Riesgo de Contraparte e los nuevos Ajustes en el mercado

Augusto Carvalho,

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Dada la importancia que está teniendo el CVA cada día en la gestión de riesgo de contrapartida en los portafolios, serán presentados en esta sesión los lineamientos generales en la evaluación y gestión CVA y su cobertura.

Agenda

Riesgo de Crédito: 4,000 años de Historia

Porqué CVA?

El camino para el CVA y su reto analítico

Impactos Obvios en el Negocio

Impactos no tan obvios

Riesgo de Crédito: 4,000 años de Historia

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Historical Reference inspired by Alonso Pena's Credit Risk lecture on CQF.

Riesgo de Crédito y el código de Hamurabi (1754 BC)

Ley 48

Si uno se ha obligado por una obligación que produce intereses y la tormenta (Hadad) ha inundado su campo y llevado la cosecha o si faltó de agua el trigo no se ha levantado sobre el campo, este año no dará trigo a su acreedor, empapará su tableta y no dará el interés de este año.

Riesgo de Crédito y el código de Hamurabi (1754 BC)

Ley 117

Si una deuda ha tomado una persona y si el deudor había tomado el dinero y dado a su esposa, su hijo y su hija, estos trabajarán durante 3 años para la casa de su comprador y del acreedor; al cuarto años esta casa los pondrá en libertad.

3,700 años después...

Grandes pierdas de crédito **no solamente** cuando hay bancarrotas.

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Porqué CVA?

Mientras el acuerdo de Basilea II cubre el riesgo de bancarrota de una contrapartita, el mismo no especifica el riesgo de CVA, que durante la crises financiera de 2008 causó pierdas más grandes que aquellas causadas por las bancarrotas.

Porqué CVA?

Basilea 2.0

Riesgos asociados a las pierdas debido a la **probabilidad de bancarrota(PD)** de contrapartidas.

Deterioro de crédito de las contrapartidas

67%

Bancarrotas
33%

Losses

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Basilea 3.0

Riesgos asociados a las pierdas asociadas al **deterioro de la cualidad de crédito** de las contrapartidas

Porqué 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

Porqué CVA?

CCR de Basiléia 3.0

=

Riesgo de Bancarrota + Riesgo de CVA

VaR de Crédito	VaR del la componente de precio del riesgo de Contrapartida

Before CVA…

Before the Crisis **During the Crisis** **After the Crisis**
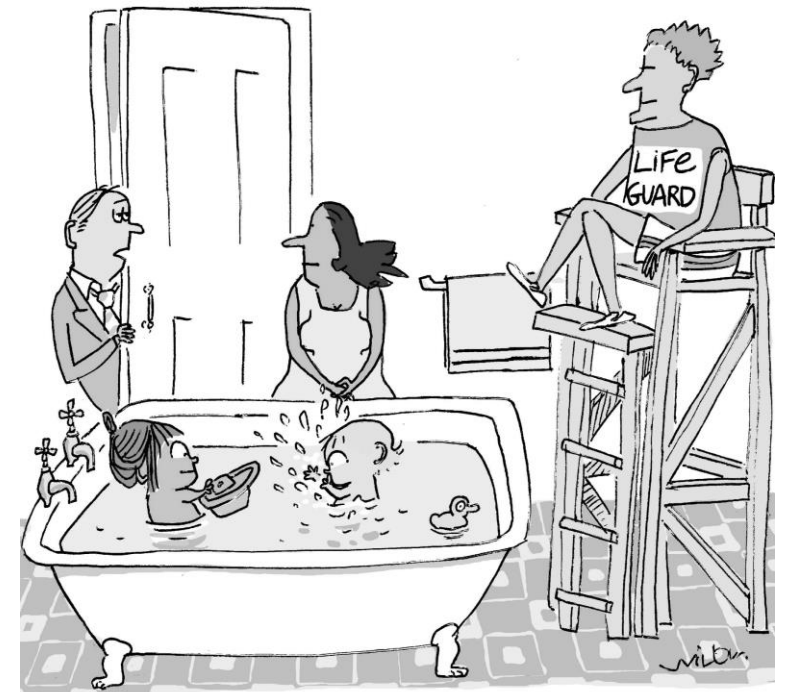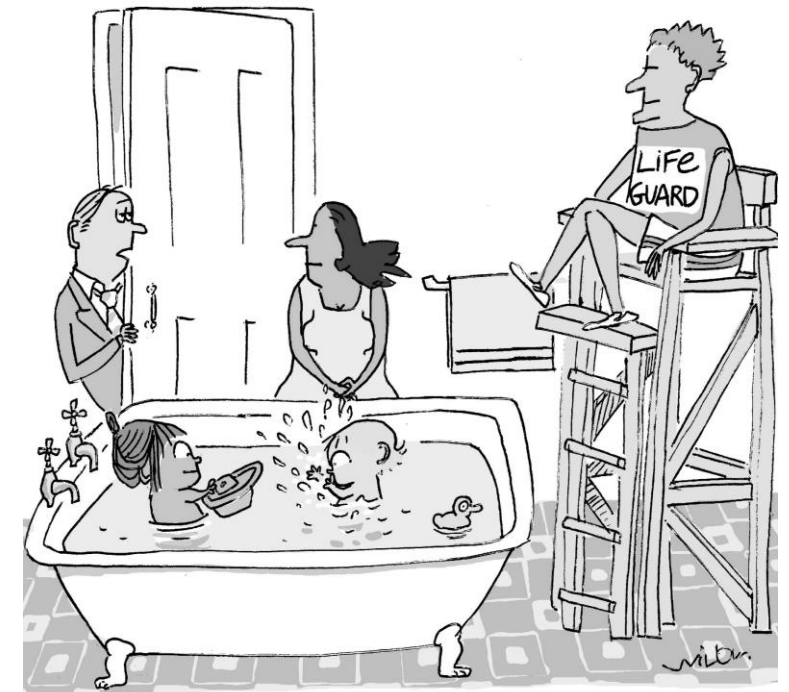
Before CVA…

Before the Crisis

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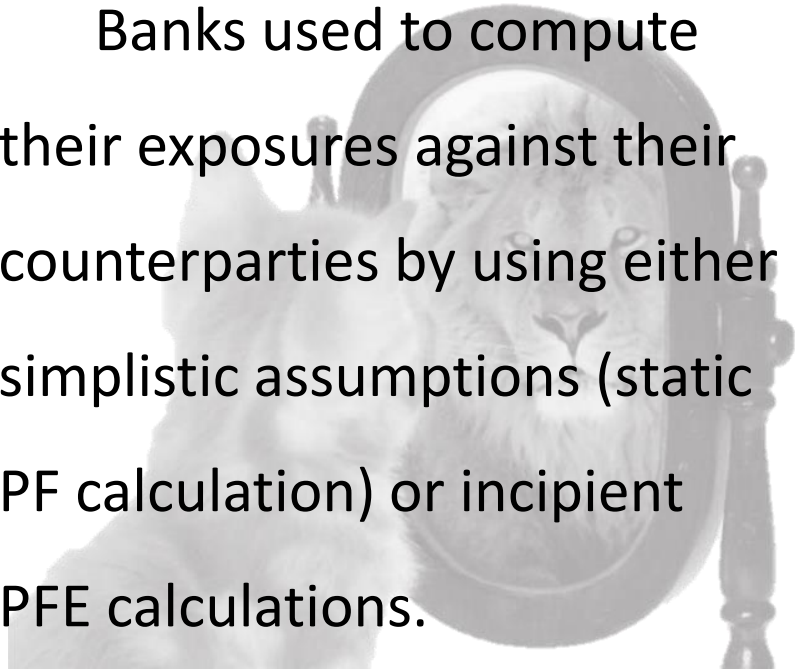
During the Crisis

After the Crisis

Before CVA...

Before the Crisis

During the Crisis

After the Crisis

Big banks started calculating simplistic approaches to CVA.

