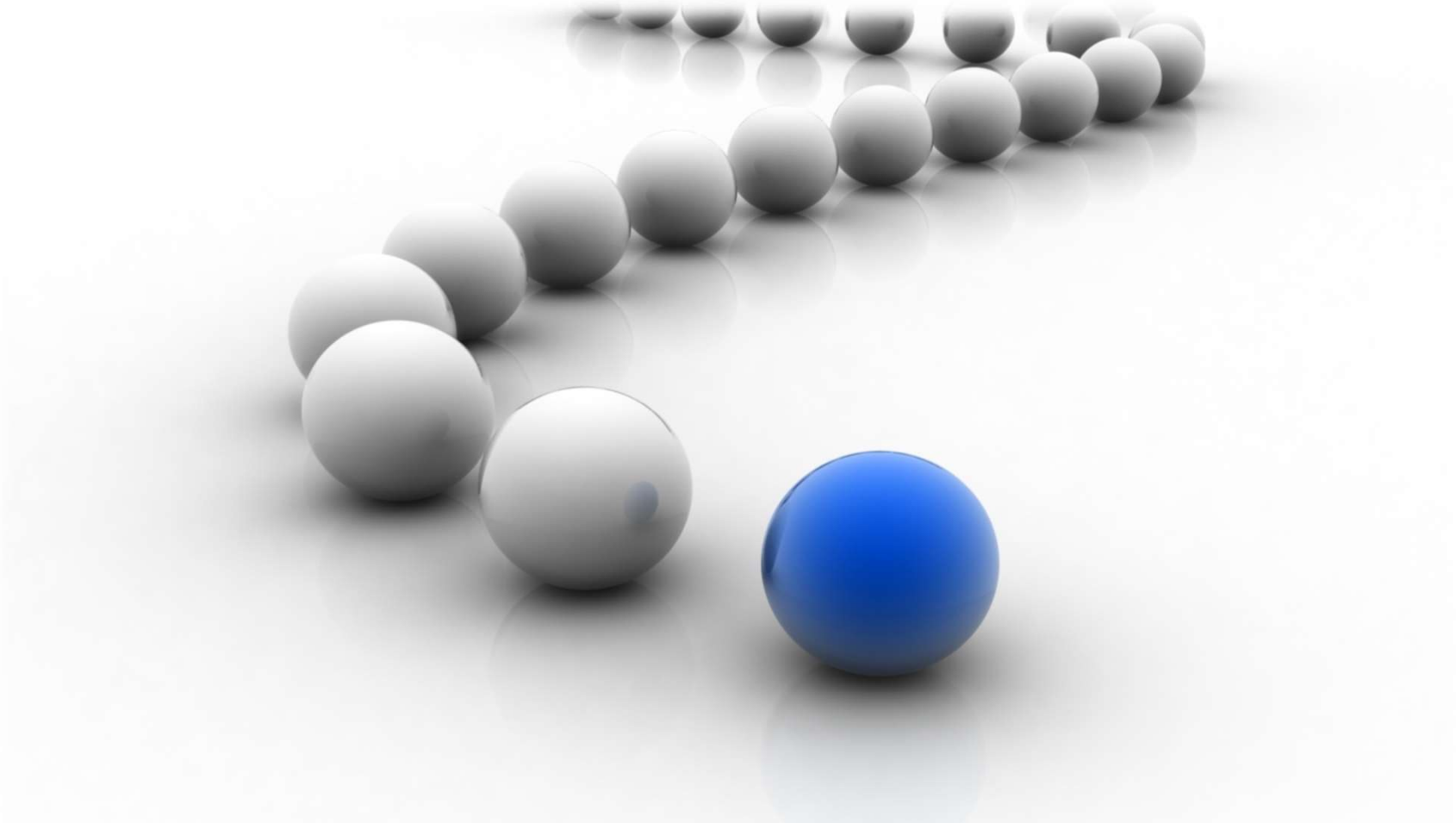


Symmetric or Asymmetric FVA?

Jon Gregory, WBS xVA conference, 14th March 2019

Important Points

1. Managing CVA can be done in isolation but FVA introduces the need to consider the funding strategy and/or funding centre (Treasury) of the bank
2. In general, xVA charges are 'unhelpful' but one exception is the funding benefit that can be seen in 'liability heavy' derivatives such as cross-currency swaps receiving the higher interest rate (some evidence of such trades occasionally clearing through mid)
3. The form of xVA depends crucially on the underlying strategy that will define the economic value and the point of view (shareholder/bondholder) in the case of accounting value
4. The funding strategy from an FVA perspective is often simplistic (for example, Treasury may charge for net borrowing only on an accrual basis)
5. Most banks calculate FVA at the counterparty level
6. Banks generally price xVAs not to a well-defined hedging cost but to create the right incentive and may make certain behavioural assumptions
7. Regulatory mandates such as NSFR are difficult to deal with since they are binary conditions and apply at the bank level
8. This talk is largely about economic FVA and not accounting FVA

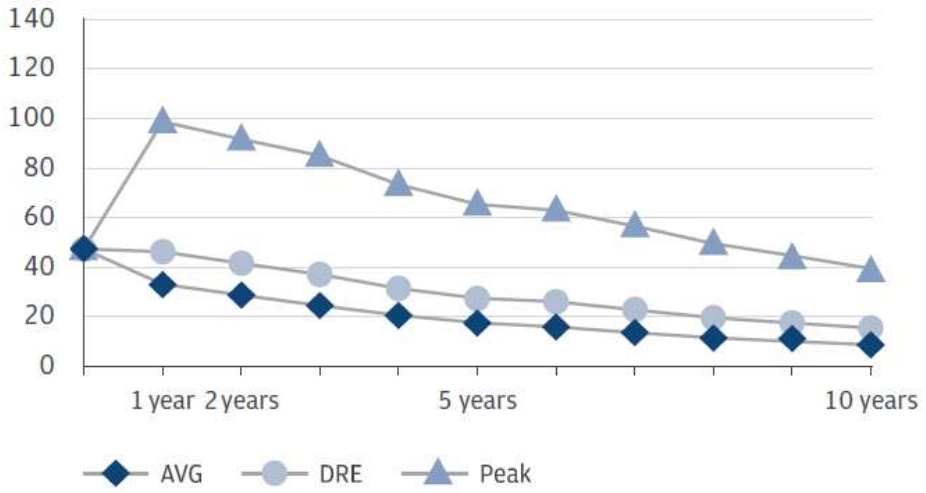
Basic FVA and Discounting

Defining Funding Costs

- **Funding in derivatives can be seen to relate to**
  - Cashflows (often hedged)
  - MTM (often zero at inception)
  - Collateral flows
- **For example, Treasury may consider collateral as defining funding but quants may use MTM to use CVA-like calculations on only the uncollateralised universe of trades**
- **Important to be consistent and deal with all possibilities**
  - Off market transactions
  - Restrikes, unwinds, change in CSA terms

