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WHITE PAPER

THE EVOLUTION OF COUNTERPARTY CREDIT RISK - AN INSIDER'S VIEW

Co-authored by Jon Gregory and David Kelly (Quantifi)

- Explores practical implementation issues and how approaches have converged
- An insider's view from the major banks that have influenced this market

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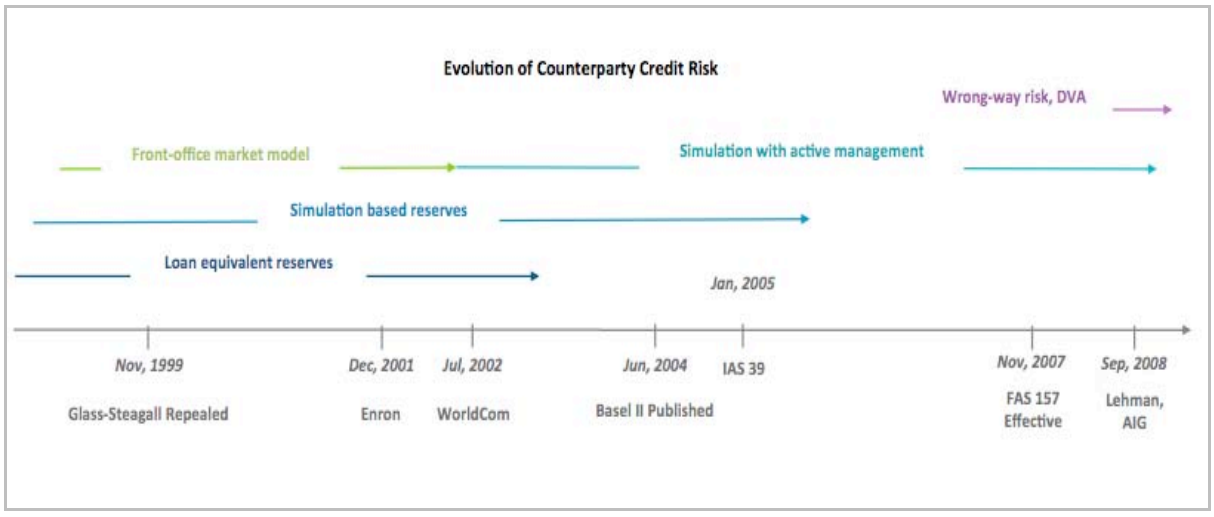
Evolution of Counterparty Credit Risk
An Insider's View

Introduction

Although the recent crisis has brought a heightened focus, counterparty credit risk theory and practice have been evolving for over a decade. Initially banks addressed the problem from their traditional financing experience while investment banks approached it from a derivatives perspective. As the industry consolidated in the 90's, culminating with the repeal of Glass-Steagall in 1999, there was substantial cross-pollination of ideas and best practices. In particular, investment banks started to apply traditional derivatives pricing technology to the problem of assessing and quantifying counterparty risk. More recently, consolidation and the necessity to free up capital as credit risk became increasingly concentrated within the largest financial institutions drove a series of innovations. These innovations involved both methodologies and management responsibilities.

Counterparty risk management is evolving from passive risk quantification to active management and hedging. The term CVA (credit value adjustment) has become well-known and represents a price for counterparty credit risk. Substantial responsibility is being transferred from credit officers to "CVA traders", groups with the responsibility of pricing and managing all the counterparty risk within an organization. As various extensions to the reserve and market models have been implemented, a general consensus has emerged that essentially replaces portfolio theory and reserves with active management. Banks today tend to be distributed along the evolutionary timeline by size and sophistication where global banks have converged to the consensus model whilst smaller and more regional banks, together with other financial institutions such as asset managers are closer to the beginning stages. This paper traces the evolution of counterparty credit risk based on actual experiences within banks that have had considerable influence.



