Funding Valuation and Prudent Valuation Adjustments (PVA & FVA)
Dal fair value al capitale

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Summary

1. Prudent Valuation
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   - Toxic assets: definition
   - An illustrative example
   - Market incompleteness & illiquidity
   - Evaluation risk
   - Prudent valuation

2. Funding Valuation Adjustment
   - Market news
   - Switch to CSA discounting
   - Switch to DVA accounting
   - Switch to FVA accounting
   - Trading vs accounting view
   - The funding curve
   - Possible approaches to FVA computation
   - Classic vs modern world

3. Main references

1: Prudent Valuation
Market risk vs credit risk

"*Default* losses on US sub-prime mortgages about 500 billion dollars.

But in a mark-to-market world, deadly losses are *valuation* losses

Valuation losses as high as 4 trillion

Major banks failed without single penny of default

BIS study of rescue package: EUR 5 trillion in committed resources"

Eli Remolona,IV Annual Risk Management Conf., Singapore, July 2010

1: Prudent Valuation
Toxic assets: definition

Financial assets the value of which has fallen significantly and may fall further, especially as the market for them has frozen. This may be due to hidden risks within the assets becoming visible or due to changes in external market environment"

FT lexicon

Toxic assets are made of

Liquidity problems ("market frozen")

Opacity, that is "ambiguity" ("hidden risk becoming visible")

1: Prudent Valuation
An illustrative example

Problem of evaluation of an Equity Linked Note promising to pay a coupon corresponding to the appreciation of an equity index in five years.

The main question is

"What will be the volatility of the market index in five years?"

Since market data cannot provide an answer to this question, this is the simplest example of what valuation uncertainty of a bond really is.

Alternatives

- Believing in Black and Scholes
- Estimating the long run component of market volatility
- Assuming volatility and probability scenarios

1: Prudent Valuation
Beyond Black and Scholes

Even assuming to know the five market volatility, adjusted for risk, one must remember that Black and Scholes is based on very strict assumptions

- Constant volatility, corresponding to gaussian returns
- Complete markets: perfect replication (attainability) of all assets
- Default-free price: derivatives are not subject to counterpart ris

1: Prudent Valuation
Market incompleteness & illiquidity [1]

Incomplete markets

There are three main reasons why markets are not complete, meaning that not all assets can be produced with no risk

- Spanning problem: in the market there do not exist enough assets to provide insurance, and pricing, of all possible risks
- Dynamic hedging: replicating portfolios cannot be rebaslanced in continuous time, in such a way to provide a perfect dynamic hedge
- Liquidity problem: market impact of portfolio rebalancing strategies

1: Prudent Valuation
Market incompleteness & illiquidity [2]

Evaluation risks

In incomplete markets the production and the evaluation of illiquid financial products is made random for different problems, among which

- Input data for the arbitrage-free evaluation of price
- Model choice for the evaluation of non linear products
- Evaluation of counterpart risk
- Market concentration
- Close-out costs uncertainty
- Funding/investing costs uncertainty

1: Prudent Valuation
Prudent valuation [1]

- The CRR (article 105) requires a prudent value that achieves an "… *appropriate degree of certainty*".

- The EBA RTS (summary, pag. 7) specifies the appropriate degree of certainty as follows
  "*…where possible, the prudent value of a position is linked to a range of plausible values and a specified target level of certainty (90%).*
  In all other cases, an expert-based approach is specified, together with the key factors that should be included in that approach. In these cases, the same target level of certainty as above (90%) is set for the calibration of the AVAs.
  The EBA accepts that for the majority of positions where there is valuation uncertainty, it is not possible to statistically achieve a specified level of certainty; however, specifying a target level is believed to be the most appropriate way to achieve greater consistency in the interpretation of a 'prudent' value"

- The EBA RTS specifies more details on the target level of uncertainty in the definitions of AVA Market Price Uncertainty, Close-Out Costs, and Model Risk (articles 9, 10, 11, respectively).

1: Prudent Valuation
Prudent valuation [2]

