Prudent Valuation

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www.ing.com

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Agenda

- Introduction and background

- Definition of AVA ("Additional Valuation Adjustments")

- Components of AVA

- A couple of remarks

- Conclusion

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Background

- Credit crisis: markets experienced significant uncertainty around true value of positions due to dramatic reductions in liquidity…

- However, not only during crisis periods there is uncertainty around valuation:
  - Low levels of observed trading or daily pricing difficult to obtain ('structured credit', 'CVA', etc.);
  - Complexity of payoffs from embedded non-linearities and option-type structures, absence of readily available market prices on related instruments that can guide valuation ('interest rate exotics, 'equity derivatives', 'structured credit' etc.);
  - One-way market, or open positions representing significant share of overall open market position ('primary dealerships', 'proprietary positions').

- Uncertainty not reflected in capital or balance sheet (=point estimate)

- CRR/CRD IV (article 34, 105) requires to apply 'prudent valuation' standards to all positions that are measured at 'fair value'. The EBA should give guidance on 'technical standards' for implementation.

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Background

- Article 105 describes number of categories of valuation adjustments to be considered in context of prudent valuation.

- Intended effect is to set valuations at level that achieves **appropriate degree of certainty** so that valuation used for regulatory purposes is not higher than true realizable value.

- Article 34 requires institutions to deduct from Common Equity Tier 1 capital the aggregate AVA made for fair value assets and liabilities following the application of Article 105.

- November 2012: Discussion Paper

- July 2013: Consultation Paper + associated QIS

- March 31, 2014: final draft RTS

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General approach

- Prudent Value is below Fair Value (incl. FV adjustments)

- Additional Valuation Adjustment (AVA) marks the difference and is taken off equity

Prudent Value   Fair Value   Mid Value

PVA: Prudent Value Adjustments

AVA: Additional Value Adjustments
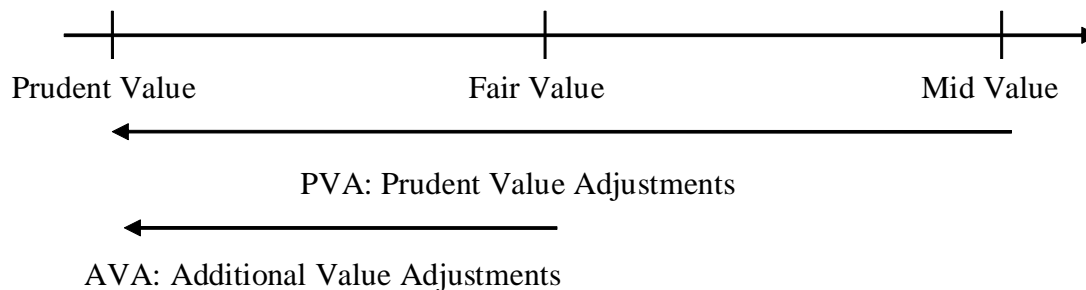
- EBA states: be 90% confident regarding prudency applied

- In other words: 90 out of 100 times we expect to transact at better price than prudent value, the difference then being equity released into P&L

- This is about orderly exit of exposures, not fire-sale

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General approach

- In scope: all assets measured at fair value

  - Trading book and Banking book

  - For assets and liabilities for which a change in accounting valuation would have a partial or zero impact on own funds, AVAs are only calculated in proportion to the impact a change in valuation would have on own funds (this would be the case, for example, for AFS positions for which the prudential filter still partially applies).

- Two approaches possible

  - Simplified (or standardised approach): 0.1% * aggregate absolute value of fair-valued positions (<15bn fair valued assets + liabilities)

  - Core (or internal model): 90% prudency based on market data or expert judgment, with a list of uncertainties to which AVA should be individually calculated

Components of AVA

- Market price uncertainty

- Close-out costs

- Model risk

- Unearned credit spreads

- Investing and funding costs

- Concentrated positions

- Future administrative costs

- Early termination

- Operational risk

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Some definitions

- Valuation position = financial instrument (or commodity) or portfolio of financial instruments (or commodities) held in both trading and non-trading books, which are measured at fair value.

- Valuation input = market observable or non-observable parameter or matrix of parameters that influences the fair value of a valuation position.

- Valuation exposure = amount of a valuation position which is sensitive to the movement in a valuation input.

Market price uncertainty AVA

- Calculate at valuation exposure level, i.e. sensitivity to valuation input.

- Market price uncertainty AVA is equal to 0 iff
  - firm evidence of tradable price or price can be determined from reliable data based on liquid two-way market;

    and

  - available market data (exchange prices, traded prices, tradable quotes, consensus data, indicative broker quotes, ctrpty collateral values) do not indicate any material valuation uncertainty.

- If sufficient data available, estimate point within range of plausible values where 90% confidence to be able to exit (or realized mid value) at that price or better.

- If not sufficient data available, use expert based approach to achieve level of 90% certainty.

- Market price uncertainty AVA

$$= \text{exposure} * (\text{prudent price} - \text{fair value price})$$

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Close-out cost AVA

- Calculate at valuation exposure level, i. e. sensitivity to valuation input

- When market price uncertainty AVA for an exposure is based on exit price, the close-out cost AVA may be assessed to be 0.