Elements of FVA

FVA is taken to incorporate the impact of funding in the Firm's valuation estimates where there is evidence that a market participant in the principal market would incorporate it in a transfer of the instrument. For collateralized derivatives, the fair value is estimated by discounting expected future cash flows at the relevant overnight indexed swap ("OIS") rate given the underlying collateral agreement with the counterparty. For uncollateralized (including partially collateralized) over-the-counter ("OTC") derivatives and structured notes, effective in 2013, the Firm implemented a FVA framework to incorporate the impact of funding into its valuation estimates. The Firm's FVA framework leverages its existing CVA and DVA calculation methodologies, and considers the fact that the Firm's own credit risk is a significant component of funding costs. The key inputs to FVA are: (i) the expected funding requirements arising from the Firm's positions with each counterparty and collateral arrangements; (ii) for assets, the estimated market funding cost in the principal market; and (iii) for liabilities, the hypothetical market funding cost for a transfer to a market participant with a similar credit standing as the Firm.



EMTM EPE PFE (97.5%)

Source: JP Morgan Annual Report 2018

FVA Definition

- **One definition of FVA is that it is the impact of discounting at 'cost of funding' compared to collateral discounting**

$$FVA = MTM(Cost\ of\ funding\ discounting) - MTM(OIS\ discounting)$$

"Transactions secured with collateral are valued using a discount curve based on the overnight index spread. Transactions not secured with collateral are valued using a discount curve based on Euribor/Libor plus a spread that reflects market conditions."

- **This is a transaction level calculation**
  - No FVA as such, just a difference in discounting methodologies
  - Very convenient in terms of sensitivities and market risk capital
- **But what does this assume?**

Discounting Approach

$$FVA = \sum_i CF_{t_i} DF_{t_i} \underbrace{\exp\left[-FS_{t_i} \times t_i\right]} - \sum_i CF_{t_i} DF_{t_i}$$

Funding spread term

$$= \sum_i CF_{t_i} DF_{t_i} \left\{\exp\left[-FS_{t_i} \times t_i\right] - 1\right\}$$

- **Define the expected MTM (EMTM)**

$$EMTM(t_i) = \sum_{i+1} CF_{t_i} DF_{t_i}$$

$$CF_{t_i} DF_{t_i} = EMTM_{t_{i-1}} - EMTM_{t_i}$$

Discounting Approach

- **FVA can then be written as:**

$$FVA = \sum_i \left[EMTM_{t_{i-1}} - EMTM_{t_i}\right]\left\{\exp\left[-FS_{t_i} \times t_i\right] - 1\right\}$$

- **To give a CVA-like formula**

$$FVA = -\sum_i EMTM_{t_{i-1}}\left\{\exp\left[-FS_{t_{i-1}} \times t_{i-1}\right] - \exp\left[-FS_{t_i} \times t_i\right]\right\}$$

- **Separated into cost and benefit terms via:** $EMTM = EPE + ENE$
- **This is the well-known symmetric FVA formula**
  - In this derivation, we implicitly assume that we can borrow or lend money arising from cashflows at the same cost of funding
  - More generally, this arises where a bond position is used to finance and invest cash (Burgard and Kjaer)
  - Survival probabilities need to be considered and outcome depends on precise strategy – no market consensus yet

Symmetric FVA

- **Symmetric FVA**

$$FVA = FCA + FBA$$

- **Has the nice additive property:**

$$FVA = \sum_i FVA_i = \sum_i FCA_i + \sum_i FBA_i$$

- **It also has resolved the DVA debate where FBA = DVA (sort of)**
- **However**
  - This funding strategy relies on the assumption that funding benefits will either offset funding costs or can always be recycled (e.g. excess cash) through other activities in the bank

Asymmetric Funding

Asymmetric FVA

- **An alternative view is that funding benefits (e.g. excess collateral) do not provide a benefit and can only be invested at the risk-free rate (e.g. Albanese et al.)**
- **FVA is now basically FCA only and must be calculated at the portfolio ('funding set') level**
  - In theory, should capture full universe of trades but may reasonably capture only uncollateralised and partially collateralised ones

$$FCA_p = -\sum_{i=1}^{m} E\left[\left(\left(\sum_{trades} V_{t_i}^{j}\right) - \left(\sum_{collateral} C_{t_i}^{k}\right)\right)^{+}\right] \times FS_{t_i}^{borrow} \times (t_i - t_{i-1})\Bigg)$$

$$\sum_j FCA_j \leq FCA_p \leq \sum_j FVA_j$$

Treasury Policy

- **Treasury policy over funds transfer pricing can vary:**
- **General approach**
  - Accrual based or
  - Term based
- **Symmetry (xVA desk point of view)**
  - Borrow and lend at OIS (no FVA)
  - Borrow and lend at unsecured rate (symmetric FVA)
  - Borrow at an unsecured rate, lend at OIS (asymmetric FVA)
  - Borrow at an unsecured rate, lend at a shorter-term unsecured rate (partially symmetric FVA)
  - (Some banks don't actually know what the lending rate is)
- **Definition of funding cost/benefit**
  - Uncollateralised MTM
  - Total collateral posted
  - Collateralised MTM
  - Total MTM minus total collateral

NSFR

NSFR for Derivatives (from BIS)