No regulatory pressure at all.
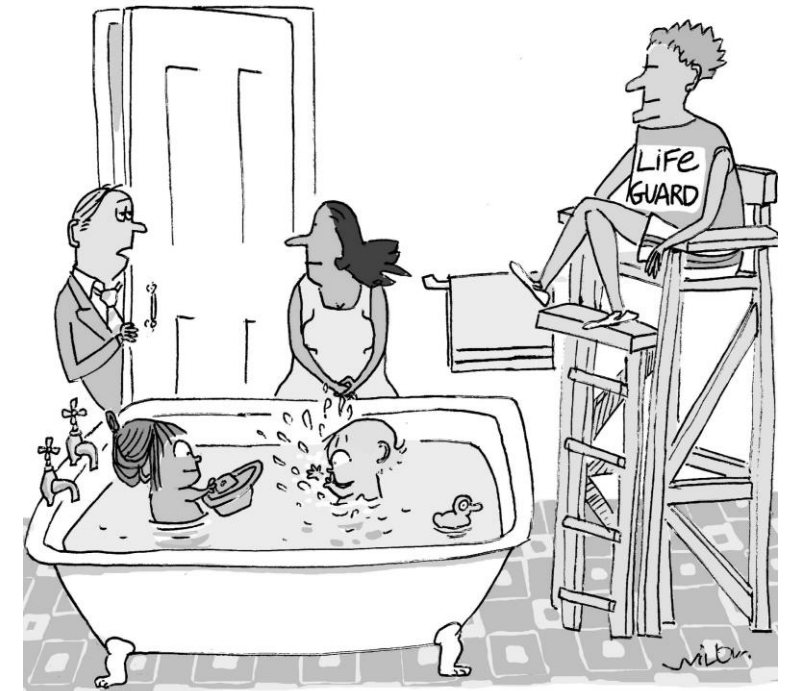
Before CVA…

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…
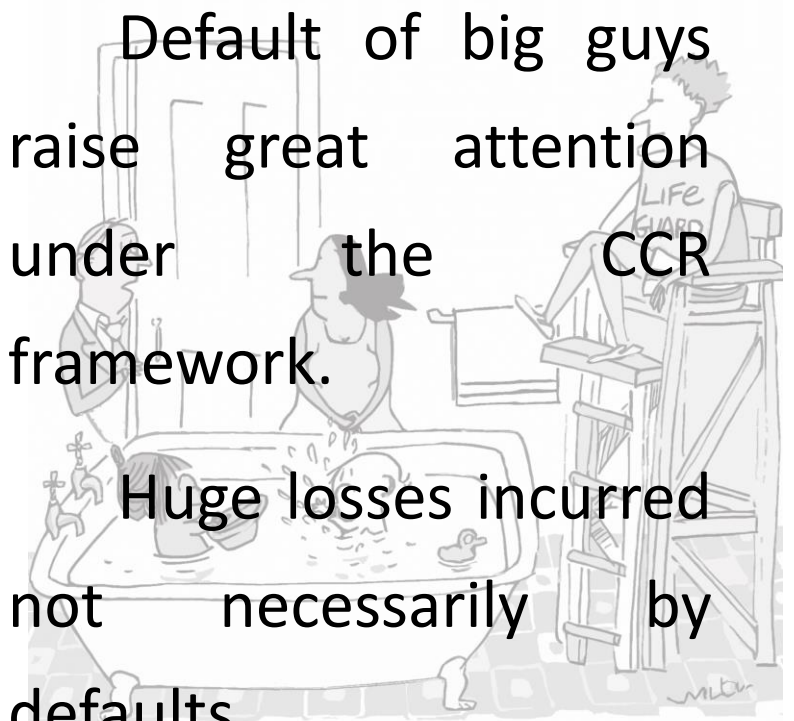
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The Building Blocks

CVA como un ajuste en el precio debido a la pierda esperada de una contrapartida.

$$CVA = E[L]$$

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

Future Value of the Amount that can be lost

Probability of Default

Discount Factor

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Exposición $V(t;s_t)$ – Valor de una transacción (portfolio) en una determinada fecha t dado un determinado estado s_t

El vector de estado (factor de riesgo) és un input crítico para la valuación.

Los estados son completamente dependientes del modelo elegido.

Exposición Potencial Futura (PFE) $= inf \{v; P(V(T) \le v) \ge \alpha \}$

Exposición **Esperada (EE) = E{ V(t) }**

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

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

El camino para el CVA y su reto analítico

Ejemplos reales

Ejemplos reales

2.1 IR Swap Vanilla: Fixed Floating Swap

Model Parameters

Spot Date: 9/18/2012

Yield Curve Stripping: Cubic interpolation to USD instruments (cash, FRA, swaps)

Model : HW2F with $\lambda_1 = 30\%$, $\lambda_2 = 5\%$, $\rho = -50\%$ and volatilities calibrated to swaptions

Method: Backward MC kernel pricing method with 500 time steps and 1000 paths

Instrument Parameters

Instrument Type: 10-year USD Swap

Paying rate: Fixed, 6m

Receiving rate: Floating, quarterly indexed to 3m Libor

Ejemplos reales

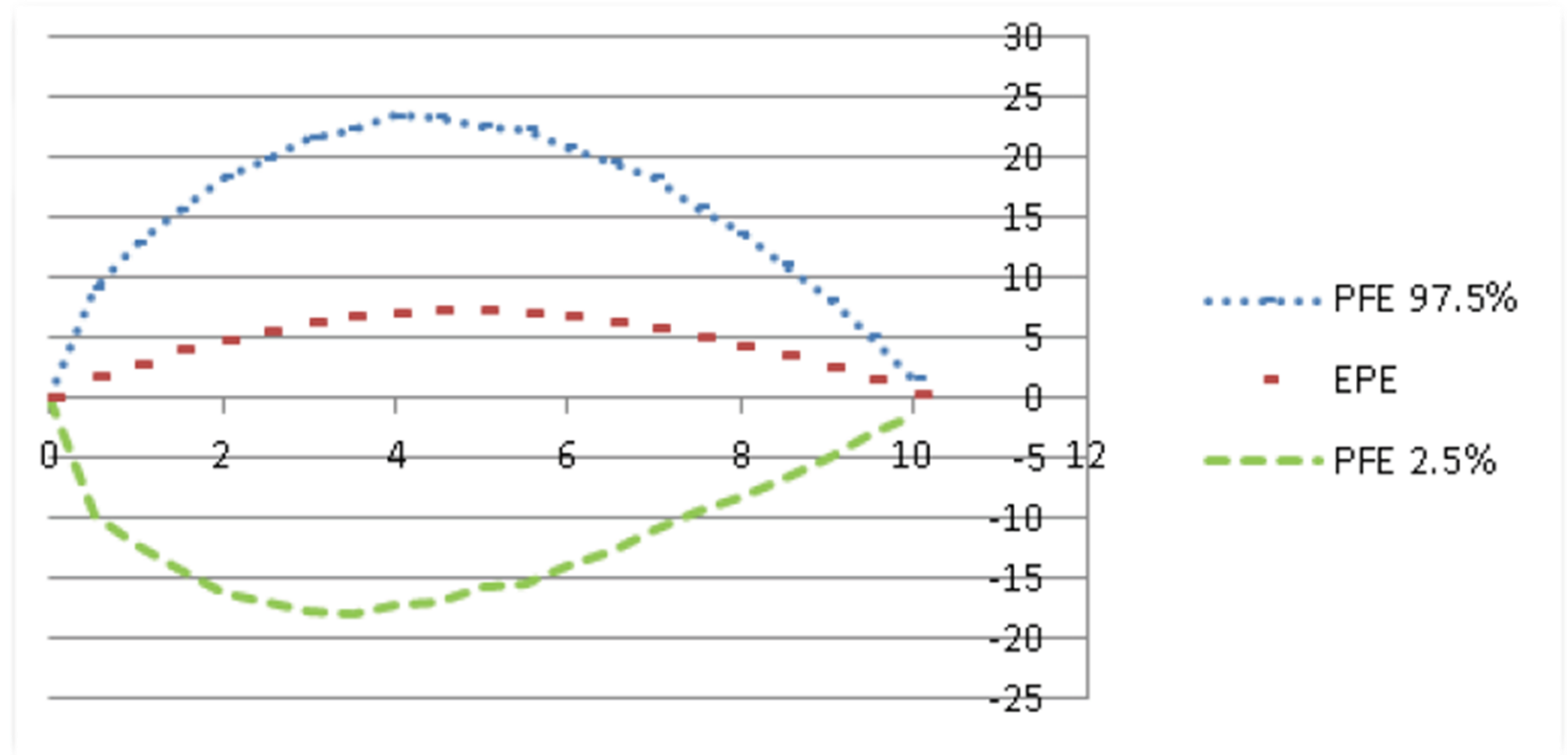**2.1 IR Swap Vanilla: Fixed Floating Swap**

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Source: Augusto Carvalho - Numerix Counterparty Credit Exposure Profile Benchmarks | October 2013 Numerix Benchmark Papers

Ejemplos reales

2.6 IR Swap: Cross-Currency Swap, USD

Model Parameters

Model: Hybrid HW1F/BS/HW1F with EUR Libor modeled with HW1F ($\lambda = 3\%$, $\sigma = 2\%$) and FX (dollars for Euro) is modeled with Black ($\sigma_1 = 8\%$, spot $= 1/0.6 = 1.66$).

