CVA

– What Does it Achieve?

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Motivation for using CVA

The uncertainty of CVA

Credit curve mapping

Challenging in hedging CVA

The impact of Basel III rules

Motivation for CVA

- Risk management need
  - An institution should consider counterparty risk as with other financial risks
  - CVA should be priced into trades to avoid adverse selection (traders find it more profitable to trade with weaker counterparties)
  - Trading should be judged on profit **after** CVA has been accounted for
  - But banks find it hard to lose PnL / franchise value
- Financial accounting
  - Periodic CVA calculation to quantify fair value of derivatives for accounting purposes
  - But precise calculation not well-defined, different standards exist (e.g. IAS39, FASB157..)
- Regulation
  - Achievement of optimum regulatory capital relief through good management of CVA
  - No ambiguity around the Basel 3 requirements (but depends on implementation process)

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CVA of a Swap

- Sorenson and Bollier, “Pricing swap risk”, 1994
- CVA for a swap (maturity T) can be constructed as a weighted series of
  - European swaptions with maturity of potential default time τ on an underlying (reverse) swap of maturity T-τ

$$CVA_{swap} \approx (1-\text{Rec})\sum_{j=1}^{n} PD(t_{j-1},t_j)V_{swaption}(t;t_j,T)$$

Default probability

Today

Swaption maturity

Swap maturity date

- Intuition
  - Short a series of swaptions with weights given by the forward default probabilities
  - Pricing the CVA of a swap has the complexity (at least) of pricing a swaption

Quantifying CVA is Very Complex

- CVA represents an option on an underlying derivative
  - Option is exotic even for a simple product like an interest rate swap
- Risk mitigants (netting, CSAs, break clauses)
  - Need to price all other trades with this counterparty as well as trade in question
  - All correlations (same asset class, cross-asset class must be known)
  - Now we are pricing a multidimensional exotic option
- Need the default probability (and recovery rate) of the counterparty
  - Often market implied probabilities not obvious (no CDS market)
  - Must look to bond spreads or some mapping procedure
  - Should we use DVA or not?
- Wrong way risk
  - Linkage between default probability and exposure at default

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CVA Risk Capital Charge (Basel III)

- CVA definition is based on spreads NOT default probabilities

$$CVA \approx LGD_{mkt} \sum_{i=1}^{T} \max\left(0; \exp\left(-\frac{s_{i-1}t_{i-1}}{LGD_{mkt}}\right) - \exp\left(-\frac{s_i t_i}{LGD_{mkt}}\right)\right)\left(\frac{EE_{i-1}D_{i-1} + EE_i D_i}{2}\right)$$

