Agenda

- Derivatives and funding risk
- Funding value adjustment
- Derivatives funding policy
  - Appendices
  - Glossary
  - Bibliography
  - References

Please read and note the DISCLAIMER stated at the end of the presentation.
EPE and ENE – and EE

- Derivative cash flows are most definitely NOT “off balance sheet”…
- …they need to be funded exactly like cash assets and liabilities
- For dealer banks, this factor is critical to valuation
- For every bank transacting in derivatives, this factor is still important because it influences how the cash flows are treated
  - Derivative liabilities correspond to what is termed an overall expected negative exposure (ENE), the most basic example of which is a deposit.
  - A derivative asset corresponds to an overall expected positive exposure or EPE and at its simplest would be a loan.
- At the aggregate portfolio level there will be a net position – lets call it expected exposure (EE) in each time bucket from o/n to $T$, with $T$ being the maturity of the longest-dated transaction in the book.
- This results in a cashflow position that is similar to the ALM profile of a cash book. One can easily draw this oneself!
CVA calculation

❖ We won’t discuss counterparty value adjustment (CVA) today.

❖ But just FYI, and to show relationships…

❖ Following existing literature (see References) we can set:

❖ CVA = EPE (or EE) x PD x LGD
❖ CVA = EE x Counterparty Credit Spread
❖ Incidentally
❖ DVA = FNE x Your Credit Spread
❖ And FVA = EE x Your Funding Spread

❖ In essence then, it’s the discounted value of the portfolio adjusted for counterparty default probability and recovery rate…

❖ Discounted EE is difficult to calculate beyond the contractual maturity at portfolio level. Generally done via a Monte Carlo simulation for each time bucket
Funding value adjustment (FVA)
FVA rationale as per CVA...

- Pre-crash, with unlimited liquidity, banks borrowed to fund collateral in short-term at Libor-flat or sub-Libor
- This borrowing cost could be expected to be offset by interest received on collateral posted
- So banks disregarded collateral and funding costs when reporting P&L
- Post-crash, this has changed (see Libor-OIS chart 2002-2010…)
  - Funding levels become material
  - Short-dated funding becomes risky
  - Collateral received becomes a funding source for the bank
Sidebar: CSA

- The CSA annexe to ISDA describes the T&C of each bilateral contract.
- The CSA can be one-way or two-way...
- ...and the amount of collateral posted can be:
  - Less (threshold)
  - The same
  - More (Independent Amount)
  - Of the m-t-m exposure
- CSA collateral is to remove counterparty credit risk, but it also influences the bank’s funding costs, viz.,
  - Borrowing collateral in interbank and receiving CSA rate on it (the OIS rate) has a cost as bank’s COF will be higher than OIS
  - Paying the OIS rate on collateral received, but using this posting to reduce the bank’s borrowing (funding) requirement is a potential benefit.
FVA principles

The funding rate to use in FVA is key to the whole concept

Under the Black-Scholes developed concept of risk-neutral pricing...

- The derivative valuation is based on the concept of establishing a riskless hedge for the transaction
- Funds used to set up the riskless hedge is borrowed
- In line with the concept of dynamic hedging, assuming collateral is continuously adjusted to match the CSA exposure (no threshold 2-way CSA), the amount of collateral required will match what is needed to fund the riskless hedge
- Given this, the CSA rate (assume OIS) is what should be used in valuation

However, the bank will be running a net +ve or –ve collateral funding requirement in reality, and this will be funded at COF

Consider FVA to be “the difference between portfolio value under the actual collateral agreement, and portfolio value under CSA discounting and the ‘perfect’ collateral agreement” (Sokol, Numerix 2012)

In the unsecured world, FVA is [Unsecured funding – CSA discounting]
Incorporating FVA

In other words, FVA accounts for the fact that in reality there is no perfect collateral agreement for the whole portfolio, and describes how to model for this.

Funding value adjustment is as important in derivative pricing as CVA, if not more so.

When incorporating CVA, FVA and where desired the cost of associated regulatory capital (“CRC”) into a transaction, we take a portfolio view with each individual counterparty.

- Consider all trades with the counterparty
- Impact of any CSA and type/amount of collateral posting mechanism

FVA represents the value adjustment made for the funding and liquidity cost of undertaking a derivative transaction.

