Break clauses and Derivatives Valuation

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- Mandatory break clause
  - Pre-defined stop point used for pre-hedge (forward-starting trades)
  - Pricing implications under mutli-curve environment
  - Bilateral CVA, Capital, PFE implications

- Optional break clause, usually bilateral
  - Bilateral right to terminate the transaction prior to maturity, governed by ISDA
  - This allows one party to force the unwinding of a transaction before the scheduled termination date, usually in response to credit concerns
  - Mainly used for long-dated rates, inflation OTCs
  - Pricing implications under mutli-curve environment
  - BCVA, Capital, PFE implications

- Other Additional Termination events
  - Rating downgrade driven
  - "Drop dead" close prior to CSA signing

- Repository data show high use of break clause for trades beyond 10y legal maturity: 85% for OTC inflation [NY Fed]
- Free exit option [RiskFeb2013]
- Strong tool to limit concentration [Italy OTC Early Termination]
- Efficient credit risk mitigant
  - Opportunity to initiate discussion with the client (restructuring, unwind...)
  - Way of ending margin call disputes
  - Way of releasing credit exposure lines, CVA, capital for uncollateralised long-dated trades that has gone ITM
- But it can become a double-hedge sword
  - Could trigger a counterparty default with knock-on effect on other trades/business lines
  - Could generate a jump in valuation leading to unexpected gains or losses

In Term Sheet

- Mutual Break Clause: Every 5 year

In the trade confirmation

- Optional Early Termination Provision
  - Optional Early Termination: Applicable
  - Option Style: Bermuda
- Procedure for Exercise:
  - Bermuda Option Exercise Dates: Five Exercise Business Days prior to each Cash Settlement Payment Date
  - Expiration Date: Five Exercise Business Days prior to the last Cash Settlement Payment Date
  - Multiple Exercise: Inapplicable
  - Partial Exercise: Inapplicable
- Settlement Terms:
  - Cash Settlement: Applicable
  - Cash Settlement Payment Date: 23 September 2018, and every 5 years thereafter
  - **Cash Settlement Method: Cash Price**
  - Quotation Rate: Mid

- Defined in the confirmation or in the ISDA Close-Out Protocol [ISDA2009]

Cash Price (ISDA 2000 to 2006 definitions)

“Notwithstanding the provisions of Section 6(e) of the ISDA Master Agreement and the definition of "Close-out Amount", the Calculation Agent will determine the Cash Settlement Amount on the basis of quotations (either firm or indicative) for a **replacement transaction** supplied by Cash Settlement Reference Banks (but the Calculation Agent may not take into account any loss or cost incurred by a party in connection with its terminating, liquidating or re-establishing any hedge related to the Relevant Swap Transaction (or any gain resulting from any of them)). The Calculation Agent will ask each Cash Settlement Reference Bank to provide a quotation using the Quotation Rate specified in the related Confirmation. In providing quotations, the Cash Settlement Reference Banks will be asked to **assume that the Calculation Agent is a dealer in the relevant market of the highest credit standing** which satisfies all the credit criteria which such Cash Settlement Reference Banks apply generally at the time in deciding whether to offer or make an extension of credit, and **no account will be taken of any existing Credit Support Document**. Notwithstanding the provisions of Section 6(e) of the ISDA Master Agreement and the definition of "Close-out Amount", if fewer than three quotations are provided, the Cash Settlement Amount will be determined by the Calculation Agent in good faith and using commercially reasonable procedures."”

Default Close-Out Amount (ISDA 2002)

“In determining the Close-out Amount, the Determining Party may consider any relevant information, including, without limitation, one or more of the following types of information: (i) quotations (either firm or indicative) for replacement transactions supplied by one or more third parties that **may take into account the creditworthiness of the Determining Party** at the time the quotation is provided and the terms of any relevant documentation, **including credit support documentation**, between the Determining Party and the third party providing the quotation;”

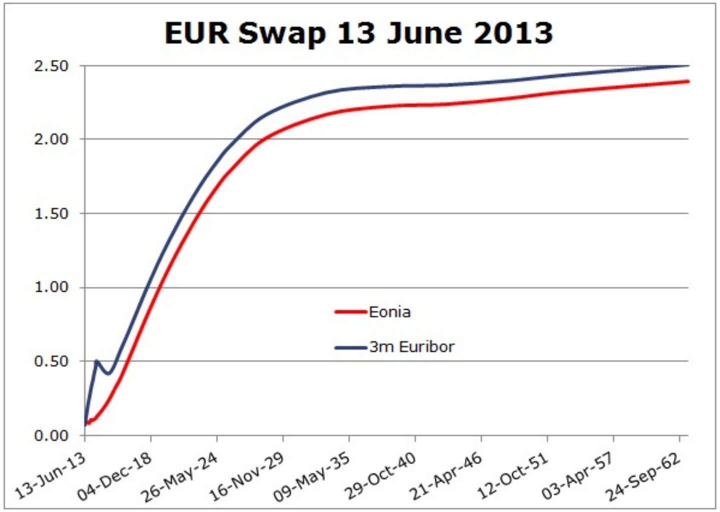
- Cash Price Settlement Method for exercised break clause: mid market quotations from Reference Banks where no account will be taken of any existing Credit Support Document or the creditworthiness of either party

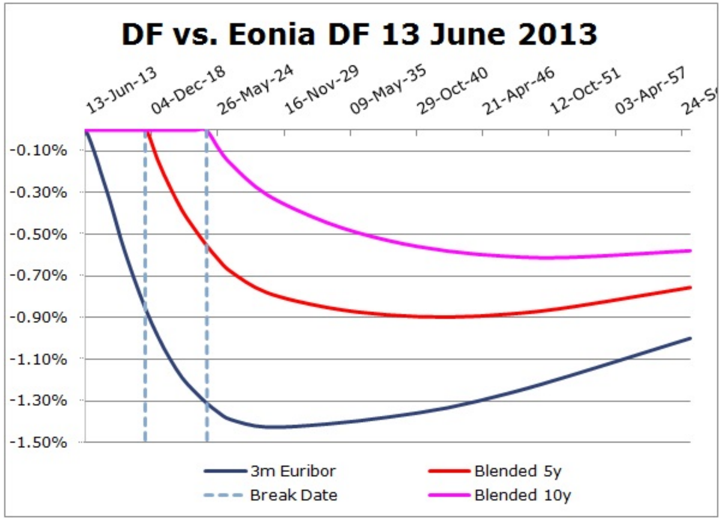
- If no agreement on the unwind amount, average of 3 quotes on a panel up to 5 excluding extremes