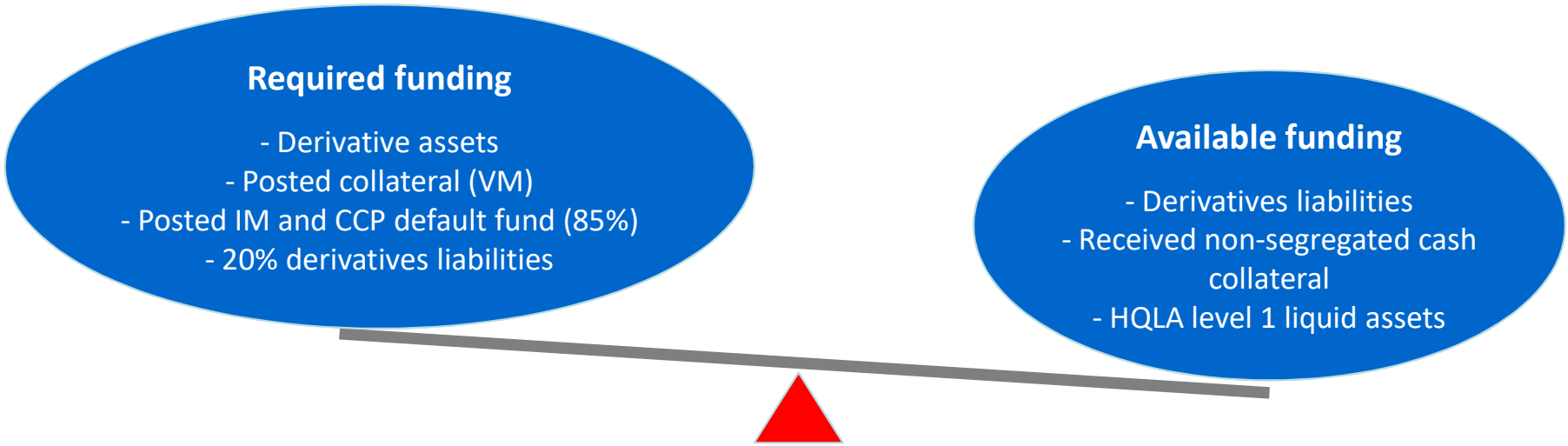
- NSFR derivative assets = (derivative assets) – (cash collateral received as variation margin on derivative assets)
- NSFR derivative liabilities = (derivative liabilities) – (total collateral posted as variation margin on derivative liabilities)

- RSF = 100% x MAX ((NSFR derivative assets – NSFR derivative liabilities), 0)
- ASF = 0% x MAX ((NSFR derivative liabilities – NSFR derivative assets), 0)

- RSF = 20% x (NSFR derivative liabilities before deducting variation margin posted)

- In the EU, there are proposed amendments relating to broadening received collateral and reducing the 20% RSF on liabilities to a minimum of 5%

Net Stable Funding Ratio (NSFR)



0%	• All other liabilities and equity not included in the above categories, including liabilities without a stated maturity (with a specific treatment for deferred tax liabilities and minority interests) • NSFR derivative liabilities net of NSFR derivative assets if NSFR derivative liabilities are greater than NSFR derivative assets • "Trade date" payables arising from purchases of financial instruments, foreign currencies and commodities

"The NSFR assigns a 20% "required stable funding" factor to derivative liabilities. The Committee has agreed that, at national discretion, jurisdictions may lower the value of this factor, with a floor of 5%."

BIS October 2017

NSFR Example

	2014	
		ASF/RSF (1)
	£bn	£bn
Equity		
- regulatory capital	49	49
- other equity	11	—
Wholesale funding > 1 year	63	63
Wholesale funding < 1 year	53	—
Derivative liabilities	350	—
Repurchase agreements	65	—
Deposits		
- retail and SME - more stable	206	196
- retail and SME - less stable	62	56
- other	147	74
Other (2)	45	—
Total liabilities and equity	1,051	438

Cash	75	—
Inter-bank lending	25	4
Debt securities > 1 year		
- governments AAA to AA-	46	2
- other eligible bonds	22	3
- other bonds	9	9
Debt securities < 1 year	25	13
Derivative assets		
- assets equal to derivative liabilities	350	—
- excess over derivative liabilities	4	4
Reverse repurchase agreements	65	7
Customer loans and advances > 1 year		
- residential mortgages	138	90
- other	123	105
Customer loans and advances < 1 year	134	67
Other (3)	35	35
Total assets	1,051	339
Derivative liabilities after mtm netting arrangements	55	11
Undrawn commitments	215	11
Total assets and undrawn commitments	1,321	361
Net stable funding ratio		121%

NSFR Ratio = 121%

NSFR Ratio (without derivatives) = 127%

Pricing to NSFR Invariance

- **Invariance pricing = charge funding to keep our NSFR the same**

$$NSFR = \frac{\sum_i ASF_i}{\sum_i RSF_i} = \frac{\sum_i ASF_i + ASF_{new}}{\sum_i RSF_i + RSF_{new}}$$

$$ASF_{new} = NSFR \times \underbrace{RSF_{new}}_{\text{Increase in RSFs}}$$

- **For uncollateralised derivatives, RSF terms from:**
  - 100% assets less liabilities (if positive) – i.e. EPE
  - 20% (or less) liabilities charge
- **For collateralised derivatives**
  - Component for non-cash variation margin
- **NSFR invariance price would be:**
  - Fully asymmetric FVA (portfolio FCA)
  - 20% (or less) charge for increase in liability component
  - Charge for collateralised counterparties posting non-cash collateral
  - All the above times a multiplier equal to the bank's current (or desired) NSFR ratio
  - Funding cost would be the cost of raising funding with 100% ASF

Move to Asymmetric FVA?

Asymmetric FVA

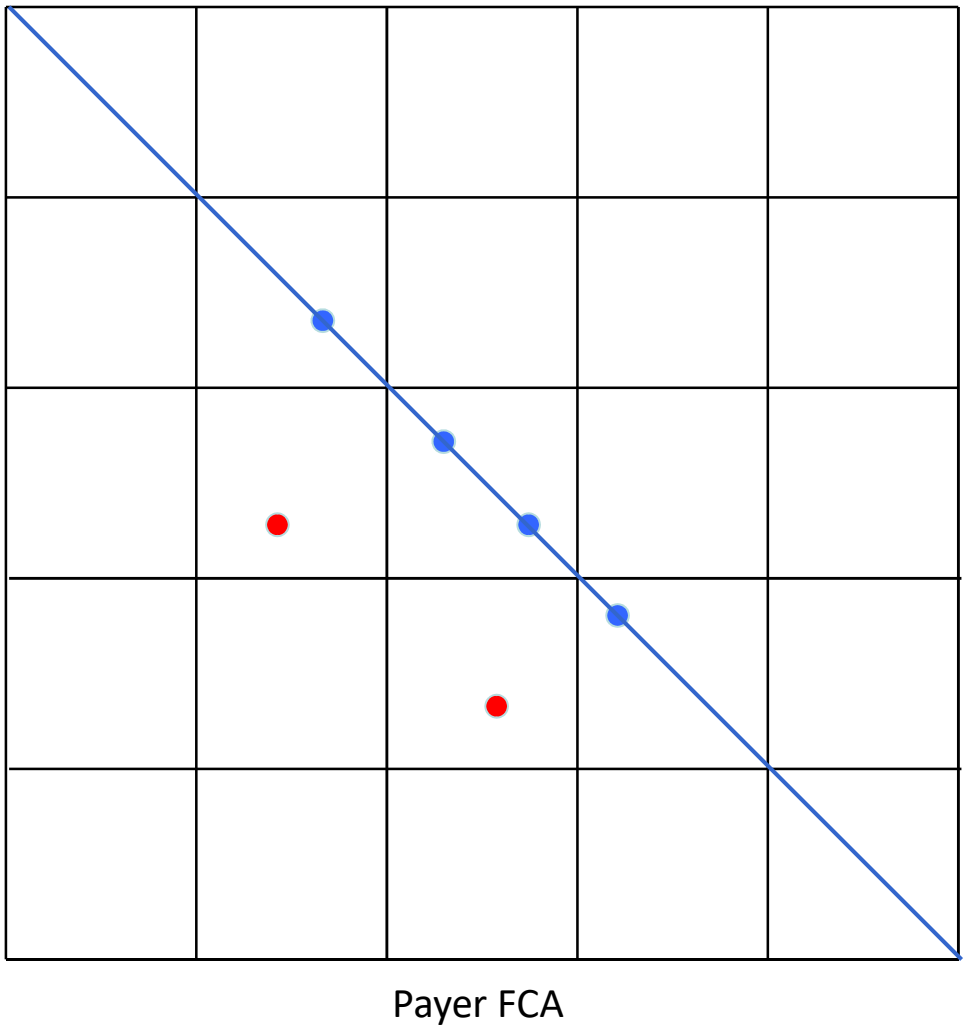
- **It is hard to argue that funding is symmetric and for most banks the reality is probably asymmetric or partially asymmetric FVA**

