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Toward Comprehensive Simulation of Complex Credit Structures

ABOUT THE AUTHOR

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Introduction

The last five years has seen an enormous increase in focus on the subject of credit. This focus has ranged from the creation and use of credit-based derivatives, the role of credit rating agencies and the measurement, modelling and pricing of credit risk.

The use of credit-based instruments has grown almost a hundredfold in the last five years. In 2003 such instruments were relatively little traded, with even the largest banks having no more than 10,000 credit default swaps (CDS's) on their books.

However, with the realisation that these instruments could be used to spread credit risk across the market, the use of CDS's has grown significantly. The largest banks have more than 100,000 CDS's on their books, in some instances rivalling the number of interest rate swaps. The Bank of International Settlements Triennial Survey (Ref) reports that positions in credit derivatives have exploded from $4.5 trillion in June 2004 to $51 trillion in June 2007 – representing more than a tenfold increase in three years.

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The collapse of the US sub-prime asset-backed securities market of 2007 and the ensuing credit crunch has significantly reduced the appetite for these credit-based instruments, particularly the more complex examples such as collateralised debt obligations (CDO's) and CDO-squared's. Attitudes are more circumspect and investors are increasingly reluctant to hold instruments where they cannot clearly see where their credit exposure may lie.

Nevertheless these credit-based instruments still remain hugely popular, particularly single name CDS's, and banks still have a large number of the less liquid derivatives on their books that have to be managed. The longer term health of the market will depend on an emphasis of transparency over complexity and, on the trading side, more structural analysis to discriminate among CDO's based on their actual underlying assets.

The problem

As is typical following a market event such as the sub-prime lending crisis, there has been a certain amount of revisionism with financial institutions now focusing their attention on the large number of credit-based instruments on

their books. Given that increasing defaults are likely in the current economic conditions, it is crucial that institutions are able to understand and communicate the potential exposure generated by their holdings of credit-based instruments and traditional asset classes.

Central to achieving this improved insight is the use of simulation-based techniques where thousands of scenarios are run in order to model the potential credit exposure.

The increasing volume of both plain vanilla CDS's and the more complex credit derivatives and CDO's has made the use of simulation a more challenging task. Historically these more complex instruments are rarely integrated into simulation-based counterparty exposure calculations because of the difficulty in simulating them in a timely fashion. A system that can run thousands of simulations for all of the underlying names within these contracts must leverage all the currently available computational technology, particularly parallel processing and distributed processes such as grid computing.

An important consequence is that many institutions have not been accurately measuring or fully managing the credit risk of these instruments, instead relying on inferior modelling and calculation approaches, such as the mark-to-market plus add-on allowed by the regulators – a somewhat punitive proxy that fails to capture most of the benefits of offsetting positions and diversification.

The wider implications of this shortfall are far-reaching. Not only is there the obvious issue of less accurate calculations but the use of the MTM plus add-on approach means that banks are being overly conservative, increasing their regulatory capital charge and restricting the activities of their traders in the front office.

Forward thinking middle office personnel want to be viewed as facilitators of trades and not obstacles. They are seeking a role similar to consultants rather than being viewed purely as the "risk police" The objective is to maximise recognition of the benefits from netting and offsetting facilities and relay these advantages to the front office.

Furthermore many institutions are still modelling their risk exposures in isolation, based on asset-class silos rather than taking a cross-asset, enterprise-wide view of risk. The more comprehensive approach means modelling credit products along with any interest rate, equity and fixed income products that involve the same counterparties. Failure to adopt such an approach reduces the transparency of risk exposure as well as limiting the ability for a bank to offset its risk across asset classes.

The motivation for moving to cross-asset, enterprise-wide, simulation-based modelling is by no means solely driven by increasing transparency for the front office. There is increased regulatory pressure for more accurate calculation of credit risk exposure. Some of this pressure has resulted from the events of 2007 and the subsequent credit crunch. Much of it though is a result of the recent introduction of the first stage of Basel II and the anticipated developments that will follow – namely a greater emphasis on banks' internal credit risk models and a reduced capital charge for those that can demonstrate reliable modelling. As well as potential reductions in the capital charge that comes with Basel II, the committee's guidelines are helping to set market standards for risk management. Many institutions will want and need to be seen as subscribing to the highest level of risk modelling not just for regulatory purposes but to establish and/or maintain their external reputation for best practice risk management.