- Potential valuation discrepancies in practice [RiskMarch2012]

Valuation at Close-Outs	CVA	DVA	FVA	Risky Interbank
Break	No	No	No	No
CCP Clearing	No	No	No	Yes
Trade Compression	No	No	No	Yes
Unwind	No	No	Yes	Yes
Assignment and Novation	Yes	Yes	Yes	Yes
Default Close Out (replacement)	No	Yes	No	No

- In case of mutual break, assuming optimal behaviour, the transaction will terminate at the next break $b < T$
- In accounting term, valuation with a blended discounted curve at the break date b assuming termination:
  - $t < b, DF_t = 1dcurveDF_b$
  - $t >= b, DF_t = 1dcurveDF_b * \frac{3mCurveDF_t}{3mCurveDF_b}$





- Break Clause is an intermediary case between risky Libor (implying OIS discounting) and riskfree Libor (allowing Libor discounting)

$$Swap(t,T_\alpha,T_\beta,K)=\mathbb{E}\left[\sum_{i=\alpha}^{\beta}D(t,T_i).\alpha_i.L(t;T_{i-1},T_i)-K)|t\right]$$

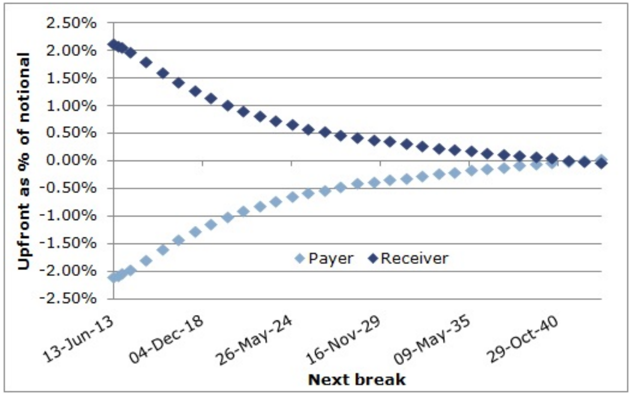
$$=\sum_{i=\alpha}^{\beta}\underbrace{P(t,T_i)}_{RiskfreeBond}\ .\ \underbrace{R_i(t)}_{\mathbb{E}[L(T_{i-1},T_i)]}.\alpha_i-K.\sum_{i=\alpha}^{\beta}P(t,T_i).\alpha_i$$

$$=\sum_{i=\alpha}^{b}P(t,T_i).\alpha_i.R_i(t)+\sum_{i=b+1}^{\beta}P(t,T_i).\alpha_i.R_i(t)-K.\sum_{i=\alpha}^{\beta}P(t,T_i).\alpha_i$$

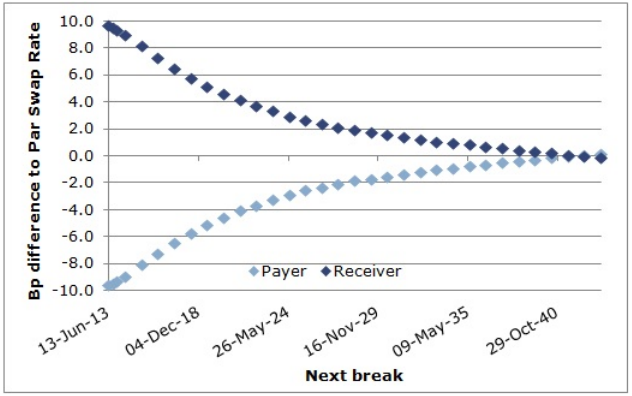
$$=\underbrace{\sum_{i=\alpha}^{b}P(t,T_i).\alpha_i.R_i(t)-K.\sum_{i=\alpha}^{b}P(t,T_i).\alpha_i}_{Swap_{dualcurve}(t,T_\alpha,T_b,K)}+\underbrace{P(t,T_{b+1})-P(t,T_\beta)-K.\sum_{i=b+1}^{\beta}P(t,T_i).\alpha_i}_{Swap_{unicurve}(t,T_b,T_\beta,K)}$$

- Deterministic break introduces valuation difference higher than bid-offer spread