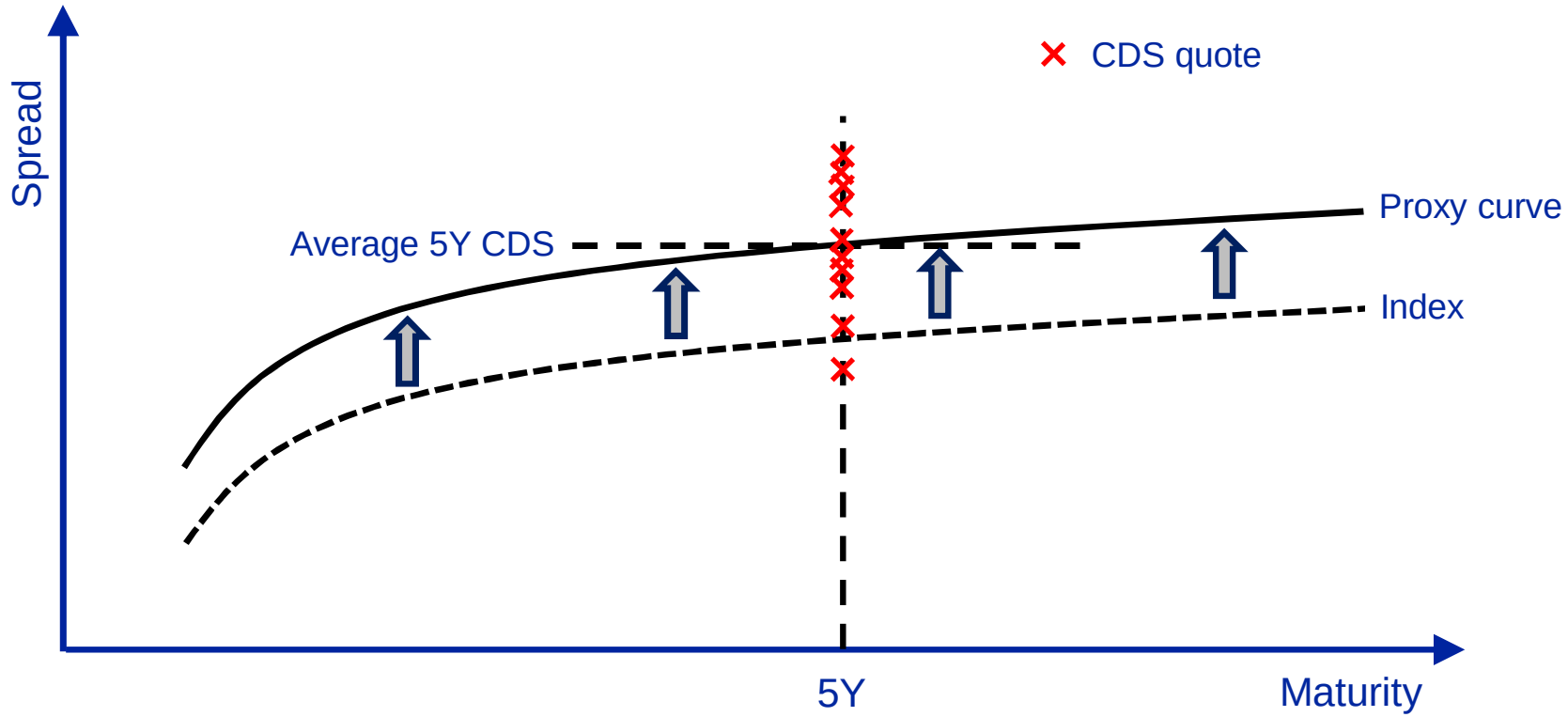
Default probability term

Exposure term

- What if we can't find the spread of a counterparty?
  - *"Whenever the CDS spread of the counterparty is available, this must be used. Whenever such a CDS spread is not available, the bank must use a proxy spread that is appropriate based on the rating, industry and region of the counterparty."*

