Toward active management of counterparty credit risk with CVA

Contents:

Executive summary

Emerging from the credit crisis that began in 2007, many financial institutions recognize the need to better manage counterparty credit risk (CCR) and have begun to centralize the quantification, pricing and management of their CCR. This centralization often takes the form of a "CVA Trading Desk" that provides the internal service of quantifying CCR for individual business lines and using the price measure of Credit Valuation Adjustment to actively manage this risk for an entire institution. CVA is a measure that adjusts the risk-free value of an instrument to incorporate CCR, and it is a complex challenge for a trading desk to quantify and manage due to its cross-asset and credit contingent nature. Furthermore, the presence of subtleties such as debt value adjustment (DVA) and wrong-way risk together with the general lack of mature CVA hedging instruments in the market today make CVA a complex topic.

Firms that are interested in improving CCR management and are considering establishing their own CVA desks have several key points to take into account as they work to develop CCR/CVA best practices by realigning their organizational processes and building the necessary systems and tools to support the proper calculation of CVA.

Key findings

CVA has become an important consideration for all firms in the aftermath of the credit crisis. Firms are looking to build up their CVA capabilities and accurately price and manage CCR across all their business lines, and CVA systems are central to this effort.

CVA is driving many firms to fundamentally reevaluate their risk systems architecture, and firms have found that the proper calculation of CVA is non-trivial, even on a periodic basis:

- Existing trading systems will most likely be a poor starting point to provide credible CVA measurement because these systems often process only a subset of all the trades with a counterparty, they cannot model netting and collateral agreements, and they cannot

generate the required risk-neutral scenarios for all risk factors at the performance levels required. Furthermore, most existing systems do not have the performance or analytical capability to calculate sensitivities (greeks), which are required for management of CVA.

- The key to running a successful CVA desk is to find the right balance between risk taking and active hedging. Although CVA must be partially hedged to avoid dramatic profit and loss (P&L) swings, this hedging is far from perfect and the residual risks must be well understood.

A history of Counterparty Credit Risk and CVA

The aftermath of the credit crisis has changed the way financial institutions look at risk, and counterparty credit risk[1] is one area that is receiving a great deal of attention (Figure 1). CCR has emerged as a key focus for banks because of the losses associated with the high-profile failures of investment banks and monoline insurers, and many now believe that no counterparty can ever be considered immune to financial instability.

For more than a decade, banks have considered CCR to be important and have used credit lines and the risk metric known as potential future exposure (PFE) to limit the possible exposure to a counterparty in the future. PFE enables firms to prevent exposure concentration while accounting for the beneficial effects of risk mitigants such as netting and collateral.[2] Before the credit crisis, not all banks recognized the value in a risk management measure like PFE, and a smaller number voluntarily adopted such measures into the quantification and valuation of CCR.

The shift for CCR management began in 2006 when an accounting standard concerning fair value measurement, the Statements of Financial Accounting Standard No. 157 (FAS) required that, when valuing a derivative, default risk (so-called non-performance risk) of the counterparty must be accounted for by adjusting the value of the derivative. FAS 157 introduced a consistent definition of fair value that was not present in the previous Generally Accepted Accounting Principles (GAAP) and was linked more specifically to the exit price of an asset. The European equivalent of FAS 157 is the fair value provision of IAS 39 published by the International Accountancy Standards Board in 2005, which has similar guidance relating to the valuation of CCR.