The correlation matrix is given below. The subscript D is for domestic model factor, F for foreign model factor, and X for FX.

$$\begin{pmatrix} \rho_{DD} & \rho_{DF} & \rho_{DX} \\ \rho_{FD} & \rho_{FF} & \rho_{FX} \\ \rho_{XD} & \rho_{XF} & \rho_{XX} \end{pmatrix} = \begin{pmatrix} 1 & 0.8 & 0.8 \\ 0.8 & 1 & 0.6 \\ 0.8 & 0.6 & 1 \end{pmatrix}$$

Instrument Parameters
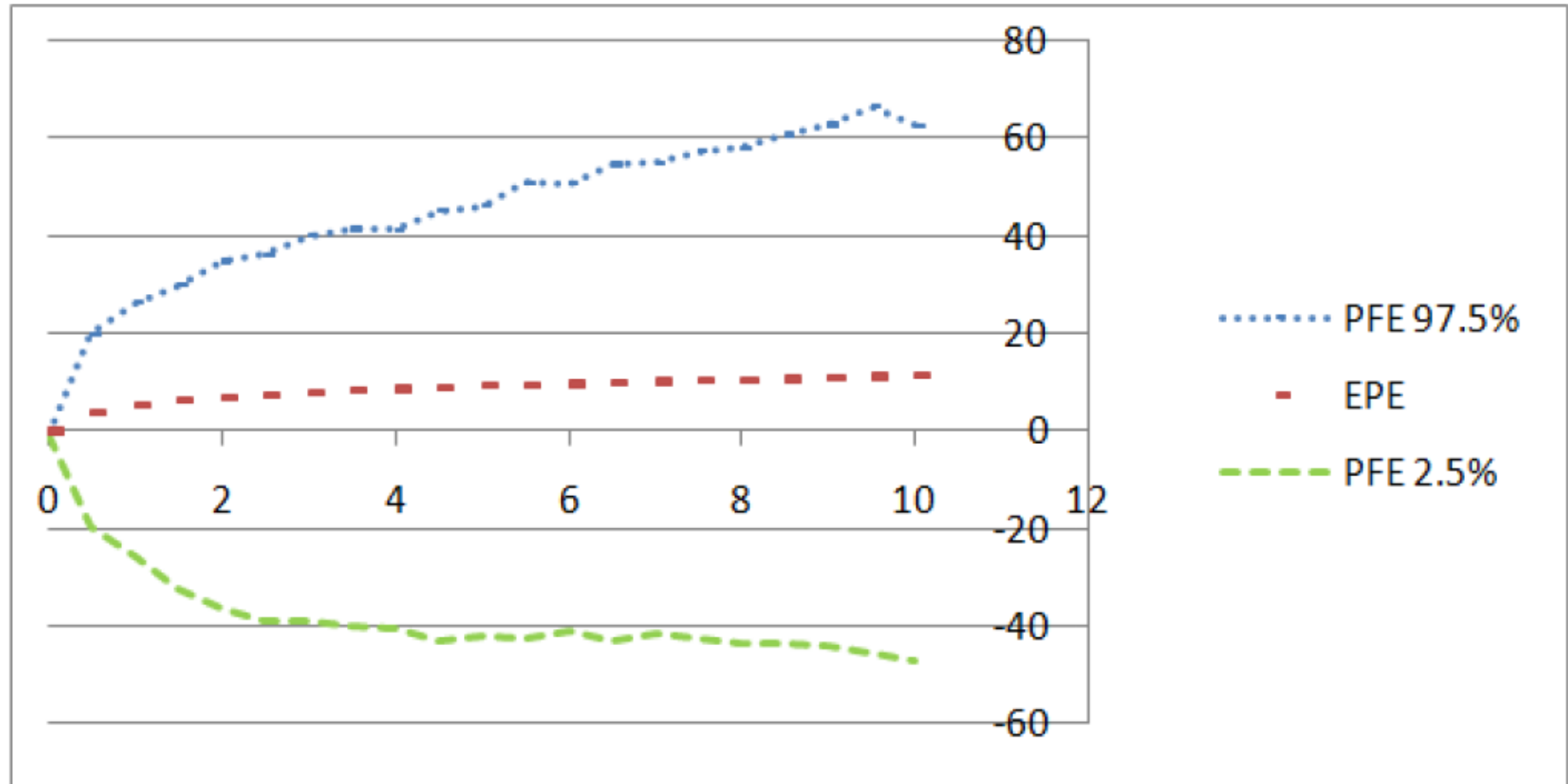
Instrument Type: 10-year cross-currency swap
Paying Rate: Fixed 1.895% USD
Receiving Rate: Three-month EUR LIBOR
Payments: Semiannual
Domestic Notional: 100 USD
Foreign Notional: 60 EUR

$$r_t = x_t + \alpha(t)$$

$$dx_t = -\lambda(t)x_t dt + \sigma(t)dW_t$$

Source: Augusto Carvalho – Numerix Counterparty Credit Exposure Profile Benchmarks | October 2013 Numerix Benchmark Papers

Ejemplos reales

2.6 IR Swap: Cross-Currency Swap, USD

Model Parameters
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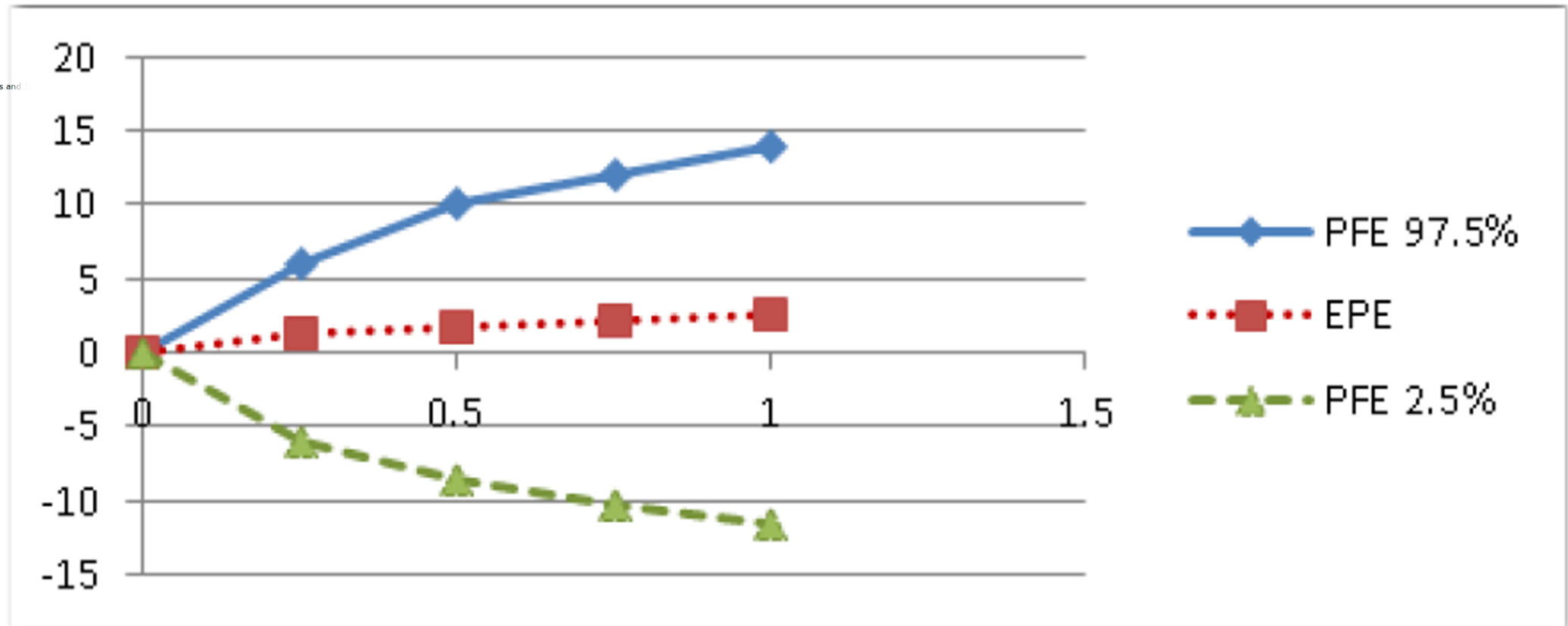# El camino para el CVA y su reto analítico