$$FCA = -\sum_{i=1}^{m} E\left[\left(\left(\sum_{trades} V_{t_i}^{j}\right) - \left(\sum_{collateral} C_{t_i}^{k}\right)\right)^{+}\right] \times FS_{t_i}^{borrow} \times (t_i - t_{i-1})\Bigg)$$

$$FBA = -\sum_{i=1}^{m} E\left[\left(\left(\sum_{trades} V_{t_i}^{j}\right) - \left(\sum_{collateral} C_{t_i}^{k}\right)\right)^{-}\right] \times FS_{t_i}^{lend} \times (t_i - t_{i-1})\Bigg)$$

- **Symmetric:** $FS^{borrow} = FS^{lend}$
- **Asymmetric:** $FS^{borrow} > FS^{lend}$
- **Partially asymmetric:** $FS^{borrow} > FS^{lend} > 0$

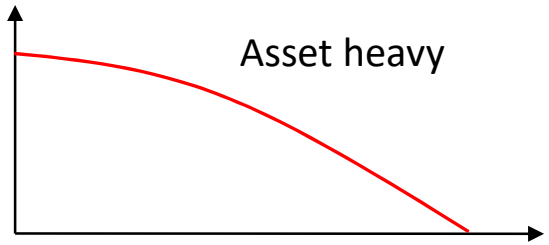
Stand-alone impact of FCA / FBA

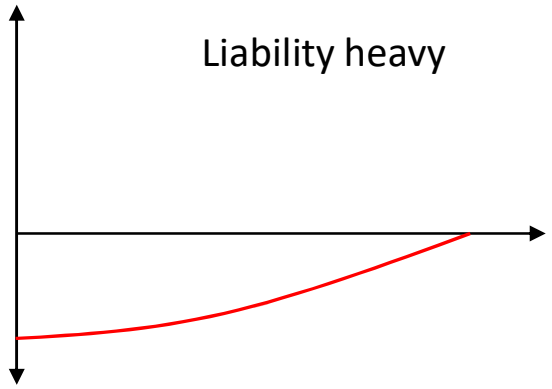


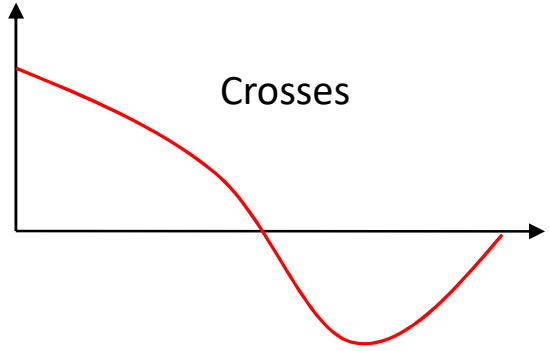
- Symmetric
- Partially Asymmetric

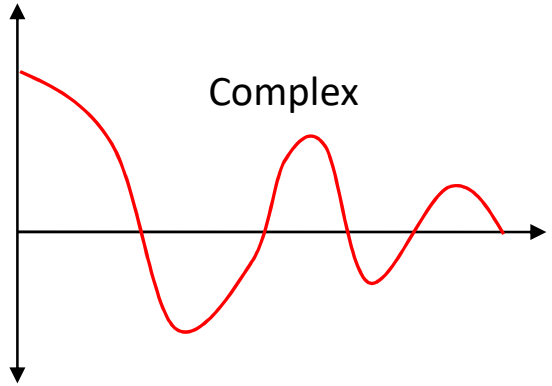
Asset or Liability Heavy

- **The nature of the underlying portfolio (EMTM) is clearly important**

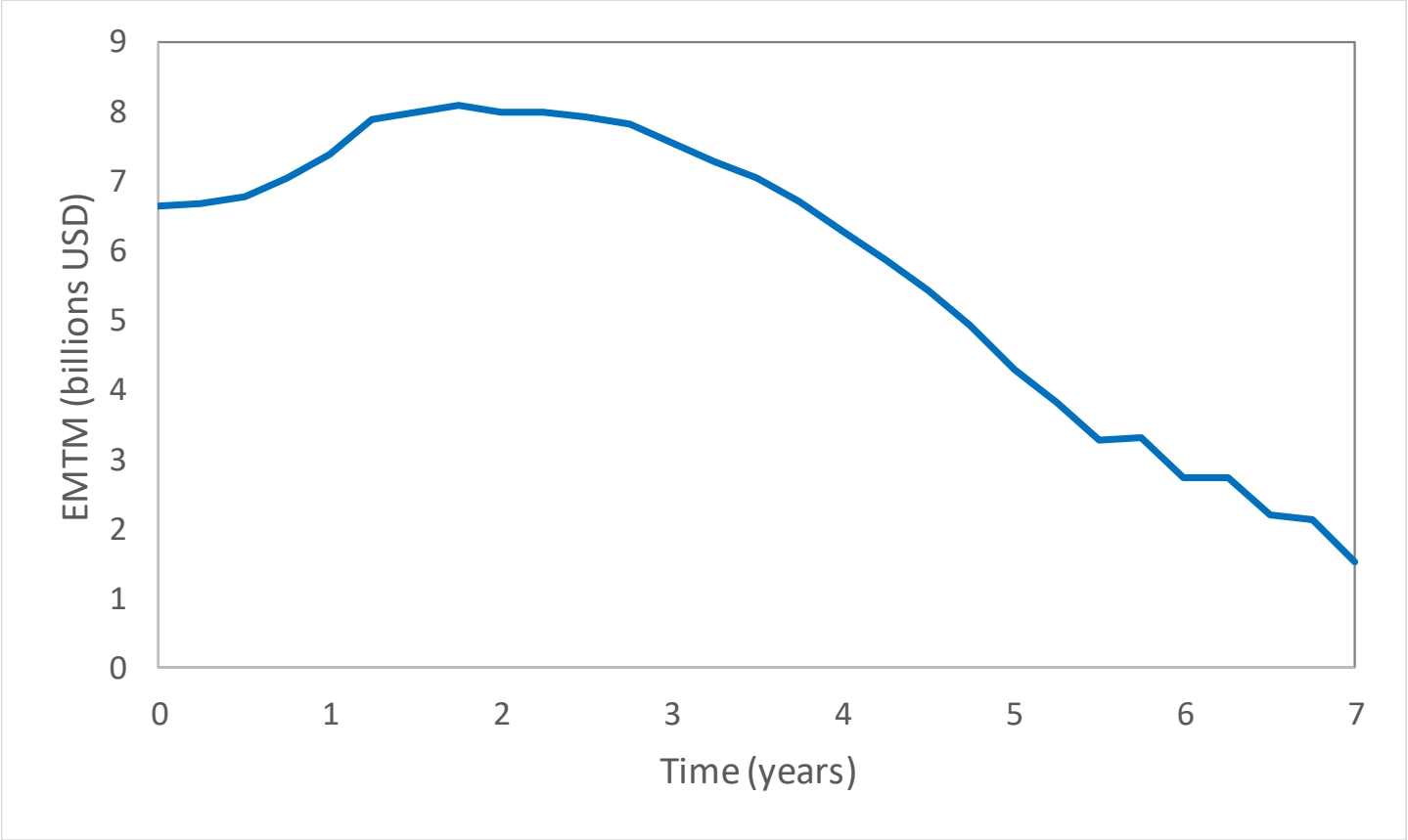




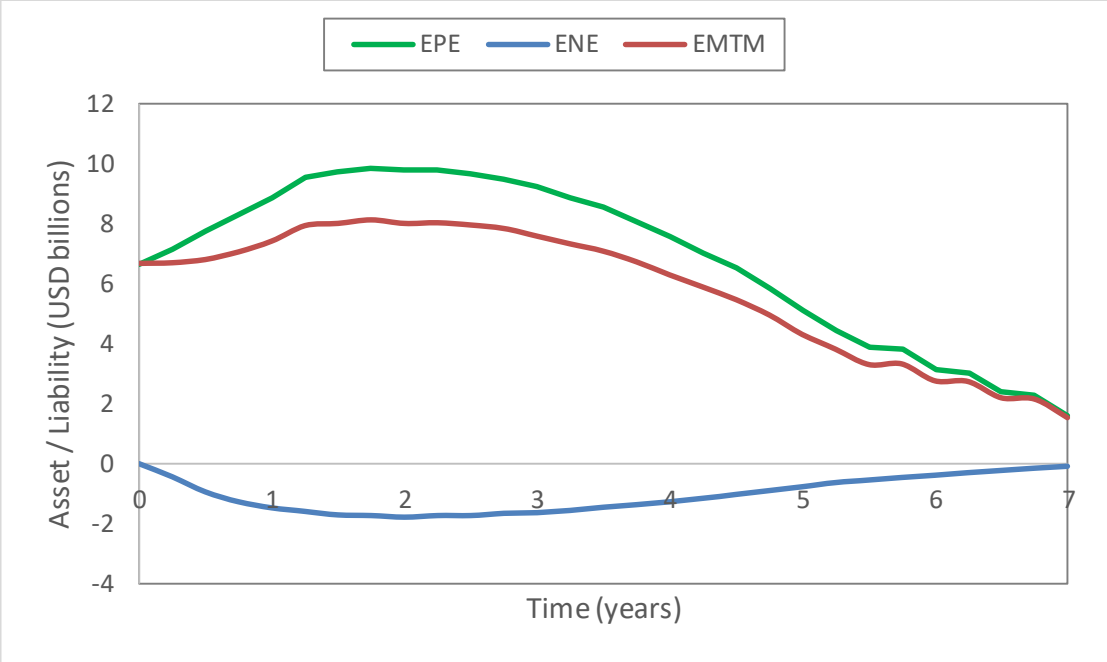




