

# Counterparty Credit Risk Management



**Counterparty credit risk theory and practice have been evolving over the past decade, but the recent market crisis has brought it heightened focus. Quantifi's David Kelly explains how the current best practice is the result of a long evolutionary process.**

Over the past decade, banks addressed the problem of counterparty credit from traditional financing experience while the 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. 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 methodologies, management responsibilities and technology.

The most significant evolution was the transition of the buy and hold mentality to a more market-based, active risk management model. Simultaneously, substantial responsibility was transferred from credit officers to traders. As various extensions to the reserve and market models have been implemented, a general consensus has emerged that essentially combines portfolio theory and reserves with active management. This combination has placed tremendous emphasis on technology infrastructure.

Banks today tend to be distributed along the evolutionary timeline by size, where global banks have converged to the consensus model while most regional banks 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



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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 overall level of portfolio diversification. Premiums are comprised of two components – the expected loss or credit value adjustment (CVA) and the potential unexpected loss within a chosen confidence level, also referred to as economic capital. Traditional banks like pre-merger Chase and Citibank and their eventual investment banking partners J.P. Morgan and Salomon Smith Barney all used reserve models but the underlying methodologies were very different.

Banks converted exposures to loan equivalents and then priced the incremental credit risk as if it were a loan. 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.

By 2000, the simulation based CVA and economic capital reserve model was state of the art. 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 Credit Default Swap (CDS) as a blunt instrument to reduce large exposures, there had been limited effort in actively hedging counterparty credit risk. 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. This had the effect of replacing economic capital reserves with significantly lower VaR. The second solution, basically in response to the first, introduced active management into the simulation model. Active management or hedging reduced potential future exposure levels and corresponding economic capital reserves. 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 the idea of incorporating the credit variable in 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 the 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.

A few institutions, including Citigroup, 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 swaps 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 caused political turf wars over pricing and P&L. Institutions that tried either configuration basically concluded that credit risk belonged in a 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 with

regard 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 next logical step was to address active management from the input end simulation. This involved perturbing the market rates used in the simulation and then calculating the portfolio's sensitivities, which could then be converted to hedge notionals. 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.

Banks that have robust simulation models are pushing the evolution in four 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. 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. Finally, robust technology infrastructure is imperative to reliably capture the wide array of market and position data and then perform the simulation in a reasonable timeframe. Automation and standardized data formats like FIX speed implementation reduce errors and ultimately enhance the integrity of the results.

Counterparty credit risk remains a very complex problem and institutions have had to approach it in stages. Huge improvements have been made and current best practice is the result of a long and iterative evolutionary process. There is still much work to do and it will be exciting to see what new innovations lie ahead.

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