The EBA Regulatory Technical Standards

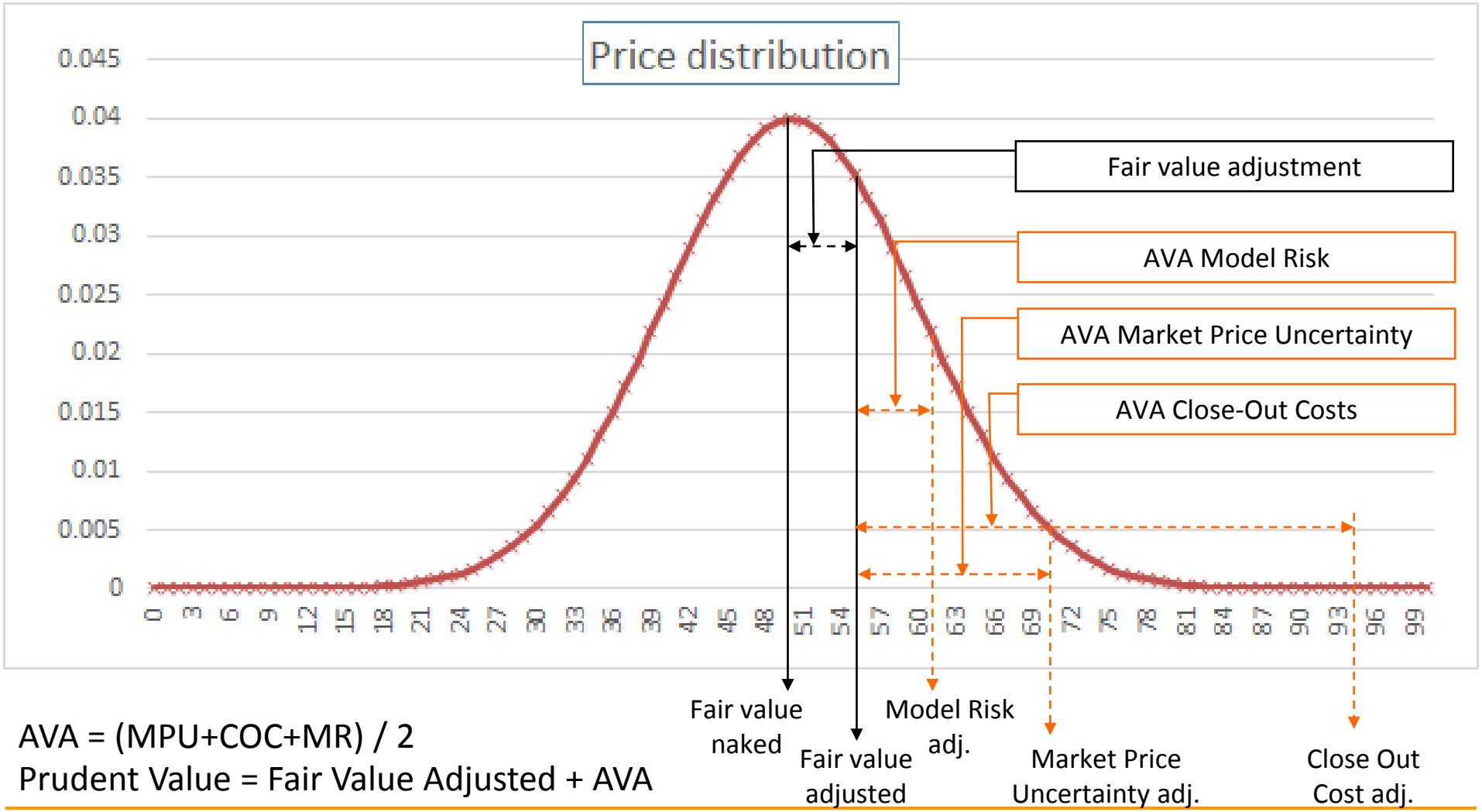
- Market price uncertainty
- Close-out costs
- Model risk
- Unearned credit spread
- Funding/investing costs
- Concentrated positions
- Future administrative costs
- Early termination costs
- Operational risks

EBA, final draft Regulatory Technical Standards on prudent valuation, 31 March 2014 (EBA/RTS/2014/06).

1: Prudent Valuation

Prudent valuation: AVA overlapping

Relationships between fair value, fair value adjustment, prudent value, AVA market price uncertainty, AVA close out cost, AVA model risk,



AVA = (MPU+COC+MR) / 2

Prudent Value = Fair Value Adjusted + AVA

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2: Funding Valuation Adjustment
Switch to CSA discounting [1]

- At end of 2010 some Banks gave disclosure about switch to OIS discounting:
  - BNP: EUR -108 MM (IRS)
  - Credit Agricole: EUR -120 MM (Fixed Income)
  - Morgan Stanley: USD +176 MM (IRD)
  - RBS: GBP +127 MM
  - UBS: CHF +76 MM
  - HSBC: not significant

  (Source: *M. Cameron, "BNP Paribas takes €108 million on swaps after switch to OIS discounting", Risk, 6 May 2011.)*