This cost is impacted by whether a CSA is in place and how the CSA functions exactly.
Collateralised interest-rate swap

In the simplest case…portfolio of just one IRS transaction

Assume one swap fully collateralised with no threshold and daily cash collateral postings

- On daily basis collateral is posted or received (MTM value)
- For the bank –ve MTM, borrow funds to post collateral at its unsecured COF
- Collateral posted earns interest at OIS rate (Fed Funds, SONIA or EONIA)

This is an asymmetric arrangement that impacts the pre-crash norm of Libor-based discounting of the IRS, acceptable when funding at Libor.

I.e., this adds to the cost of transacting the swap. The magnitude of this cost is a function of \([\text{OIS}\% – \text{COF}\%]\) for the bank

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Sidebar: CSA/OIS, FVA and CSA threshold

- The CSA rate is the rate quoted in the CSA – but generally the rate used in CSA is OIS so in practice CSA/OIS are used synonymously.
- If the CSA rate used is different to the OIS rate, then the convention is that the baseline relative to which one calculates FVA is the CSA rate.
- There is considerable optionality in an individual CSA. Some include a threshold element which will reduce the collateral posted to less than actual m-t-m.
  - On bilateral basis impact is: a funding benefit for the counterparty negative m-t-m and posting collateral (the posted amount is below the m-t-m).
  - There is a funding cost for the counterparty receiving collateral, and so additional borrowing is required to fund the total position (in theoretical terms, to fund the riskless hedge).
- For CCPs, banks will need to post an excess of collateral over m-t-m. This creates a borrowing requirement that is funded at COF.
- So for CCP the issue is: there is an additional funding cost to doing business that may exceed the benefit of removing the CVA element.
Portfolio FVA

Moving to a book of derivative transactions, the funding cost for Banks A and B is a function of the size of the net MTM for the entire portfolio.

Therefore, exactly as with CVA, to calculate the impact of the asymmetric funding cost we need to consider the complete portfolio value with each counterparty, as well as the terms of the specific CSA.

This leads to…

…the GREAT DEBATE (eg., RISK magazine, Sep 2012)

- When pricing the single swap, unless Banks A and B have the same funding costs – unlikely unless one is being very approximate – we see that the banks will not agree on a price, irrespective of their counterparty risk and CVA.

- Therefore a bank can choose to use FVA for a profitability-type analysis only, not impacting swap MTM, or it can choose to cover this cost in which case it will impact swap valuation.

- The decision may depend on the counterparty and the product / trade type, or it can be a universal one.

- But not passing it on or adjusting price for FVA means the derivatives portfolio is not covering its costs correctly.
Uncollateralised IRS

- The position is not markedly different with uncollateralised derivatives, generally ones where one counterparty is a “customer”, eg., a corporate that is using the swap to hedge interest-rate risk.
- The bank providing the swap will hedge this exposure with another bank, and this second swap will be traded under a CSA.

- The first swap has no collateral posting flows, but the second one does. This is in itself an asymmetric CSA position; moreover the second swap cost will include an FVA element.
- The bank may wish to pass on this FVA hedge cost into the customer pricing, which means making the FVA adjustment to the swap price.
FVA calculation

- In any of the above illustrations, at any time the transaction (or hedge transaction) or portfolio MTM is negative, the bank will be borrowing cash to post as collateral.
- This borrowing is at the bank’s cost of funds (COF), which we denote Libor + s where s is the funding spread. (Ignore specific tenor at this point).
- Like CVA, FVA is counterparty dependant in that the transaction terminates of either party defaults.
  - See Appendix 4 for FVA calculation summary. This is a generalised description because it does not consider default correlation between counterparties or the relationship with the transaction present value.
  - Note that FVA is calculated as a function of a positive exposure, similar to CVA, but also including the bank default probability, as with DVA.
  - FVA is “negative”, like CVA, as it is a cost to the bank.
  - FVA is “positive” for the entity that lends funds to the derivatives bank. So for this entity, FVA is in effect its CVA to the bank it lends funds to. If the bank defaults, the FVA is the loss to the entity lending the bank funds.
- That said, if we look at FVA intuitively, it is an actual cost borne by the derivatives desk (and therefore, the bank) as part of maintaining the derivatives portfolio – no different in cost terms than funding the cash asset side of the balance sheet.
FVA treatment

- At the very least, a bank needs to incorporate FVA into its derivatives business returns and profitability analysis.

- Ideally, the governance of FVA is incorporated alongside all collateral management functions, including CVA, and overseen by the Treasury/ALM function. Some alternative governance approaches include:
  - Collateral management, CVA and FVA P&L and risk managed by a central CVA desk, reporting to Treasury.
  - FVA et al managed by each business line, in line with a bank-wide policy (not recommended).
  - FVA et al managed by each desk on its own guidance (not recommended).