Reserve model

Reserve models are essentially insurance policies against losses due to counterparty defaults. For each transaction, the trading desk pays a premium into a pool from which credit losses are reimbursed. The premium amount is based on the creditworthiness of the counterparty and the future exposure, accounting for risk mitigants such as netting and collateral (margin) agreements and higher level aspects such as the overall level of portfolio diversification. Originally, reserve models used historical (usually ratings based) assessment of the probability of default (PD) rather than market credit spreads. Premiums are comprised of two components – the expected loss or CVA and the potential unexpected loss within a chosen confidence level, also referred to as economic capital. Traditional pre-merger banks and their eventual investment banking partners all used reserve models but the underlying methodologies were very different.

Banks typically converted exposures to so-called "loan equivalents" and then priced the incremental credit risk in loan terms. In the early days, loan equivalents were critical to simplify a potentially quite complex future exposure into a single number that could be used for rudimentary calculations. In practice, traders simply added the number of basis points prescribed by a table for that counterparty's risk rating, the transaction type and tenor. In contrast, the more derivatives oriented investment banks calculated reserves by simulating potential future positive exposures of the actual positions. The simulation models persevered because they more precisely valued each unique position and directly incorporated credit risk mitigants, such as collateral and netting agreements. Many banks still use loan equivalents or simple conservative approximations for pre-deal CVA pricing although most have the ability to calculate CVAs on a periodic basis, which may range from daily to monthly.

By 2000, the simulation based CVA and economic capital reserve model was state of the art although only a very few institutions were able to calculate pre-deal CVA on a real-time basis for new transactions. Institutions had expanded portfolio coverage in order to maximize netting and diversification benefits. However, trading desks were complaining that credit charges were too high while reserves seemed insufficient to cover mounting credit losses instigated by the Enron and WorldCom failures. The down credit cycle, following the wave of consolidation and increased concentration of risk, forced the large banks to think about new ways to manage credit risk. While banks had used CDS as a blunt instrument to reduce large exposures, there had been limited effort in actively hedging counterparty credit risk.

Furthermore, changing standards for fair value accounting (FASB 157 and IAS39) required banks to remove from the risk-free value of derivatives positions the expected loss associated with future counterparty defaults. This meant that CVA had to be calculated with market implied parameters (such as credit spreads rather than historical default probabilities) alongside other P&L on a monthly basis. This development has signaled the end of the pure reserve model since a bank's counterparty risk becomes a continuously changing value as opposed to a relatively static reserve pool.

The need to either free capital or increase capacity spawned two significant and mostly independent solutions. The first solution, driven by the front office, involved pricing and hedging counterparty credit risk like other market risks. The second solution, basically in response to

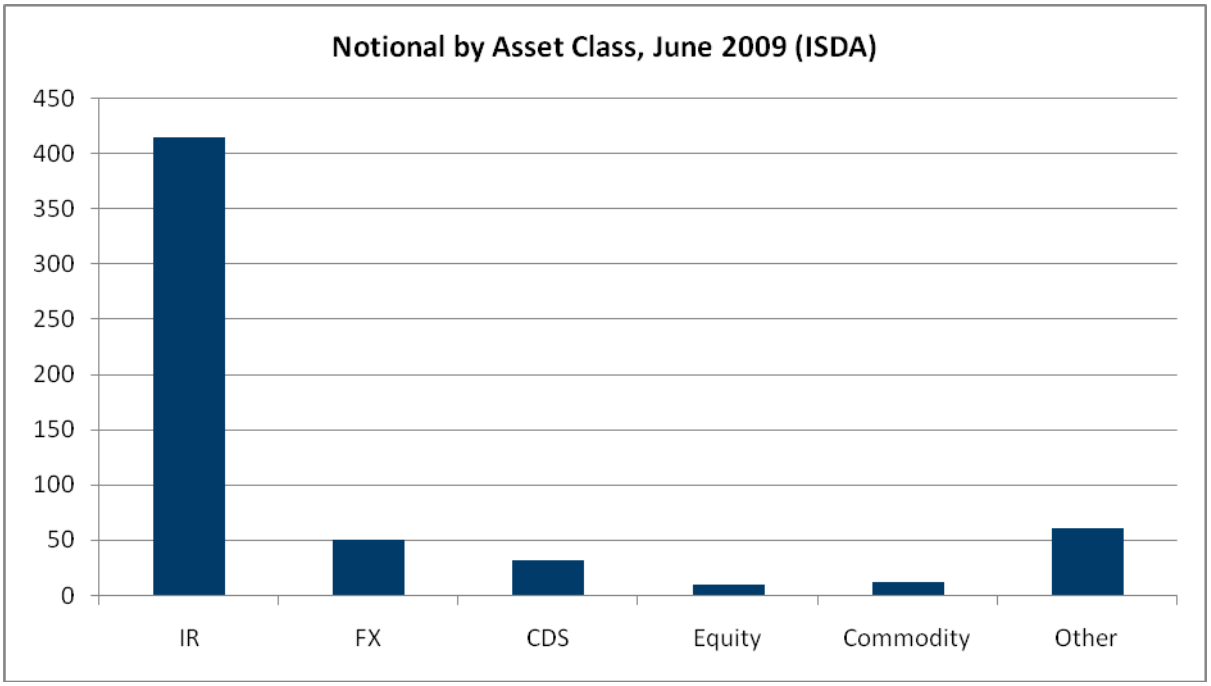
the first, introduced active management into the simulation model. Active management (hedging) reduced potential future exposure levels and corresponding economic capital reserves, potentially allowing increased trading capacity with counterparties. The next two sections review these solutions in more detail.