- *"In the fourth quarter of 2010, the Company began using the overnight indexed swap ("OIS") curve as an input to value substantially all of its collateralized interest rate derivative contracts. The Company believes using the OIS curve, which reflects the interest rate typically paid on cash collateral, more accurately reflects the fair value of collateralized interest rate derivative contracts. Previously, the Company discounted these collateralized interest rate derivative contracts based on London Interbank Offered Rates ("LIBOR")."*

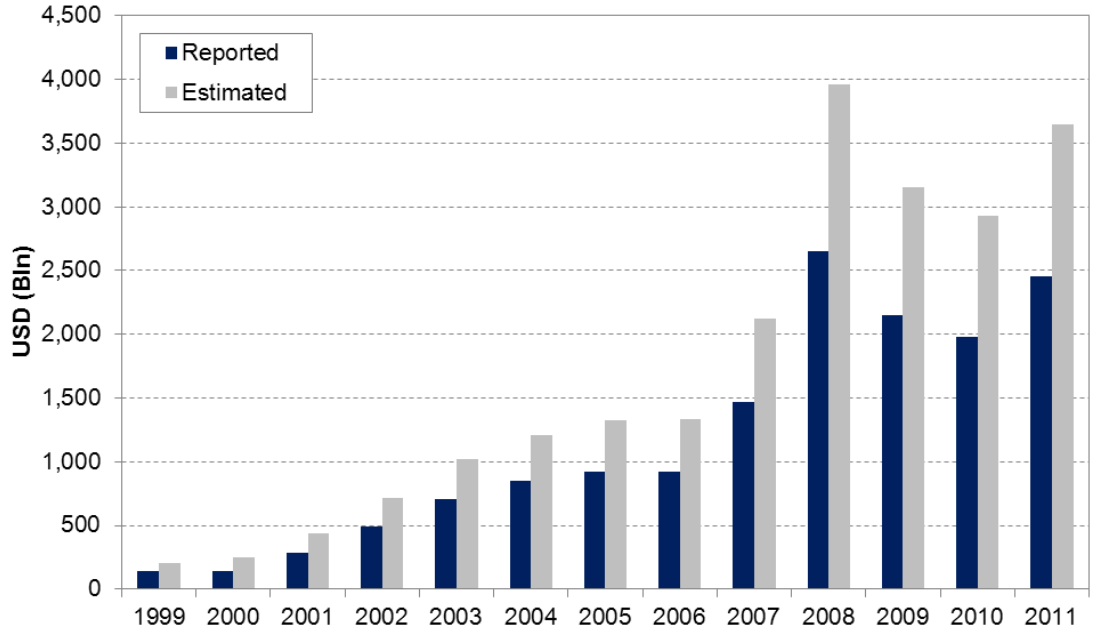
  (Source: Morgan Stanley & Co. Inc., Consolidated Statement of Financial Condition as of Dec. 31, 2010 and Independent Auditors' report.)

2: Funding Valuation Adjustment

Switch to CSA discounting [2]

CSA diffusion (ISDA Margin Survey, 2012, 51 ISDA members respondents, 14 large dealers.

	All	Large Dealers
All OTC Derivatives	71.4%	83.7%
Fixed Income Derivatives	78.1%	89.9%
Credit Derivatives	93.4%	96.1%
FX Derivatives	55.6%	70.6%
Equity Derivatives	72.7%	85.3%
Commodities Derivatives	56.3%	63.9%



2: Funding Valuation Adjustment
Switch to DVA accounting

- *"Royal Bank of Scotland Group Plc […] net income was 1.23 billion pounds compared with a 1.15 billion-pound loss in the year-earlier period […]. That figure includes a 2.36 billion-pound so-called credit valuation adjustment, an accounting rule that requires banks to book losses when the value of their debt rises and gains when it declines on the theory that a loss, or profit, would be realized were the bank to repurchase that debt."*
  (Source: Bloomberg, 4 Nov. 2011)

IFRS13

- [42] *"The fair value of a liability reflects the effect of non-performance risk. Non-performance risk is the risk that an entity will not fulfil an obligation. Non-performance risk includes, but may not be limited to, an entity's own credit risk."* (this is DVA).

- [56] *"Credit risk: the entity shall include the effect of the entity's net exposure to the credit risk of that counterparty or the counterparty's net exposure to the credit risk of the entity in the fair value measurement when market participants would take into account any existing arrangements that mitigate credit risk exposure in the event of default."* (this is bilateral CVA).