- Either way, collateral management, CVA and FVA operation presents significant challenges with regard to data quality and daily MI reporting.
  - Every transaction with each counterparty must be marked-to-market for market and credit (counterparty) risk, and a time-bucketed portfolio cashflow ladder, both contractual and collateral cash flows, needs to be generated every day.
  - The optionality of the CSA agreement – there is much variation between individual CSA signed with each counterparty - also presents modelling and data problems.
Wrong-way funding risk and FVA
Wrong-way risk and FVA

- Wrong-way funding risk is change in FVA due to a correlation between funding requirements of the bank and the bank’s COF

- For example: consider CCPs
  - The overcollateralisation amount is a function of m-t-m and usually a VaR calculation – which is related to market volatility
  - In a stress event, both the amount of excess collateral (the IA) and the bank’s funding costs can be expected to increase. This is wrong-way funding risk

- To address this, bank should model wrong-way risk in FVA
  - Calls for as accurate as possible estimate of funding requirement, and costs, for the life of the transaction / portfolio, accounting also for correlation between funding requirement and COF
  - Stressed results as well for funding requirement and funding costs
Wrong-way risk and FVA...

- Modelling the wrong-way risk should be kept simple and use a single correlation factor for the (i) amount of collateral requirement (absolute and relative to perfect CSA) and (ii) the funding spread (COF)
- A positive correlation means that it will become more expensive to borrow funds for collateral in the interbank market at the same time that the collateral requirement is increasing / is high
- Negative correlation is the other way
Other FVA issues

- With a CCP, a bank does not have any counterparty risk and so no CVA charge, BUT it does have to borrow additional collateral (excess over CSA) as the CCP is overcollateralised
  - Cost of funding the IA may exceed the no-CVA benefit, expected for banks with high COF / low credit rating…
  - …or for everyone during a stress event
- As the dealer has an asymmetric position (client no CSA, interbank counterparty CSA), there will be a net +ve or –ve collateral position for the portfolio (“collateral imbalance”) and FVA is a key part of the cost of running this position
FVA, Liq Risk and Derivatives Funding Policy

- FVA is a key component of a robust and best-practice derivatives funding policy at a bank. It is part of the process to ensure correct allocation of (funding) cost between the Treasury / ALM desk and the derivatives business line...

- …and also a way of managing the funding risk (liquidity risk) of the business line and ensuring the cost of this risk management is borne appropriately

  - Treasury / ALM desk can set a mid-, or very narrow bid-offer, rate for FCA and FBA, and hence transfer the actual funding costs to the derivatives desk rather than just simply “Libor”

  - Set FCA-FBA (or COF with b-o spread) to cover funding costs, and allows Treasury / ALM to allocate this funding cost based on actual funding needs (pay for what you borrow, or receive what you lend…)

- FVA as part of Treasury funding policy is the mechanism which ensures the derivs desk writes business with an eye on liquidity risk stress on balance sheet

  - Incentive to generate less funding requirement
  - Incentive to generate funding for the bank over a longer time period

  - Requires narrow b-o spread that charges (FCA) and pays right tenor rate (FBA)
Derivative cash flows and bank funding policy
Derivatives Funding Policy

Principles

All collateralised derivatives MTM are assumed to be self-funding

- Assuming fully hedged, as MTM movement for collateralised derivatives are netted against collateral posted, secured derivatives are seen as self-funded
- Posting of initial margin (IM) or independent amount (IA) does however cause a funding requirement
- This needs to be stated in DFP as being charged in line with the cash flow profile of the underlying trades
- Collateral funding TLP covers for collateral costs and is passed via the “Collateral Management” or “Counterparty Risk/CVA” desk to the business line generating the collateral requirement. NOTE: CM desk can be part of Treasury: an Op Model issue
- These costs can be part of DFP or undertaken separately thru CM desk (OpModel issue to discuss)
DFP...

