IM}(s)\, IM(s)\, ds\right]$$

$$\simeq \sum_{n=0}^{N_T-1}\left(\frac{1}{N_p}\sum_{p=1}^{P} DF(t_n)[p] s_{IM}(t_n)\, IM(t_n)[p]\, \Delta t_n\right)$$

where $IM(t)[p]$ is a value of the IM at time t for simulated path p, $DF(t)[p]$ is a value of the discount factor at time t for simulated path p and $s_{IM}(t)$ is an appropriate spread reflecting cost of maintaining IM.

MVA with ISDA SIMM

ISDA Safe, Efficient Markets

Final Document
Appendix 1

ISDA SIMM™,1 Methodology, version R1.0 (same as v3.15: 7 April 2016)
Effective Date: September 1, 2016

$$IM(t_n)$$

and the margin for each risk class is defined to be the sum of the Delta Margin, the Vega Margin and the Curvature Margin for that risk class. That is

$$IM_X = DeltaMargin_X + VegaMargin_X + CurvatureMargin_X,$$

for each risk class *X*.

Within each product class, the initial margin (IM) for each of the six risk classes is calculated as in paragraph 5 above. The total margin for that product class is given by the formula:

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

where *product* is one of the four product classes, and the sums on *r* and *s* are taken over the six risk classes. The correlation matrix ψ_{rs} of correlations between the risk classes is given in Section K.

The total SIMM is the sum of these four product class SIMM values:

$$SIMM = SIMM_{RatesFX} + SIMM_{Credit} + SIMM_{Equity} + SIMM_{Commodity}.$$

MVA with ISDA SIMM

Initial Margin calculation

Compute sensitivities

Use closed formulas for initial margin, using sensitivities and regulatory parameters as input

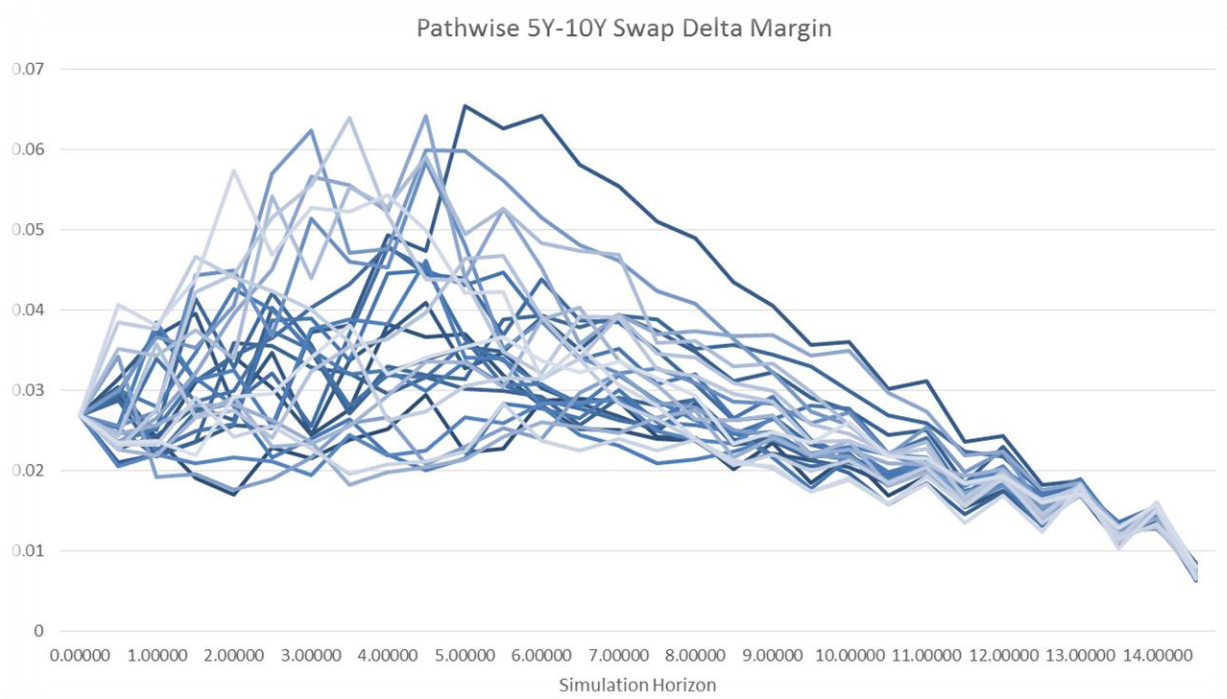
Corresponding MVA calculation (cost of initial margin over the life of portfolio)