2: Funding Valuation Adjustment
Switch to FVA accounting [1]

- *"The firm implemented a FVA framework this quarter for its OTC derivatives and structured notes, reflecting an industry migration towards incorporating the cost or benefit of unsecured funding into valuations. For the first time this quarter, we were able to clearly observe the existence of funding costs in market clearing levels. As a result, the firm recorded a $1.5 billion loss this quarter."*
  (source: M. Cameron, Risk Magazine, 14 Jan. 2014)

2: Funding Valuation Adjustment
Switch to FVA accounting [2]

IFRS 13

- *[Fair value] Definition [9]: the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date.*

- *[2] It is a market-based measurement, not an entity-specific measurement. […] It is an exit price at the measurement date from the perspective of a market participant that holds the asset or owes the liability.*

- *[15] A fair value measurement assumes an orderly transaction between market participants […] at the measurement date under current market conditions.*

- *[16] The transaction is assumed to take place either in the principal market […]; or, in the absence of a principal market, in the most advantageous market […].*

- *[19] The principal, or most advantageous, market shall be considered from the perspective of the entity, thereby allowing for differences between and among entities with different activities.* (reading "different funding activities", this allows for FVA ?)

2: Funding Valuation Adjustment

Switch to FVA accounting [3]

FVA accounting as of end of 2013			
Bank	**4Q12**	**4Q13**	**Comments**
Barclays	-£101 MM	?	FVA is calculated as the valuation impact of changing from Libor-based discounting to using a discount rate that reflects the market cost of funding. Barclays' internal Treasury lending rates are used as an estimate of this rate, although it continues to assess viable alternatives and evolving market practice. The discounting period applied takes into account the probability of default of each counterparty, as well as any mandatory break clauses. The FVA incorporates a scaling factor that is an estimate of the extent to which the cost of funding is incorporated into observed traded levels. On calibrating the scaling factor, it is with the assumption that credit valuation adjustments (CVAs) and debit valuation adjustments (DVAs) are retained as valuation components incorporated into such levels. The effect of this scaling factor at December 31, 2013 was £200 million (£303 million in 2012).
Deutsche Bank	--	-€364 MM	In the corporate banking and securities division, the bank gained €83 million for funding valuation adjustment (FVA). FVA is an adjustment being implemented in the fourth quarter that reflects the implicit funding costs borne by Deutsche Bank for uncollateralised derivative positions. In the consolidation and adjustments segment, the bank took a €276 million FVA charge related to internal funding transactions with treasury to mitigate interest rate exposure. While in the non-core operations unit, fourth-quarter results also included a €171 million charge for FVA. Overall, the total adjustment was a €364 million loss.
Goldman Sachs	?	?	Valuation adjustments are integral to determining the fair value of derivatives portfolios and are used to adjust the mid-market valuations produced by derivatives pricing models to the appropriate exit price valuation. These adjustments incorporate bid/offer spreads, the cost of liquidity, credit valuation adjustments and funding valuation adjustments, which account for the credit and funding risk inherent in the uncollateralised portion of derivatives portfolios. The firm also makes funding valuation adjustments to collateralised derivatives where the terms of the agreement do not permit the firm to deliver or re-pledge collateral received.

2: Funding Valuation Adjustment

Switch to FVA accounting [4]

FVA accounting as of end of 2013 (continued)			
Bank	**4Q12**	**4Q13**	**Comments**
JP Morgan	--	-$1.500 MM	The firm implemented a FVA framework this quarter for its OTC derivatives and structured notes, reflecting an industry migration towards incorporating the cost or benefit of unsecured funding into valuations. For the first time this quarter, we were able to clearly observe the existence of funding costs in market clearing levels. As a result, the firm recorded a $1.5 billion loss this quarter. Libor + 50 bps, portfolio average lifespan 5Y.
Lloyds Banking Group	- £143 MM	-£135 MM	The group has recognised a funding valuation adjustment to adjust for the net cost of funding certain uncollateralised derivatives positions where it considers this cost is included in market pricing. This adjustment is calculated on the expected future exposure discounted at a suitable cost of funds. A 10 basis point increase in the cost of funds will increase the funding valuation adjustment by approximately £9 million. The bank took a £135 million adjustment.
Nomura	--	-¥10.000 MM (-$98 MM)	During the third quarter, the valuation methodology for uncollateralised derivatives was refined to incorporate funding costs – the bank took a ¥10 billion ($98 million) adjustment.
Royal Bank of Scotland	- £475 MM	-£424 MM	Funding valuation adjustments now reflect the counterparty contingent nature of the exposures. FVA is also now considered the primary adjustment applied to liabilities; the extent to which own credit adjustment (OCA) and FVA overlap is eliminated from OCA. The bank recorded an adjustment of £424 million.
Societè Generale	?	?	Risk understands the bank has incorporated FVA into its books and records. No public disclosures have been made.