- **Charging Treasury ALM costs to CM desk**
  - CM desk charges the business line funding costs on Day 1 as FVA. See Appendix 1.
  - In paying the FVA, the business line is transferring the funding risk to CM desk on Day 1, to manage for the life of the trade. This is business best-practice.
  - Treasury charges CM desk the term funding costs (TLP), on the uncollateralised exposure of the Derivatives business (which contributes to a net +ve or –ve cash flow for the entire portfolio)
Charging methodology

OTC uncollateralised derivatives

CM and Treasury model the derivative portfolio’s unstressed uncollateralised MTM exposure profile (the portfolio cash flows) by currency

Treasury charges the uncollateralised exposure (which is driving an unsecured funding requirement)

In each tenor bucket there will be a net uncollateralised exposure balance (OR aggregate portfolio net cash flow profile, both collateralised and uncollateralised) of either zero, net EPE or net ENE

Diagram of net uncollateralised MTM exposure in specific CCY (snapshot in time, eg., at month-end) overleaf…
DFP...
**DFP...**

*Clearing margin*
- For exchange traded derivatives (non-OTC), treatment lies outside DFP
- Margin posted to exchanges on behalf of business lines is reported separately and attracts a flat [1]-year TLP charge
- This [ ] tenor should match the TLP tenor in the Securities Funding Policy
- Client margin: not charged

*Initial margin or Independent Amount for collateralised derivatives*
- IM or IA on secured derivatives to be split out and attract TLP charge relevant to the cash flow profile of the underlying trades
- Charge borne by the business
### DFP...summary of charging principles

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FVA - conclusion

- The cost of funding a derivatives portfolio, whether as a market maker or simply for hedging purposes, is an important part of the overall profitability of a bank and needs to be treated exactly as the funding cost of a cash asset.
- It is also a vital element in analysing risk and returns profitability of a derivs transaction (just as it is in a cash asset transaction).
- FVA is one approach to measure funding cost.
- FVA can be passed on in customer pricing or the bank can choose to wear it, but the business line still needs to be charged for it (as with cash asset funding).
- FVA value is a direct function of a bank’s funding cost (COF) which fluctuates, so important for FVA to reflect current reality...
- …by definition, banks with the highest COF (highest s and lowest perceived credit quality) will suffer a competitive disadvantage in this space.
Appendix 1
FVA calculation

- For the single swap example described in the main text, FVA can be defined as the expected cost for the bank of funding the transaction to maturity (see the “simplified” expression in the text).
- We state formally as

\[ FVA = -\int_{t}^{T} s_i \cdot PV_i^+ \cdot P(\tau_A > t) \cdot P(\tau_B > t) \cdot dt \]

- This expression describes FVA as the product of funding spread \( s \) and trade present value \( PV \) (at time \( t \)), from trade inception to maturity \( T \), adjusted for deal life by survival probability \( P \) for period \( t \) to early termination due to default of Bank A or counterparty Bank B.
- \( \tau_A, \tau_B \) are default times of Bank A and Bank B.
- \( P(\tau_A > t), P(\tau_B > t) \) are time \( t \) survival probabilities of A and B.
- In a collateralised world, irrespective of whether the trade is +ve or –ve MTM, the hedge trade will be the opposite. The asymmetry of funding costs arises because of differences between CSA rate (OIS) and Bank A’s COF.
- Higher COF presents a competitive disadvantage.
FVA calculation...

- The bank funding spread $s$ can be expressed in terms of the recovery rate $RR$ and time $t$ survival probability thus:

$$s_t \cdot P(\tau_A > t) = (1 - RR_A) \cdot P(\tau_A = t)$$

- This expression assumes a flat CDS curve for Bank A

- Substituting into the previous formula gives us

$$FVA = -(1 - RR_A) \cdot \int_0^T PV_t^+ \cdot P(\tau_A = t) \cdot P(\tau_B > t) \cdot dt$$

- Which in fact equates to the formula for CVA if we replace Bank A $RR$ with Bank B $RR$
FVA calculation...

- A strictly precise FVA requires us to consider dependencies / relationships between
  - Bank credit risk and transaction / portfolio MTM
  - Counterparty credit risk and transaction / portfolio MTM
  - Correlation between Bank credit risk and counterparty credit risk

- An approximation is given by

\[ FVA = s \cdot EE \]

- Where EE is the expected exposure (in cashflow terms) of the portfolio
Glossary

- **CVA**: credit value (or valuation) adjustment
  - Difference between the “risk-free” MTM value of a derivative contract and its risky value, adjusted for effect of probability of counterparty default

- **DVA**: debt value adjustment
  - The gain on its liabilities derived from the firm’s own default

- **EE**: expected exposure
  - Net of EPE and ENE

- **EFE**: expected future exposure
  - Average expected exposure over the derivative’s life

- **ENE**: expected negative exposure
  - Weighted average of individual negative exposures over given time horizons

- **EPE**: expected positive exposure
  - Weighted average of individual positive exposures over given time horizons

- **FVA**: funding value adjustment
  - xxxx

- **PFE**: potential future exposure
  - Maximum exposure estimated on a future date
Biased one-sided bibliography...

References

- Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector*, BIS 2009
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