Derivatives FVA and Recommended Bank Funding Policy

PRMIA Numerix Seminar, Fitch Learning London

3 June 2014

Professor Moorad Choudhry FCSI FIFS
Department of Mathematical Sciences
Brunel University
Agenda

● Funding value adjustment
● FVA calculation
● FVA and Internal Funds Policy

Please read and note the DISCLAIMER stated at the end of the presentation.
Incorporating FVA

- 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.
  - Funding need driven by contractual cash flows and CSA cashflows.
  - Uncollateralised derivatives still drive a CSA funding requirement on the hedge side.
- This cost is impacted by whether a CSA is in place and how the CSA functions exactly.
- It means derivatives are now treated exactly as cash.
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 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 Debt Valuation Adjustment (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. So we see the overall “XVA” relationship.

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 – via its Derivatives Funding Policy.
- 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 all 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.
FVA Calculation

The funding amount charged is the net Expected Exposure (EE) by counterparty, for all trades, and irrespective of credit mitigants and collateralisation

- For a vanilla derivative contract with no credit mitigants this is approximated by the forward MtM
- Although commonly FVA calculations are based on Monte-Carlo driven EEs
- Back of stamp summary: Treasury (or Collateral Management desk) calculates FVA as a basic integral/summation of the product of EE and funding spread (see Appendix)
- Funding spread a function of appropriate tenor COF…
- …which is specific to the bank
- No more law of one price…
FVA Calculation...

- In theory and to preserve pricing discipline trades attract bid side or offer side price (b-o spread 1-2 bps as per standard FTP practice)

- Although sometimes at market making banks the derivatives funding policy may elect – executive decision – that trades attract FVA pricing at mid unless they exceed a pre-determined funding threshold (e.g., £5k funding delta)

  - The business line can approximate pricing based on the trade’s funding delta (where no collateralisation) to assess whether they exceed FVA funding thresholds and hence whether to apply mid- or spread pricing

  - If the delta threshold is breached, Treasury can assess FVA level on a specific trade basis
FVA and internal funds pricing
**FVA and FTP**

- Liquidity risk principles dictate:
  - Customer pricing that reflects the bank’s COF
    - This is the liquidity premium input to loan pricing
  - Business line internal pricing that reflects the bank’s COF
    - This is the bank’s Funds Transfer Pricing regime
  - There is more than one COF at every bank bar the very simplest…
COF curves

- Wholesale unsecured
- WACF
- Private Placement
- Secured
- Customer deposits (contractual)

Bps vs. Tenor

© 2012, 2014 Moorad Choudhry
Recommended FTP model

- Internal funding regime vital to reflect the liquidity risk generated when asset origination takes place, centralising IR, FX and Basis risk in Treasury
- FTP regime must reflect both sides of the balance sheet.
  - Basis risk inherent in the business model
  - Where does hedging cost sit? CSA collateral funding cost of the derivative hedge? Treasury? Passed on to the business line through FTP or month-end adjustment?

- Origination process creates Base-Libor basis risk

~ Competitive pressures will drive lower TLP tenor

<table>
<thead>
<tr>
<th>Retail Customer Asset</th>
<th>£ Cash out</th>
<th>£ Cash in</th>
<th>Retail Business Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail Customer Liability</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- £ Cash in/out
- Asset
  - Floating asset 3M Libor + TLP
  - Fixed asset 3M Libor + TLP (product tenor 1Y - 5Y)
- Liability
  - Liability tenor convention 3M Libor + TLP

- TLP tenor: theoretical 7Y, practically…~
FVA and FTP

FVA is the external reflection of the FTP regime. The external trade or customer trade must reflect accurately the liquidity pricing (internal and external) of the bank’s cash funding requirement - just like a cash customer asset....

Considerations

Tenor
CSA Secured / unsecured
EE on Day 1 (funding generative or funding requirement)
Apply relevant tenor funding spread (FVA adjustment to price)
Derivatives funding policy

- Much inter-bank derivatives trading takes place under the CSA arrangement in the standard ISDA agreement. This means that the mark-to-market value of each derivative contract is passed over as collateral, usually in the form of cash.

- In general, the collateral requirements under a two-way CSA agreement should result in a netted zero cashflow position, because what a bank needs to pass over as collateral on a derivative that is offside, it will receive from the counterparty to the hedge on this derivative. However a number of counterparties, such as certain corporates, sovereign authorities, sovereign debt management offices and central banks, do not sign CSA agreements.

- This one-way CSA arrangement will create a funding requirement for a bank, as it will have to transfer cash if it is m-t-m negative, while it will not receive any cash if it is m-t-m positive.
Derivatives funding policy...

