

Challenges in xVA Pricing and Valuation

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Introduction

Regulation

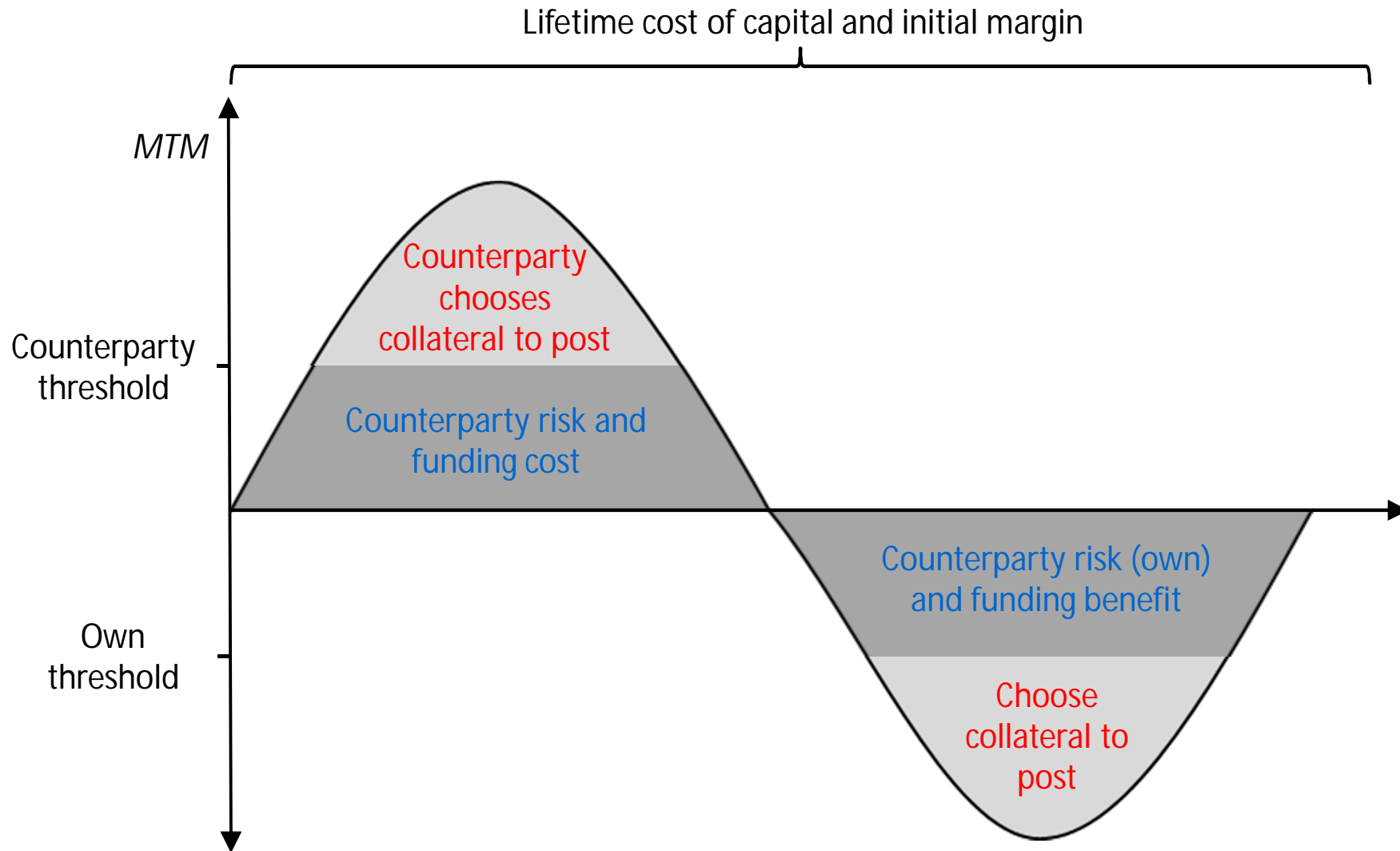
Quantification

Usage and overlaps

Derivatives Pricing

- **Pricing (and risk management) of OTC derivatives has been a large field and covered many products, for example:**
 - Barrier options
 - Bermudan callables
 - Cliquets
 - PRDCs
 - CDOs
 -
- **We thought we could price these**
- **But then xVA happened**

Economic Costs of Holding a Derivative Transaction



xVA, Pricing and Accounting

- Generally, xVA can be seen as proper up-front pricing and valuation of future costs (and benefits)

	Traditional bank approach	Current market practice	Drivers
CVA	Trading desk and sales division face default losses	CVA pricing, accounting and central management (most banks)	IFRS 13, Basel III
FVA	Treasury funds the bank and charges trading desk overnight funding	FVA inception pricing, accounting and central management (more advanced banks)	IFRS 13 (DVA), best practice and experience of losses
CoIVA	Collateral management manages operational aspects of collateral. Bank faces unexpected costs and benefits from collateral terms	CoIVA inception pricing, accounting and central management (most banks but with differing levels of sophistication)	Best practice and experience of losses
KVA	Trading desk is charged for capital and businesses set soft return on capital metrics	KVA is priced more directly into transactions via hurdles but not generally charged by xVA desk or managed centrally	Poor return on capital achieved by derivatives