Mapping Credit Spreads - Example

- Based on 5-year maturity CDS and index curve shape



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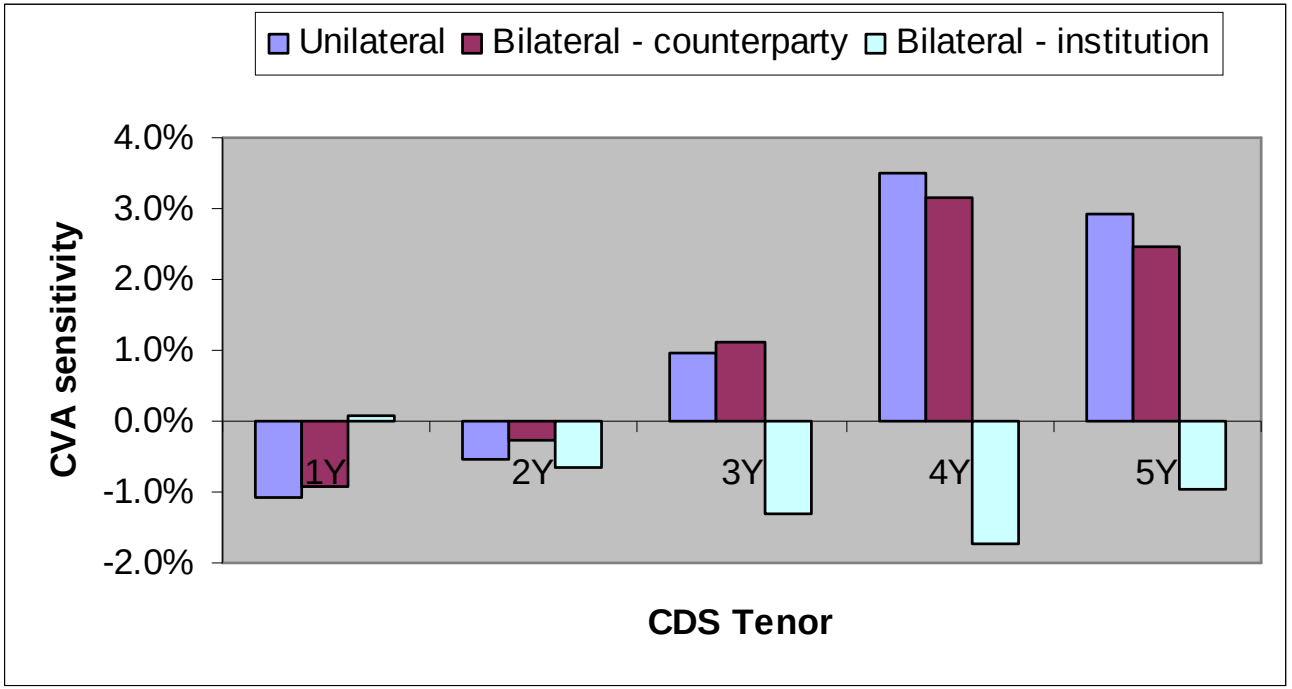
CVA Greeks

- Market risk components
  - Linear sensitivities (e.g. interest rate risk, FX risk) – reasonably easy to hedge
  - Vega – much more difficult long dated / out of the money problems
  - Correlation – generally unhedgeable so marked to historic
- Credit
  - Credit spread delta
  - Jump to default risk
  - Basic risk (single name hedges not available)
- For example for a single interest rate swap, theoretical hedge involves
  - CDS (to hedge credit spread and jump to default risk)
  - Interest-rate futures / FRAs (to hedge sensitivity of exposure to interest rates)
  - Interest rate swaptions (to hedge interest rate volatility)

Credit Hedges

- Impact of DVA on CDS hedges
  - Buy slightly less protection on counterparty (due to possibility of self defaulting first)
  - Sell protection on oneself



Basis Hedging and DVA

- $100m, Payer IRS, 5-year maturity
  - Counterparty spread = 500 bps, own spread = 250 bps