Ejemplos reales

2.10 FX Forward

Model Parameters

Model: Hybrid cross-currency model

Domestic IR Model: HW1F with $\lambda_1 = 3\%$, $\sigma_1 = 2\%$

Foreign IR Model: HW1F with $\lambda_1 = 5\%$, $\sigma_1 = 1\%$

FX Model: Black model with $\sigma_1 = 10\%$, spot $= 0.65$

Correlation: Identity matrix between the three factors

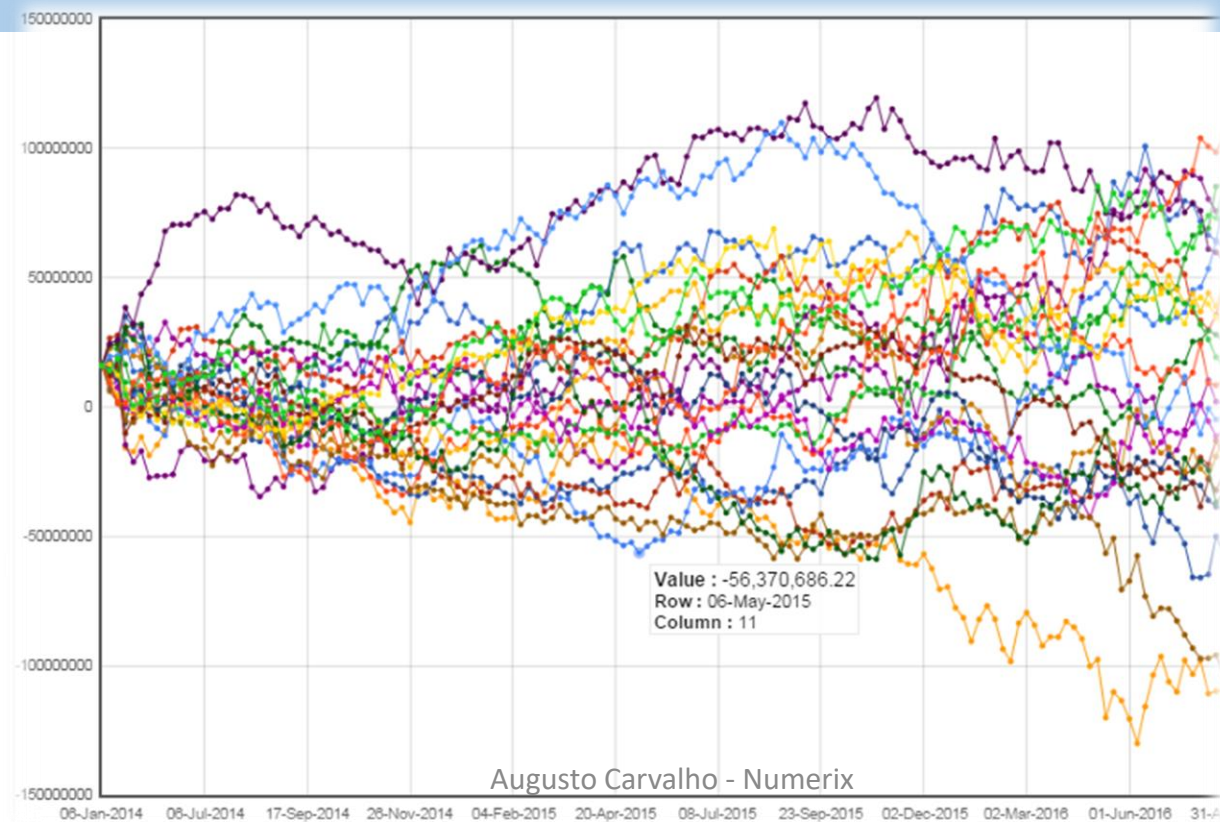Method: Backward MC kernel pricing with 500 time steps and 1000 paths

Instrument Parameters

Instrument Type: FX forward

Domestic Currency: EUR

Foreign Currency: USD

Tenor: 1 year

Strike: 0.65

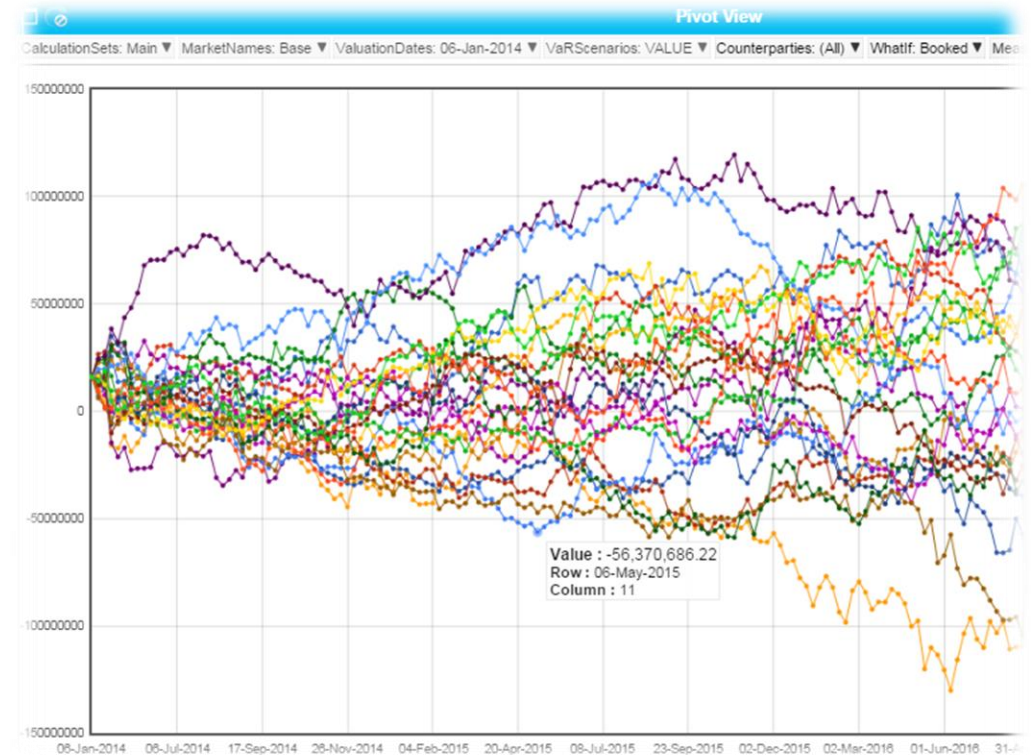Notional: 100%

El camino para el CVA y su reto analítico

Ejemplos reales

El camino para el CVA y su reto analítico

En la práctica

Simulando las exposiciones

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En la práctica

El camino para el CVA y su reto analítico

En la práctica

El camino para el CVA y su reto analítico

En la práctica

Calculando los XVAs

Agenda

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Porqué CVA?