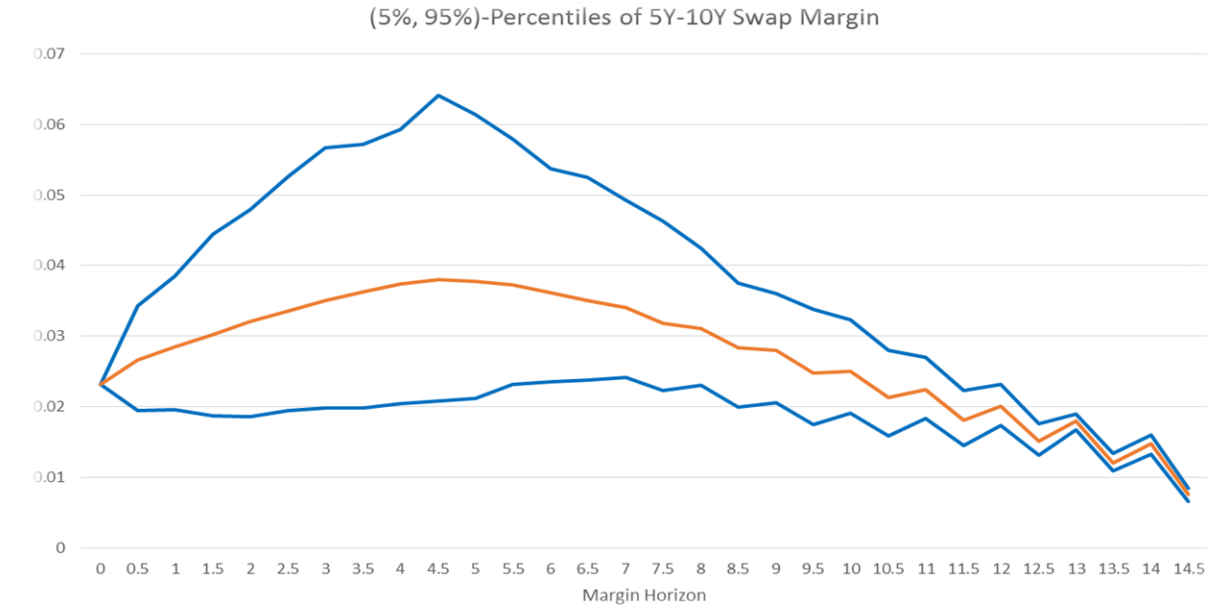
Simulate Monte Carlo scenarios into the future

Compute sensitivities <u>on future dates</u> ← most challenging

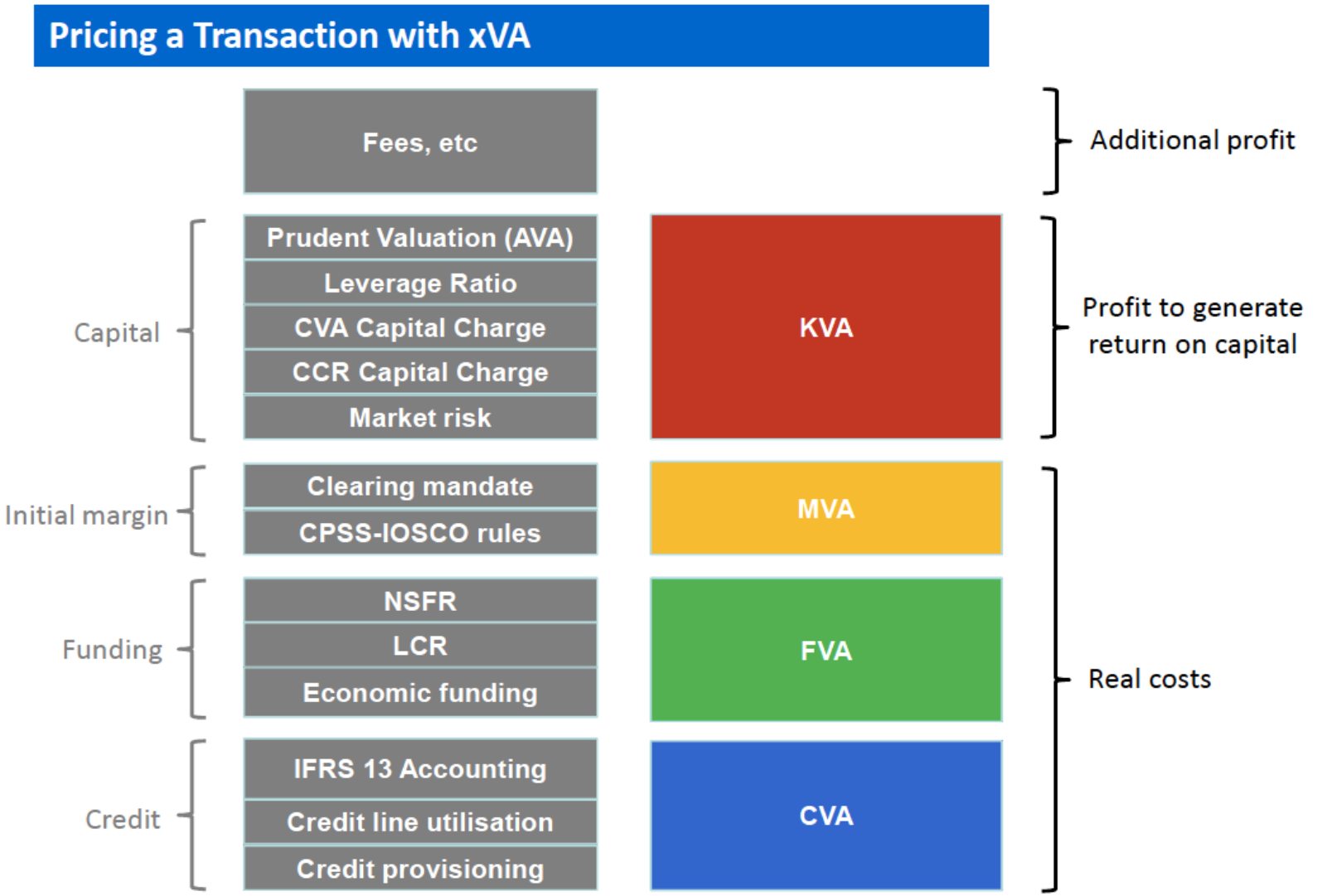
Compute margin requirements on future dates (grid paths x timesteps) using closed formulas