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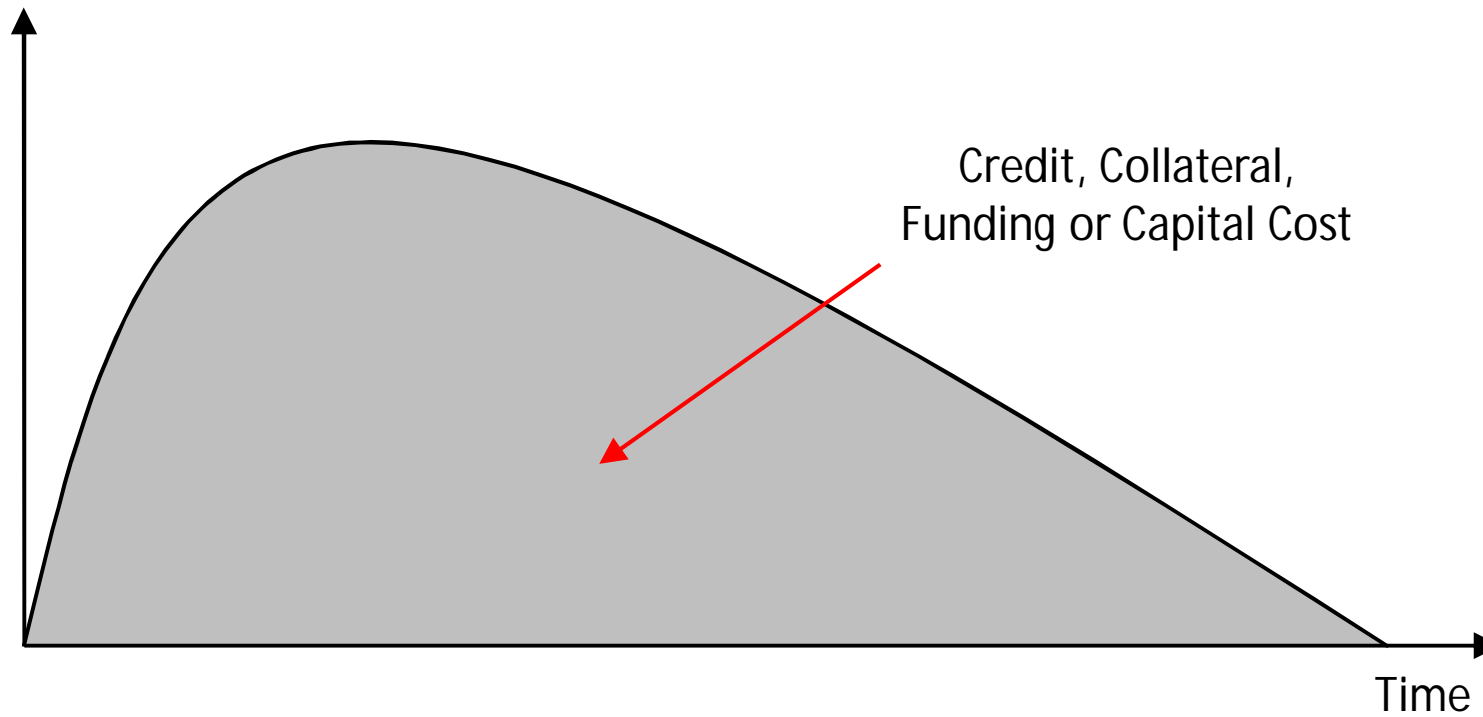
2015 Cost Analysis

- **Consider the following transaction executed in 2007**
 - 20-year maturity, receive fixed interest rate swap
 - Two-way CSA with cash and high quality assets and rating triggers on collateral posting
 - Now quite In-the-money

Problem	Comment
Counterparty risk (CVA)	Accounting CVA now calculated including collateralised transactions. May become uncollateralised if counterparty is upgraded.
Funding (FVA)	Funding costs may arise (for example, if counterparty has posted bonds that are difficult to repo).
Collateral (CoIVA)	Counterparty is utilising their "cheapest-to-deliver" optionality when posting.
Capital (KVA)	CVA capital charge and potential to use a margin period of risk (MPR) of 20 days.
Liquidity coverage ratio and net stable funding ratio (FVA)	Rating triggers in a CSA: buffer for all potential outflows on the basis of a 3-notch downgrade of own rating.
Leverage ratio (KVA)	May be an extra capital constraint and not recognise bonds as being risk reducing.
Clearing mandate and initial margin rules	Clearing fees and initial margin on any (future) hedges.