- Otherwise calculate close-out cost AVA similar to market price uncertainty, but based on range of bid/offer quotes (rather than mid prices).

- Close-out costs AVA = exposure * 0.5 prudent bid/offer spread

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Matrix of valuation inputs

- Netting approach?

- If valuation input consists of matrix of parameters (e.g. buckets on yield curve, volatility matrix, …), then AVAs for each parameter within that matrix.

- However, reduction of number of parameters is allowed provided:
  - Total value of reduced exposure = total value of original exposure.
  - Ratio of volatility measure 2 over volatility measure 1 (based on historical data from the most recent 100 trading days), is less than 0.1:
    - Volatility measure 1: P&L volatility of exposure based on unreduced input.
    - Volatility measure 2: P&L volatility of exposure based on unreduced input minus exposure based on reduced input.

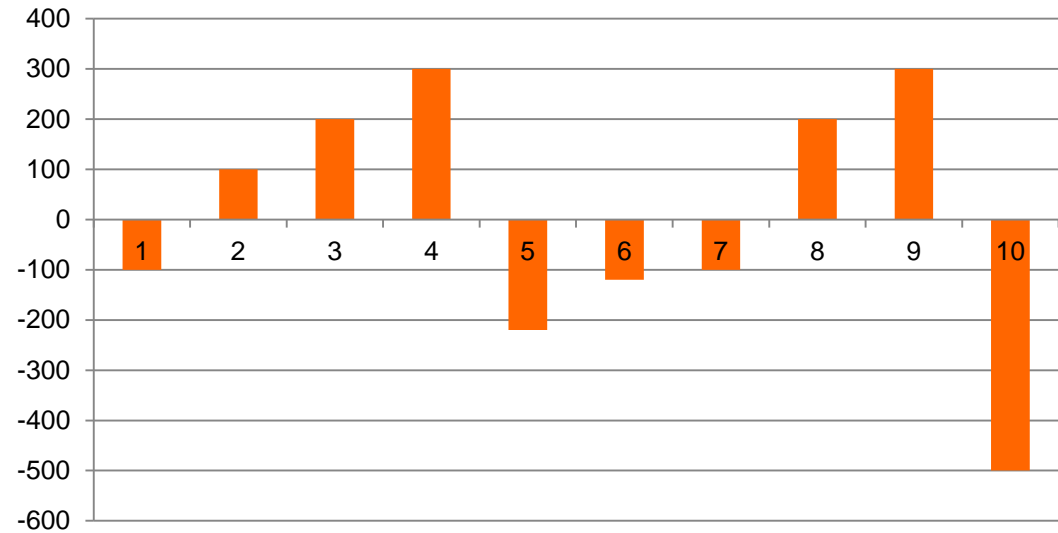thinkforward

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An example

Unreduced exposures:

ID	BPV (in EUR)
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	200
3Y	300
5Y	-500

AVA charge:

ID	AVA shift
1D	2
2D	2
1M	3
2M	3
3M	3
6M	4
1Y	4
2Y	4
3Y	5
5Y	5

Exposure

Initial AVA:

8,240 EUR

Daily market moves

	O/N	T/N	1W	1M	2M	3M	6M	2Y	3Y
Today -100	-0.000152	-0.001445	-0.000898	-0.000505	-0.000226	-8.98E-05	-9.7E-05	0.000273	0.000322
Today -99	-0.001221	-0.001217	-0.003487	-0.001715	-0.001876	-0.000921	-0.000702	-0.000569	-0.000479
Today -98	-0.001455	-0.001014	0.000227	0.000239	0.000241	3.23E-05	4.98E-05	-9.09E-05	1.71E-05
Today -97	0.001586	0.001778	0.000739	-8.89E-05	-1.07E-05	-1.29E-05	1.95E-05	-0.000793	-0.001099
Today -96	0.00038	-0.000256	-0.000324	-0.000454	-0.000512	-0.000396	-0.000297	-0.000384	-0.000387
Today -95	0.002264	0.002268	0.000877	0.000226	-5.19E-05	4.33E-06	-9.66E-05	-0.000554	-0.000615
Today -94	0.000233	0.000279	0.000195	4.53E-05	0.000172	-0.000106	-0.000146	-7.21E-05	-4.83E-05
Today -93	0.000177	0.000172	0.000148	3.34E-05	-4.21E-05	-8E-05	-2.11E-05	0.00039	0.000426
Today -92	0.000494	0.000449	0.00032	0.000195	3.23E-05	2.31E-05	2.79E-05	-0.000512	-0.00059
Today -91	-0.001495	-0.001495	-0.000927	-0.000334	-0.00044	-0.000257	-0.000177	-5.51E-05	-9.85E-06
Today -90	-0.001322	-0.001318	-0.000455	-0.000206	-0.000347	-0.000199	-0.000119	-0.000314	-0.000319
Today -89	-5.91E-05	0.000476	0.000449	0.000183	0.000141	-0.000103	-0.000277	-0.000782	-0.000709
Today -88	0.001419	0.001124	0.000363	0.000123	-5.15E-05	-0.000101	-0.000193	-0.000321	-0.000373
Today -87	5.07E-05	9.87E-06	-8.66E-05	-7.7E-06	-0.000263	-0.000319	-0.000547	-0.001106	-0.001045
Today -86	-0.000139	-0.000342	-0.000322	-0.000197	-0.000589	-0.000718	-0.000647	-0.000326	-0.000259
Today -85	-0.000321	-0.000317	-0.000143	-9.96E-05	-0.000199	-0.000289	-0.000262	-0.000336	-0.000285
Today -84	2.98E-05	0.000275	0.000203	9.55E-05	0.000116	-0.000138	-0.000292	-0.000803	-0.000725