Front-office market model

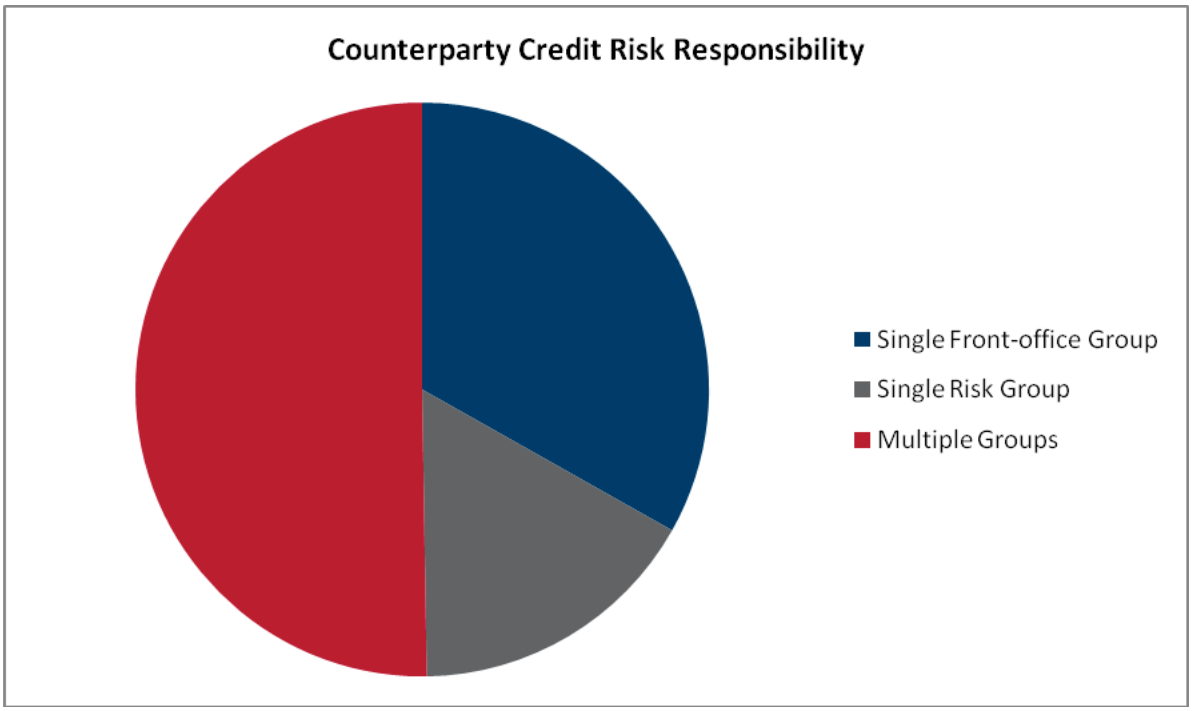
An innovation that emerged in the mid to late 90's was incorporating the credit variable into pricing models in order to hedge counterparty credit risk like other market risks at the position level. There were two ways to implement this 'market model'. The first involved valuing the counterparty's unilateral option to default. The second used the bilateral right of setoff, which simplified the model to risky discounting due to the offsetting option to 'put' the counterparty's debt struck at face value against an exposure. Using the unilateral or bilateral model at the position level was appealing since it collapsed credit risk management into the more mature and better understood market risk practice.