Asset Heavy Example



But Not Completely Asset Dominant

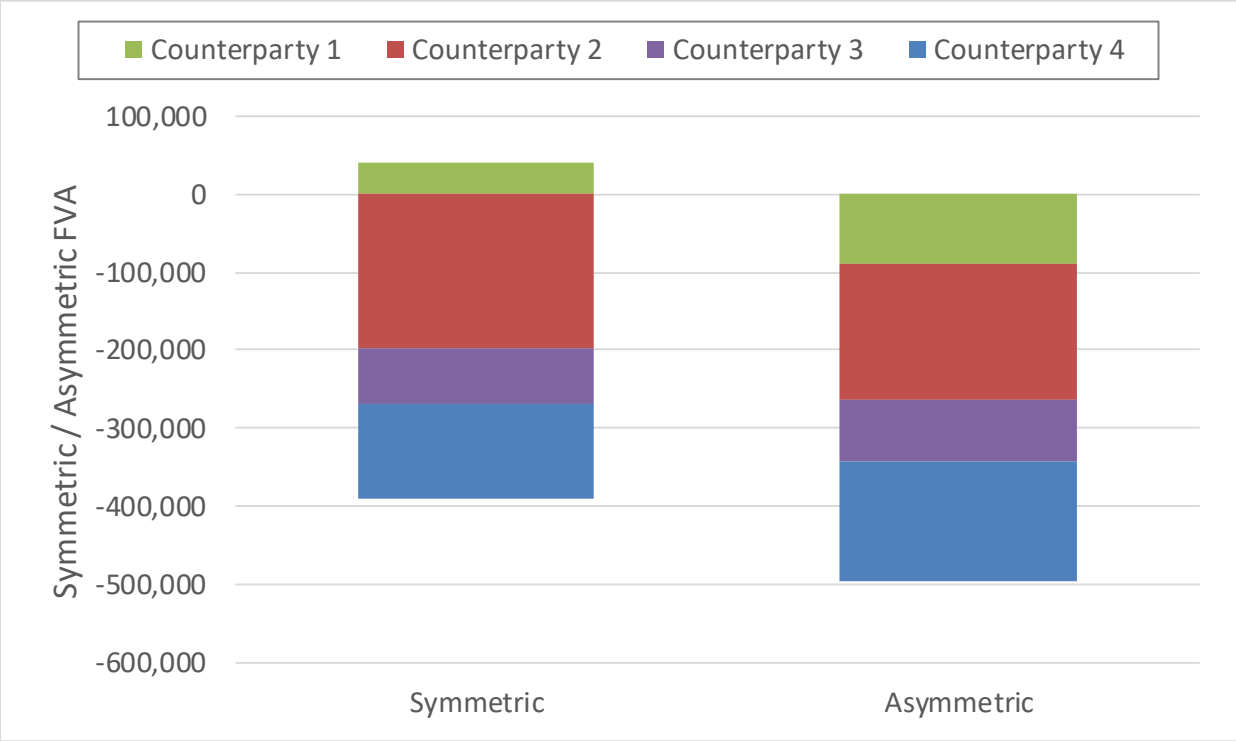


	Symmetric	Asymmetric
FCA	-523,467	-464,766
FBA	132,993	n/a
FVA	-390,474	-464,766

Increase of 19%

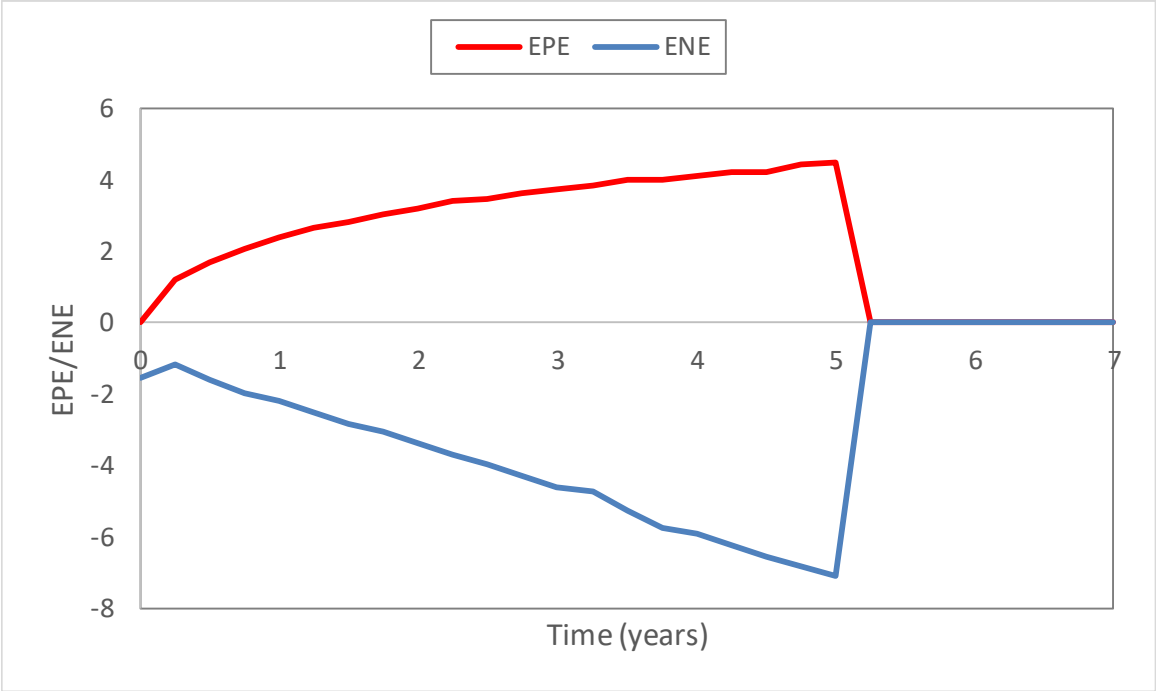
FVA Allocation

- **Euler allocation by counterparty**



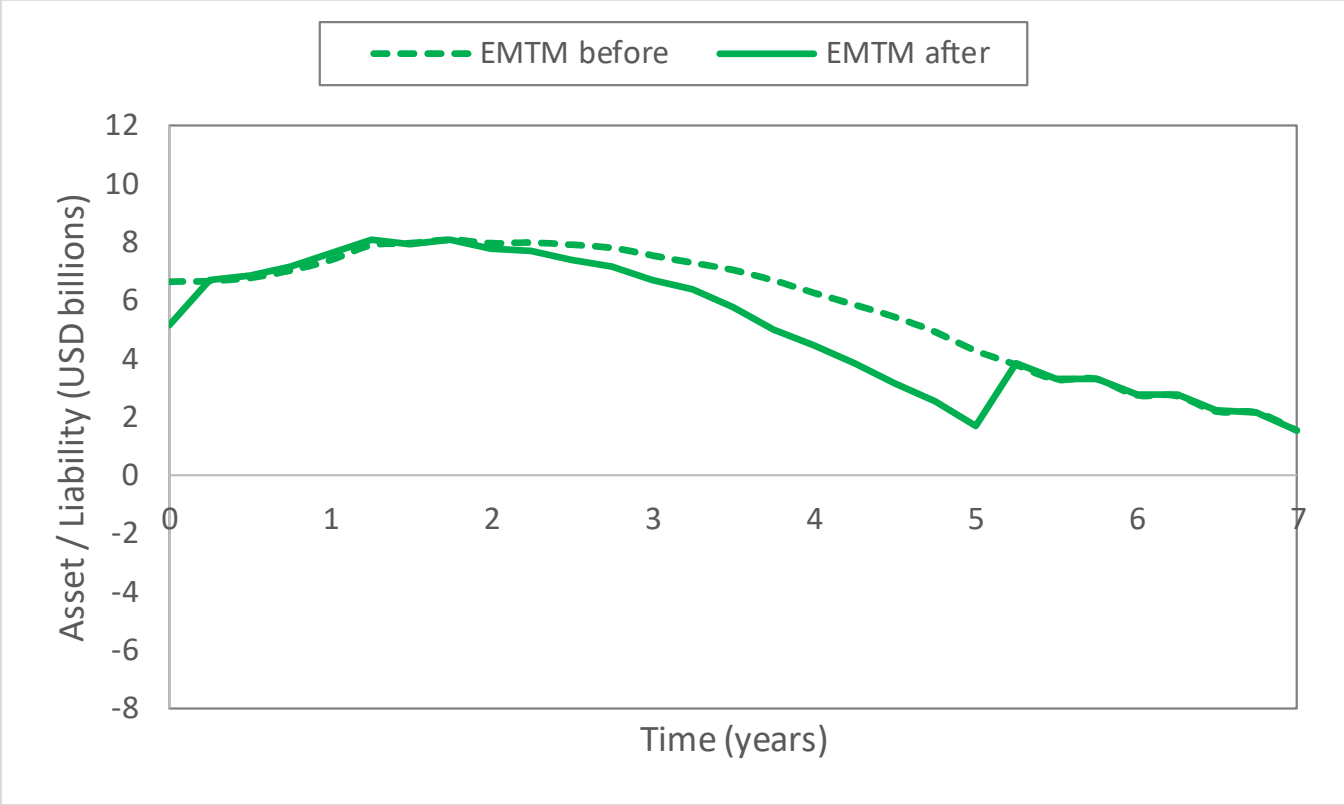
	Symmetric	Asymmetric
Counterparty 1	41,073	-88,313
Counterparty 2	-196,910	-174,080
Counterparty 3	-72,101	-80,805
Counterparty 4	-121,462	-151,869