Unreduced exposures:

ID	BPV
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	200
3Y	300
5Y	-500

Daily market moves

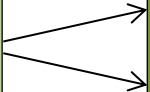|	O/N	T/N	1W	1M	2M	3M
Today -100	-0.000152	-0.001445	-0.000898	-0.000505	-0.000226	-8.98E-05
Today -99	-0.001221	-0.001217	-0.003487	-0.001715	-0.001876	-0.000921
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Today -95	0.002264	0.002268	0.000877	0.000226	-5.19E-05	4.33E-06
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Today -93	0.000177	0.000172	0.000148	3.34E-05	-4.21E-05	-8E-05
Today -92	0.000494	0.000449	0.00032	0.000195	3.23E-05	2.31E-05
Today -91	-0.001495	-0.001495	-0.000927	-0.000334	-0.00044	-0.000257
Today -90	-0.001322	-0.001318	-0.000455	-0.000206	-0.000347	-0.000199

Unreduced P&L vector

-0.44082124
-0.64062424
0.07756494
0.26363672
-0.12411278
0.28825714
0.03930258
0.0431146
0.11503648
-0.16784218
-0.04440774
0.14874234
0.15431646
0.0589955
0.08179544
0.02101658

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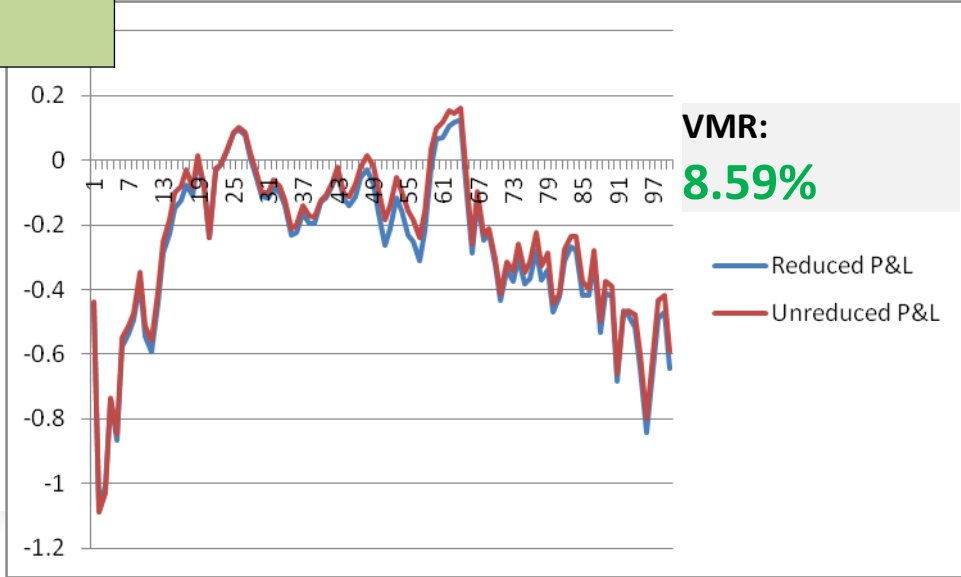
Unreduced exposures:

ID	BPV
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	200
3Y	300
5Y	-500

Rebucketed exposures:

ID	BPV
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	350
3Y	0
5Y	-350

Initial AVA:

8,240 EUR

Rebucketed AVA:

6,590 EUR

VMR:

8.59%

Legend: Reduced P&L, Unreduced P&L

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Unreduced exposures:

ID	BPV
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	200
3Y	300
5Y	-500

Rebucketed exposures:

ID	BPV
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	350
3Y	0
5Y	-350

Rebucketed exposures:

ID	BPV
1D	-100
2D	100
1M	200
2M	300
3M	-220
6M	-120
1Y	-100
2Y	0
3Y	0
5Y	0

Rebucketed AVA 2:

3,440 EUR

Initial AVA:

8,240 EUR

Rebucketed AVA:

6,590 EUR

VMR:

36.43%

Legend: Reduced P&L, Unreduced P&L

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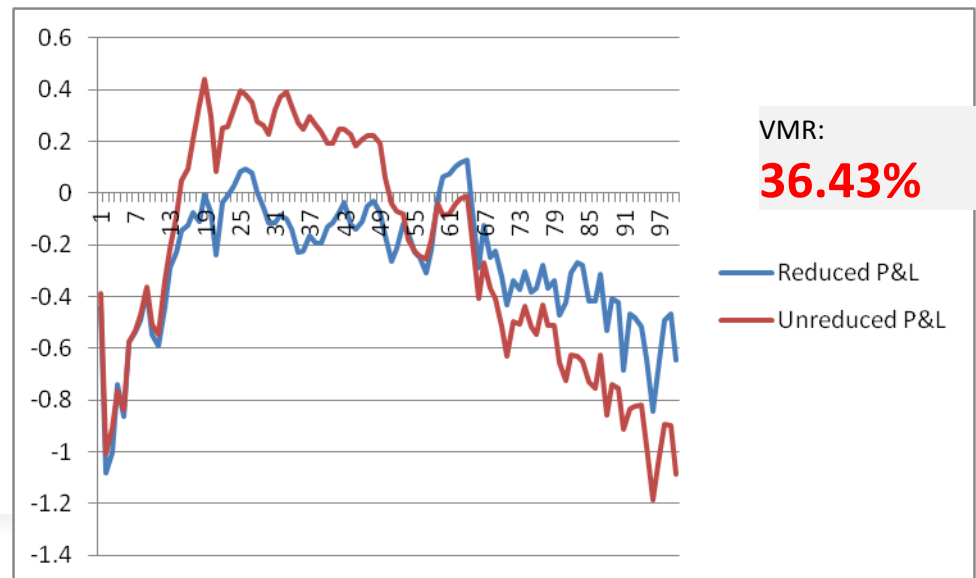
Model risk AVA

- For each valuation model consider model risk arising from potential existence of range of different models/model calibrations.

- Two approaches:

- Determine range of plausible valuations produced from alternative appropriate modelling/calibration approaches. Estimate point within resulting range of valuations associated to 90% confidence level.

- Expert-based approach considering:

  - complexity of products priced by model;

  - diversity of possible mathematical approaches and model parameters (if not related to market variables);

  - degree to which market for relevant products is 'one way';

  - existence of unhedgeable risks in relevant products;

  - adequacy of model in capturing behavior of pay-off of products in portfolio.

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Model risk AVA

- If using expert-based approach, prudence of method shall be confirmed annually by comparing:

  - AVAs calculated using expert based method, if it were applied to a material sample of valuation models for which the institution applies alternative modelling method;

    and

  - AVAs produced by alternative modelling method for same sample of valuation models.

- Alternative modelling approach seems to be most efficient…

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Unearned credit spread AVA

- Uncertainty on CVA ("Credit Valuation Adjustment")

- CVA: market price of ctrpty default on derivative (LGD * PD * EPE)

- Three components:
  - Market price uncertainty → include in market price uncertainty AVA
  - Close-out cost uncertainty → include in close-out AVA
  - Model risk → include in model risk AVA

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Investing and funding costs AVA

- Uncertainty in funding costs when assessing exit price.

- Three components:
  - Market price uncertainty → include in market price uncertainty AVA
  - Close-out cost uncertainty → include in close-out AVA
  - Model risk → include in model risk AVA

- Related to ongoing discussions in industry on FVA ("Funding Valuation Adjustment")

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Concentrated positions AVA

- Three-step approach:
  - Identification of concentrated positions;
  - Estimation of prudent exit period;
  - If prudent exit period > 10 days, estimate AVA (accounting for volatility of valuation input, volatility of bid offer spread, and impact of hypothetical exit strategy on market prices).

- Identification shall consider all of the following:
  - size of all valuation positions relative to liquidity of related market;
  - institution's ability to trade in that market;
  - average daily market volume and typical daily trading volume of institution.

- Relation with liquidity horizons in Fundamental Review of the Trading Book

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Future administrative costs AVA

- If market price uncertainty and close-out cost AVAs for a valuation exposure account for fully exiting exposure, then AVA = 0 for future administrative costs.

- Otherwise: calculate future administrative cost AVA considering administrative costs and future hedging costs over expected life of valuation exposures (discounted using a rate which approximates the risk free rate).

- Administrative costs include all incremental staffing and fixed costs for managing portfolio (reduction may be assumed as size of portfolio reduces).

- Institutions shall calculate the total category level AVA for future administrative costs AVA as the sum of individual future administrative costs AVAs.

Early termination AVA

- Potential losses arising from non-contractual early terminations of client trades.

- Calculate taking into account percentage of client trades that have historically terminated early and losses that arise in those cases.

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Operational risk AVA

- Potential losses as a result of operational risk related to valuation processes (including balance sheet substantiation process, including those due to legal disputes).

- If institution applies Advanced Measurement Approach for Operational Risk, then operational risk AVA = 0 provided that operational risk relating to valuation processes is fully accounted for by the Advanced Measurement Approach calculation.

- Otherwise, operational risk AVA = 10% of sum of aggregated category level AVAs for market price uncertainty and close-out costs.

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Aggregation of AVA's

- Aggregation of adjustments within categories – should diversification be allowed?

- Not realistic that actual realizable price of a position will turn out to be disadvantageous for all positions at same time.

- Correlation matrices (inside asset class and between asset classes)?

- Single large correlation matrix simpler, but for large diversified portfolio with non-zero correlation between errors, benefit tends towards square root of correlation number input.

- For simplicity assume straightforward haircut:

    25% correlation implies 50% haircut.