The use of setoff at some banks began as a proprietary business. The desk cherry-picked counterparties that had sufficient outstanding debt to set-off against derivative exposures. Negative exposures, i.e., where the bank owed the counterparty, were particularly attractive since holding bonds yielded a higher return and could be marked up to face value in the event of default. Pricing derivatives in this context provided a distinct competitive advantage since the CVA reduced to the different between risk-free and risky valuation and there was minimal incremental capital charge due to the replicating hedge. The relatively low rate environment of the late 90's and early 2000's caused large negative payer swap exposures that could be 'monetized' this way. However, using the right of setoff had very limited application due to liquidity and legal risks.

A few institutions considered transitioning as much of their credit portfolio as possible into the market model, using bilateral setoff wherever possible and the unilateral option model for everything else. The idea seemed reasonable since over 90% of corporate derivatives were vanilla interest rate and cross-currency swaps. Implementing risky discounting or an additional option model for each product type was certainly plausible. Trades that were actively managed in this way were simply tagged and diverted from the reserve model. Aside from the obvious issues, e.g., credit hedge liquidity, the central argument against this methodology was that it either neglected credit risk mitigants like collateral and netting or improperly aggregated net exposures. The ultimate demise of the market model as a scalable solution was that the marginal price under the unilateral model was consistently higher than under the simulation model.



Another detriment was the viability of having each trading desk manage credit risk or be willing to transfer it to a central CVA desk. Having each desk manage credit risk meant that traders needed credit expertise in addition to knowledge of the markets they traded. In addition, systems had to be substantially upgraded. A central CVA desk proved a more effective solution but raised political challenges over pricing and P&L. Institutions that tried either configuration basically concluded that credit risk belonged in a support-oriented risk management unit with the ability to execute hedges but without a P&L mandate. In short, the substantial set of issues with the market model caused firms to revisit the reserve model.



Merger of the reserve and market models

Attempts to move credit risk out of the reserve model and into a market model inspired important innovations in the simulation framework related to active management. Banks had been executing macro or overlay CDS hedges with notional amounts set to potential exposure levels. The CDS hedges were effective in reducing capital requirements but ineffective in that the notional amount was based on a statistical estimate of the exposure, not a risk-neutral replication. In addition, that exposure (notional) varied over time. The introduction of contingent credit default swaps (CCDS) addressed the varying notional but not the replication issue.

In CCDS, the reference obligation is a derivative, an interest rate swap for example, and the notional is the fluctuating value of that derivative at each payment date. CCDS was initially designed as a means of replicating the unilateral exposure of individual transactions in the market model. In the simulation context, a CCDS with a synthetic underlying that mimicked the general behavior of the exposure profile for a counterparty could be a more effective hedge than a traditional CDS with fixed notional. Whilst CCDS are tailor made to transfer counterparty risk within a given contract, extending them to cover many netted contracts and include collateral agreements is extremely complex, not least in terms of the required documentation. For these reasons, the CCDS product has not developed strongly despite the increasing focus on counterparty risk.