30y IRS EUR valuation jump

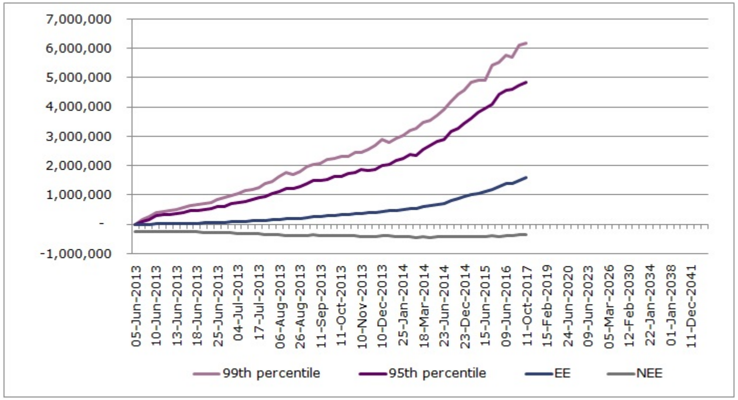


30y IRS EUR initial par rate

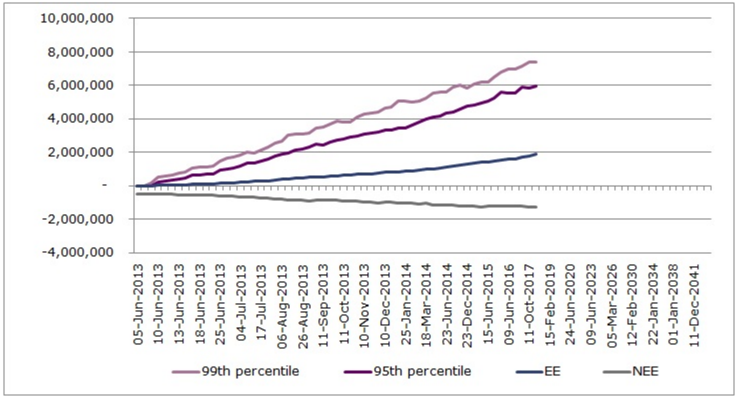


- No valuation impact if the trade is uncollateralised
- Could create valuation discrepancies if the break is a fixed boundary condition
- Option value to be reserved
- Break clauses generate OIS basis risk that needs to be managed
- Would potentially make similar trades under the same netting set priced with a different DF
- Complicate pricing for free boundaries products (callable, autocallable)

Long-dated single currency trade with intermediary cashflow



Long-dated trade with final fx risk on notional exchange



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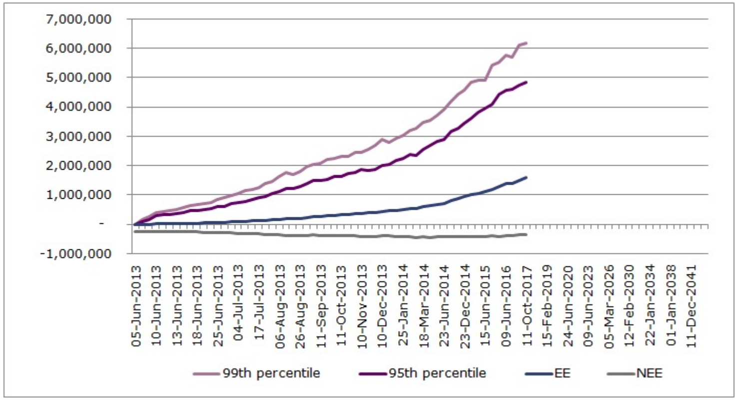

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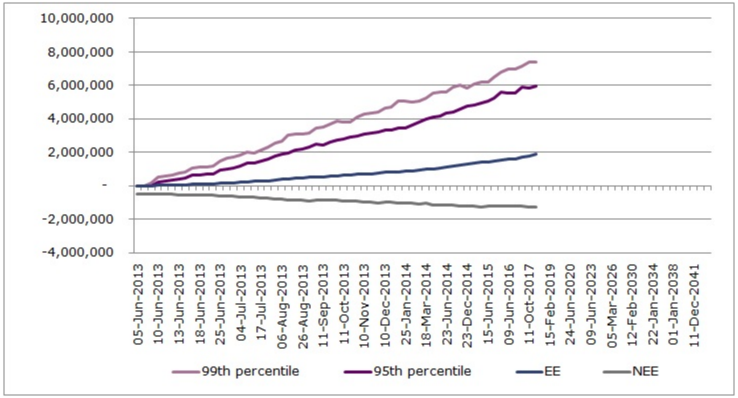

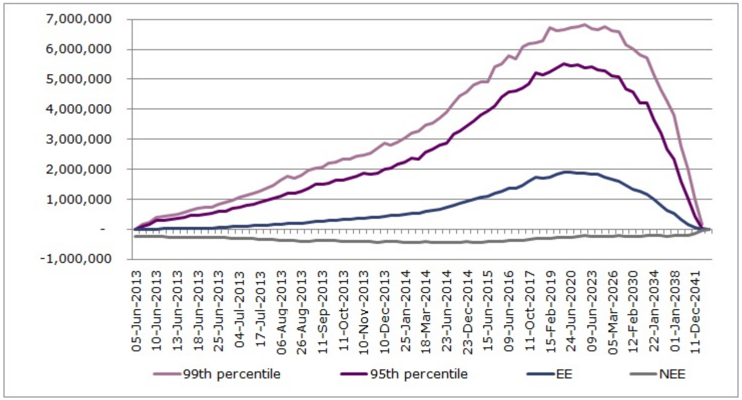

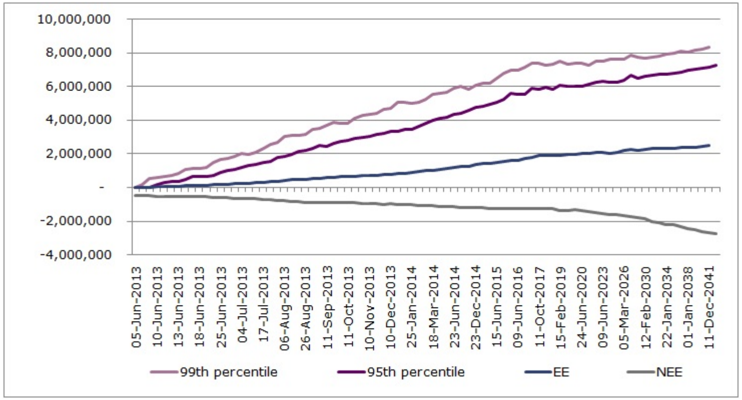

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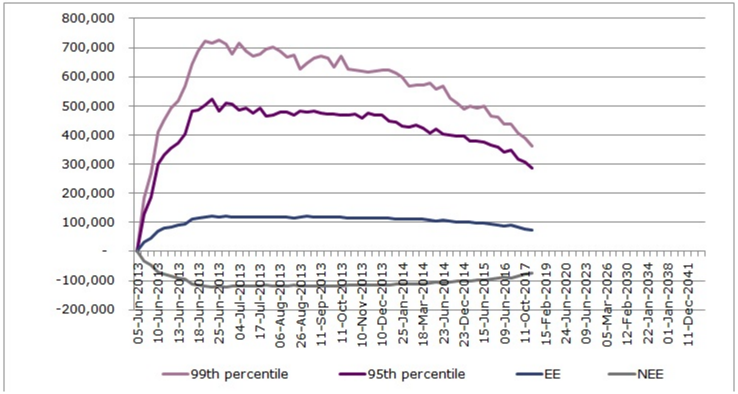
Long-dated single currency trade with intermediary cashflow