- Applicable to MPU, CoC and Model Risk AVA

- Rest AVA's: simple sum

Aggregating AVA for MPU, CoC, Model risk

Method 1:

$$APVA = (FV - PV) - 50\% \cdot (FV - PV)$$
$$= 50\% \cdot (FV - PV)$$
$$AVA = \sum APVA$$

Method 2:

$$APVA = max\{0, (FV - PV) - 50\% \cdot (EV - PV)\}$$
$$= max\{0, FV - 50\% \cdot (EV + PV)\}$$
$$AVA = \sum APVA$$

Where:

FV = The valuation exposure level fair value after any accounting adjustment applied in the institution's fair value that can be identified as addressing the same source of valuation uncertainty as the relevant AVA.

PV = The valuation exposure level prudent value determined in accordance with this Regulation.
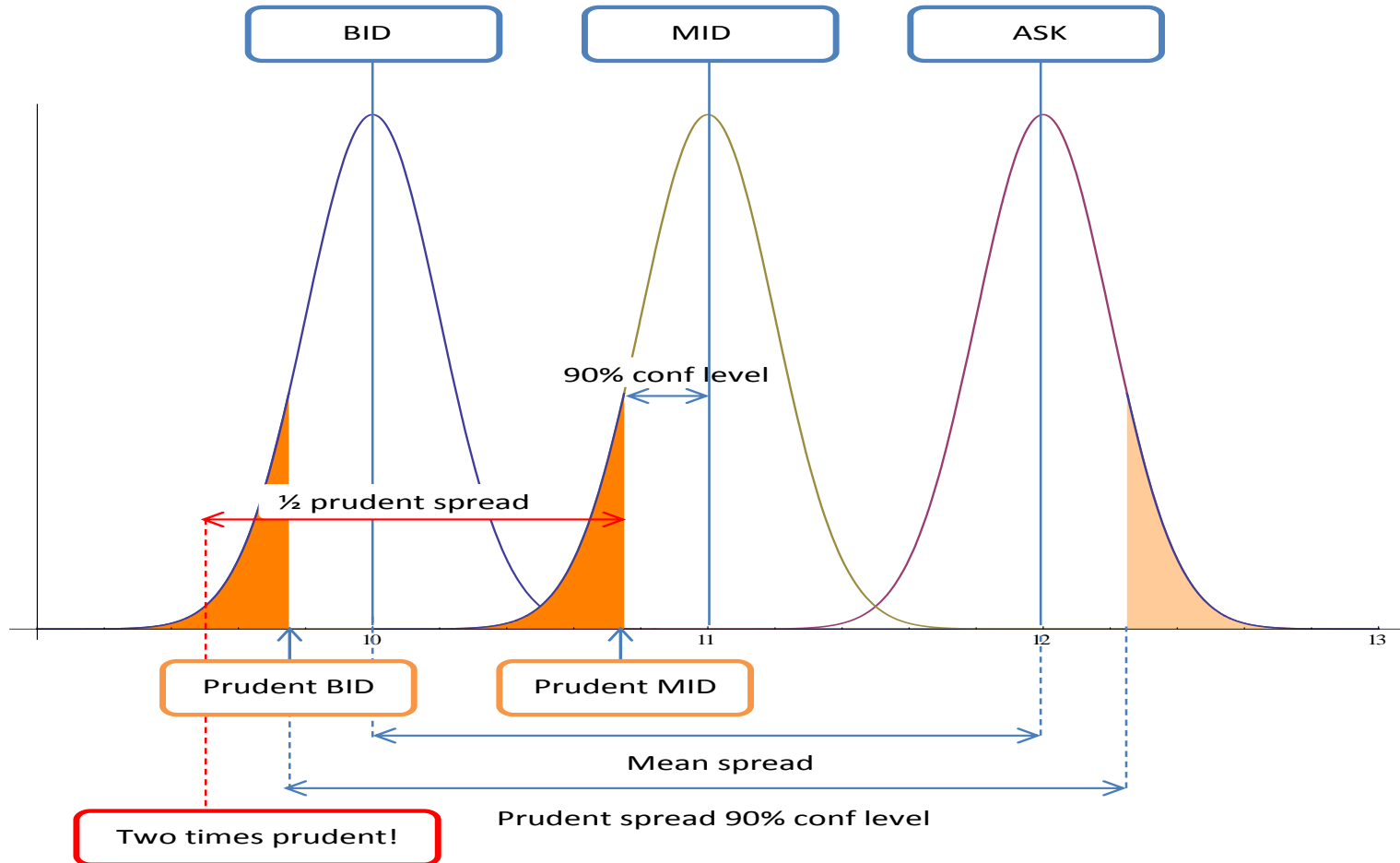
EV = The expected value at a valuation exposure level taken from a range of possible values.

$APVA$ = The valuation exposure level AVA after adjusting for aggregation.

AVA = The total category level AVA after adjusting for aggregation.