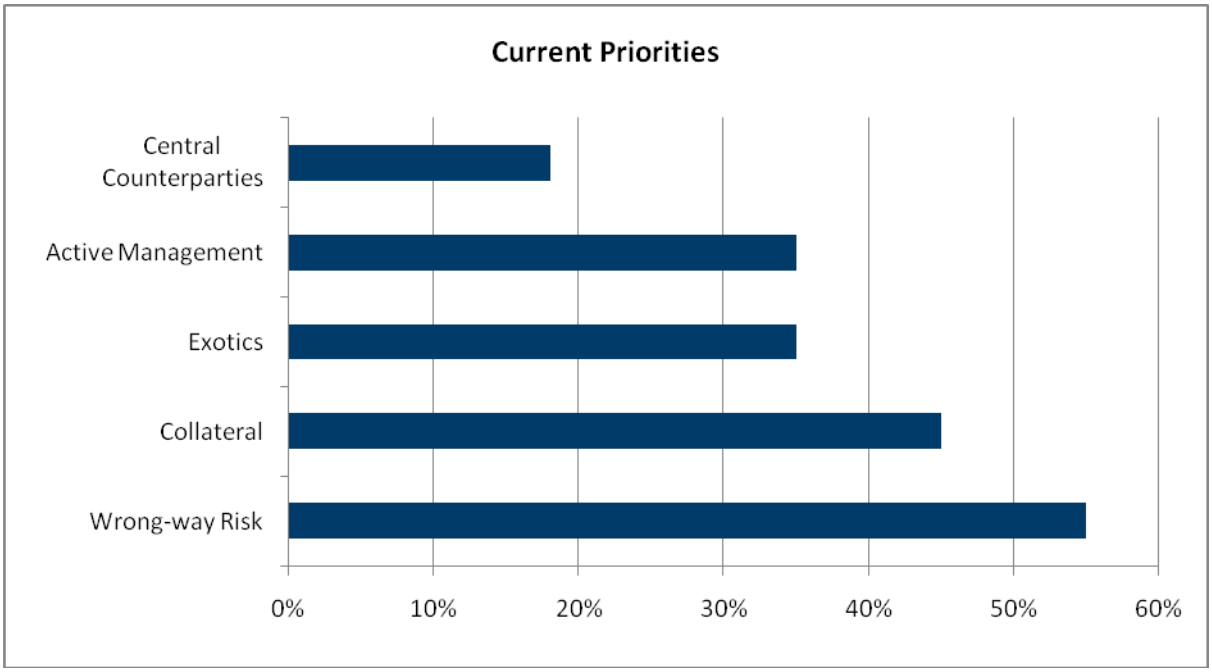
Hedging also involved perturbing the market rates used in the simulation and then calculating the portfolio's sensitivities, which could then be converted to hedge notionals. The goal was to stabilize the potential exposures in order to make the credit hedges more effective and improve incremental pricing. There were several issues with this approach. Simulation of the entire portfolio could take hours and re-running it for each perturbed input restricted rebalancing frequency to weekly or longer. In addition, residual correlation risk remained, which had critical consequences over the past two years.

Correlation in portfolio simulation remains an open problem. Simulators typically use the real or historical measures of volatility as opposed to risk-neutral or implied volatilities in projecting forward prices. One reason is that risk-neutral vols may not be available for some market inputs, e.g., credit spreads. The bigger reason is that historical vols already embed correlation. Correlation is not directly observable in the market and the dimensionality of pairwise correlations causes substantial if not unmanageable complexity. The end result is that correlation has been managed through portfolio diversification instead of replication. Given the role of correlation in terms of 'wrong-way risk' over the recent cycle, it is on the short list of priorities for the next evolution.

Current priorities

Over the past two years, firms that had a comprehensive, integrated approach to credit risk management survived and emerged while those that had a fragmented approach struggled and failed. This punch line and the evolutionary process that helped deliver it have resulted in a general convergence toward the portfolio simulation model with an active management component. Several global banks are at the cutting edge of current best practice whereas most mid-tier and regional banks are still balancing the need to comply with accounting requirements, which require CVA, with more ambitious plans. In some cases, the accounting requirements have caused many banks to revisit the front-office market model with its known deficiencies, at least as a stepping-stone to implement a complex real-time CVA simulation.