Source: M. Cameron, *"The black art of FVA, part II: Conditioning chaos"*, Risk, 26 Mar. 2014

2: Funding Valuation Adjustment

Switch to FVA accounting [5]

FVA accounting as of end of 2013 (continued)			
Bank	**4Q12**	**4Q13**	**Comments**
UBS	--	--	Fair value measurements – funding valuation adjustments UBS [… is] currently analyzing how the costs and benefits of funding associated with uncollateralized derivatives receivables and payable can be incorporated into their valuation techniques. Those costs and benefits (referred to as "funding valuation adjustments") differ from …CVA and DVA, and theoretically represent a spread over LIBOR to compensate for the inherent cost of funding those uncollateralized derivative positions. Currently, there is diversity within the industry as to how such inputs should be quantified and applied. We expect to incorporate funding valuation adjustments into our fair value measurements, prospectively, as a change in accounting estimate, possibly during 2014, when our analysis is completed and the related financial effects can be validated. Notably, our exposure to uncollateralized derivatives continues to reduce in line with the acceleration of our strategy to exit many of the business with which they are associated.". UBS, "*Addendum to the Base Listing Document dated 5 April 2013 relating to Non-collateralised Structured Products*", 25 Feb. 2014.

2: Funding Valuation Adjustment
Switch to FVA accounting [6]

Remarks:

- Scope:
  - uncollateralised derivatives (all), structured notes (JPM),
  - collateralised derivatives with non-rehypotecable collteral (Goldman Sachs)
- From Libor discounting to funding discounting (Barclays, UBS)
- Probability of default included (Barclays)
- Mandatory break clauses included (Barclays)
- Scaling factor to include the fraction of funding cost observed in traded levels, calibrated assuming that bCVA is included (Barclays).
- Expected future exposure approach (Lloyds)
- OCA (Own credit adjustment) and FVA overlap is eliminated from OCA (RBS)

2: Funding Valuation Adjustment

Switch to FVA accounting [7]

Three phases:

1. Early movers (2011-2012)
   - Barclays, Lloyds, RBS, GS (?)
   - Rough/pioneering methodology
   - Large P&L jumps

2. First followers (2013-2014)
   - DB, JPM, Nomura, SocGen (?), others
   - Refined/consolidated methodology
   - Large/medium P&L jumps

3. Last followers (2015-?)
   - Others

2: Funding Valuation Adjustment
Trading vs accounting view [1]

The trading view

FVA reflects the funding cost/benefit generated when hedging an uncollateralised client trade in the collateralised interdealer market (replication approach).

- If the dealer is in-the-money on the client trade (NPV>0) , it is out-the money on the hedge trade (NPV<0), it must post collateral to the hedge counterparty, and must borrow collateral from the money market (through its internal treasury). Hence this is a funding cost (FCA).

- If the dealer is out-of-the-money on the client trade (NPV<0), it is in-the money on the hedge trade (NPV>0), it receives collateral from the hedge counterparty, and (if the collateral is rehypothecable), it lends that collateral to the money market (through its treasury). This is a funding benefit (FBA).

2: Funding Valuation Adjustment
Trading vs accounting view [2]

The accounting view

The fair value of a financial instrument is an exit price.

