

The Impact of Initial Margin on xVA

Jon Gregory

Central clearing and bilateral margin rules

The cost of initial margin (MVA)

The cost of regulatory capital (KVA)

Including initial margin in CVA and KVA

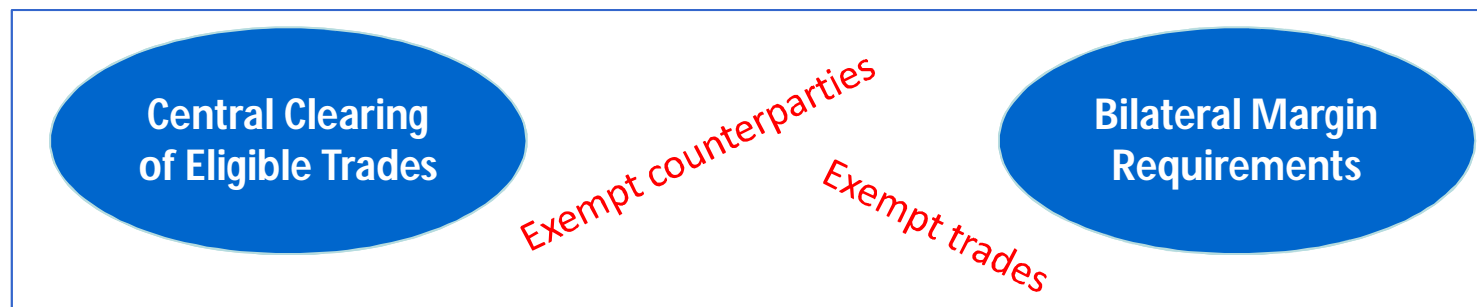
The overall cost of MVA vs. CVA/KVA

OTC Derivatives and the Crisis

- **OTC derivatives were generally seen as causing / contributing to the global financial crisis (2007 onwards)**
 - Lehman had millions of OTC trades which were difficult to closeout and replace
 - Counterparty risk and lack of transparency triggered fears of knock-on effects and other systemic concerns
- **What about CCPs?**
 - SwapClear had a \$9 trillion 66,000 trade interest rate portfolio to deal with
 - Closed out all positions within 3 weeks (most of the risk was hedged prior to this)
 - Held enough initial margin from Lehman to cover related losses (they returned two thirds of it to the Lehman administrators)
 - SwapClear seemingly managed their counterparty risk to Lehman very well

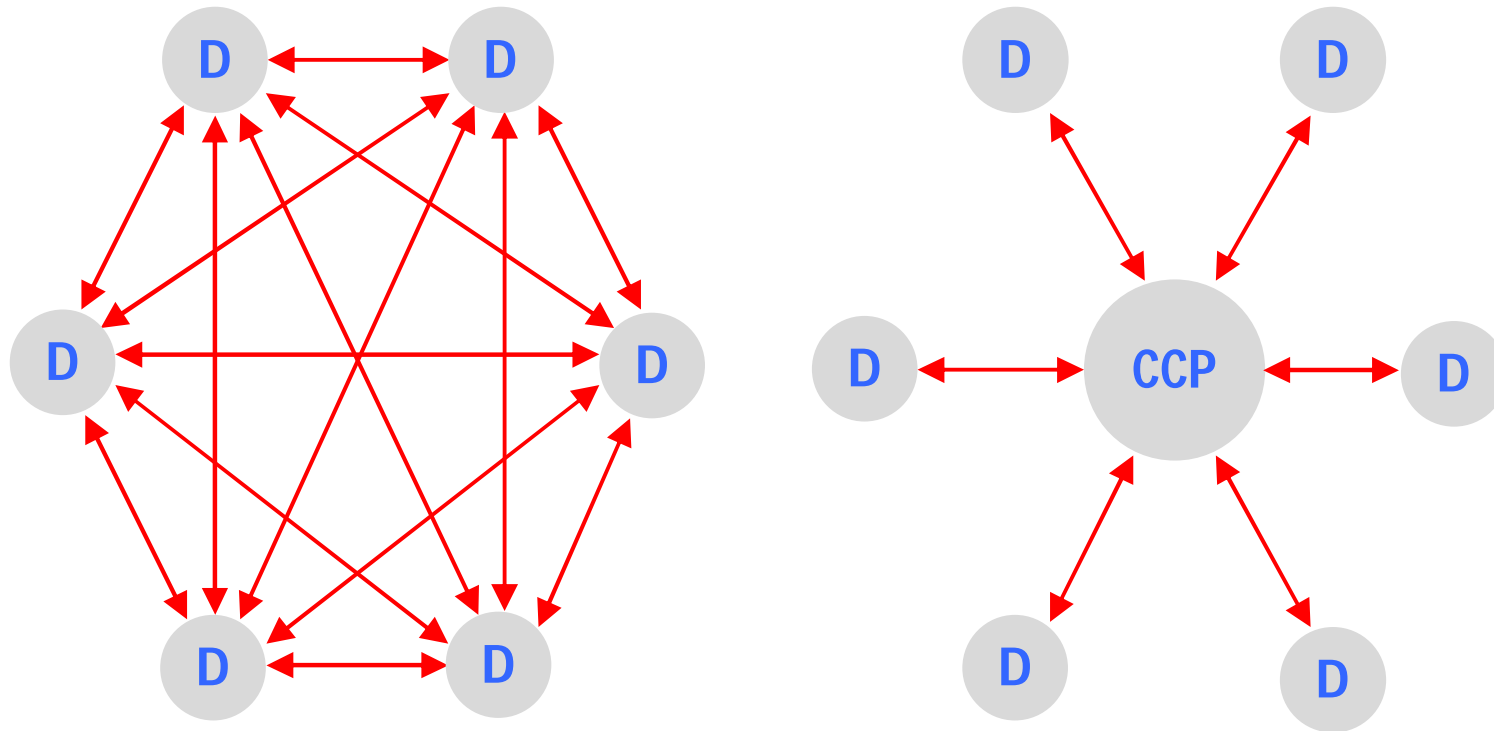
Regulatory Response to the Crisis

- **In order to reduce systemic risk, the G20 agreed in 2009 to require**
 - Central clearing of standardised OTC derivatives
 - All standardised OTC derivatives should be traded on exchanges or electronic platforms
 - Reporting of OTC derivatives to trade repositories
 - Higher capital requirements for non-centrally-cleared OTC derivatives
- **In 2011, the mandate was expanded to cover**
 - Bilateral margin requirements for non-centrally clearable derivatives



G20 Pittsburg Summit Declaration, www.g20.utoronto.ca/2009/2009communique0925.html

Centrally Cleared Market – Clearing Members Only



Basic CCP Workings

- **A CCP sets certain standard for its clearing members (CMs)**
- **Takes responsibility for closing out all the positions of a defaulting CM**
- **Maintains financial resources to cover losses in the event of a CM default:**
 - Variation margin to closely track market movements
 - Initial margin (independent amount) to cover worst case closeout costs above the VM
 - Default fund to mutualise losses in the event of a severe default
- **Manages the situation when all financial resources are depleted, e.g.:**
 - Additional calls to the default fund
 - Variation margin haircutting
 - Selective tear-up of positions

Bilateral Margin Requirements

- **Covered entities for non-centrally cleared derivatives must exchange:**
- **Variation margin**
 - Bilateral full margin (zero threshold)
 - On a regular basis (e.g. daily)
 - Minimum transfer amount must not exceed €500,000 / \$650,000
 - Cash in transaction currency is required (US) or highly incentivised via haircuts (Europe)
- **Initial margin**
 - Based on an extreme but plausible move based on a 99% confidence level
 - 10-day time horizon (assuming variation margin is exchanged daily)
 - Using quantitative (approved) model or a standardised margin schedule (no “cherry picking”)
 - Margin models must be additive across asset classes (currency/rates, credit, commodities)
- **Rigorous and robust dispute resolution procedures should be in place**

