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Risk Management and Operations Solutions

The Future of Market Risk Management

Regulatory pressure, in the form of revisions to the required treatment of market risk in Basel II, is reinforcing other factors to create a renewed focus on market risk management. Supervisors, security analysts, senior management and boards are demanding more detailed insights into the magnitude and composition of potential extreme loss events. Careful planning and organisational discipline are required to use new technology most effectively.

Risk Management's Evolving Focus

Market risk was the central focus of financial risk management for much of the 1990s. The Basel Committee's 1995 decision to allow the use of internal models for calculating regulatory capital related to market risk set off a flurry of activity. The resulting amendment to the Basel Capital Accord meant that existing market risk models had to be documented; product and geographic coverage had to be expanded; and procedures for back testing had to be established. All this caused extensive discussions about the theoretical and practical merits of different techniques. Market risk was a frequent topic at risk management conferences - there were even conferences that covered nothing else.

Those days now seem ancient history. Once banks received supervisory approval for their internal models, market risk discussions often quickly faded. To be sure, there were occasional debates over the strengths and weaknesses of Value-at-Risk (VaR) – the central component of the calculation of market risk – but as a hot topic, market risk had seen its day.

Since the late 1990s banks have run their market risk models on a routine basis, generating VaR numbers daily. This has been interrupted only by occasional unavoidable enhancements as new products, particularly equity and credit derivatives, have appeared. But several forces may now be about to upset this comfortable routine.

Pressures for Change in Market Risk Practice

Changing Perceptions of the Sufficiency of Value-at-Risk

In the 1990s, VaR was quite rightly seen as a major advance in market risk management. Previously, trading positions were controlled by a plethora of micro-limits on such things as duration-adjusted open positions; maximum maturity mismatches - individually and in total - and individual gamma and vega limits on option positions.

The aggregate potential risk arising from this eclectic set of detailed limits was unquantified – perhaps even unquantifiable. Thus, for all its shortcomings – for which see below - VaR allowed policy makers to set trading limits according to their risk appetite. But now that VaR has become standard operating procedure, risk managers and banking supervisors have focused increasingly on what it does not address: potential losses beyond the standard VaR cut-off.

The Sting in the Tail: Magnitude and Diagnosis

While VaR sets a limit to losses in normal market conditions, it does not cover the extreme loss events that can threaten an institution's very existence. As a result, stress testing has received increased attention in recent years. But while virtually all agree that stress testing is a necessary supplement to VaR, not much has been said about what constitutes best practice. In a July 2005 statement[1], The Basel Committee highlighted

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[1] Basel Committee on Banking Supervision, *The Application of Basel II to Trading Activities and the*

the need to focus on both the *length of the loss tail* of the market value distribution and the *particular market events* that could generate an extreme loss.

Migration of Credit Risk from the Banking Book to the Trading Book
When the market risk amendment to the Basel Capital Accord went into effect in 1998, the value of most trading book derivatives was driven by generic market variables such as exchange rates, interest rates and commodity prices. The subsequent growth of equity derivatives made these the first significant source of company specific risk[2]. More recently the big growth area has been various credit sensitive derivatives. One important result has been the migration into the trading book of significant credit exposure that would formerly have been held in the banking book.

Limited Progress in Modeling Specific Risk
The original 1995 market risk amendment incorporated a regulatory capital penalty if VaR models did not deal explicitly with specific risk factors such as credit spread changes and company-specific rating migrations. The aim was to encourage banks to introduce detailed treatment of specific credit risk into their VaR models. Most banks have taken the position that the cost of such an enhancement outweighed the benefit in terms of a lower regulatory capital requirement. As a result, most institutions have made little progress toward effective modeling of specific risk.[3]

Supervisory Angst
The migration of credit risk from the banking book to the trading book and disappointing progress in the treatment of entity-specific credit risk in the trading book have worried banking supervisors. This appears to be why the Basel Committee now proposes to require explicit treatment of entity-specific credit risk for approval of internal market risk models or revert to a more onerous standardised-based specific risk charge.[4]

Converging Market and Credit Risk
Integrating market and credit risk has been discussed for almost ten years and integrating the underlying market and transaction data certainly has both theoretical and practical value. Nevertheless, the illiquidity of many sources of credit risk made meaningful analytic integration unrealistic. But the growth in credit derivatives over the past five years has produced well-publicised inroads of market forces into the credit risk arena: liquidity has expanded dramatically in the credit default swap market; Nth to default basket structures have become common; and collateralised debt and loan obligations are now a widely applied credit risk management tool for major banks. As the markets for these instruments have grown both in coverage and depth, a significant volume of credit risk has been transformed into a complex type of market risk.

Furthermore, the Basel Committee recently sanctioned the use of multi-period simulation techniques for estimating counterparty credit risk generated by derivative portfolios. Both these developments mean that many analytic tools and their supporting data apply to both market and credit risk. Taking advantage of this commonality can both reduce the cost and improve the reliability of a bank's risk measurement infrastructure.