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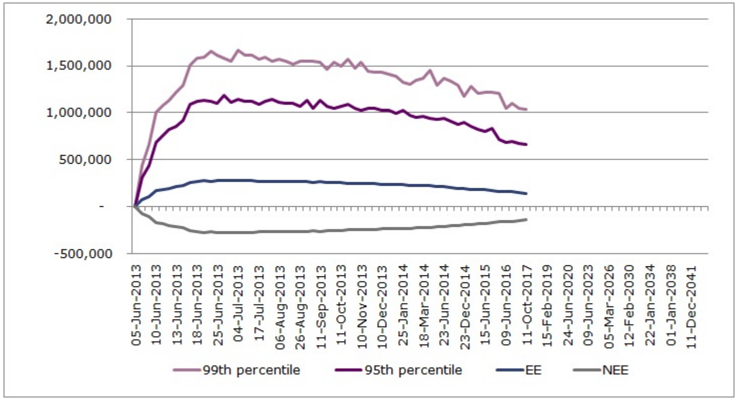

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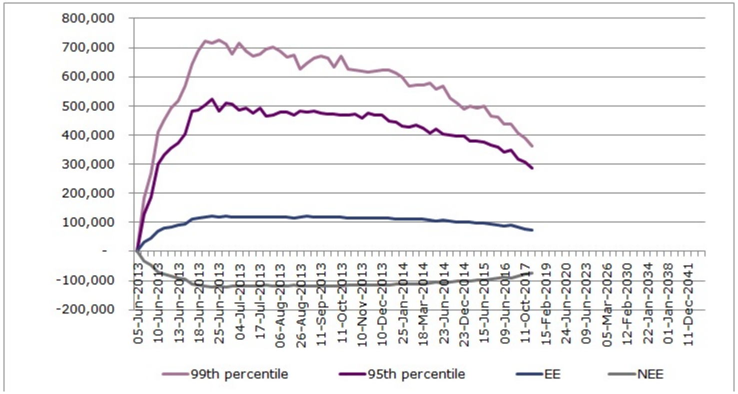

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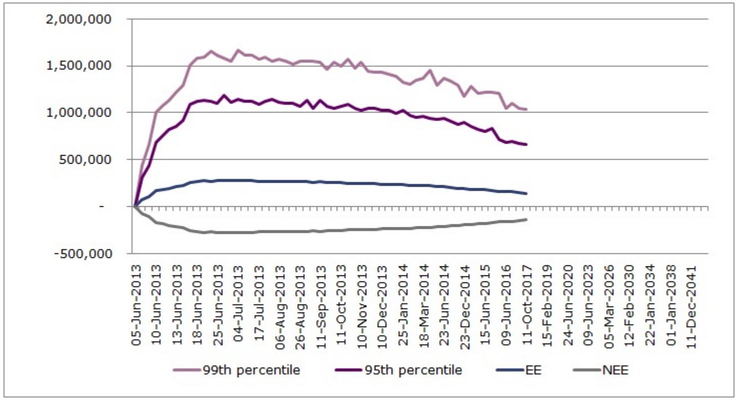
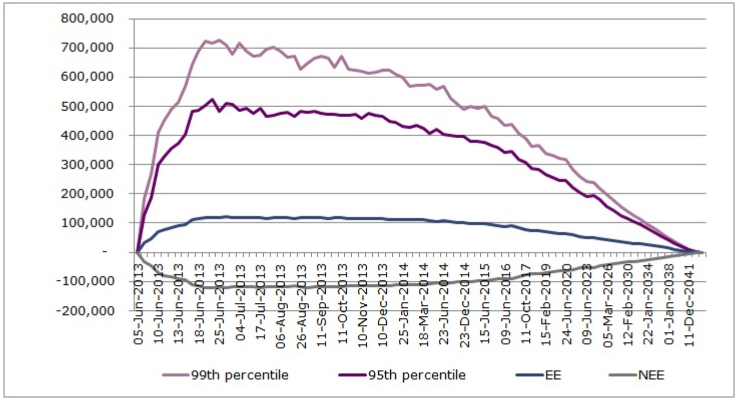
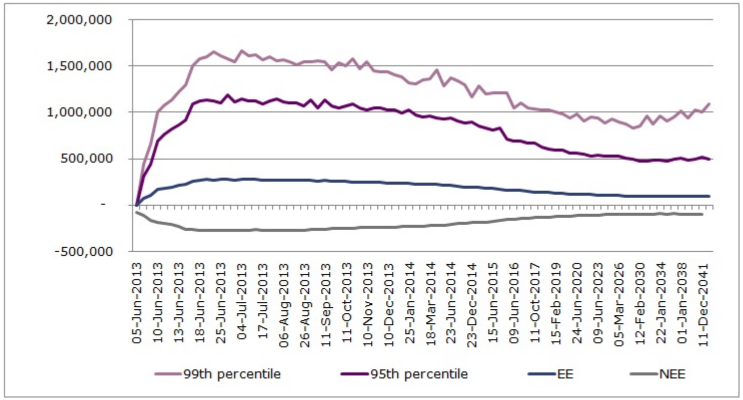






- In case of mandatory break or mutual break, assuming optimal behaviour, the transaction will terminate at $Min(b, \tau_{Corporate}, \tau_{Bank})$
- $b < T$, the next break before maturity
- $\tau_{Corporate}$, the default time of the *Corporate*
- τ_{Bank}, the default time of the *Bank*

$$V_{Bank}^{Corporate}(t) = V_{Bank}^{riskfree}(t) - BCVA_{Bank}(t, b) + BDVA_{Bank}(t, b) \tag{1}$$

$$BCVA_{Bank}(t, T) = \mathbb{E}\left[LGD_{Corporate}.D(t, \tau_{Corporate}).\mathbb{1}_{Corporate}(t, T).Max[0, V_{Bank}^{riskfree}(\tau_{Corporate})]|t\right]$$

$$BDVA_{Bank}(t, T) = \mathbb{E}\left[LGD_{Bank}.D(t, \tau_{Bank}).\mathbb{1}_{Bank}(t, T).Min[0, V_{Bank}^{riskfree}(\tau_{Bank})]|t\right]$$

$$\mathbb{1}_{Corporate}(t, T) = \mathbb{1}_{t < \tau_{Corporate} < min(\tau_{Bank}, T)}$$