Therefore to incorporate the correct discipline with regard to the liquidity effects generated by uncollateralised derivatives business, the FTP policy needs to incorporate an appropriate liquidity premium charge. This will apply to the net m-t-m value of all uncollateralised derivatives on the balance sheet.

The daily FTP rate is charged to each business line on its net m-t-m exposure, either interest earned if positive balance or interest paid if negative balance. By charging an appropriate FTP rate, the business lines are incentivised to work towards reducing uncollateralised business wherever possible.
Funding Profile

Modelled funding profile
Derivatives funding policy...

- Set the appropriate FTP tenor depending on what the expected cash flows – both contractual and under CSA – are and for what tenor
- The FTP rate for the appropriate tenor is charged / received for cashflow of that tenor bucket
- See opposite for “expected positive exposure” (EPE) and “expected negative exposure” (ENE)
- The Derivatives funding FTP may sit above the bank’s COF
Derivatives funding policy...

Assuming a “balanced book” (all derivative positions are hedged), a funding effect is generated by derivatives uncollateralised MTM exposure

- Net uncollateralised EPE represents a funding requirement
- Net uncollateralised ENE is funding generated
- I.e.,
  - +ve MTM uncollateralised: no funding on +ve uncoll exposure, collateral posted on the hedge (which is –ve coll exposure), so a net liquidity OUTFLOW
  - -ve MTM uncoll: no funding on –ve uncoll exposure, collateral received on hedge (+ve coll exposure), so a net liquidity INFLOW
  - +ve or –ve MTM collateralised: net zero liquidity impact so “self-funded”

The relevant tenor FTP is charged / credited to the net cashflow in that bucket
# DFP...summary of charging principles

<table>
<thead>
<tr>
<th>Cash flow type</th>
<th>Liquidity impact</th>
<th>Managed by</th>
<th>Business line charged</th>
<th>Treasury charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncollateralised Derivatives</td>
<td>Funding on negative uncollateralised exposure; Collateral posted on hedge requires funding</td>
<td>CM/Treasury</td>
<td>by CM/Treasury (Day 1 FVA)</td>
<td>To CM (relevant tenor TLP on uncollateralised profile monthly)</td>
</tr>
<tr>
<td>Exchange Margin</td>
<td>Nets with client margin; Exchange-traded derivatives require margin posted for futures MTM</td>
<td>CM/Treasury</td>
<td>by CM/Treasury</td>
<td>To CM (1-year TLP on balance)</td>
</tr>
<tr>
<td>IA or IM posted</td>
<td>Collateralised derivatives viewed as self-funded as MTM moves netted against collateral posted; Funding requirement is created due to necessity for IM posted</td>
<td>CM/Treasury</td>
<td>by CM/Treasury</td>
<td>To CM (TLP based on profile of underlying trades)</td>
</tr>
<tr>
<td>Market stress of derivatives</td>
<td>UK FSA ILAA stress testing includes stress impact on derivatives portfolio; Outflow numbers add to LAB size requirement</td>
<td>Treasury</td>
<td>by CM/Treasury</td>
<td>To CM (based on net running cost of LAB)</td>
</tr>
</tbody>
</table>
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 derivatives 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
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

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

- This expression describes FVA as the product of funding spread \( s_t \) 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.
- \( \tau_A \) and \( \tau_B \) are default times of Bank A and Bank B.
- \( P(\tau_A > t) \cdot P(\tau_B > t) \) 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.
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

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

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
  - The add-on to discounting rate in derivatives valuation reflecting actual funding cost of the bank on whose balance sheet the derivative is booked

❖ PFE: potential future exposure
  - Maximum exposure estimated on a future date
Reference


Email: mooradchoudhry@gmail.com
DISCLAIMER

The material in this presentation is based on information that we consider reliable, but we do not warrant that it is accurate or complete, and it should not be relied on as such. Opinions expressed are current opinions only. We are not soliciting any action based upon this material. Neither the author, his employers, any operating arm of his employers nor any affiliated body can be held liable or responsible for any outcomes resulting from actions arising as a result of delivering this presentation. This presentation does not constitute investment advice nor should it be considered as such.

The views expressed in this presentation represent those of Moorad Choudhry in his individual private capacity and should not be taken to be the views of his employer or any other affiliated body, including Brunel University or YieldCurve.com, or of Moorad Choudhry as an employee of any employer or affiliated body. Either he or his employers may or may not hold, or have recently held, a position in any security identified in this document.

This presentation is © Moorad Choudhry 2011, 2012, 2014. No part of this presentation may be copied, reproduced, distributed or stored in any form including electronically without express written permission in advance from the author.