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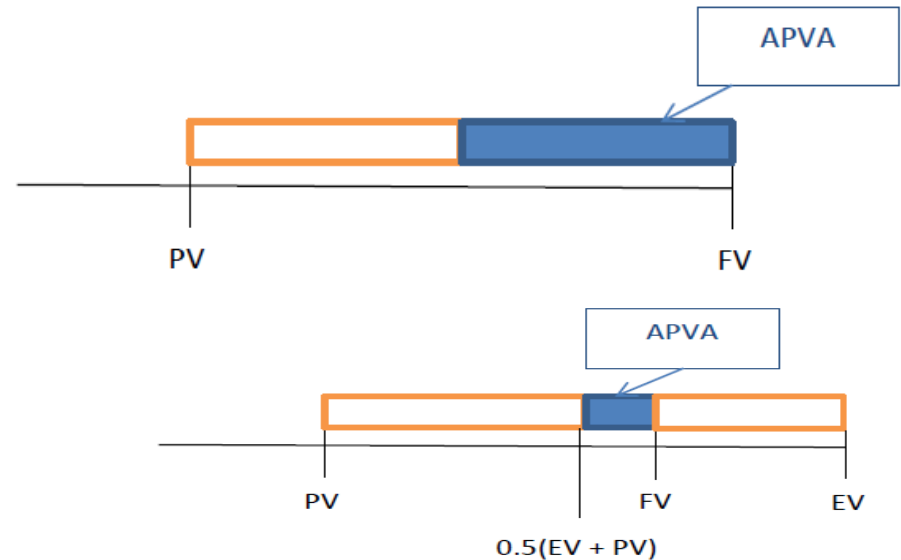
Overlap between market price uncertainty and close out cost

Three scenarios

- Scenario 1:
  - market price AVA using exit prices,
  - close-out cost AVA = 0; no uncertainty in spread since using bid

- Scenario 2:
  - market price AVA based on prudent mid and ½ mean spread (no prudent spread and no netting),
  - close-out cost AVA = 0

- Scenario 3:
  - market price AVA based on ½ prudent spread
  - close-out cost AVA = 0

ONLY Market Price Uncertainty AVA!

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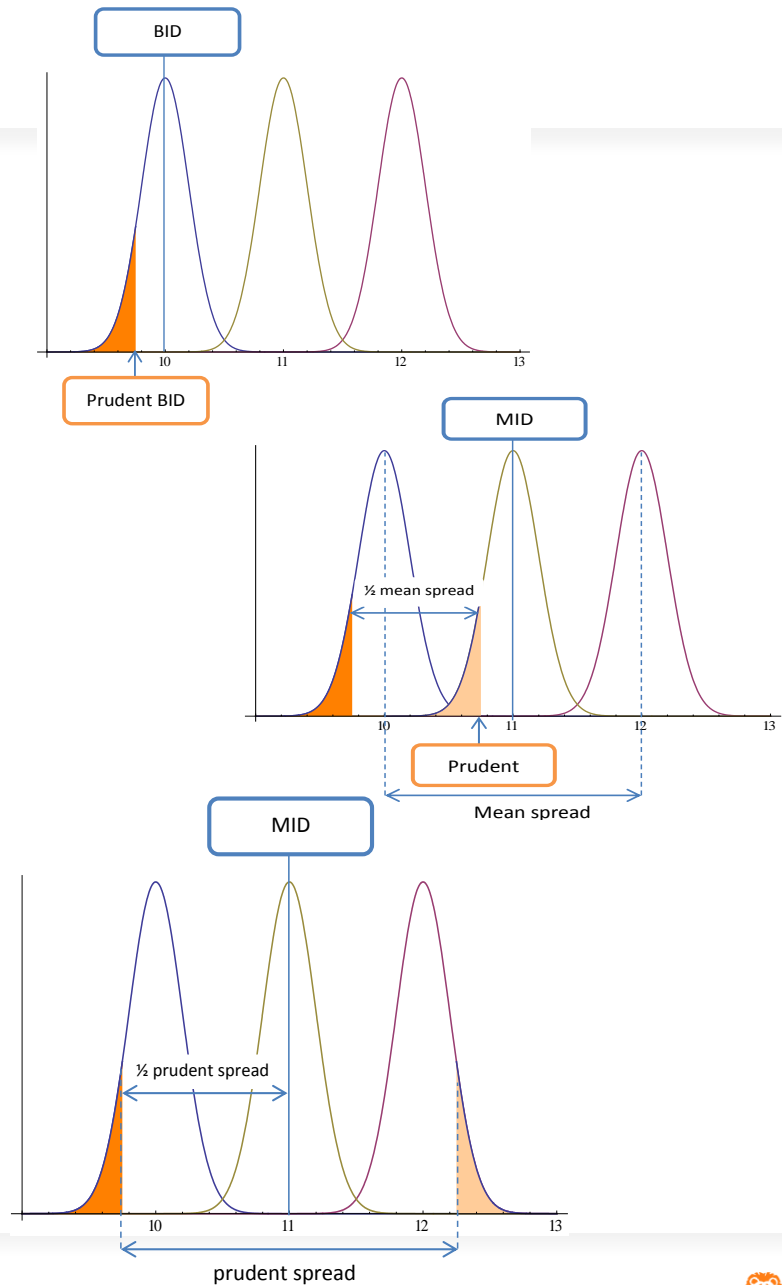
Concerns from industry on netting

- Test for netting is position dependent
  - → different institutions will have inconsistent methodologies by default
  - → variation in netting approaches over time as profile changes

- High correlation of 99.5% required between P&L series of reduced versus unreduced valuation inputs in order to achieve netting benefit.

- Implementation?