- In case of unilateral break, additional terms in (1): an option on *BCVA*, a CCCDS

$$V^{Corporate}_{Bank}(t) = V^{riskfree}_{Bank}(t) - BCVA_{Bank}(t,b) + BDVA_{Bank}(t,b) + UBC(t,b) \quad (2)$$

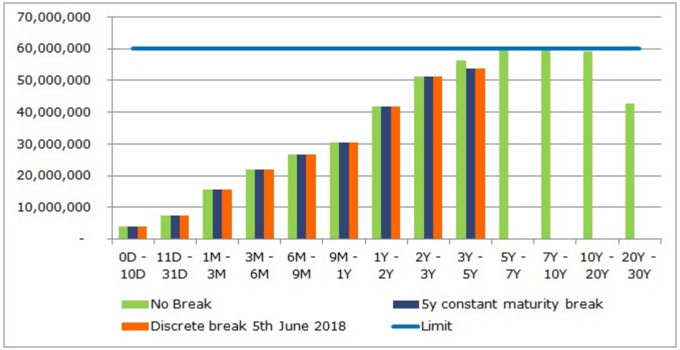
$$UBC(t,b) = \mathbb{E}\left[\mathbb{1}_{\tau>b}.D(t,b).Max[0, V^{Corporate}_{Bank}(b) - V^{riskfree}_{Bank}(b)]\right]$$

$$UBC(t,b) = \mathbb{E}\left[\mathbb{1}_{\tau>b}.D(t,b).Max[0, BCVA_{Bank}(t,b) - BDVA_{Bank}(t,b)]\right]$$

- Theoretically a dealer could offer a better strike since the counterparty sells him an option to exit at risk-free
- Prudent practice would be to reserve the value of this option until the trade is terminated
- Mandatory Break Clause taken into account in CVA but no clear market practice for optional break clause [ErnstYoung Survey 2012]

- Tenor and peak PFE mitigants: if the break is exercised by Credit Risk Department, it could prevent building too large exposure
- Constant maturity for exposure limit management vs. constant date for valuation
- Enforceability to be checked against risk criteria: law governing the ISDA, jurisdiction...
- Break-Clause, an option for OTC trades, ineffective for trades cleared through CCPs.

At start date (5th June 2013)



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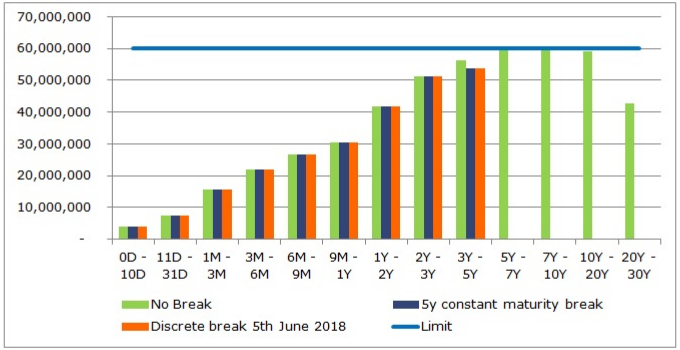
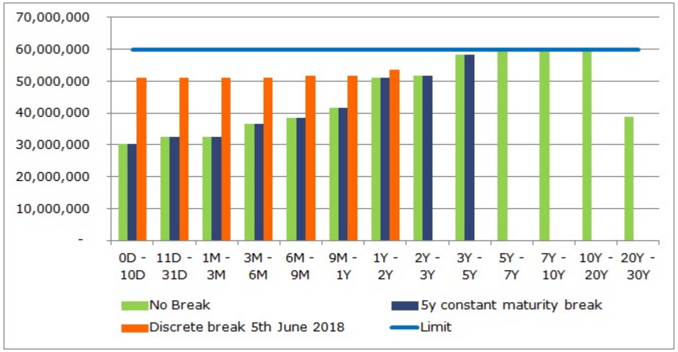


At start date + 3y (5th June 2016)



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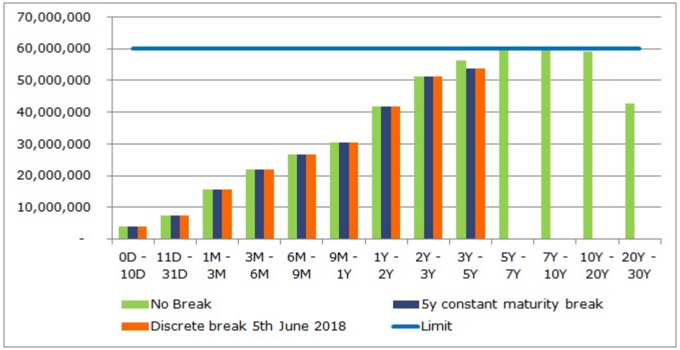
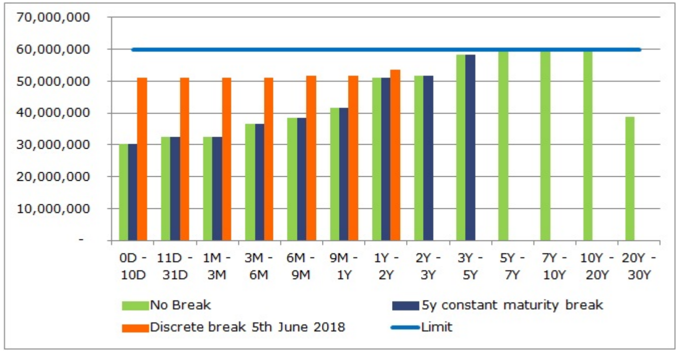
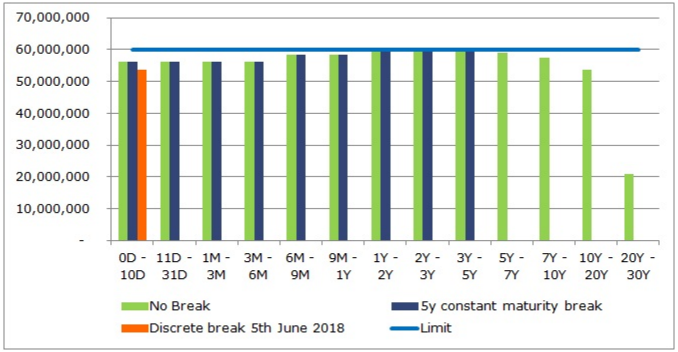