Pre-deal Pricing – Stand-alone



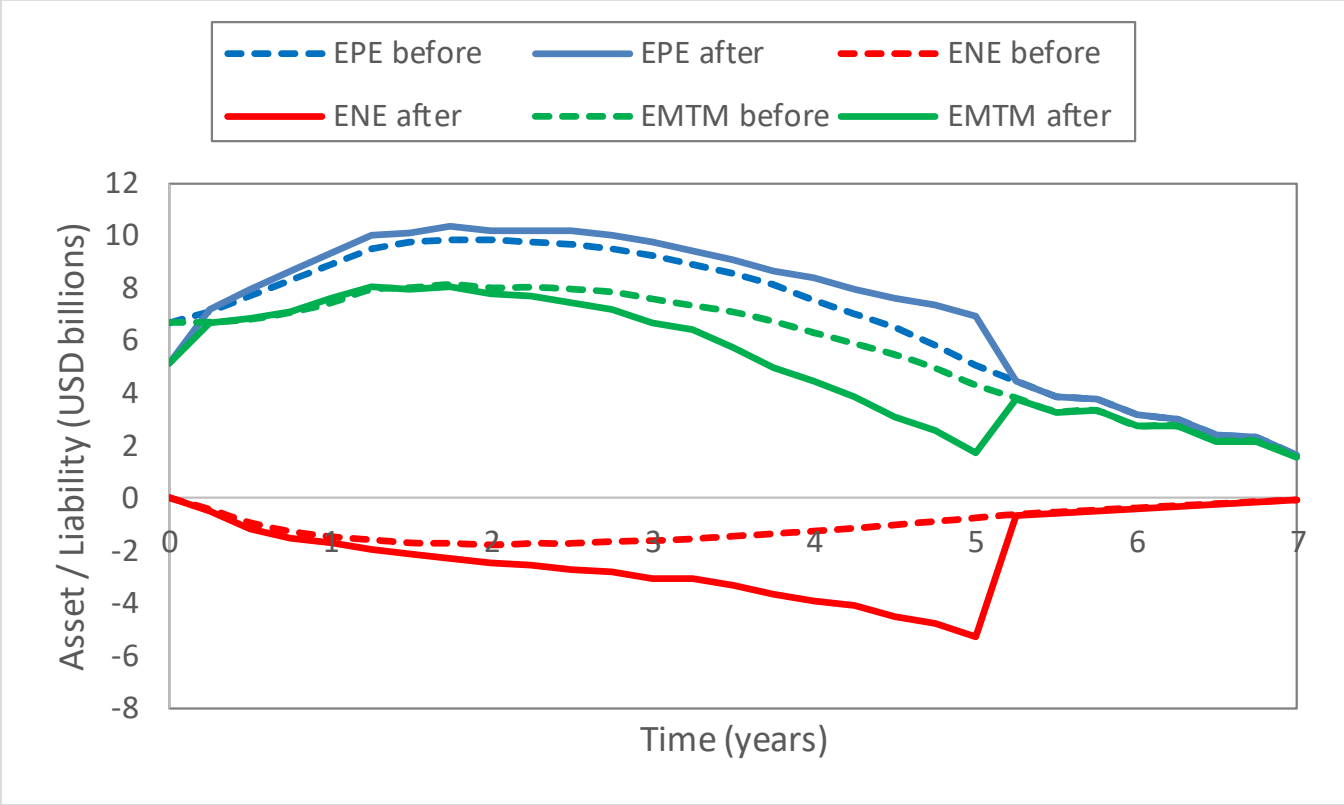
	Symmetric
FCA	-161,612
FBA	202,685
FVA	41,073