Continued Product Innovation
The continued development of new and innovative derivative products has strained market risk systems. Inflexible architectures have frequently made ad hoc extensions for such products the only practical alternative. This is particularly troublesome when products depend on new and esoteric market factors such as implied correlation, complex forms of basis risk and the volatility of implied volatility.

Treatment of Double Default Effects, July, 2005, pp. 62-79, available at www.bis.org/publ/bcbs116.pdf.

[2] Of course, physical portfolios of both private debt and equities always have been subject to company and issue specific risk factors.

[3] In a few cases, mergers and acquisitions have given supervisors a second chance to vet the treatment of specific risk. In the US, at least, this has led to much more demanding standards than were applied in the original supervisory approval process in the late 1990's.

[4] Op. cit., Basel Committee on Banking Supervision, July, 2005; p.63, para. 265; p. 67, para. 285 and p. 74, para. 307.1.

(Uncertainty surrounding both valuation and forward risk simulation of such products is also a stated concern of the Basel Committee.[5]) Treatment of these new products is often poorly integrated into the original VaR systems of the late 1990s. Often this has resulted in degraded computational performance; extended run times; and operational mishaps that delay the availability of results.

Concern About Limited Liquidity
Closely related to the increased emphasis on tail events is concern about potential lack of liquidity, especially in new complex products where volumes are small and two-way deal flow is limited. This issue was highlighted in 1998 by the failure of hedge fund Long-Term Capital Management and has been a concern ever since. The inability to liquidate or hedge a market risk quickly can arise from excessive positions in thinly traded products, that are inherently vulnerable to gapping in prices, or from oversized positions in normally liquid instruments. Legal or operational constraints also may hamper the ability to respond quickly to adverse market conditions. Concerns around potential illiquidity are noted in the Basel Committee's July 2005 statement.[6]

Rising Demands for Transparency
In addition to regulatory demands, boards are coming under greater scrutiny and are demanding better insight into the risks faced by their institutions. This often takes the form of greater drilldown into the sources of risk and explanations of how these have changed from the previous reporting period. No longer limited to VaR and its composition, such demands extend to assessment of unlikely but extreme events with potential catastrophic impact. This serves as yet another basis for the need to analyse and understand the "sting in the tail." VaR is no longer sufficient to satisfy these demands for improved transparency.

[5] Ibid. p. 77 para. 309.
[6] Ibid. p. 70 para. 297, p. 75 para. 307, and p. 77 para. 309:738b.

Best Practice and the Steady March of Technology
A very shrewd supervisory tactic emerged with the approved use of internal models for market risk, namely the demand that banks apply "best practice" methods in their risk measurement and control systems.[7] This effectively has made minimum acceptable practice a moving target. As in so many other areas, an important driver of best practice risk management is the continuing advance in available computing power, memory capacity and communications bandwidth. In this context, the time since the Basel Committee's market risk amendment went into effect at the beginning of 1998 has immense implications: Moore's Law[8] means that computing capacity available for a given outlay has risen by more than 30-fold in that period. Also, huge amounts of broadband communications capacity have accompanied this increase in computing capacity. Most banks are a long way from using all these advances in their market risk systems.

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Likely Future Implications

As has been true in the past, supervisory demands promise to be the most effective catalyst for change in market risk practices. Such demands, especially when they affect minimum regulatory capital, inevitably capture senior management attention. But all the above pressures for change point in a consistent direction: the need *and the capacity* to supplement aggregate macro-estimates of potential losses with far more micro-oriented information about the nature and magnitude of specific vulnerabilities.

[7] For example, "Further, as techniques and best practices evolve, banks should avail themselves of these advances.", ibid. p. 75
[8] While subject to various formulations over the years, Moore's Law (named after a 1965 projection by Gordon Moore, co-founder of Intel) basically states that computing capacity available for a given cost will double every 18 months.

The Inadequacy of Correlated Aggregation
Many institutions still utilise a reduced form approach to calculating VaR based on correlated aggregation. This derives the standard deviation of the potential P&L distribution by aggregating the volatility from individual risk factors based on estimates of the correlation of their relative changes. Such an approach falls well short of emerging supervisory demands. This is primarily because it assumes a normal distribution for relative changes in market variables and is therefore fundamentally unsuited to examining extreme losses. Although correlated aggregation may hint at sources of greatest risk, these are not always comprehensive since big potential losses may be driven by leveraged basis risk or breakdowns in expected correlations. Effective analysis of the long tail of the loss distribution requires the much greater level of detail provided by either historical simulation or non-Gaussian Monte Carlo methods. But even these approaches will sometimes fall short: for example, basing either method on aggregated Greek sensitivities can mask important specific risk details needed to satisfy the newly published demands of Basel II.