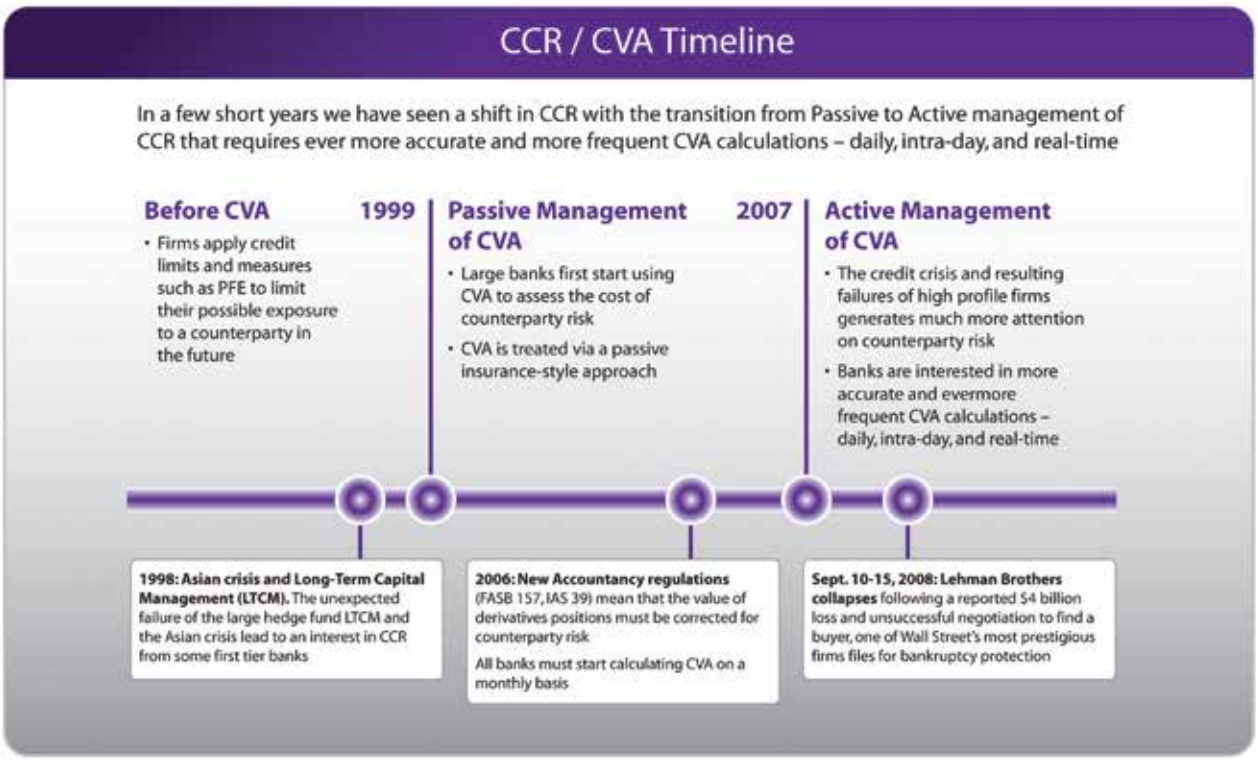

Figure 1: Timeline of CCR practices and CVA

Despite the general improvements in assessing PFE and changes to accounting rules, the major wake-up call for banks and financial institutions in relation to CCR came with the credit crisis that began in 2007. Many factors added to the CCR concerns of firms, such as the default and rescue of prominent financial institutions and dealers, the partial failure of some risk mitigation methods such as collateral and ratings triggers, and the toxicity of credit derivative products. Suddenly CCR received a great deal of attention and firms focused on improving methods to evaluate CCR, much like the emergence of the Value-at-Risk (VaR) concept in the mid-1990s.

Organizational and operational requirements for active management of CVA

Most large users of derivatives have accepted the need for centralizing the quantification, pricing and management of CCR for all their different business lines. Meeting this need is very beneficial to an institution's risk management. Often, dedicated team members work on centralization in a CVA desk. The CVA desk enables the firm to price more competitively, increase transaction volumes with beneficial counterparties or highlight needs for additional risk mitigation on certain counterparties. But just as importantly, this team will assist a firm in recognizing when to walk away from business or when not to transact with another counterparty. When such processes and practices are fully integrated in the firm, a CVA desk can act as a catalyst for bringing together different areas with influence over CCR, such as collateral management, market risk, credit risk, and credit derivatives trading.

Because CVA is P&L component, CVA desks are trading desks. They can be viewed as providing a service by taking the problem of quantifying CCR away from the individual businesses – albeit for a (hopefully competitive) fee. To align with the general interests of the firm, a CVA desk should not be a profit center, although it might be reasonable to permit them to make reasonable profits that are in line with the significant unhedged risks they face and even take proprietary positions, because of their somewhat privileged point of view of the credit markets (Figure 2).

In theory, the trading of counterparty risk on individual contracts would require internal trades of contingent credit default swaps (CCDS) for all transactions. In practice, "internal goodwill" means that heavy documentation can be avoided as long as the general principles are well defined. That said, it is important for an institution to define to what extent a CVA desk is being a "good citizen" to their internal clients and to what extent they are an aggressive trading desk indifferent to the problems their internal clients face and simply wishing to generate P&L while avoiding excessive risk. For example, is it justified for a CVA desk to quote a high charge for a given transaction without giving a reason (as most trading desks are free to do[3]) or should they price within a predefined methodology and parameter set? Can a CVA desk refuse to give the benefit of effects such as netting since, if their internal client were forced to trade externally, then they would not receive these benefits?

Ultimately, there needs to be a balance between the good citizen and the aggressive trading desk because CVA desks must serve the needs of their organizations while remaining focused on profitability and skeptical about the risks they face.