Phase-In and Exemptions

- **Variation margin**

- Full exchange based on total notional of OTC derivatives

Threshold	From
3 Trillion	1 st September 2016
All	1 st September 2017

- **Initial margin**

- Universal IM threshold of 50m Euro below which IM doesn't have to be exchanged
- Phase-in

Threshold	From
3 Trillion	1 st September 2016
2.25 Trillion	1 st September 2017
1.5 Trillion	1 st September 2018
0.75 Trillion	1 st September 2019
8 Billion	1 st September 2020

- **End-user and FX exemptions**

- FX derivatives exempt
- Includes FX component of cross-currency swap

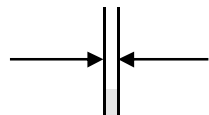
Traditional and Future Bilateral Clearing Compared

- Take an example of a 5-year transaction

Traditional Bilateral Approach

Credit exposure, PFE, CVA, Capital all assessed over entire lifetime (potentially with impact of future collateral taken into account)

Initial margin
computed over a 10-
day time horizon



Future Bilateral Approach (Initial Margin)

Uncertain liquidity impact of change in future margin requirements

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The overall cost of MVA vs. CVA/KVA

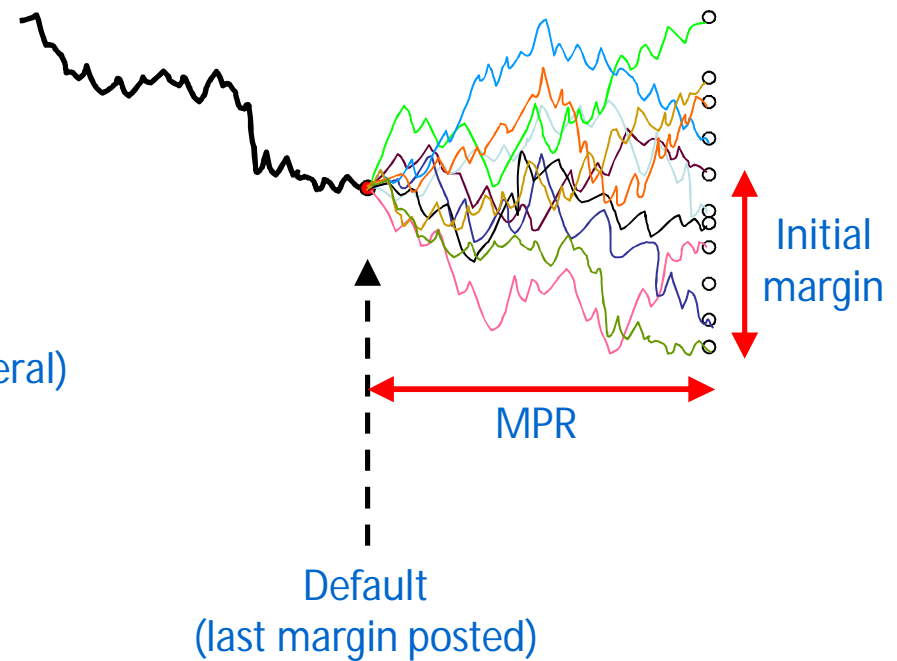
Margin Requirements

- **Variation margin**

- CCP - cash only in transaction currency
- Bilateral - haircuts to penalise non-cash (US rules suggest cash-only)

- **Initial margin**

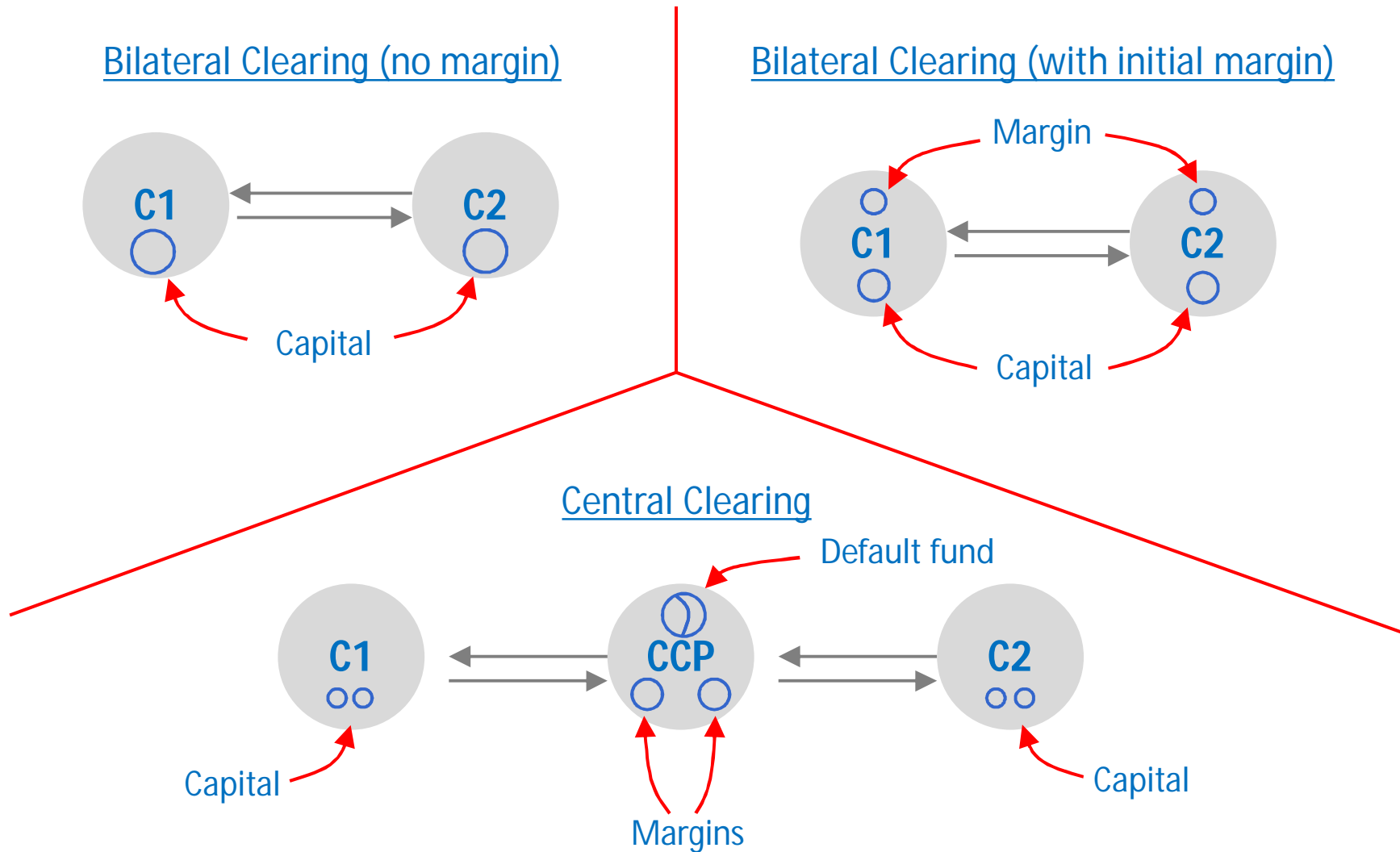
- Historical value-at-risk / SIMM
- 99% confidence level (or more)
- 5-day time horizon (CCP) or 10-day (bilateral)