- Higher–dimensional cubes (e.g. volatility surface or cube)

Relationship of volatility ratio threshold and correlation

$$A = \frac{\sigma_{(y-x)}}{\sigma_x} = 0.1$$

$Therefore$: $A = \sqrt{\dfrac{\sigma_x^2 + \sigma_y^2 - 2Cov(x,y)}{\sigma_x^2}}$

$$\rho_{xy} = \frac{\sigma_{xy}}{\sigma_x \times \sigma_y}$$

It is reasonable to assume the variance of x and y are of a similar size give the proximity of points on a given curve/surface and the high level of correlation between them, and therefore we simplify by setting them to be equal in this example. Therefore

$$\rho_{xy} = \frac{Cov(x,y)}{\sigma_x^2}$$

$From\ the\ above$: $\quad A = \sqrt{\dfrac{\sigma_x^2 + \sigma_y^2 - 2Cov(x,y)}{\sigma_x^2}}$

$\sigma_x = \sigma_y, therefore$: $\quad A = \sqrt{\dfrac{2\sigma_x^2 - 2Cov(x,y)}{\sigma_x^2}}$

$$A = \sqrt{2 - 2\rho_{xy}}$$

$$A = \sqrt{2(1 - \rho_{xy})}$$

$Therefore,\qquad \rho_{xy} = 1 - \frac{1}{2}A^2$

$A = 0.1, therefore$: $\quad \rho_{xy} = 1 - \frac{1}{2} \times 0.01 = 99.5\%$

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RTS example[1] (using revised risk profile)

Tenor	Risk €/bp	FV rate	Upper rate	Lower rate	Shift from mid (bps)	AVA calc
3y	3,250	0.7775	0.7875	0.758	-2	(6,500)
4y	(2,750)	0.88	0.89	0.86	1	(2,750)
5y	(1,500)	1.02	1.03	1	1	(1,500)
6y	2,250	1.185	1.195	1.165	-2	(4,500)
7y	(3,250)	1.3625	1.3725	1.343	1	(3,250)
8y	1,750	1.54	1.55	1.52	-2	(3,500)
9y	(1,000)	1.7075	1.7175	1.688	1	(1,000)
10y	3,750	1.865	1.875	1.845	-2	(7,500)
12y	(3,100)	2.1375	2.1525	2.113	1.5	(4,650)
15y	2,500	2.43	2.445	2.405	-2.5	(6,250)
20y	(1,500)	2.7375	2.7525	2.713	1.5	(2,250)
25y	1,750	2.895	2.91	2.87	-2.5	(4,375)
30y	(2,750)	2.9675	2.9825	2.943	1.5	(4,125)
40y	1,250	3.0525	3.0775	3.018	-3.5	(4,375)
50y	(750)	3.07	3.105	3.025	3.5	(2,625)
	(100)					
5y-3y spread		0.2425	0.2575	0.2275		
7y-3y spread		0.585	0.6	0.57		
30y-10y spread		0.83	0.85	0.81		
50y-10y spread		1.205	1.245	1.165		

AVA   **(59,150)**

[1]From Section 4.1 (scenario 3) of the RTS

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Adjusted RTS example with reduced buckets

Maturity	Tenor bucket1	Tenor bucket 1 apportionment	Tenor bucket2	Tenor bucket 2 apportionment	Tenor	Risk	Shift from mid (bps)	AVA calc
3y	3Y	100%			3y	1,875	-2	(3,750)
4y	3Y	50%	5y	50%				
5y			5y	100%	5y	(1,750)	1	(1,750)
6y	7y	50%	5y	50%				
7y	7y	100%			7y	(1,292)	1	(1,292)
8y	7y	67%	10y	33%				
9y	7y	33%	10y	67%				
10y			10y	100%	10y	2,437	-2	(4,873)
12y	20y	20%	10y	80%				
15y	20y	50%	10y	50%				
20y	20y	100%			20y	5	-2.5	(13)
25y	20y	50%	30y	50%				
30y			30y	100%	30y	(1,250)	1.5	(1,875)
40y	50Y	50%	30y	50%				
50y	50Y	100%			50y	(125)	3.5	(438)

AVA   (13,990)

Issue with calibration of the ratio test

- Daily rate changes for 100 day period of 7 November 2013 to 31 March 2014:

	X Daily P&L based on unreduced inputs	Y Daily P&L based on reduced inputs	Difference
Cumulative profit and loss	15,474	15,580	(106)
Standard deviation	2,189	1,985	497
Ratio			22.7%
Correlation			97.64%

- Based on RTS, the inputs can not be reduced, even though correlation is high and difference in cumulative profit and loss is almost negligible.

- Reason: RTS deals with volatility ratio rather than variance ratio.