Whilst many banks are still trying to implement simulation models across all products, those that do are pushing the evolution in three main areas. First, with the recent monoline failures, there is a recognized need to incorporate wrong-way risk. Basically, wrong-way risk is the case where the counterparty's probability of default increases with its exposure, i.e., there is positive correlation between its credit spread and the underlying market rate(s) that drive its exposure. Second, in the wake of AIG's bailout, recognizing collateral risks in terms of valuation and delivery is clearly important. Third, capturing as much of the portfolio as possible, including exotics, increases the effectiveness of centralized credit risk management and allows more accurate pricing of the incremental exposure of new transactions. Many banks have portfolios following something like an 80-20 rule, i.e., 80% of their counterparty risk falls within 20% of their business. Since this 20% may include many of the products (such as credit derivatives) for which they struggle to quantify the CVA, many market participants favor central counterparties as a means to manage counterparty risk.



Another key recent priority has been the use of bilateral over unilateral CVA. Bilateral counterparty risk is often expressed as DVA (debt value adjustment), which mirrors CVA. CVA represents a cost for counterparty risk whilst DVA represents a gain that is linked to the future default of the institution in question. Prior to 2007, financial credit spreads were extremely low and banks had little interest in accounting for DVA. However, the recent severe deterioration of all credit spreads, including financials, has incentivized banks to price DVA in order to offset CVA losses. Although counter-intuitive, since the bank makes money when their own credit spread widens, the use of DVA is becoming increasingly common and generally accepted.

Although these priorities were a direct result of recent events, they are not new. Many banks were aware of wrong-way and collateral risks a decade ago. DVA has been a fairly obvious component that was not given focus since banks credit spreads were until recently rather low. The issue back then and now is that counterparty credit risk remains a very complex problem and institutions have had to approach it in stages. Due to the substantial complexity, which includes massive data management in addition to scalable technology infrastructure and advanced credit analytics, institutions are increasingly looking to vendors for solutions. Huge improvements have been made and current best practice is the result of a long and iterative evolutionary process from which we can expect another round of innovation.

About the Authors

Jon Gregory

Jon Gregory is a consultant specializing in the area of counterparty risk. He started his career at Salomon Brothers (now Citigroup). From 1997 to 2005, he worked for BNP Paribas, initially developing the framework for the pricing and management of counterparty risk for the fixed income division and later being part of the rapid growth of the credit derivatives business. From 2005 to 2008, he was Global Head of Credit Analytics at Barclays Capital based in London. He has published many papers in the area of credit risk, recently looking at some of the complex counterparty risk issues in relation to the credit crisis. In 2001, he was co–author of the book Credit: The Complete Guide to Pricing, Hedging and Risk Management, short–listed for the Kulp–Wright Book Award for the most significant text in the field of risk management and insurance.

Gregory's new book, **Counterparty Credit Risk: The New Challenge for Global Financial Markets**, was published on Friday, December 4th 2009 by Wiley & Sons.

David Kelly

David Kelly, Director of Credit Product Development, **Quantifi**, brings almost 20 years of experience as a trader, quant, and technologist to Quantifi. At Citigroup, he was the senior credit trader on the Global Portfolio Optimization desk, responsible for actively managing the credit risk in derivatives positions and establishing the CVA business. Prior to this, he ran Chase's Global Analytics group, where he was responsible for front-office pricing models and risk management tools for the global derivatives trading desks including the firm's first CVA system for active counterparty risk management and credit charging.

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Quantifi Inc is a leading provider of state of the art models, pricing tools and risk analysis for the global credit markets. Quantifi's extensive suite of integrated products and services provide fast, accurate and innovative solutions which set the standard for advanced pricing and risk analysis.

Since 2002, active participants in the global credit markets including banks, hedge funds, asset management and insurance companies have relied on Quantifi to provide immediate time-to-market advantages along with independent market-validated pricing.

Quantifi's team of professionals have many years of experience working for top-tier firms within the financial services sector, offering clients applied capital markets experience combined with technological expertise.

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