Bilateral CSAs vs. CCP Margin Rules

	Traditional CSA	Bilateral CSA	CCP
Initial margin	Rare	Bilateral	Unilateral (CCP does not post initial margin)
Frequency	Daily (or sometimes less frequently)	Daily ("frequently")	Daily (and intraday in volatile markets)
Symmetry	Generally symmetric - can be asymmetric (e.g. thresholds)	Symmetric – zero threshold	Asymmetric in favour of the CCP
Type (variation)	Relatively flexible	Cash in transaction currency	
Type (initial)		Cash and other	Cash and other (but less flexible)
Disputes	Common and resolved bilaterally		None (CCP determines)
Negotiation	Bilateral		CCP rule book
Changes	Must be negotiated and agreed by both parties		CCP can change rule book

High Level Impact of Bilateral Margin Rules and CCPs



Initial Margin vs. Variation Margin

- **Variation margin**
 - Can be seen as reducing CVA and KVA and removing the need for FVA
- **Initial margin**
 - Reduces CVA and KVA further but creates MVA

Variation margin	Initial margin
Parties pay what they owe to each other	Parties pay more than what they owe
Calculation relatively straightforward and objective (for vanilla products certainly)	Calculation highly subjective and complex (e.g. VAR models, confidence level and margin period of risk)
Netting of offsetting margins is natural	Netting is not natural
Re-hypothecation natural concept and segregation not needed	Re-hypothecation and segregation issues have to be resolved
Perfect variation margining leads to standard pricing results (OIS discounting, Piterbarg 2010)	Initial margin is “imperfect” in this sense as parties will all have an MVA charge in relation to the initial margin

MVA Formula

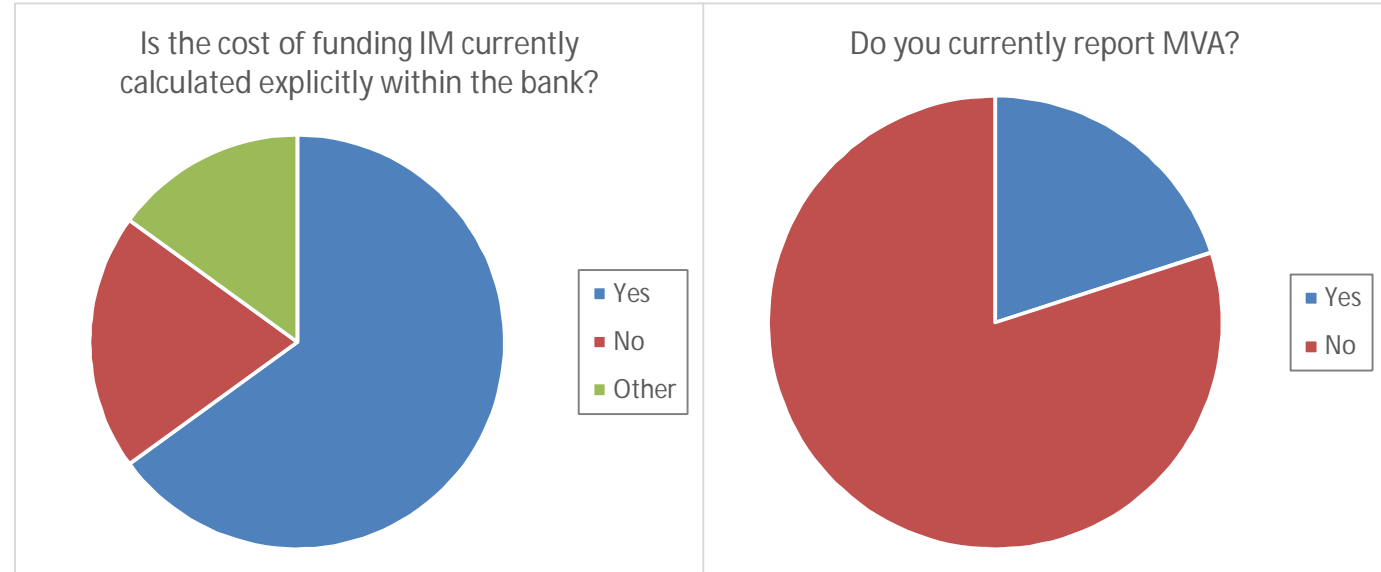
$$MVA = \sum_{i=1}^m EIM(t_i) \times (FC(t_i) - S_{IM}) \times (t_i - t_{i-1}) \times S(0, t_i)$$

Expected IM
profile

Cost of
funding IM

Remuneration
of IM

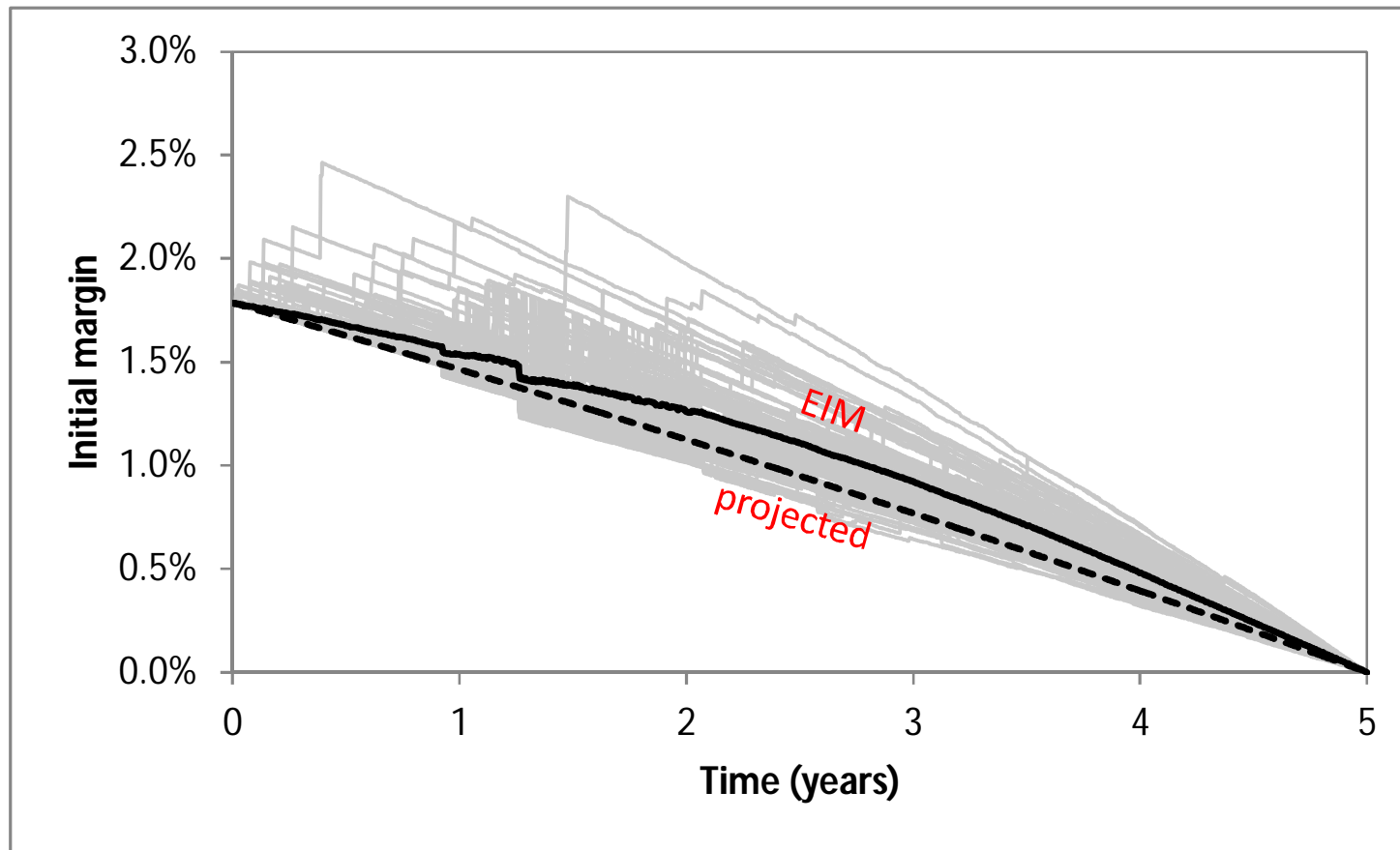
Probability of no
defaults



Source: Solum Collateral Survey 2015

Projected IM and Expected IM Costs

- IM can go up more than it can go down!