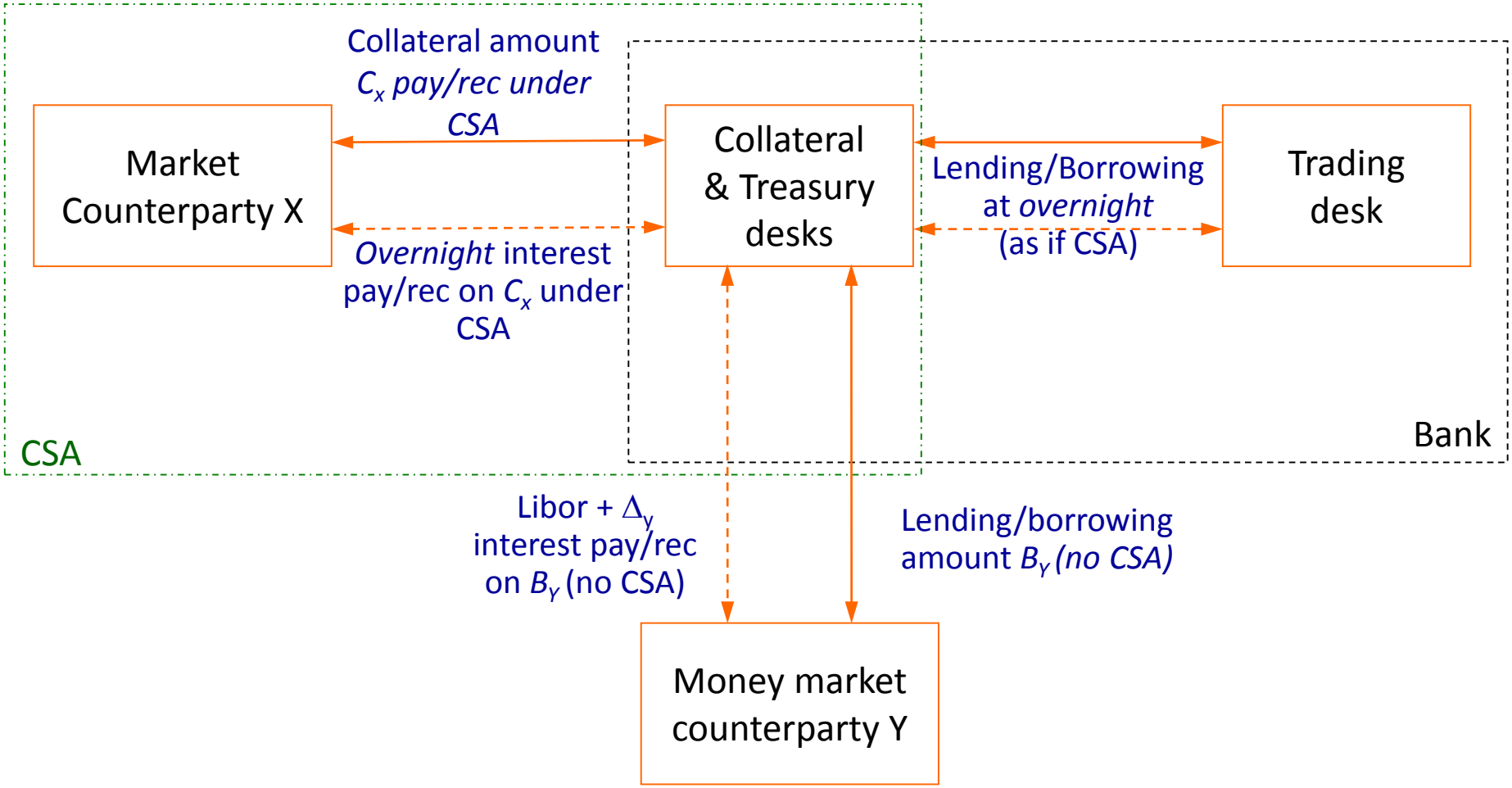
- If a third party steps into an in-the-money receivable, it must pay an upfront to the first party, and it must borrow from the money market (through its internal treasury). Hence it will charge a Funding Cost Adjustment (FCA). From the point of view of the first party, the third party is unknown, and each possible party has a different funding spread.

- If a third party steps into an out-the-money payable, it must receive an upfront from the first party, and it must lend to the money market (through its internal treasury). Hence it will pay a Funding Benefit Adjustment (FBA).

But from the point of view of the 1st party, the 3rd party is unknown, and each possible party has a different funding spread…

2: Funding Valuation Adjustment

Trading vs accounting view [3]



2: Funding Valuation Adjustment

The funding curve [1]

The construction of a funding curve reflecting the term structure of market cost of funding of a Bank is not an easy task because:

- A Bank has many sources of funding:
  - Collateral (cash or securities), rehypotecation allowed
  - Money market: Certificate of Deposits, Commercial Papers, etc
  - Repo market: Repos
  - Bond market: issuance of Bonds
  - Bank accounts of retail customers (for retail banks)
  - Repayment of credits through credit lines
  - Prepayment of mortgages
  - Selling of shareholdings
  - Etc.
- These sources of funding implies different funding spreads at different maturities.
- Market funding channels (1-4) are quoted, carries stochastic spreads, and deterministic amounts
- Other funding channels (5-8) are not quoted on the market and carries stochastic cash flow times and amounts.

2: Funding Valuation Adjustment
The funding curve [2]

Common practices:

1. TIT curve
   - Below 1 year: use market quotations for buying deposits.
   - After 1 year: use market quotations for bonds, selected by liquidity and seniority.
   - Interpolate/estrapolate using the preferred methodology (none is right).

2. Blended curves: weighted average of short term funding (e.g. Deposit 6M) and term funding (e.g. TIT).

3. Use the 1st party own funding spread.

4. Use the average funding spread of a set of possible dealers or peers.

5. Use a market observable indexes such as IBOXXs.

2: Funding Valuation Adjustment
The funding curve [3]

What about Libor discounting ?

- «Libor discounting» is a pricing methodology based on the adoption of a «classic» Libor curve as funding curve.

- Libor discounting amounts to include the component of FVA corresponding to the OIS-Libor basis into the fair value of uncollateralised derivatives. So, after the crisis and the switch to CSA OIS discounting for collateralised derivatives, market participants have always considered this part of the FVA.