    El camino para el CVA y su reto analítico

    Impactos Obvios en el Negocio

    Impactos no tan obvios
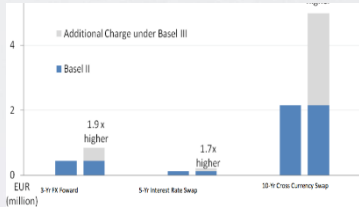
Cargos de CCR más grandes

Mayor uso de colaterales

Mayores costos de negociación

Cargos de CCR más grandes

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.

Average total counterparty risk charge under Basel II & III rules
BBB rated companies

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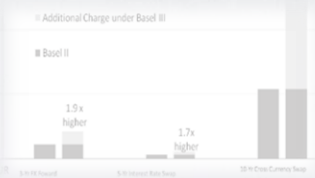
Cargos de CCR más grandes

Mayor uso de colateral

Mayores costos de negociación

Mayor uso de colateral

Aumento de la eficiencia de los acuerdos de colateral;

Reconocer mas efectos mitigadores para las medidas d e exposición regulatorias;

Re-negociación de las condiciones de los acuerdos de colateral actuales;

Los bancos pueden costear su necesidades de colaterales a través de préstimos de corto-plazo.

Impactos Obvios en el Negocio

Cargos de CCR más grandes

Mayor uso de colateral

Mayores costos de negociación

Mayores costos de negociación

Consecuencias obvias caso no hayacambios en los acuerdos de colateral.

Desplazamiento de los costos de riesgo de contrapartida desde el departamento de riesgo hacia el Front-office.

No todos los bancos en América Latina tienen sus *front-offices* consiente de tal responsabilidad.

Source: https://goo.gl/GHIFjr

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Porqué CVA?

El camino para el CVA y su reto analítico
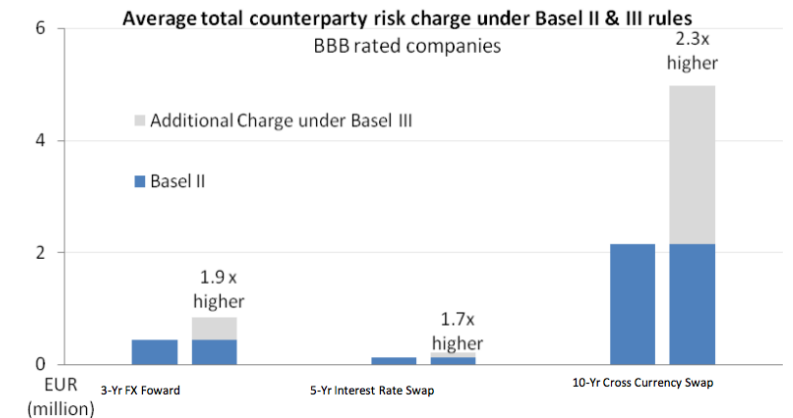
Impactos Obvios en el Negocio

Impactos no tan obvios

CVA y sus impactos Impactos no tan obvios

CVA y sus impactos Impactos no tan obvios

Cultura de los Modelos

Gestión de Colaterales

Datos de mercado alternativos

CVA y sus impactos no tan obvios

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CVA es medido con respecto al portafolio.

CVA requiere una modelaje robusta para tratar diferentes tipos de clases de activos.

Exposiciones tienen que manejar la estructura de correlación.

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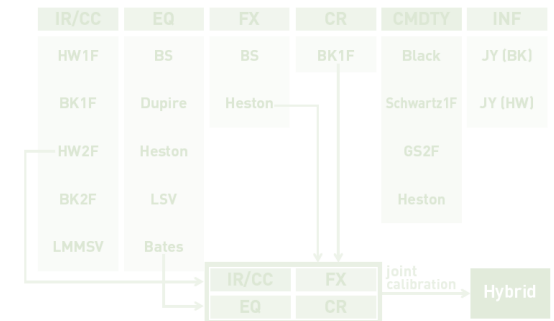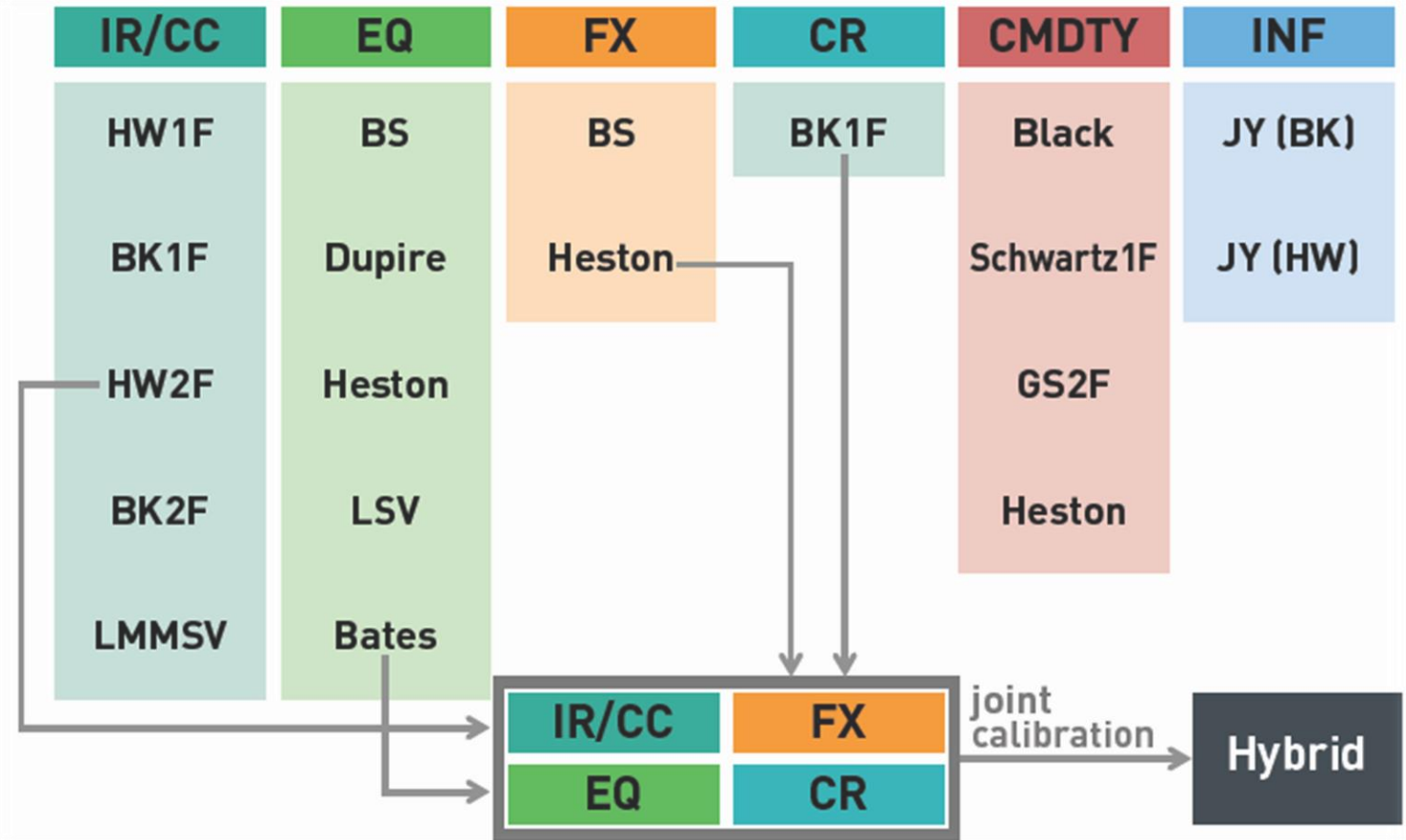
Transformación de la cultura de modelaje

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

Cultura de los Modelos

Gestión de Colaterales

Datos de mercado alternativos

CVA y sus impactos no tan obvios

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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