An institution would be creating huge problems if it allowed traders to choose not to insure their CCR with the CVA desk or indeed allowed a CVA desk to reject certain trades. Therefore, there needs to be the relevant channels to solve disputes over CVA charges. Inevitably, CVA desks will always struggle between the desire to fully charge for the underlying CCR and associated hedging costs they bear and the need to curtail charges to minimize the likelihood that their internal clients will feel they are overpaying for the insurance they are purchasing.

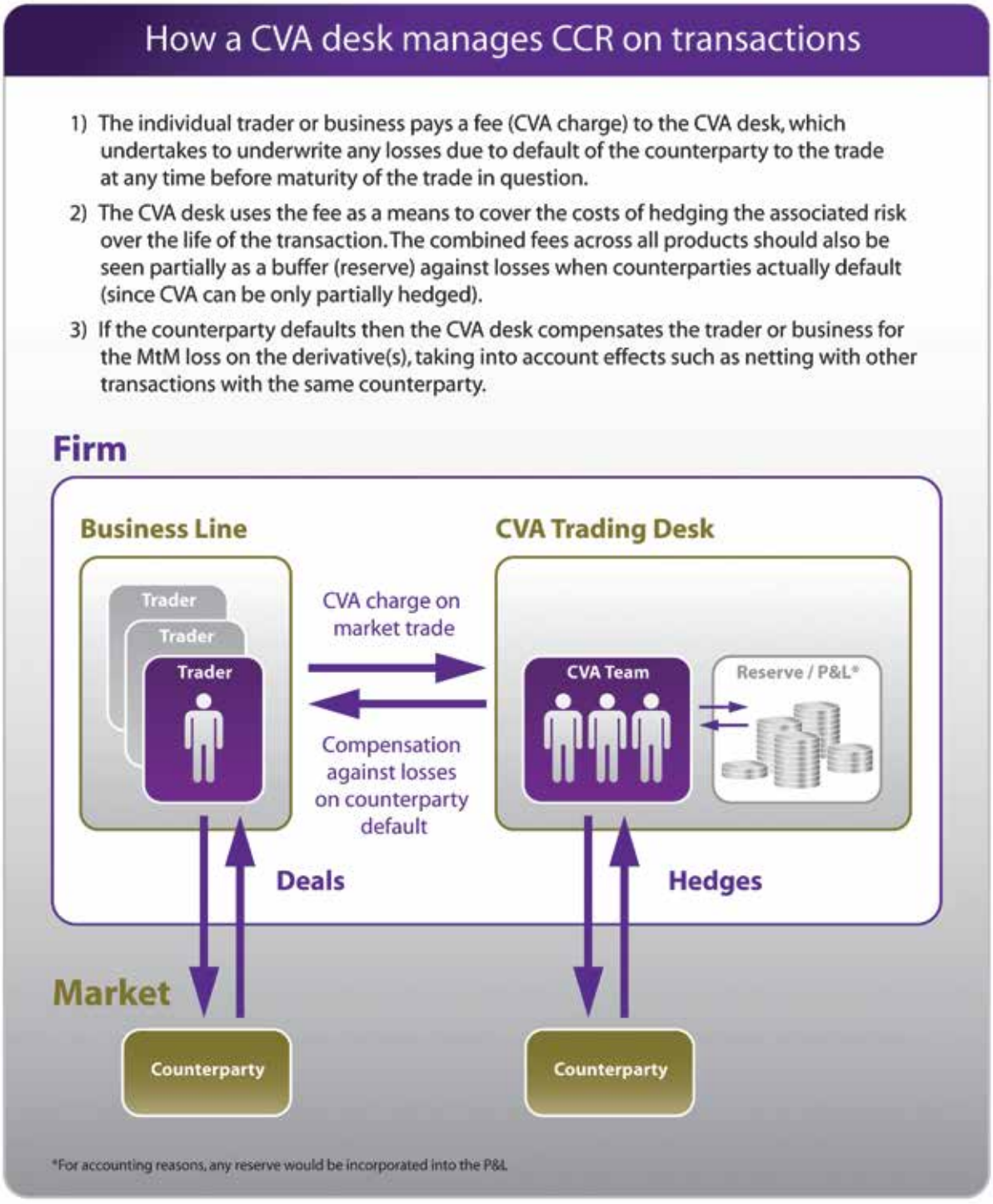

Figure 2: How a CVA desk manages CCR on transactions

Implications of using CVA to value CCR in derivatives

Over-the-counter (OTC) derivatives are customized and potentially complex financial instruments that are traded bilaterally between parties who can have significantly differing credit qualities. Many derivatives, for example swaps, can have both positive and negative value and therefore can change over time from assets to liabilities and vice versa. The OTC derivatives market dominates the more standard exchange-traded structures (where there is arguably no CCR) by a factor of around five to one. Despite the ongoing movement of some OTC derivatives to centralized counterparties,[4] significant bilateral CCR is likely to remain in the OTC markets for many years to come.