The spread of simulation-based counterparty credit modelling has been slow. Most larger banks have employed simulation-based modelling to some extent, at considerable expense and frequently dependant on in-house technology development. While simulation is often used for more vanilla products such as FX and interest rate swaps, when it comes to more complex derivatives and structured

products, simulation-based modelling is often a work-in-progress. For the smaller institutions, simulation-based modelling has simply been considered too expensive and complex to deploy either based on in-house development or purchased from third party vendors.

The Solution

Fortunately simulation-based modelling is becoming more commoditised and vendors have been able to bring solutions to market. Nevertheless, it is still a complex task to produce risk engines that are powerful and fast enough to produce the simulations for thousands of credit names in a timely fashion.

Such a system requires multi-factor credit risk models that are able to simulate credit spreads across different sectors and countries and model correlation between credit spreads and other market rates in order to give a truly cross-asset class view of credit exposures.

The next stage is to incorporate CDO's into these models, which requires an additional increase in performance to satisfy the short timeframe in which to evaluate what are often thousands of names underlying these complex instruments.The modelling of CDO's over long horizons is complicated by the impact that a default absorbed in one tranche can have on all other tranches. A full featured CDO modelling engine has to be powerful enough to capture real-time credit risk events and correlate the updated exposure to all of the underlying names.

SunGard's Adaptiv Analytics solution, a high performance trade valuation and portfolio simulation engine, has been enhanced to meet the demands of the current credit market. The latest benchmarking tests verify that performance has been substantially increased, reaching 18 million valuations per second on a representative professional counterparty portfolio. The tests showed that Adaptiv Analytics can calculate the Potential Future Exposure of more than 140,000 trades across 1,200 counterparties in an actual large bank's portfolio in just over 40 minutes.

Aside from the performance aspect, today's solutions also need to be reliable, scalable and extensible enough to be deployed as mission critical applications. They need to be suitable for future market conditions – including a further increase in volume and complexity and potentially, the next market crisis. When institutions invest in solutions they increasingly expect them to meet their future needs rather than simply cover their current requirements.

Satisfying this criteria means building the solution on a modular architecture designed for genuine scalability across every dimension and utilising grid-enabled technology that can be efficiently deployed with new hardware. Using grid-enabled solutions for credit calculations is not new. Nevertheless, many firms have only been able to gain part of the benefit of their investment in grid computing due to unexpected bottlenecks that appear when new nodes are added to the grid. Fully effective grid technology must be flexible enough to accommodate the inclusion of additional hardware that differs in speed and performance from the existing nodes.

Similarly a set of transparent processes, where the risk exposures can be easily seen and reported to both senior management and a bank's client base will not only help individual institutions but also help the credit market as a whole which will continue to grow in areas where the risks are clearly reported and understandable.

Yet all of these developments in credit calculation engines and simulation-based modelling will have limited relevance if the cost and complexity remains inordinately high and within the reach of only the most elite of institutions. Fortunately there are now a number of innovative ways for vendors to work with financial institution of all sizes to ensure broader application of these advances capabilities.

The use of service-oriented architecture and SunGard's hosting capability means that pricing can be offered on an 'on-demand' basis. This allows institutions to call upon surplus computer power when necessary, only paying for the power that is used. Similarly, calculation capability can be priced on a per-transaction or calculation basis.

Advantages

As is abundantly clear, the credit markets are under uniquely intense scrutiny from both regulators and potential investors. Trading institutions and the systems they use must be able to withstand this scrutiny and meet the more exacting standards required of them. The ability to do this will bring advantages that are clear and tangible. Through the combination of advanced computing power, innovative pricing, architectural flexibility and operational transparency and resilience, financial institutions can realise benefits in the front, middle and back office as well as in the boardroom.

The middle-office will be able to fulfil its ambitions of being a value-add service to the front-office traders rather than purely an internal regulator, by offering more accurate and timely calculations of credit exposure, thereby allowing more efficient credit limits and offering more advantageous hedging opportunities. The front-office gains the advantage of better trading returns and, potentially, the information needed to avoid the worst impact of a sudden credit crisis such as we have recently experienced.

Meanwhile senior management, board members and regulators can gain confidence based on a clear and transparent representation of a firm's credit exposures despite the increasing volume and complexity of the instruments involved.

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About Adaptiv Analytics

Adaptiv Analytics is SunGard's architecture for complex simulation based financial calculations. Built upon a modular, extensible architecture it leverages Microsoft's .Net ™ framework and Intel® Xeon® multi-core processors to deliver a grid-enabled solution to meet the demands of today's risk managers.

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