At start date + 3y (5th June 2016)



At break date - 1day (4th June 2018)



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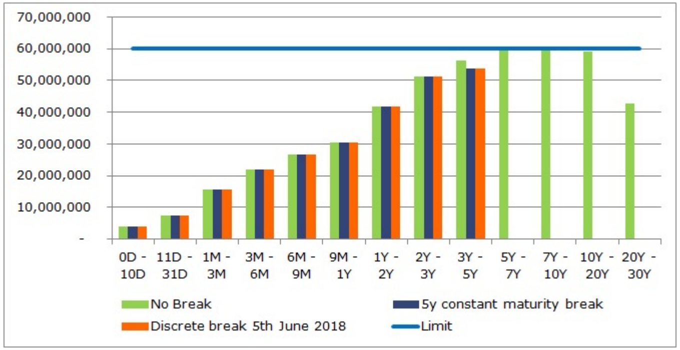
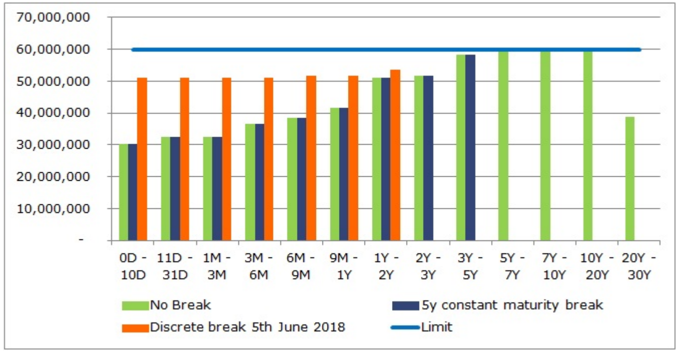
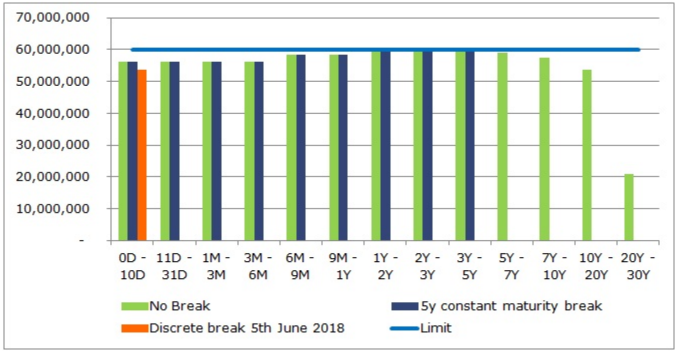
At start date (5th June 2013)



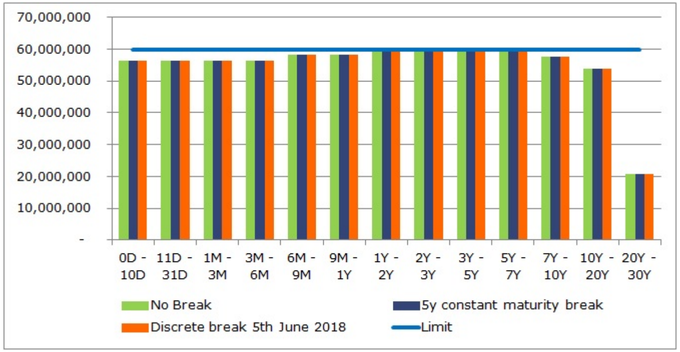
At start date + 3y (5th June 2016)



At break date - 1day (4th June 2018)



At break date + 1day (6th June 2018)



- Bilateral optional break-clause would lead to termination on first break date if only economic considerations
- Practically the option is probably unilateral in favor the calculation agent: need to compute complex quantities: $V_X^{riskfreeLibor}(b)$ and $BCVA_X(b, T)$
- Key considerations leading to non-optimal exercise:
  - Client relationship
  - Netting set impact: will the break reduce credit risk? market risk?
  - Decision process and governance policy
- Exercise boundary certainly not 0
- Break exercises are last resort action

Business Line	Decision criteria to break at $b < T$
Trading Desk	$V_{Bank}^{riskfreeLibor}(b) > V_{Bank}^{riskyLibor}(b)$
CVA Desk	$BCVA_{Bank}(b, T) > BDVA_{Bank}(b, T)$
Central Treasury	$FVA_{Bank}(b, T) > 0$
Credit Risk	$V_{Bank}^{riskfree}(t) > 0$
Exposure Management	$PFE_{Bank}(b, T) > 0$
Market Risk	Is break risk reducing?
Sales	Cross-selling and future trades

- Multiple and potentially conflicting criteria call for a clear governance policy that needs to be:
  - Transparent
  - Defines information and decision process across Business lines
  - Flexible enough to handle quick resolution