CVA	77,566	Total	47,215
DVA	-30,351		

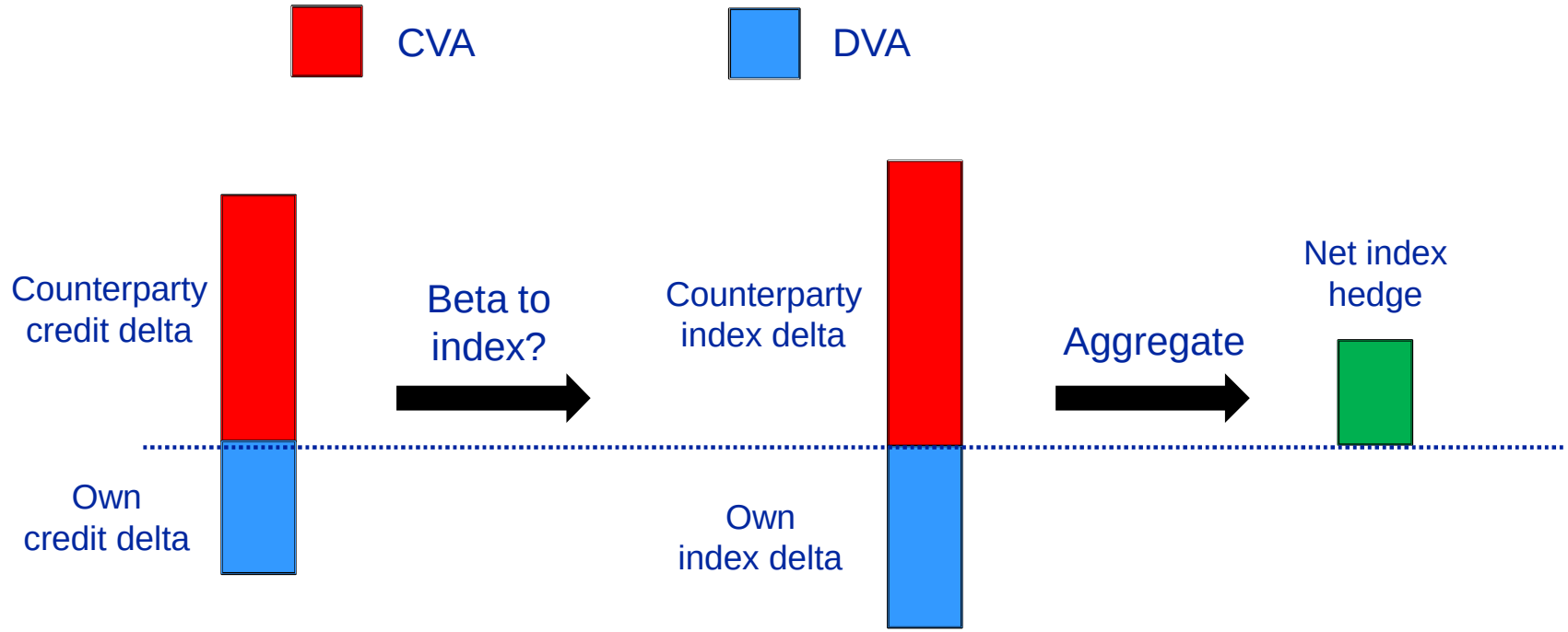
- Spreads widen ……
  - Counterparty spread = 600 bps, own spread = 350 bps

CVA	86,292	Total	46,900
DVA	-39,392		

- Spreads widen proportionally
  - Counterparty spread = 600 bps, own spread = 300 bps

CVA	87,937	Total	53,534
DVA	-34,402		

Hedging With Indices (with DVA)



- Trading your own credit via the index?
  - But since the hedge is aggregated it doesn't look as bad!
  - Works well as long as the betas are correct (or are consistently wrong)
  - Net index hedge can be short protection (DVA dominates CVA)

Unintended Consequences of CVA

"… given the relative illiquidity of sovereign CDS markets a sharp increase in demand from active investors can bid up the cost of sovereign CDS protection. CVA desks have come to account for a large proportion of trading in the sovereign CDS market and so their hedging activity has reportedly been a factor pushing prices away from levels solely reflecting the underlying probability of sovereign default."

Bank of England Q2

Source: Barclays Capital

- CVA desks with similar hedging requirements
  - Extreme moves in a single variable (e.g. spread blowout)
  - Sudden change in co-dependency between variables (creating cross gamma issues)
  - At this point do we stop hedging bear the pain?