Increased Demand for Deal-level Detail
One implication of this is the need for much more detailed information on the trading book. Deal-level details, including identification of the entities whose status drives the value of credit risky positions, are essential for a reliable and verifiable treatment of specific risk. Such details also are important in spotting potentially dangerous concentrations of strike prices and maturity dates within an option book.

Increased Computing Demands
The need to deal explicitly with specific credit risk and differential liquidity by instrument or size of position obstructs some of the most common efficiency enhancement techniques used in calculating VaR. Cash flow consolidation, for example, is fine if all cash flows are effectively interchangeable. But once cash flows differ in their credit sensitivities consolidating them is less appropriate. This constrains the applicability of a common technique for transforming detailed positions into simpler risk-equivalent forms. Since the primary purpose for this technique is to reduce the necessary computation in the simulation process, constraining its application implies the need for greater computing capacity than is required by most market VaR system today. Fortunately, both historical and Monte Carlo simulations are highly amenable to parallel computing techniques, which have made substantial advances in the past seven years.

Consolidation for Efficiency and Consistency
Market factors such as interest rates and exchange rates have long played a role across multiple trading areas. But company and even issue specific risk considerations dramatically increase the complexity of such cross-product influences. This results in a correspondingly greater incentive to move away from independent specialist systems toward platforms that can be used across products and business lines. This can extend to using functionality from front office valuation services in an enterprise market risk solution. At a minimum, such re-use may allow rapid but temporary incorporation of new products into the enterprise VaR system while a more efficient approach to recurring simulation is developed. Where multiple application of data and analytics can be permanent, the general result is both lower cost (from avoiding unnecessary duplication) and greater consistency than is possible using fragmented specialist systems.

Flexibility and Scalability
The increasing volume, complexity and range of application for derivative products will continue. While margins are often attractive in the early stages of a new product, the duration of such profitable margins continues to fall. Once a product becomes commoditised and margins become razor thin, operational efficiency is the key to remaining profitable. In this context, finding ways to make best use of technology on a regional and global scale is crucial to securing an acceptable return on IT investment. Business solutions adopted today must be able to work with both existing and future applications as new products are introduced and technology continues to advance. Extensibility and scalability are therefore essential requirements if the business is to be supported in the long term.

Software Architecture Implications
An object-oriented software architecture that is also modular and scalable is essential to meeting the evolving technology demands of market risk assessment and oversight. Unfortunately, there are many forces that work against this. For example, the rapid pace of change is a constant source of demands for the quick fix. While such quick fixes are often necessary, it takes patience and discipline to be sure that they are cleaned up later. Most importantly, this requires senior management understanding of the long-term payoff in cost and reliability from such a disciplined approach. Without such understanding and support, the software law of entropy takes over, resulting in the all-too-familiar fragmentation that hampers both efficiency and reliability.

Strengthening the Role of Risk Managers
Risk managers will continue to oversee limit management and enforcement. But in addition, senior management will also increasingly expect them to provide timely and reliable insights into the nature and magnitude of unlikely extreme losses. These will include simulation of "the market's greatest hits" - those traumatic crisis periods that are indelibly etched in the consciousness of those who experienced them. But beyond that, such analysis will incorporate tailored stress simulations based on specific vulnerabilities at any given point. This will require the capability to identify the causes of the largest losses in a VaR simulation and to use this information to design corresponding stress scenarios.

Conclusion

Many banks' market risk management systems have evolved only slowly in recent years, largely to incorporate newly introduced product types. During that time, various forms of specific risk have grown in importance, the most important being credit risk in a variety of forms. While computing and communications capacity have been radically transformed, only limited progress has been made in applying these advances to the analysis of specific risk and potentially extreme loss events.

Regulatory pressure, in the form of revisions to the required treatment of market risk in Basel II, is reinforcing other factors to create a renewed focus on market risk management. Supervisors, security analysts, senior management and boards are demanding more detailed insights into the magnitude and composition of potential extreme loss events. Careful planning and organisational discipline are required to use new technology most effectively.

Risk simulation is inherently more computer-intensive than front office pricing. As a result, despite the continuing expansion of computing power, there is still a need for trade-offs and analytic compromises. But if properly deployed and managed, technology can provide more nuanced insight into the composition and magnitude of market risk. Doing so requires understanding, will and discipline. Lacking these, market risk information will continue to fall short of its potential and this shortfall will doubtless have severe consequences for some institutions.

SunGard Adaptiv
SunGard Adaptiv is an enterprise wide credit and market risk management solution for financial services institutions. Adaptiv assists institutions of varying size and complexity to deploy technology to meet both internal and regulatory requirements for risk management and operational control. We help more than 160 financial services institutions from the banking, hedge fund, asset management, insurance and corporate sectors with our deep understanding of risk management and operational processes.

For more information on SunGard Adaptiv's market risk capabilities, please visit our website at www.sungard.com/adaptiv, or contact us at:
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