- Like economic call, break-clauses carry potential operational risk

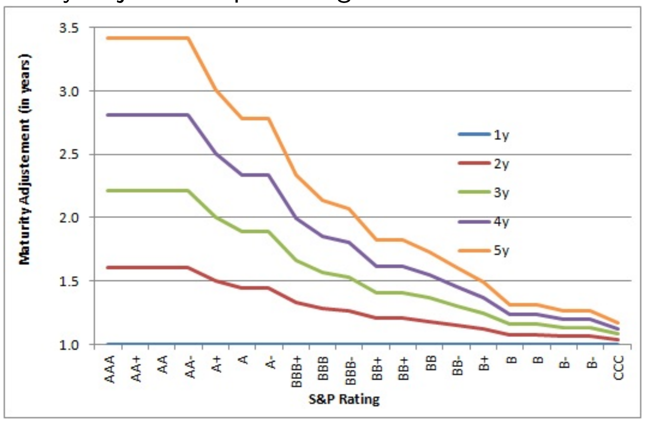
Basel II for Internal Model Method

$$RegulatoryCapital = EAD * LGD * MA * \mathcal{N}\left(\frac{\mathcal{N}^{-1}(PD)+\sqrt{\rho}*\mathcal{N}^{-1}(99.9\%)}{\sqrt{1-\rho}} - PD\right)$$

- $EAD = Alpha * EEPE$ with EEPE, the weighted average over the first year of the non-decreasing Expected Exposure
- Maturity Adjustement: $MA = \frac{1+(EM-2.5)*b}{1-1.5*b}$ with $b = (0.11852 - 0.05478 * \ln(PD))^2$
- EM, the Effective Maturity is the weighted average maturity of the portfolio

  $EM = Min\left(\frac{\sum_{t=0}^{1y} EEE_t.L_t.df_t + \sum_{t=1y}^{T} EE_t.L_t.df_t}{\sum_{t=0}^{1y} EEE_t.L_t.df_t}, 5\right)$ with $L_t = \frac{Date_t - Date_{t-1}}{Min(T,1y)}$, T, longest maturity in the netting set
- PD is floored at 0.03% and EM is capped at 5y

Maturity Adjustment per rating as % of effective maturity



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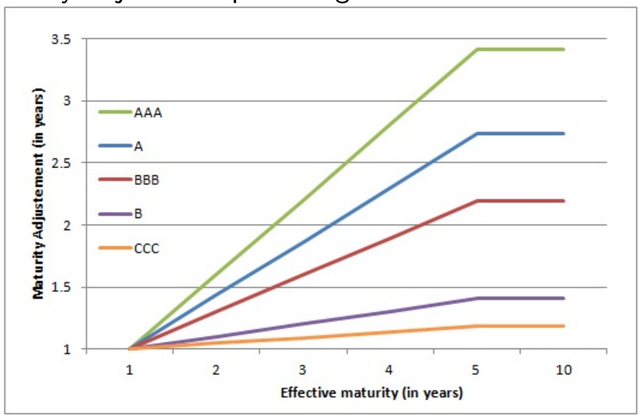
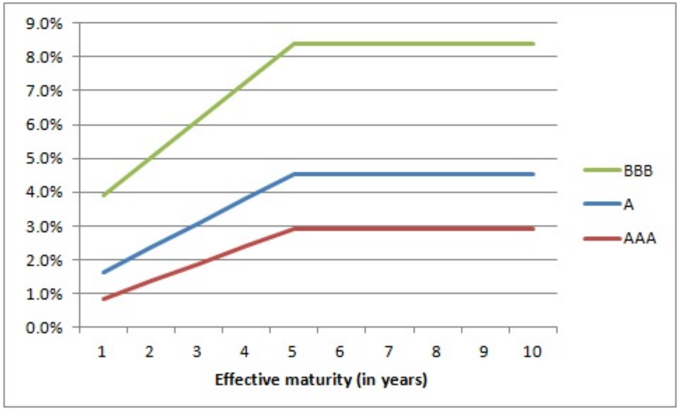
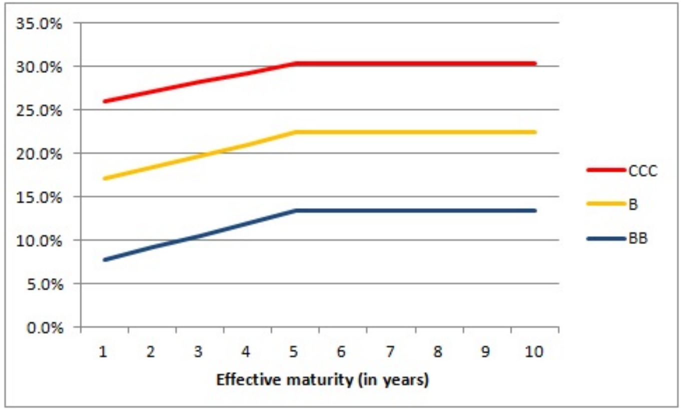


- Most impact for non-CSA counterparties with long-dated trades but limited impact because of:
  - Sensitivity of Maturity Adjustment to Effective Maturity is lower for counterparties that attract high capital (the low-rated)
  - Effective Maturity capped at 5y and PD floored at 0.03 percent p.75 (Basel II: Fist Pillar - Minimum Capital Requirements p.67 and p.75 [bcbs])
  - Impact on Economic Capital and therefore profitability metrics could be higher depending on the internal rules used
- Illustration using Standard and Poors probability of default [2012 Annual Global Corporate Default Study And Rating Transitions], $LGD = 60\%$

Regulatory Capital as % of EAD for high rating



Regulatory Capital as % of EAD for low rating



Standardised CVA Risk Capital Charge [bcbs]

$$2.33\sqrt{h}\sqrt{\left(\sum_n 0.5W_n\left(M_n EAD_n^{total} - M_n^{hedge}B_n^{hedge}\right) - \sum_{index} W_{index}M_{index}B_{index}\right)^2 + \sum_n 0.75W_n^2\left(M_n EAD_n^{total} - M_n^{hedge}B_n^{hedge}\right)^2}$$

- $h = 1$ i.e. One year risk horizon
- EAD_n^{total}, the Exposure At Default of counterparty n (summed across its netting pools), discounted by multiplying by $\frac{1-e^{-5\% M_n}}{5\% M_n}$
- M_n, the effective maturity of the transactions with counterparty n, **not capped**.
- M_n^{hedge}, the maturity of the hedge instrument with notional B_n^{hedge}. $M_n^{hedge}B_n^{hedge}$ is summed across all the hedge positions
- M_{index}, the notional-weighted average maturity of the index hedges
- B_{index}, the fulll notional of the CDS on index used to hedge, discounted by multiplying by $\frac{1-e^{-5\% M_{index}}}{5\% M_{index}}$
- W_{index}, the weight applicable to CDS on index hedges mapped to one of the 7 W_n in the table below based on the average spread of index *index*
- W_n, the weight applicable to counterparty n based on its rating according to the table below