- Libor discounting served as a «better than nothing» approach in vacancy of a clear market practice, even when it was clear to everybody that the Libor term structure is lower than the funding term structure.

- Nowadays there are no longer reasons to use this curve for pricing.

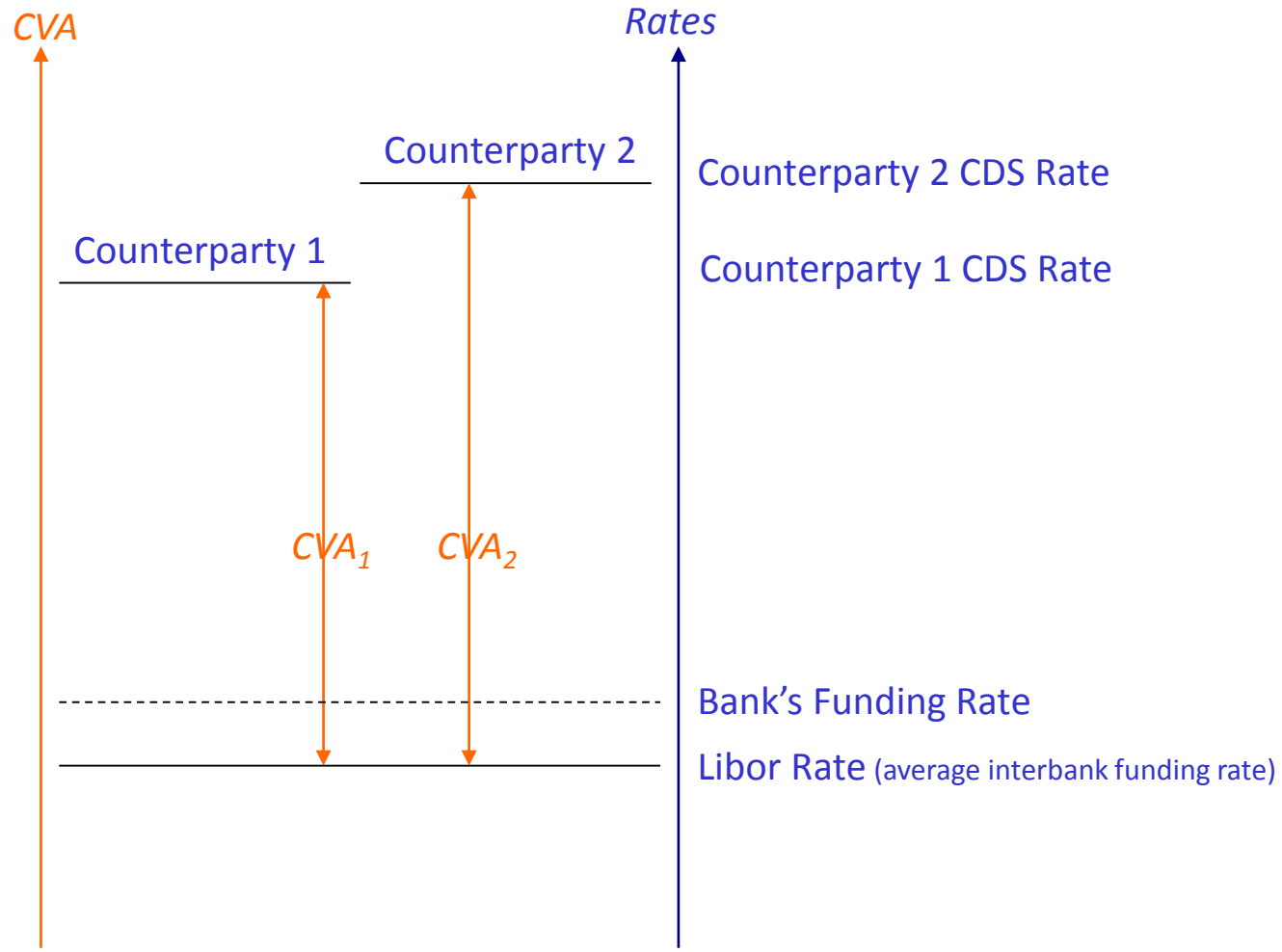
2: Funding Valuation Adjustment

Possible approaches to FVA computation

Practical approaches to FVA			
Approach	Description	Pros	Cons
Discounting approach	Switch the discounting curves	○ Simple and sound ○ Correct for most of the positions	○ Not straightforward for some trades (e.g. CCS) ○ Survival probabilities of the counterparties can be added as further discounting spread curves.
Sensitivity approach	Compute FVA using sensitivities to discount curves and funding spreads	○ Simple and sound ○ Quick	○ Dirty: first/second order approximation ○ Sensitivity term structure needed.
Exposure approach	Compute FVA from mean/positive/negative exposures	○ Exact ○ Reuse CVA framework to produce the exposures	○ Computationally intensive also for plain vanillas ○ More complex.