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KVA (Capital Value Adjustment) Formula

$$KVA = - \sum_{i=1}^m ECP(t_i) \times CC(t_i) \times (t_i - t_{i-1}) \times S(0, t_i)$$

Expected capital profile

Cost of capital

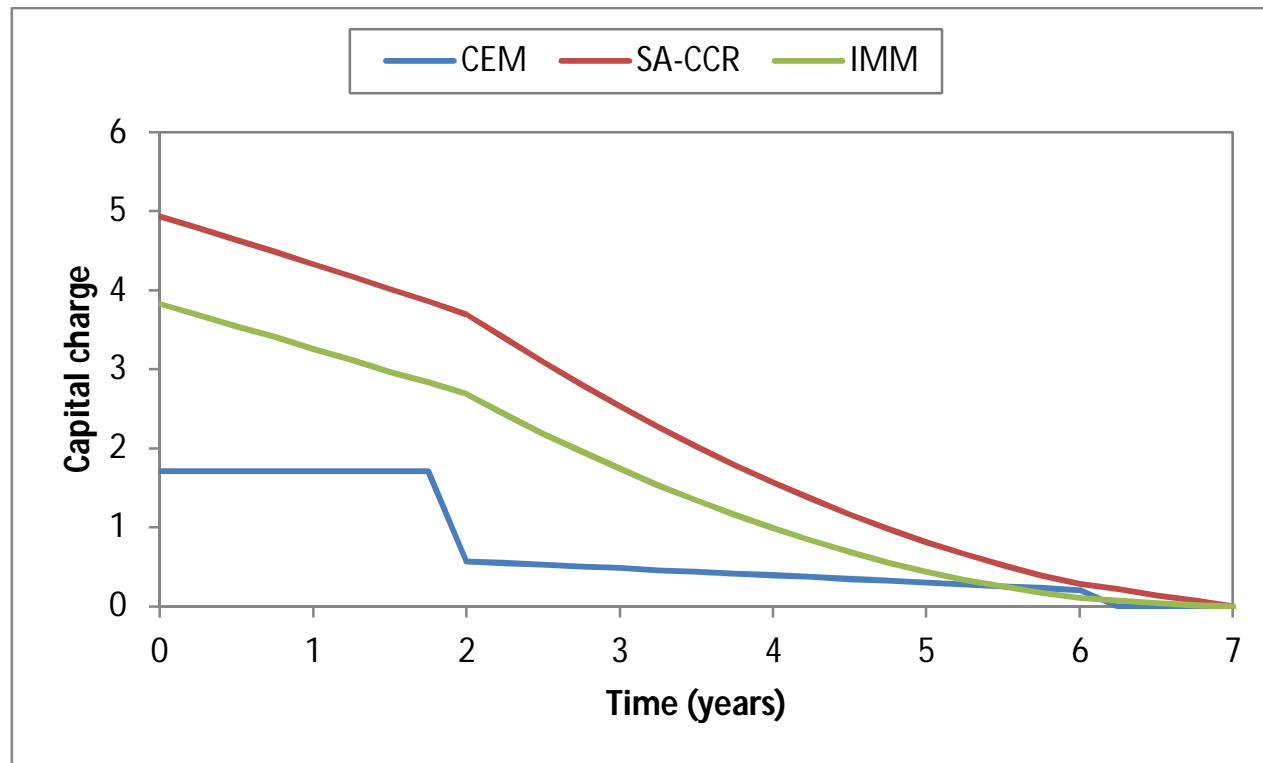
Probability of no defaults

- **Aim of KVA**

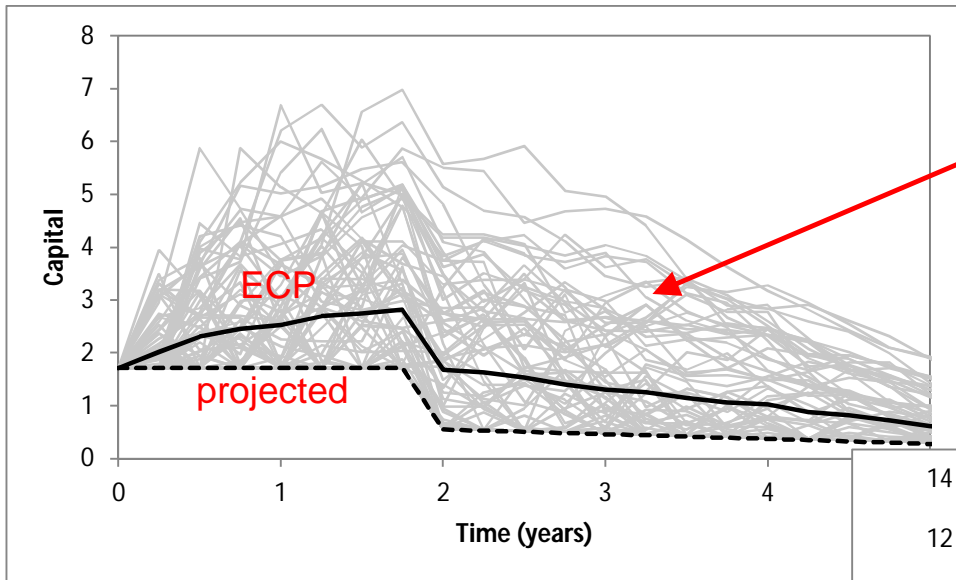
- To provide a profit that can be released over time and matches the cost of regulatory capital requirements
- NOTE: most banks still see KVA as a hurdle and do not charge it explicitly

Projected Capital Profile

- For a 7-year interest rate swap
 - We just project the calculation forward at a number of points in the future
 - But what about the uncertainty of future capital?