Gestión de Colaterales
CVA y sus impactos Impactos no tan obvios

Personalizando el CSA
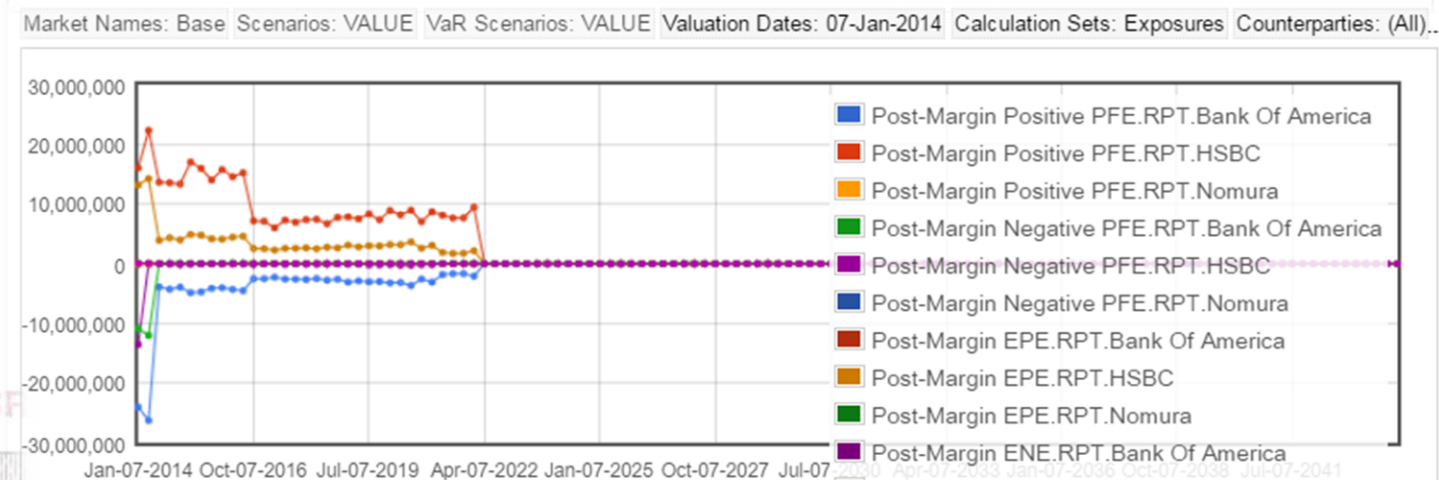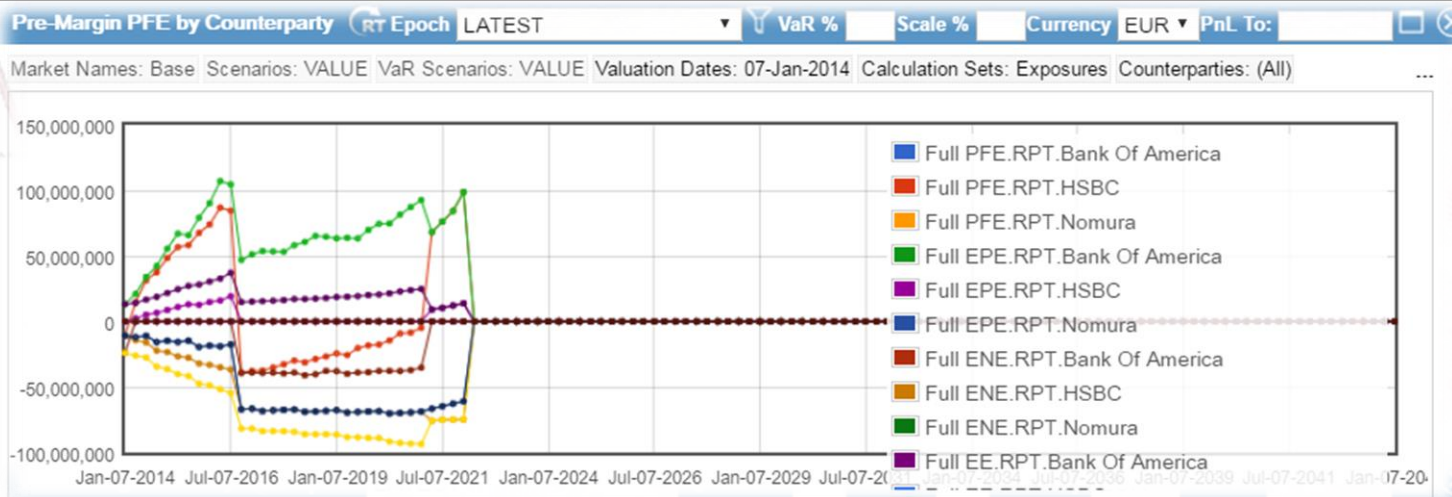
Probando la efectividad del CSA: Pre y Post-Margine
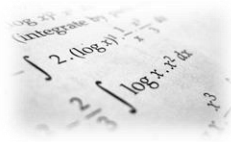
Cultura de los Modelos

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CVA y sus impactos no tan obvios
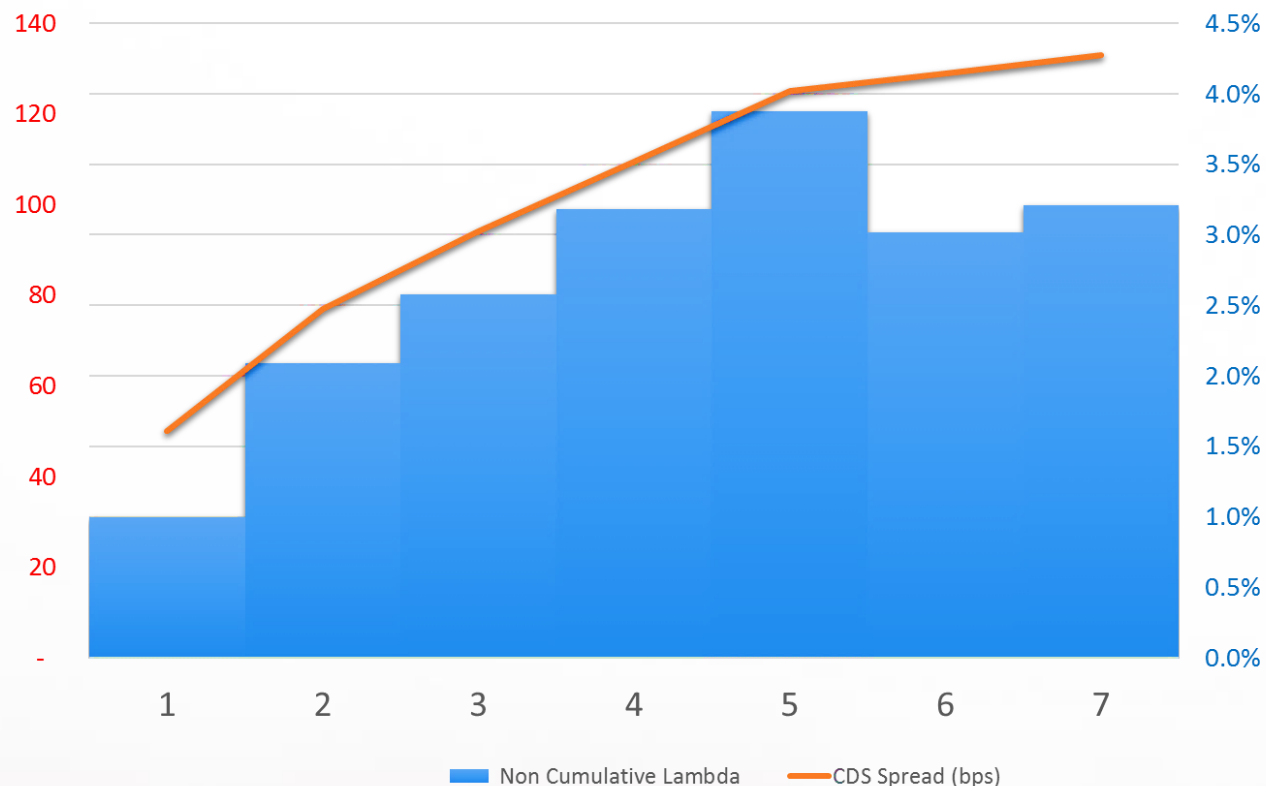
Bootstrapping de las Probabilidades de Default a partir de las curvas de CDS no es siempre posible debido a el gap de liquidez (incluso la inexistencia) en los mercados de LatAm.