2: Funding Valuation Adjustment

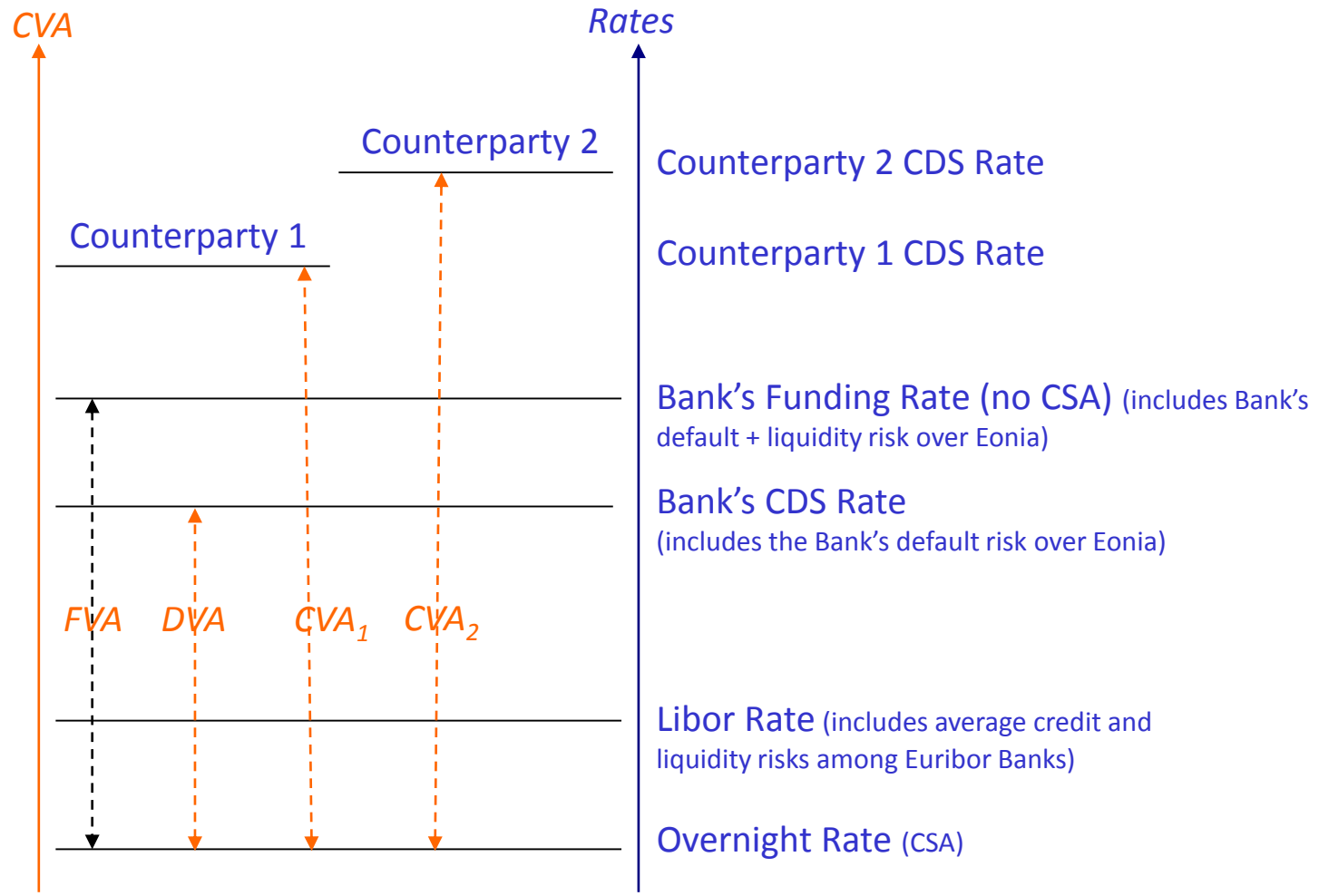
Classic vs modern world [1]



Classic pre-credit crunch Libor discounting for interbank counterparties
+ CVA for non-interbank counterparties.

2: Funding Valuation Adjustment

Classic vs modern world [2]



Modern post-credit crunch CSA Discounting + bilateral CVA/DVA + FVA.

3: Selected references on Prudent Valuation [1]

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3: Selected references on FVA [1]

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3: Selected references on FVA [2]

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