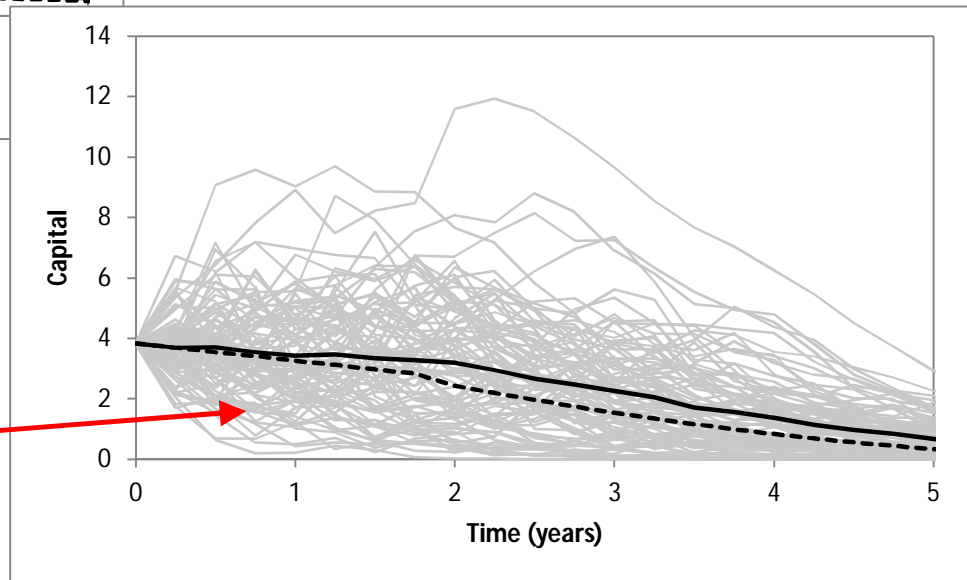


Expected Capital Profile



Standardised CVA
+ current exposure method

Advanced CVA + IMM



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Margin Requirements and xVA

	Centrally cleared	Bilateral with IM
CVA	No – although CVA on default fund is real	Small (depending on how much IM) – note that posted IM does not increase CVA (segregation)
DVA	No (CCP is covered via IM)	
FVA	No due to “full” variation margin	
CoVA	No (generally) due to cash only variation margin in transaction currency	
KVA	Small (CCP capital rules)	Hopefully small (depending on methodology)
MVA	YES	



CVA and Collateral

- Variation margin (zero threshold) reduces CVA quite significantly
- An approximate estimate (swap type exposure) of the reduction is:

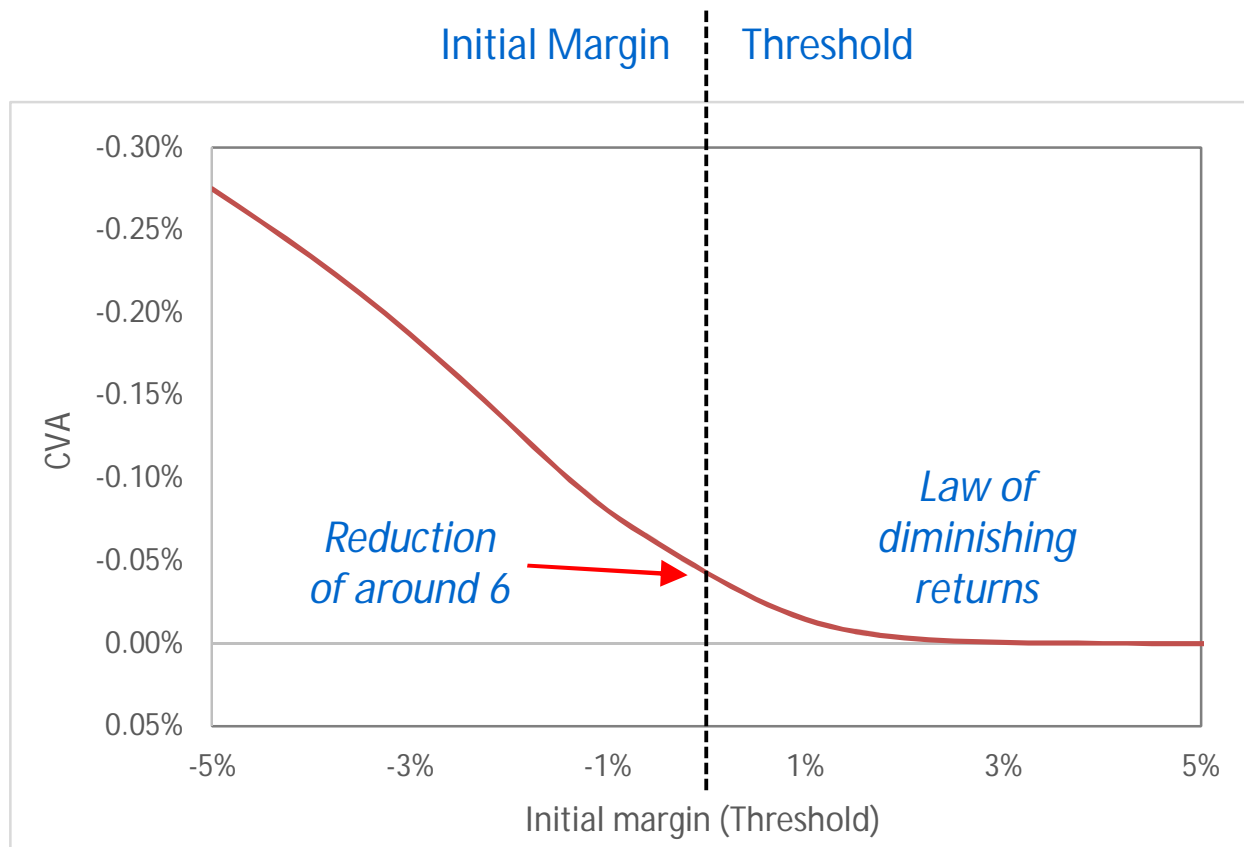
$$\frac{CVA_{collateralised}}{CVA_{uncollateralised}} \approx \frac{8}{15} \sqrt{\frac{T}{\tau_{MPR}}}$$

← Margin period of risk

- For a 5-year swap, MPR of 10 business days this would give a factor of about 6
- To reduce CVA further, the only option is initial margin.....