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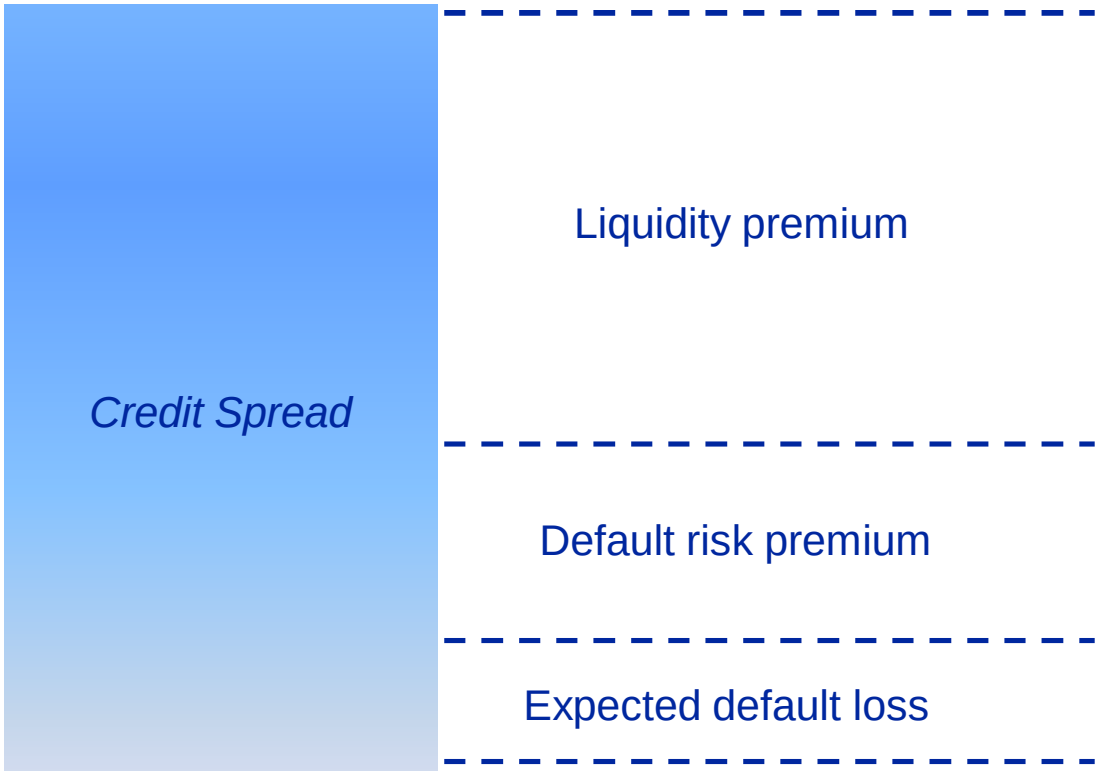
Regulatory Reaction to Crisis(Basel 2.5 & 3)

- Stressed EPE
  - IMM Banks must calculate exposures using stressed market data
- Wrong way risk
  - Must identify “general” WWR and assume a higher exposure for “specific” WWR
- Systemic risk
  - Correlation multiplier (1.25) for large regulated / unregulated financial firm exposure
- Collateral.
  - A “margin period of risk” of 20 days must be applied for certain transactions
- Central counterparties
  - Risk weighting of 2% for CCPs which meet various rigorous conditions
- CVA VAR
  - Banks must hold additional capital to capture the volatility of CVA

What's in a Credit Spread?

- Decomposition of a typical CDS spread
  - Hull et al. [2005], Elton et al. [2001], Driessen [2005]
  - Expected default loss is small especially for high good credits



What Can We Do With CVA?

- Basel III forces banks to price / manage CVA actively - what can we do?
- Trade out of CVA?
  - Hedging - possible but limited single name CDS market makes this difficult
  - Securitize it – might not be an easy idea to sell to the regulators
- Take more collateral?
  - Converts CVA into funding liquidity risk and residual unhedgeble “gap risk”
  - Limitations over counterparties who can sign CSAs (e.g. corporates, sovereigns)
- Trade through central counterparties?
  - More funding requirements than CSAs – more funding liquidity risk
  - Creates more SIFIs

Conclusion

- Beware of attempts to hide CVA
  - Over collateralising positions (especially those with significant wrong way risk) creates significant other risks (funding liquidity risk, systemic risk)
  - These are almost impossible to quantify and control (helpful in the short term but potentially explosive in the longer term)
- Beware the mark-to-market approach towards CVA
  - Mapping of spreads is an art not a science
  - Capital relief achieved under Basel III via hedging with indices is linked to mapping becoming a self-fulfulling prophecy
  - DVA can be seen as a way to try and take us back to an actuarial style CVA
  - Hedging CVA is important but important to consider where is the CVA going?