S&P Rating	W_n
AAA	0.7%
AA	0.7%
A	0.8%
BBB	1.0%
BB	2.0%
B	3.0%
CCC	10.0%

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Basel Advanced CVA Formula [bcbs]

$$CVACharge = 3 * \left(CVA10dayLoss_{99\%}^{1ycurrent} + CVA10dayLoss_{99\%}^{1ystressed} \right)$$

$$CVA_n(t_0, t_T) = LGD_n * \sum_{i=1}^{T} Max \left(0; e^{-\frac{S_{i-1}^n * t_{i-1}}{LGD_n}} - e^{-\frac{S_i^n * t_i}{LGD_n}} \right) * \left(\frac{EE_{i-1}^n * D_{i-1} + EE_i^n * D_i}{2} \right)$$

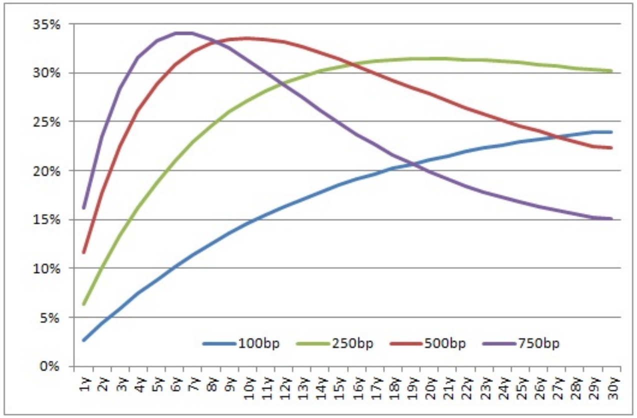
- $CVA_n(t_0, t_T)$, the CVA of counterparty n i.e the difference between the value at t_0 of default risk-free derivatives positions and risky derivatives positions with the same maximum maturity date t_T. $CVA_n(t,T) \equiv V(t,T) - \tilde{V}(t,T)$
- LGD_n, the Loss Given Default of the counterparty n based on the credit spread of a market instrument of the counterparty (Bond,CDS)
- t_i, the time of the i-th revaluation time-point, starting from $t_0 = 0$
- t_T, the longest contractual maturity across the netting pool
- S_i^n, the credit spread of the counterparty n at tenor t_i
- EE_i^n, the Expected Exposure of counterparty n at revaluation time-point t_i. EE_i^n of different netting pools are added
- D_i, the default risk-free discount factor at tenor t_i, starting with $D_0 = 1$

CRD IV exemptions [Risk28June2013]

- Corporates
- Sovereigns
- Pension schemes
- Intragroup entities

- Potential impact on unilateral CVA capital charge bigger than BCVA magnified by the factor 3 but exemptions would strongly reduce impacts
- Regulatory CS01: $1bp.t_i.e^{-\frac{S_i^n.t_i}{LGD_n}}.\left(\frac{EE_{i-1}^n.D_{i-1}-EE_{i+1}^n.D_{i+1}}{2}\right)$
- CVA Charge proxy assuming flat EE and flat credit spread curve S: $3.(10dShock_{Stressed}^{99\%}+10dShock_{lastyear}^{99\%}).T.EE.D_T.e^{-\frac{S.T}{LGD}}$
- Numerical illustration assuming $10dShock_{Stressed}^{99\%}=10dShock_{lastyear}^{99\%}=30\%$ relative credit spread shock, $LGD=60\%$, CDS curve flat
- Strange behavior for high spread compared to LGD due to max reached at $T=\frac{LGD}{S}$ i.e. 12y for $S=5\%$ and $LGD=60\%$

CVA capital charge in % of EE as a function of maturity T



- Multiple interpretations [Risk3March2012]

- Basel Committee on Banking Supervision (BCBS)
  Basel II: Revised International Capital Framework. June 2006. Available at bis.org
  Basel III: A global regulatory framework for more resilient banks and banking systems - revised version June 2011, *"II. Risk Coverage, A. Counterparty credit risk", p. 29-44*. Available at bis.org

- L. Giada, C. Nordio, 2013, Breaking break clauses
  Risk April 2013, pages 66-70 available in April 2013 Risk Magazine

- February 2013, Deloitte, Counterparty Risk and CVA Survey, Current market practice around counterparty risk regulation, CVA management and Funding, p.30 risk mitigants accounted in the payoff
  Available at deloitte.com

- Ernst & Young. Reflecting credit in the fair value of financial instruments. A survey
  Available at ey.com

- International Swap and Derivatives Association, 2009, ISDA close-out amount protocol
  27 February 2009, available at isda.org

- 21 March 2012, Financial Times, Morgan Stanley in EUR2.57bn Italy payout
  Available at ft.com

- October 2012, Federal Reserve Bank of New York, Staff Reports, An analysis of OTC Interest Rate Derivatives Transactions: Implications for Public Reporting, p.8
  Available at newyorkfed.org

- Risk, September 2011, CVA's cousin: Dealers try to value early termination clauses
  Available at September 2011 Risk Magazine

- Risk, March 2012, Dealers call for revised language on break clause close-outs
  Risk March 2012, available in March 2012 Risk Magazine
- Risk, March 2012, Banks tout break clauses as capital mitigant
  Available at March 2012 Risk Magazine
- Risk, February 2013, UBS fixed-income exit highlights difficulties of unwinding
  Risk February 2013, available in February 2013 Risk Magazine
- Risk, July 2013, The CVA helter skelter: European supervisors could quash exemptions
  Available at July 2013 Risk Magazine
- Average One-Year Global Corporate Default Rates By Rating Modifier
  Available at standardandpoors.com