CVA with Initial Margin / Threshold

Zero threshold, 10-day margin period of risk

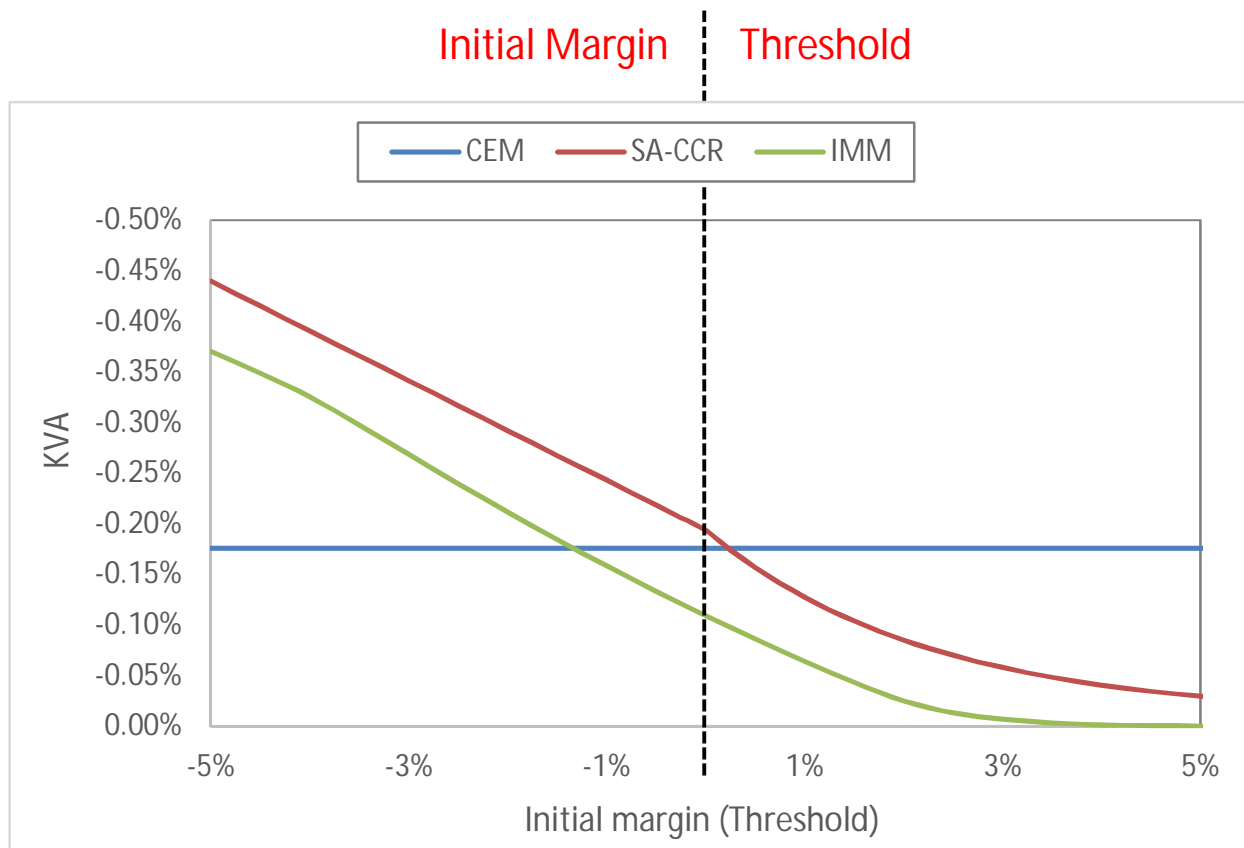


KVA With Initial Margin

- **Initial margin *should* reduce KVA**
- **However, this depends on the methodology for regulatory capital**
 - Current exposure methodology (CEM): initial margin not captured
 - Internal model methodology (IMM): initial margin modelled – but how to model a risk sensitive initial margin amount?
 - SA-CCR (2017) – initial margin (fixed only) parametrised within formula

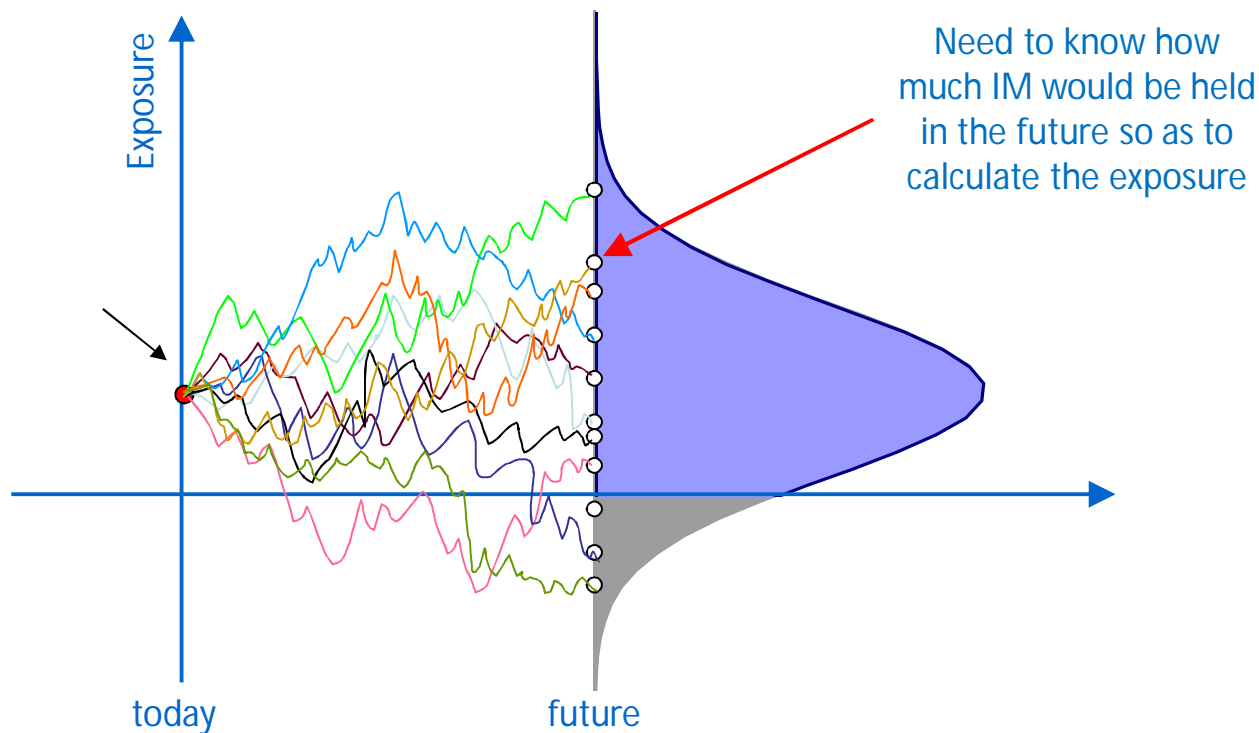
KVA with Initial Margin / Threshold

Zero threshold, 10-day margin period of risk



Modelling Future Initial Margin

- **Initial margin is generally risk sensitive and therefore time-varying**
 - Broadly speaking a VAR (or ES) measure at a high confidence level
 - For example, see Green and Kenyon (2014)



Simple Example

- Surely if we take a IM to a high confidence level then the residual exposure should be small?
 - Under normal distribution assumptions, it should be reduced by a factor given by:

$$R_\alpha = [\varphi(\sqrt{\lambda}K) - \sqrt{\lambda}K\Phi(-\sqrt{\lambda}K)]^{-1} (2\pi)^{-0.5}$$

$$\lambda = \tau_{IM}/\tau_{MPR}$$

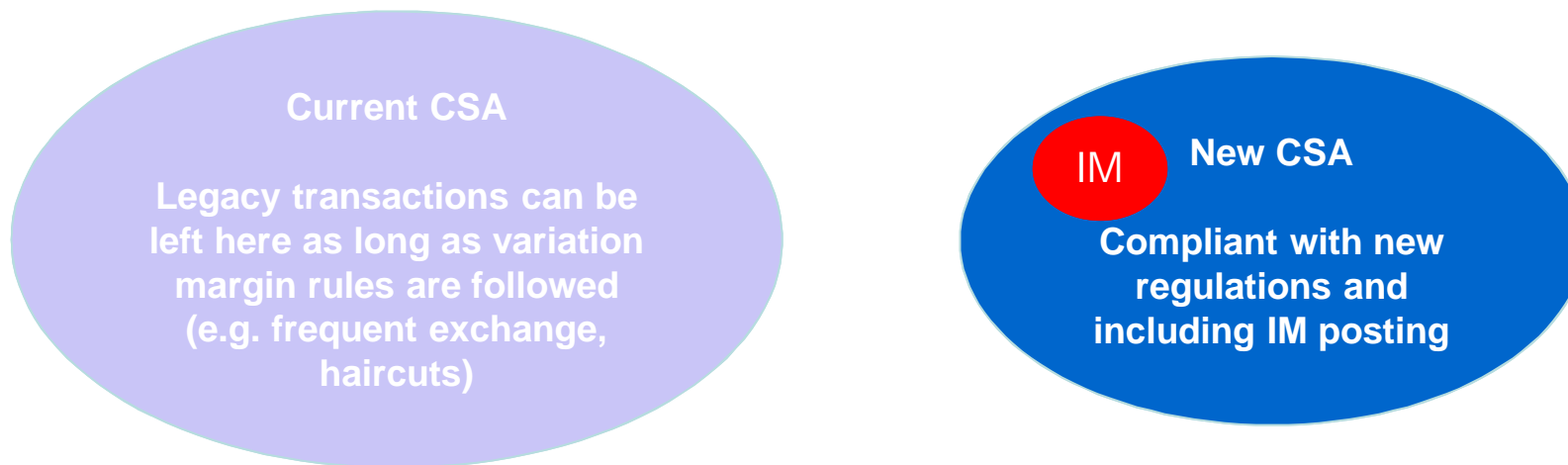
$$K = \Phi^{-1}(\alpha)$$

	$\lambda = 1$	$\lambda = 0.5$	$\lambda = 0.25$
90%	8.4	4.0	2.5
95%	19.1	6.6	3.5
99%	117.7	19.1	6.6
99.5%	252.4	29.5	8.5