Discount back to today to obtain MVA

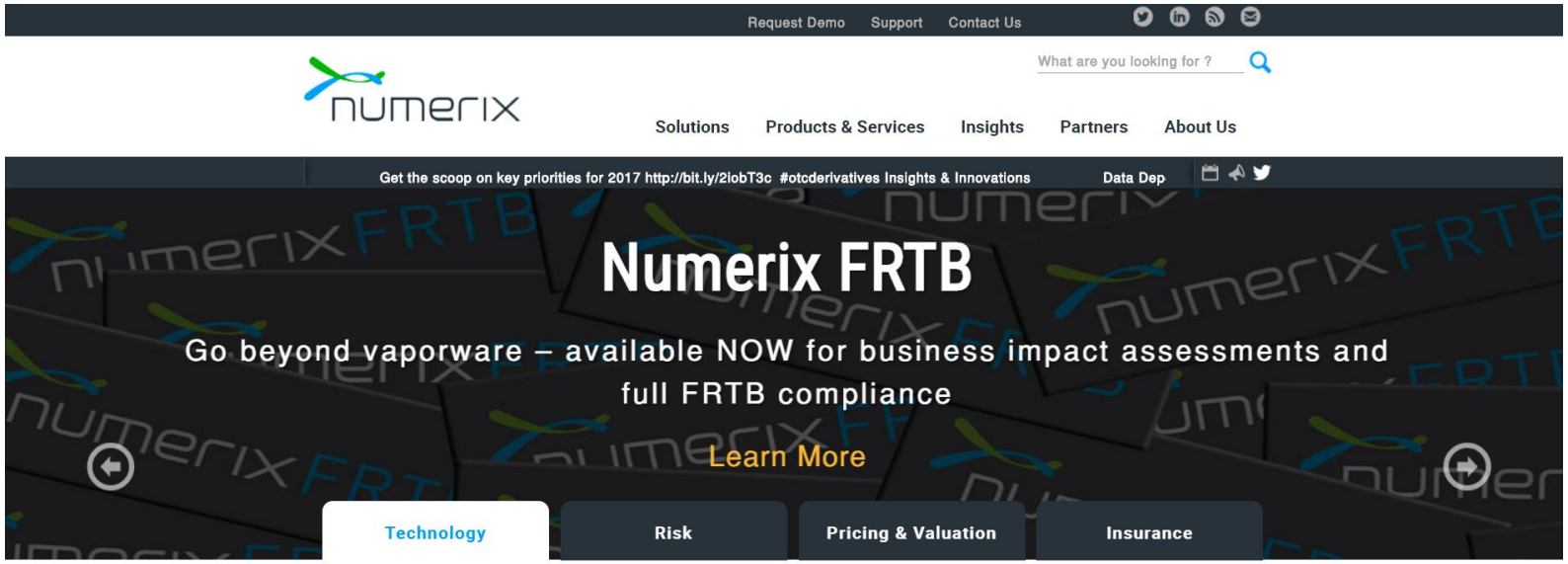




XVA will become the standard for derivative pricing



“Do not let the only person to stick closer to you in adversity to be a creditor.”



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Mobile: 786-338-1899

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Evolving Regulatory Landscape, from IACPM (International Association of Credit Portfolio Managers). https://goo.gl/GHIFjr

Cesari, G., Aquilina, J., Charpillon, N., Filipovic, Z., Lee, G., Manda, I., Modelling, Pricing, and Hedging Counterparty Credit Exposure: A Technical Guide.

Christopher L. Culp, Ph.D., Single-name Credit Default Swaps: A Review of the Empirical Academic Literature

Risk Magazine Quant of the year: Alexandre Antonov Numerix quant revolutionizes negative rates modelling, available at http://www.risk.net/risk-magazine/analysis/2442477/quant-of-the-year-alexandre-antonov

Aite Impact Report**:** XVA and Risk Transformation: Establishing the Data Fundamentals, available at: http://www.numerix.com/impact-report-xva-and-risk-transformation-establishing-data-fundamentals

Add See Antonov and Issakov and Mechkov 2011

Are Negative Res Having a 'Negative' Impact on Your Derivative Pricing and Modelling?, available at http://www.numerix.com/info-graphic/negative-rates-trends-continue-2016#

John Gregory, XVA Theory 2016 CQF Lecture Notes