Pre-deal Pricing - Symmetric



	Symmetric
FVA	41,073

Pre-deal Pricing - Asymmetric

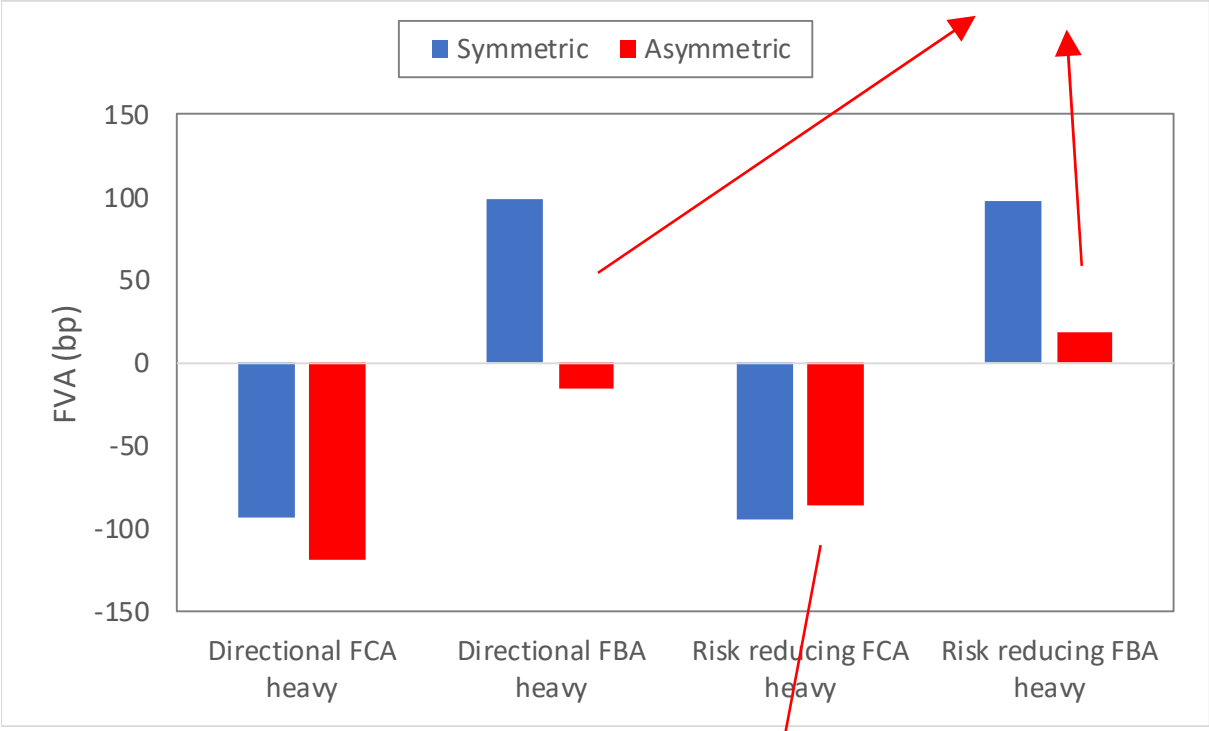


	Symmetric	Asymmetric
FVA	41,073	-30,302

Symmetric / Asymmetric FVA Pre-Deal Pricing

- **Asset Heavy Portfolio**

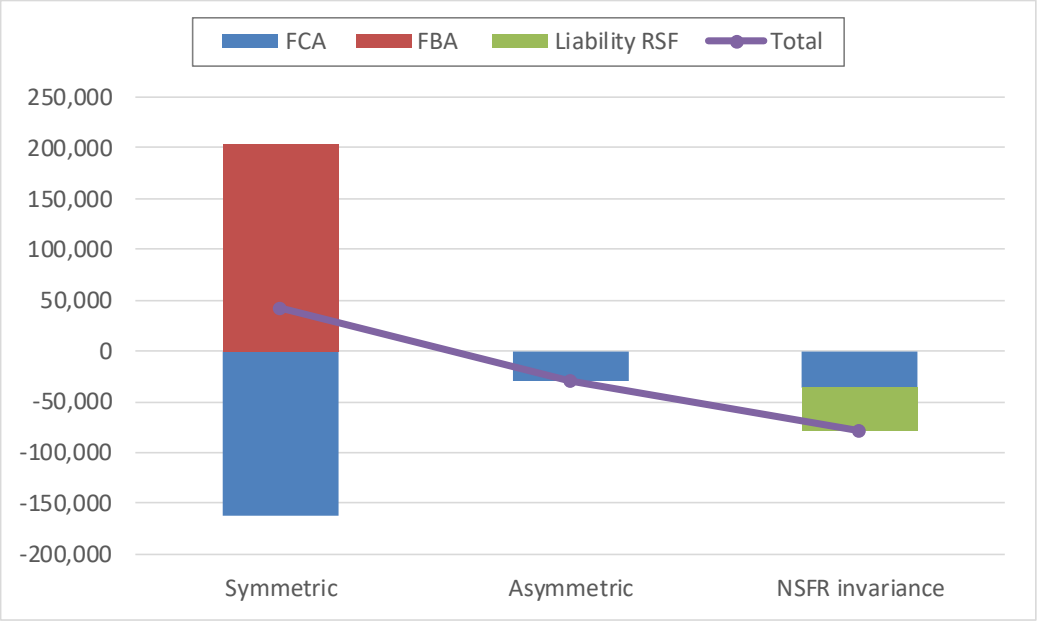
Approximate by pricing at the transaction level with $\max(FCA + FBA, 0)$



Asymmetric gives better price (don't lose funding benefits)

NSFR Invariance Pricing

- **Assuming an NSFR of 130%**



	Symmetric	Asymmetric	NSFR invariance
FCA	-161,612	-30,302	-36,362
FBA	202,685	-	-
Liability RSF	-	-	-42,861
FVA	41,073	-30,302	-79,223

Managing an Asymmetric FVA Framework

How to Monetise Funding Benefits

- **Banks with asymmetric lending rates are incentivised to:**
  - Lend to the market (e.g. novations)
  - Look for other ways to offset funding benefits
- **Is it possible to maintain an asset heavy portfolio and be pseudo-symmetric?**
  - Relatively easy (e.g. novate into asset heavy trades or restrike liability heavy client trades)
  - But this will have CVA and KVA (and FCA) implications

Offset with Initial Margin

- **Can argue that funding benefit could be used for initial margin posting (bilateral and exchange/CCP)**
  - Again, not NSFR compliant
  - Maturity transformation concern?
  - Needs an integrated IM and FVA calculation

$$FCA = -\sum_{i=1}^{m} E\left[\left(\left(\sum_{trades} V_{t_i}^{j}\right) - \left(\sum_{collateral} C_{t_i}^{k}\right) + \sum_{CCP,UMR} IM_{t_i}^{l}\right)^{+}\right] \times FS_{t_i}^{borrow} \times (t_i - t_{i-1})$$

$$FBA = -\sum_{i=1}^{m} E\left[\left(\left(\sum_{trades} V_{t_i}^{j}\right) - \left(\sum_{collateral} C_{t_i}^{k}\right) + \sum_{CCP,UMR} IM_{t_i}^{l}\right)^{-}\right] \times FS_{t_i}^{lend} \times (t_i - t_{i-1})$$

A Word on Accounting

- Exit price definition creates a problem here
- Can a liability-heavy bank report asymmetric FVA even though most other asset heavy banks use symmetric FVA?
- Will we see different FVA approaches in the market in line with different 'funding strategies'?

Conclusions

- **Hard to justify fully symmetric FVA**
- **The implications of (partially) asymmetric FVA are:**
  - More negative FVA adjustment (even for asset heavy portfolios)
  - Portfolio level calculations, potentially extended beyond uncollateralised universe
  - Different FVA allocation by trade and counterparty
  - Change in pre-deal pricing – usually (but not always) more conservative but sometimes with some difficult to predict results (drift vs. volatility effect)
- **This leads to questions around**
  - Optimal funding strategy and incentive this creates in terms of FVA pricing
  - Treasury funding of derivatives – better ALM process with term funding and offset with initial margin?