Bilateral result with 10-day time horizon for IM and 99% confidence level and 20-day MPR

Future CSA Set-Up

- **The previous result is misleading because it assumes IM is held against the full risk which in reality is not the case, for example:**
 - The requirement to post initial margin impacts only new transactions and so legacy trades may not have IM held against them (although this effect will fade over time)
 - The threshold of €50m that can be applied to the IM amount
 - There are exempt transactions (e.g. some FX)



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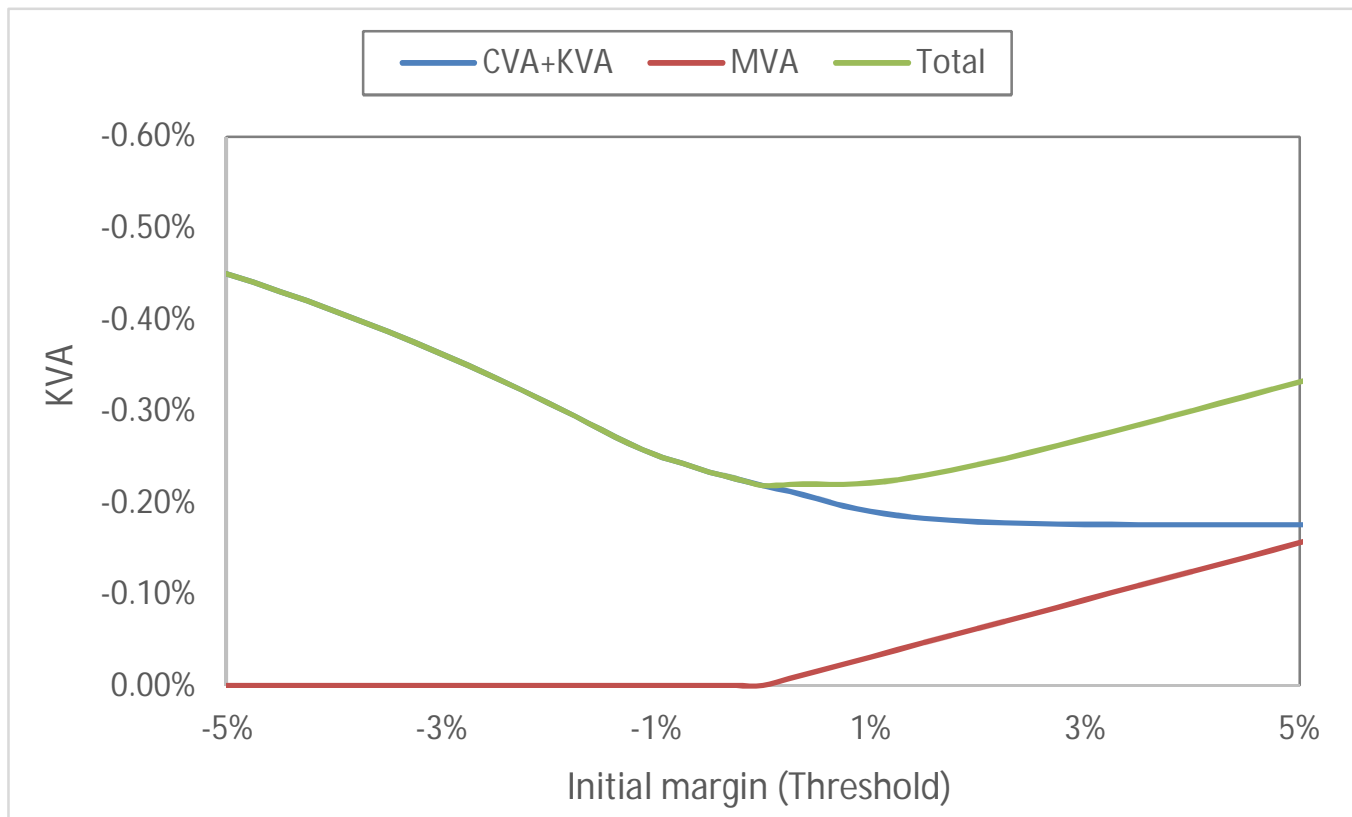
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Optimal Initial Margin Amount (I)

- **Current exposure method**

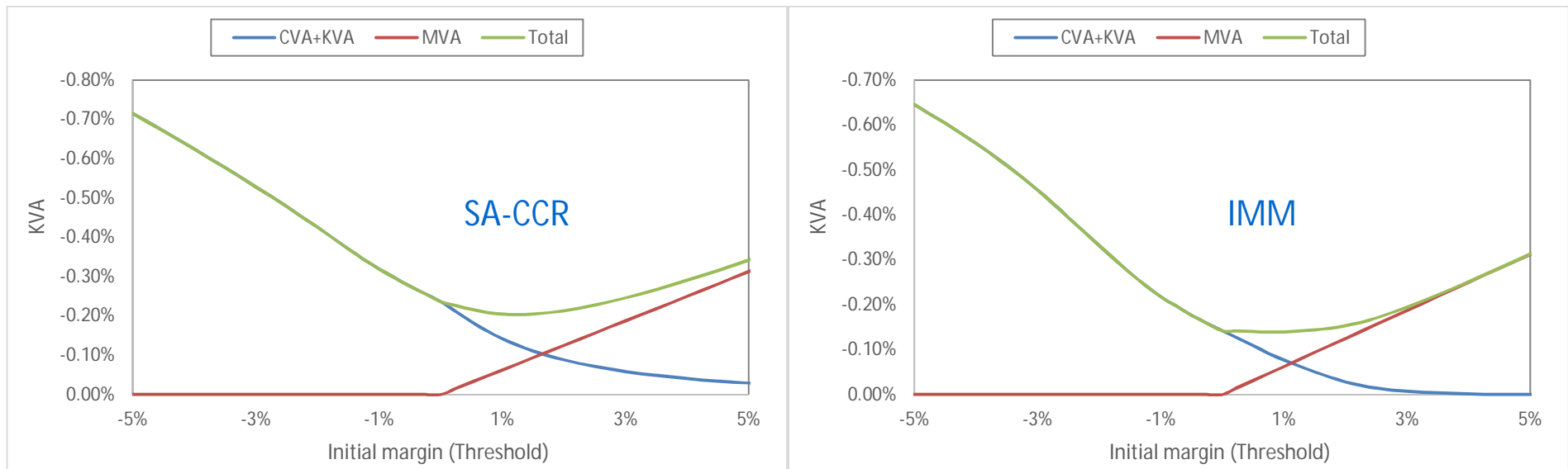
- Initial margin is not favoured due to no reduction in KVA as a result of IM