Que tipo de modelo debemos elegido?

Data requirements	Advantages	Disadvantages
CDS curve (own or counterparty)	► Market observable ► Information is current (for counterparties with adequate CDS trading volume) ► Easy to source from third party data providers ► Exposure-specific data available for most banking counterparties	► Not available for many entities ► May not be representative of all the assets of the entity ► May have liquidity issues due to low trading volumes, resulting in higher-than-expected spreads and additional volatility in calculations ► CDS quotes may be indicative quotes, not necessarily reflective of actual trades
Current debt credit spread	► Market observable ► Available for some publicly traded debt instruments ► Easy to source from third party data providers	► May require an adjustment for illiquidity ► May require a judgemental adjustment due to maturity mismatch and amount of security of debt issuance and derivative to be valued
Sector-specific CDS Index or competitor CDS Curve	► Market-observable ► Information is current ► Easy to source from third party data providers ► Proxy CDS curve mapping is possible for almost all entities	► Not exposure-specific; may require judgemental adjustments to reflect differences between proxy and entity (e.g., size, credit rating, etc.) ► Index CDS curves can be influenced by macro-economic factors, which do not affect entity or affect entity to a lesser or greater extent
Debt issuance credit spread	► Market observable ► Information can be current, in case a recent issuance can be referenced (or where pricing terms are available ahead of debt issuance) ► Easy to source from third party data providers and/or from treasurer, through communications with the banks	► Information can be outdated and may require an adjustment for illiquidity ► As it is not always possible to reference a recent issuance, a judgemental adjustment may be required to bridge gap between debt issue date and derivative valuation date (i.e., financial reporting date) ► May require a judgemental adjustment due to maturity mismatch of debt issuance and derivative to be valued
Credit rating /historical default information (e.g. Moody's publication of Historic Probability of Default)	► Rating agency data available for most entities ► Easy to source from third party data providers	► Information can be outdated ► Conversion to PD may be based on historical information ► May require an adjustment from long-term average measure to a 'point-in-time' measure ► Not associated with a specific maturity; ratings are generally long term average estimates of creditworthiness, which may not be appropriate for short term derivatives
Internal credit risk analysis	► May be applied by most entities ► Ability to customise internal models	► Based on unobservable information ► Information can be outdated ► May not be consistent with what other market participants would use

Source: https://goo.gl/ZDecyh

El modelo mas conocido en el mundo de crédito minorista

$$ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m$$

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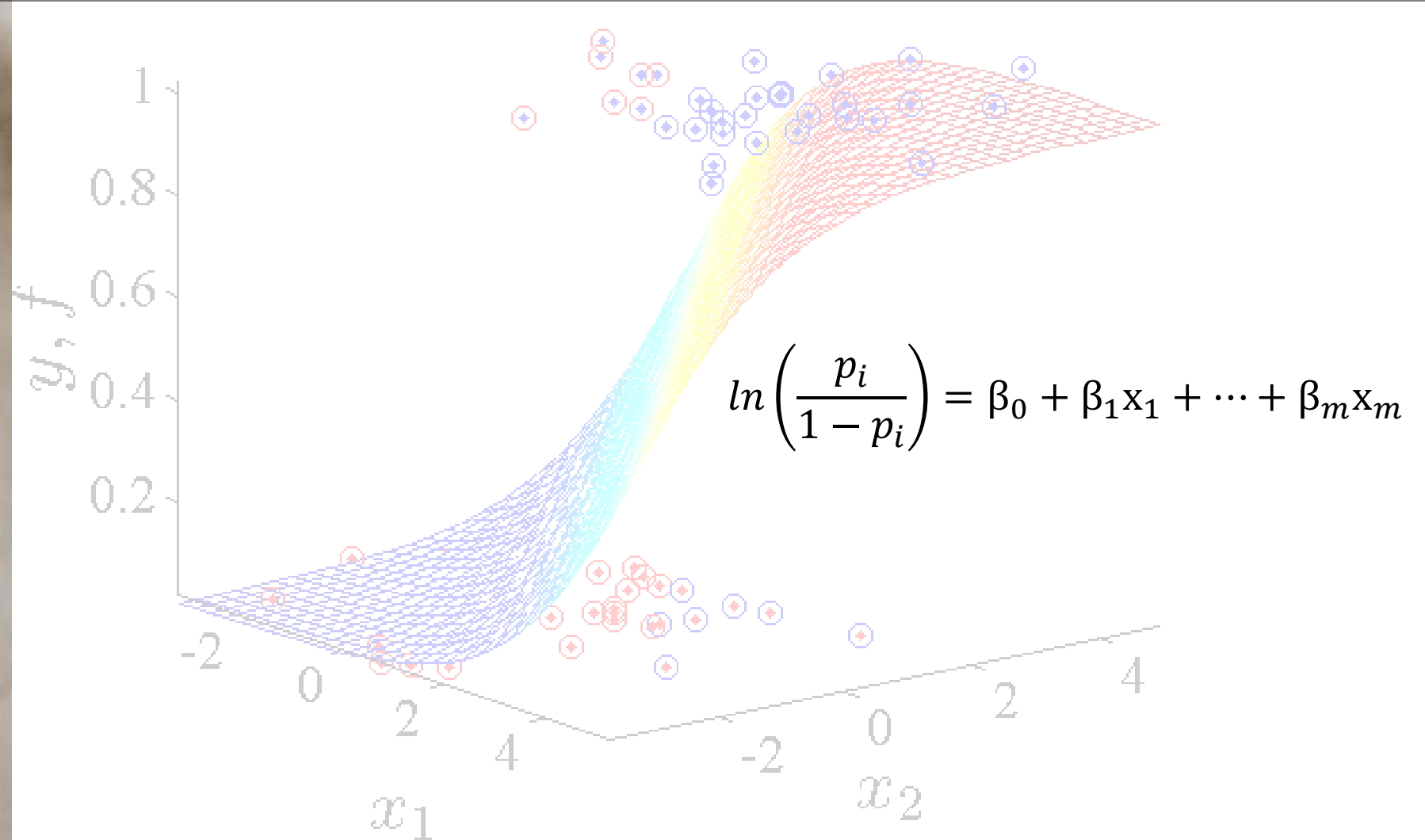
Datos de mercado alternativos
o nuevos retos en el modelaje?

Diferencia entre las fuentes de datos de crédito.

A. Historical- and market-implied PDs compared

Moody's grade	Five-year PD (%)	Selected credits	CDS-implied five-year PD (%)
Aaa	0.0029	Exxon Mobil	0.40
		Johnson & Johnson	1.77
		Microsoft	0.35
Aa3	0.142	3M	0.18
		Coca-Cola	1.34
		Colgate-Palmolive	2.20
A2	0.467	Anheuser-Busch InBev	6.41
		Boeing	3.26
		BP	8.15
Baa1	1.10	21st Century Fox	3.39
		AbbVie	6.95
		Lockheed Martin	2.30

Source: Markit, Moody's Investors Service

Source: http://www.risk.net/derivatives/2450880/traders-shocked-712m-cva-loss-stanchart

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Impactos Obvios en el Negocio

Impactos no tan obvios

Market Risk
(MR)

Credit
Counterparty
Risk
(CCR)

Front-Office

Market Risk (MR)

Credit Counterparty Risk (CCR)

Front-Office

Consistencia entre los escenarios generados por los departamentos de riesgo de Mercado y contrapartida: **Motor de modelos centralizado.**

Consistencia entre los modelos de PD cuando hay una baja liquidez (o inexistencia) en el mercado de CDS.