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RTS example using spread trades

Tenor	Risk	Switch Trades				Residual Risk	Shift from mid (bps)	AVA Calc
		50y - 10y	30y - 10y	7y - 3y	5y - 3y			
3y	3,250			(3,250)		0	-2	-
4y	(2,750)					(2,750)	1	(2,750)
5y	(1,500)					(1,500)	1	(1,500)
6y	2,250					2,250	-2	(4,500)
7y	(3,250)			3,250		0	1	-
8y	1,750					1,750	-2	(3,500)
9y	(1,000)					(1000)	1	(1,000)
10y	3,750	(750)	(2,750)			250	-2	(500)
12y	(3,100)					(3,100)	1.5	(4,650)
15y	2,500					2,500	-2.5	(6,250)
20y	(1,500)					(1,500)	1.5	(2,250)
25y	1,750					1,750	-2.5	(4,375)
30y	(2,750)		2,750			0	1.5	-
40y	1,250					1,250	-3.5	(4,375)
50y	(750)	750				0	3.5	-
5y-3y spread						0	-1.5	-
7y-3y spread				3,250		3,250	-1.5	(4,875)
30y-10y spread			2,750			2,750	-2	(5,500)
50y-10y spread		750				750	-4	(3,000)

AVA   **(49,025)**

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Overview

Reserves AVA
- Market Price Uncertainty AVA
- Close-out cost AVA
- Model risk AVA

Diversification effects

CVA/FVA
- Unearned credit spreads AVA
- Investing and funding cost AVA

Allocation to MPU, CoC, Model risk

Other AVA
- Concentrated positions AVA
- Early termination AVA
- Future administrative costs AVA
- Operational risk AVA

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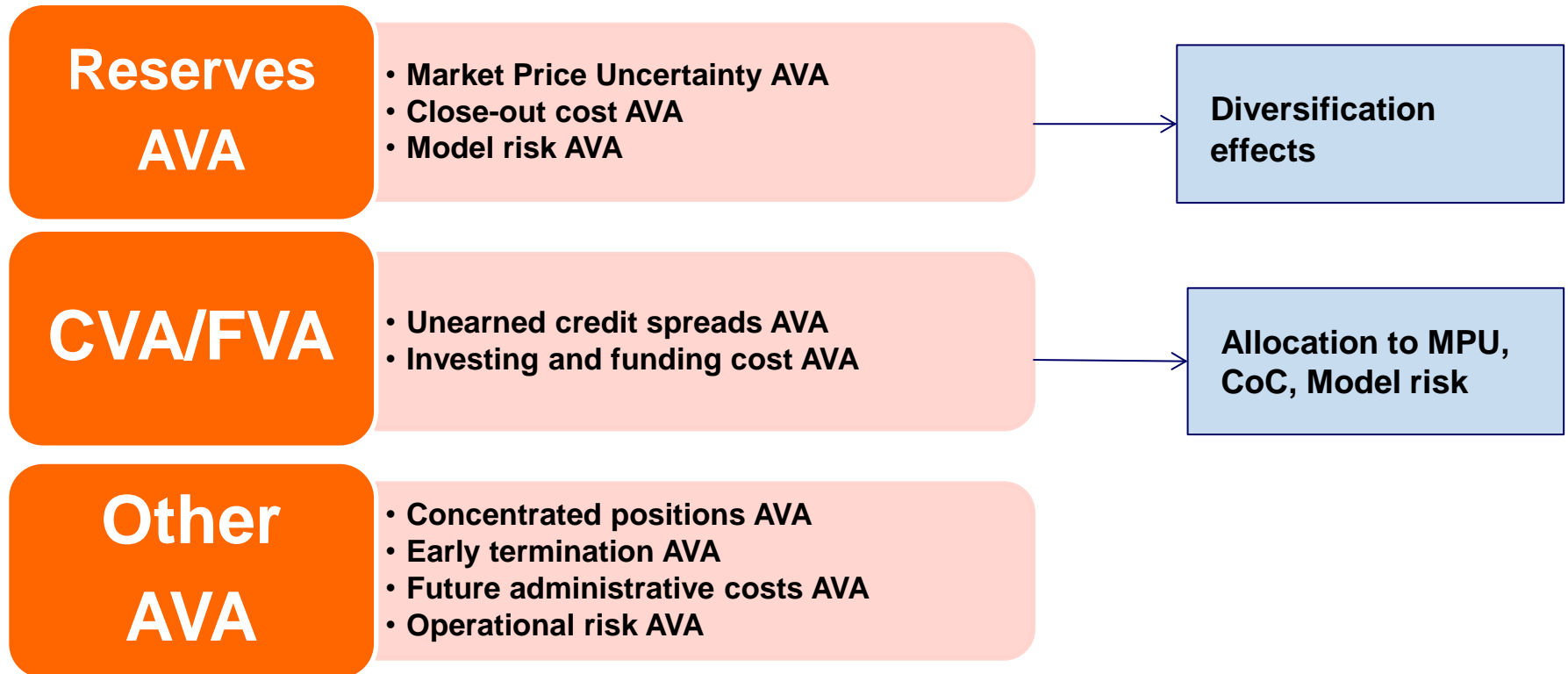
References

- Final Draft RTS:

  http://www.eba.europa.eu/regulation-and-policy/market-risk/draft-regulatory-technical-standards-on-prudent-valuation

- Discussion paper (13 November 2012)

  http://www.eba.europa.eu/regulation-and-policy/market-risk/draft-regulatory-technical-standards-on-prudent-valuation/-/regulatory-activity/discussion-paper

- Consultation paper (10 July 2013)

  http://www.eba.europa.eu/regulation-and-policy/market-risk/draft-regulatory-technical-standards-on-prudent-valuation/-/regulatory-activity/consultation-paper

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Questions

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