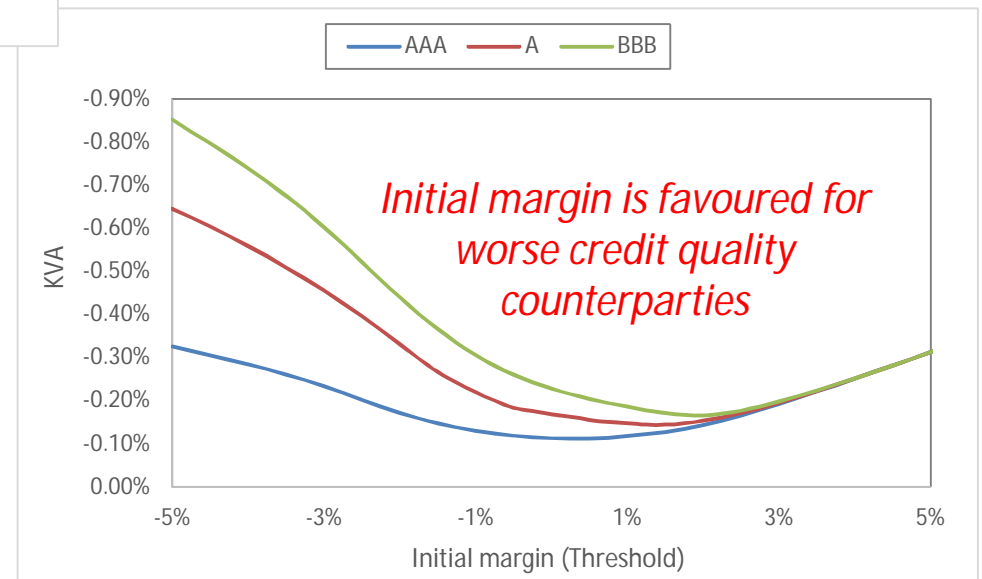
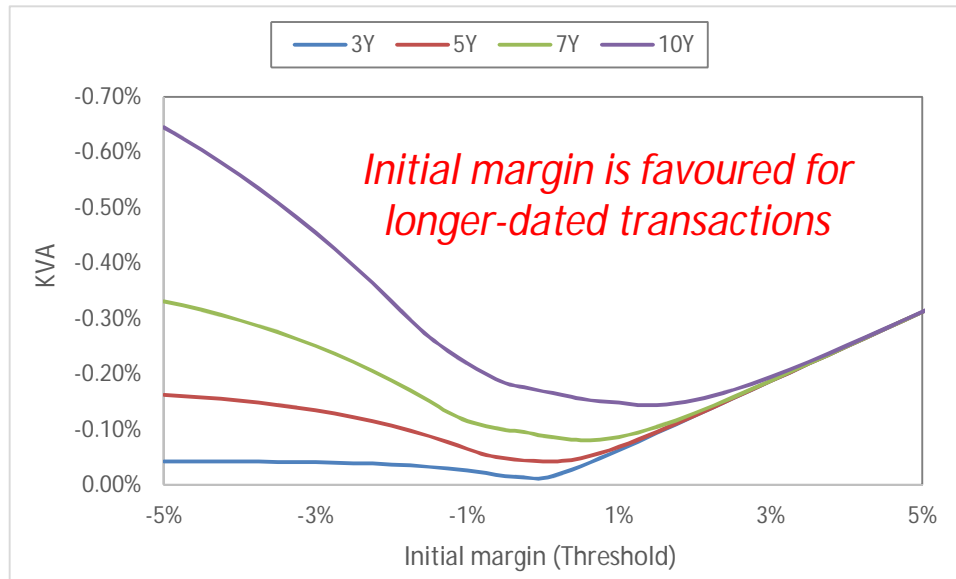
Optimal Initial Margin Amount (II)

- **SA-CCR and IMM**

- Both favour a moderate IM in the region of 1%
- At some point IM is more expensive (law of diminishing returns)
- Actual IM would be larger (CCP standards or SIMM) in the region of 4%

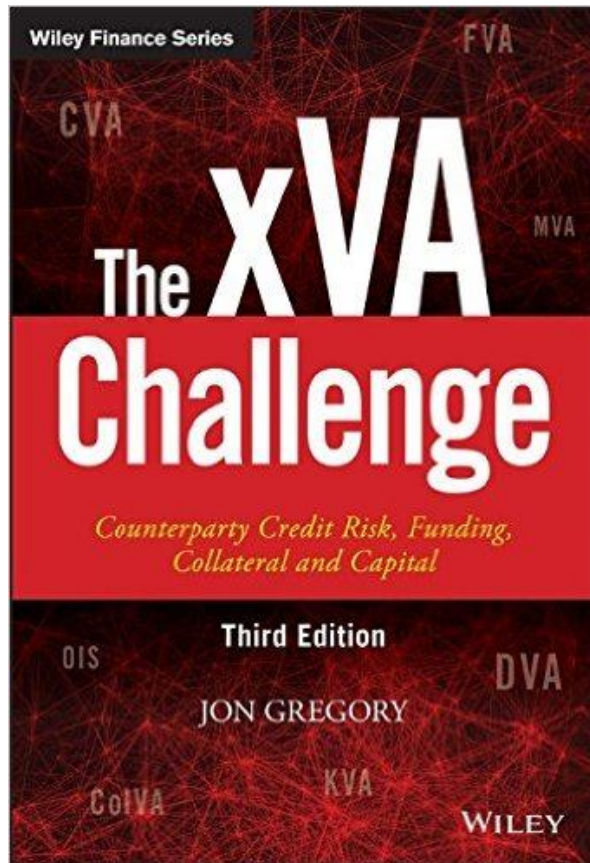


Impact of Maturity and Credit Quality



Summary

- **The clearing mandate and bilateral margin rules place a greater emphasis on margin value adjustment (MVA)**
- **Initial margin reduces CVA and KVA but this depends on methodology**
 - Simple capital methodologies do not properly capture the effects of IM
 - Modelling dynamic IM is challenging
- **From an xVA point of view, moderate IM posting may be favoured**
 - But IM to a high confidence level will probably not be favoured
 - IM is more highly favoured by longer-dated transactions and lower credit quality counterparties
- **Banks have been criticised historically for maturity transformations**
 - Yes increased initial margin requirements represent a regulatory maturity transformation for OTC derivatives



"The issue of counterparty risk has undergone rapid change since the credit crisis. All end-users of OTC derivatives are affected by these changes. The new title 'xVA' of the third edition reflects the increased complexity generated by these changes. Jon Gregory provides the reader with a comprehensive, yet readable, discourse on the different facets of counterparty risk. This book is essential reading for regulators and OTC derivatives users."

Stuart M. Turnbull, Bauer Chaired Professor of Finance, Bauer College of Business, University of Houston

"Jon Gregory is one of the godfathers of the VA story. He is amongst the few who can demystify the puzzle and this book is a key tool for bringing light into these dark matters."
Wim Schoutens, independent consultant and professor in financial engineering at the University of Leuven, Belgium

"This is by far the clearest and most comprehensive reference work on counterparty credit risk and related value adjustments. With this new edition, Jon Gregory explains the latest changes in market practice, along with critical expert commentary."

Darrell Duffie, Dean Witter Distinguished Professor of Finance at Stanford Graduate School of Business

"The first and second editions of Jon Gregory's book on the post-crisis OTC derivatives markets were classics, packed with a wealth of information. This third edition greatly extends the coverage of the first two editions. Like them, it is a must-buy for anyone involved with derivatives markets. Congratulations Jon on another excellent book."

John Hull, Maple Financial Chair in Derivatives and Risk Management Joseph L. Rotman School of Management, University of Toronto

"Jon Gregory manages again to grab the XVA animal in its relentless flight and restrain it long enough to take a picture of its present state. The picture is, as usual, neat and clear, with full awareness of the continuous commitment of the market to optimise this aspect of pricing that has become a crucial factor for a bank's competitiveness."

Massimo Morini, Head of Interest Rate and Credit Models at Banca IMI and Professor of Fixed Income at Bocconi University

"Jon Gregory has written a fantastic book on counterparty risk, funding, collateral management and capital. It is remarkably clear and accessible, especially considering how technical and sophisticated these topics are. The book is an indispensable guide to the challenges of understanding and computing XVA measures and definitely one to read!"

Giovanni Cesari, Author of Modelling, Pricing, and Hedging Counterparty Credit Exposure (Springer)