CVA es Integración

Market Risk (MR)

Credit Counterparty Risk (CCR)

Front-Office
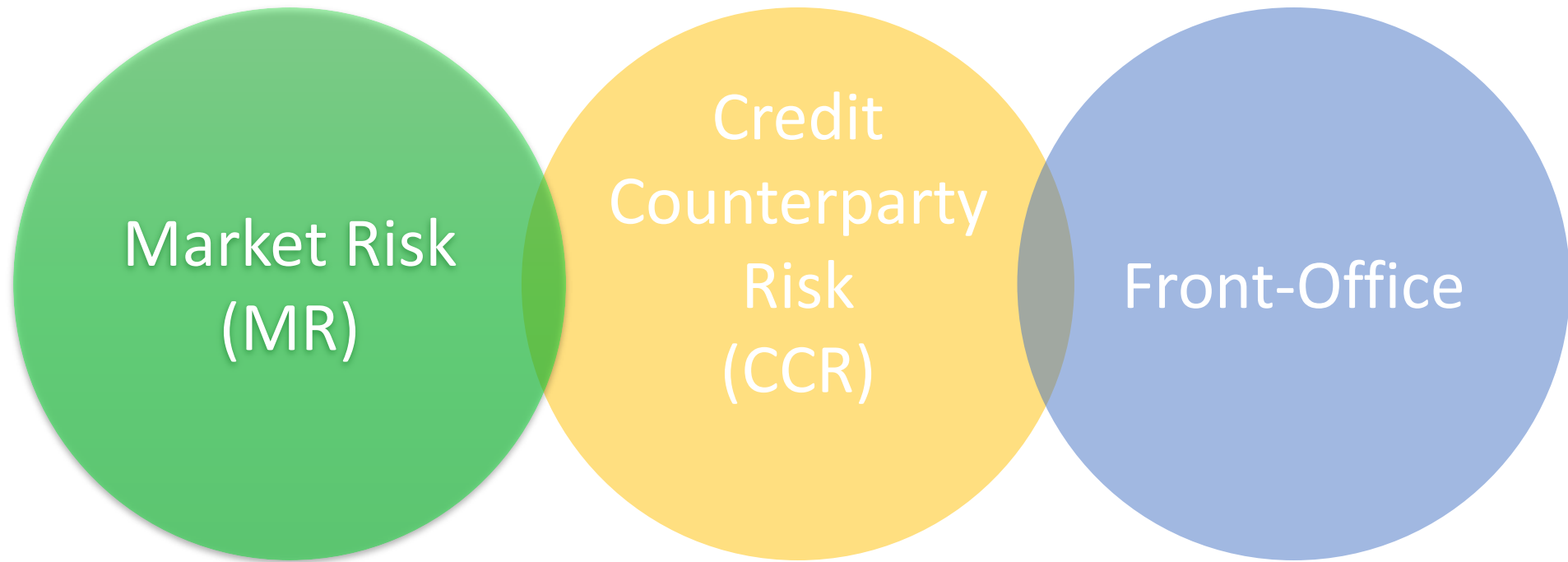
Consistencia entre los escenarios generados por los departamentos de riesgo de Mercado y contrapartida: **Motor de modelos centralizado.**

Consistencia entre los modelos de PD cuando hay una baja liquidez (o inexistencia) en el mercado de CDS.

Motor de Riesgos robusto para análisis *pre-trading* (What-if): PFE, VaR, XVAs.

Capacidad de analizar medidas de riesgo de contrapartida Pre y Post-margines .

CVA es Integración

"The scenarios have to be consistent across systems to build a counterparty view. This is a requirement which is much more stringent than what is generally specified in the design of a Front Office system used for pricing or a Risk system used to monitor the Profit and Loss (P&L) of a bank….

Basically what we need here is the same underlying models, or the same family of models, for all types of products. …

This consistency can be difficult to achieve , as often large financial companies have different systems to book and value, for example, interest-rate, equity, or FX products."

Market Risk (MR)

Credit Counterparty Risk (CCR)

Front-Office

CVA es Integración
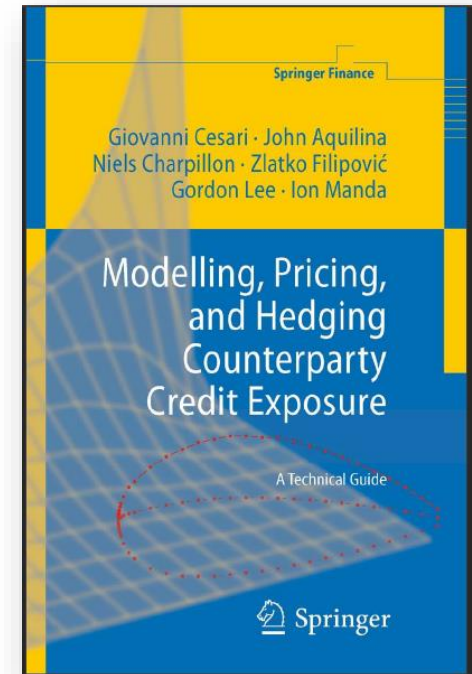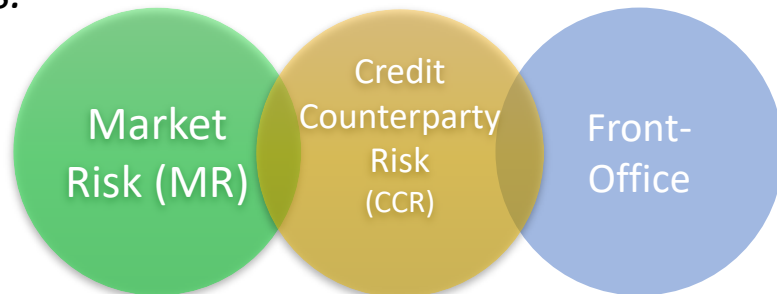
Counterparties

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_DI

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

Maturity: * 16-Apr-15 ... Date ▾

Number of Shares: * 37000

Currency: * USD

Market Risk (MR)

Credit Counterparty Risk (CCR)
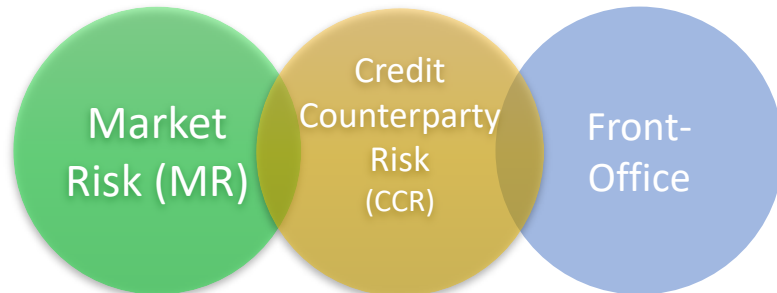
Front-Office

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CVA es Integración

Pivot View			RT 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).

■ *Measures*

■ 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
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

Market Risk (MR)

Credit Counterparty Risk (CCR)

Front-Office

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CVA es Integración
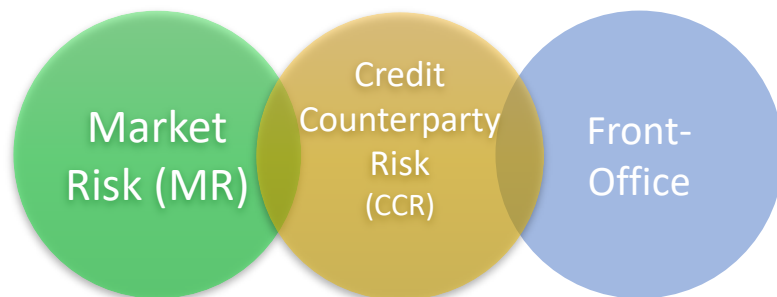
Eso es todo?

No, XVA will become the standard for derivative pricing

Pricing a Transaction with xVA

	Fees, etc		Additional profit
Capital	Prudent Valuation (AVA)	KVA	Profit to generate return on capital
	Leverage Ratio		
	CVA Capital Charge		
	CCR Capital Charge		
	Market risk		
Initial margin	Clearing mandate	MVA	Real costs
	CPSS-IOSCO rules		
Funding	NSFR	FVA	
	LCR		
	Economic funding		
Credit	IFRS 13 Accounting	CVA	
	Credit line utilisation		
	Credit provisioning		

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Planee con anticipación. Cva es **transformación**

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✓ *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

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