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The xVA Concept



Challenges of Curve Building

- **Credit curve (CVA)**
 - Single-name CDS market is relatively illiquid (especially for uncollateralised counterparties)
 - Mapping methods are subjective and may lead to spurious results and volatility
- **Collateral (CoVA)**
 - Multi-curve framework is required with OIS in different currencies, government bonds etc
 - Cheapest-to-deliver pricing very challenging (eligibility, substitution etc)
- **Funding (FVA / MVA)**
 - Short- medium- or long-term funding? How do we really fund a derivative?
 - What about the credit quality of a counterparty?
 - What is the cost of funding initial margin and default funds?
- **Capital (KVA)**
 - Return on capital required?
 - Tax, costs etc?

Challenges of Exposure Modelling

- **Choice of model**
 - One-factor Gaussian is broadly acceptable for interest rate swaps
 - More complex models needed for exotics
 - Multidimensional modelling framework
 - Collateral modelling
- **Computation time**
 - Need for full revaluation creates a massive bottleneck
 - More advanced models such as LMM are computationally intensive
 - Numerical optimisations important (fast pricing, MC acceleration, AAD for greeks, GPUs)
- **Risk neutral vs. real world**
 - Support of both CVA (pricing) and limits (risk) frameworks (and IMM for some banks)
 - Illiquid markets with no access to long term volatilities and correlations
 - Not easy to be conservative with correlation estimates
- **80/20 rule**
 - With 20% of the effort I can tackle 80% of the problem - law of diminishing returns

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When is an xVA adjustment real?

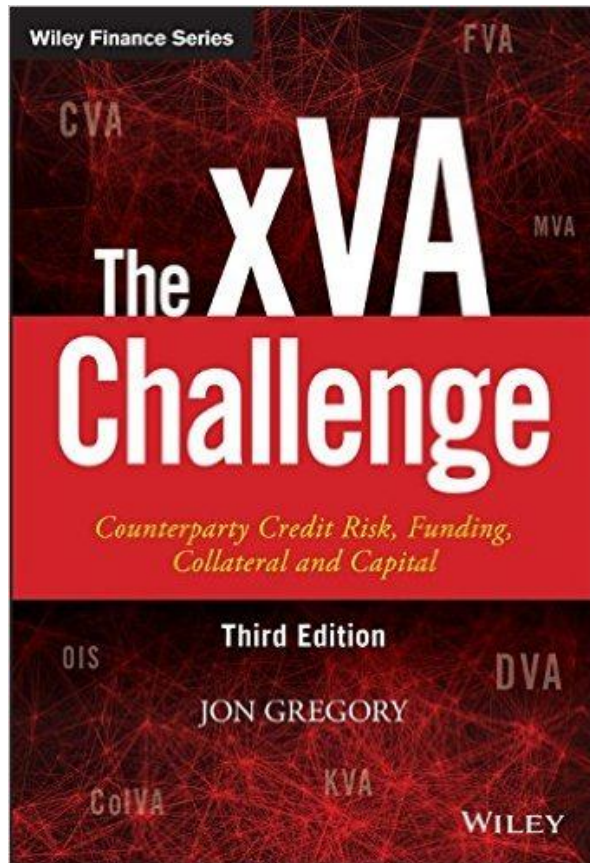
- **FVA shouldn't be included in pricing and valuation**
 - Hull and White (2012)
 - Totem results show that FVA is included in pricing and is roughly symmetry for most banks
- **FVA should not be symmetric**
 - Albanese and Iabichino (2013) - posting collateral is a funding cost but excess collateral is not a funding benefit as it is an unstable source of funding
- **FVA is a wealth transfer from shareholders to bondholders**
 - Burgard/Kjaer (2011)
 - So the overall impact on a balance sheet is zero but valuation typically has only shareholders in mind?
 - Albanese et al. (2014) suggest taking FVA into CET1 capital instead of net income

Overlaps are Important

- **DVA and FBA**
 - Double counting of DVA (own default) and FBA (funding benefit)
 - Significant overlap is generally accepted
 - But what curve should we use (own CDS, own cost of funding)?
- **CVA and FCA**
 - Overlap between counterparty risk and cost of funding
 - Arguably some overlap which may lead to no FCA (Hull-White) or using a lower cost of funding (funding liquidity risk premium?)
- **CVA and KVA**
 - CVA is the (theoretical) cost of hedging counterparty risk
 - KVA is the cost of holding regulatory capital when we don't or can't hedge
 - How much capital relief will our CVA desk on this transaction?
- **FVA and KVA**
 - Can we use regulatory capital for funding?

Summary

- **We will face many challenges in xVA in the years to come, for example:**
 - Modelling
 - Computational
 - Incorporation of regulatory rules (including future rules)
 - Curve building
 - Accounting treatment
- **Only then will be able to claim to be able to price OTC derivatives again**



"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)