The valuation of CCR in a derivative is achieved with the CVA, which adjusts the risk-free value of a derivative to incorporate CCR. CVA can be thought of as the cost of bearing CCR and is therefore associated with a price. There is then a need to value the CVA embedded in any OTC derivative, which has a number of direct implications for high-level management:

- **Effects such as netting**. CVA charges are not additive over transactions because the combined CVA of two or more trades will usually be less than the sum of the individual or standalone CVAs. This means that CVA cannot be priced at the trade level as is standard when marking to market of derivative books. This further implies that CVA is best measured and managed at a high level covering all asset classes and business lines (Figure 3).
- **Allocation at source**. CVA charges can be fairly significant components in the valuation of derivatives. Indeed, the decision to enter into many transactions, especially vanillas, can be largely driven by the associated CVA. This implies that CVA should be charged at the source so that an individual business or trader makes the correct economic decisions in any trading activity that takes CCR into account.
- **Hedging and management**. The total CVA book will represent a very large component in the P&L of an institution. Hence, it is important to hedge the overall CVA to market moves and therefore avoid CVA uncertainty having a negative impact on profitability or risk-adjusted returns. This is, of course, especially important during times of distress and high volatility in financial markets. Often, hedging CVA requires institutions to take relatively large positions in hedging instruments that must be adjusted rapidly even though their liquidity is sometimes limited. Using imperfect proxy hedges for counterparties with no available credit default swaps (CDSs) can also be required. Therefore, there are significant benefits to hedging a residual CVA exposure at the aggregate counterparty level rather than hedging individual transactions.

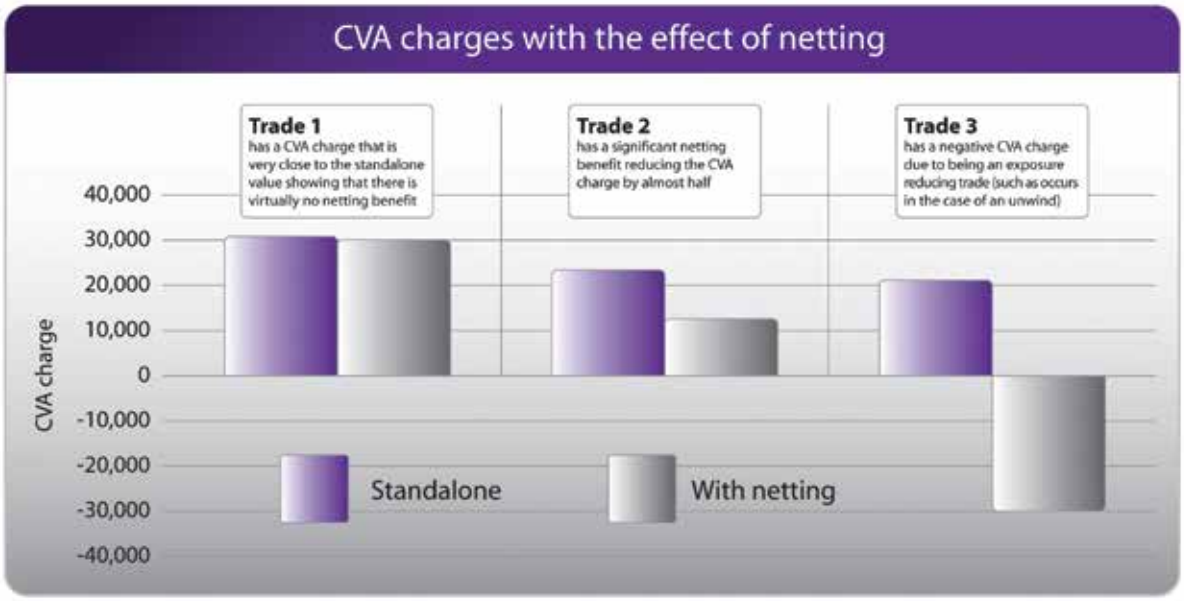

Figure 3: Illustration of CVA charges with the effect of netting

These considerations have supported the business case for banks to build a CVA desk dedicated to the internal centralization, allocation and management of a firm's entire CCR all products. While banks and other financial institutions are at very different stages in such developments and are pursuing differing approaches, the practice of having a CVA desk in the front office is an ongoing trend and is likely to emerge as a standard practice for all banks and some other users of large OTC derivatives.

Quantifying and integrating CVA

Quantification of CVA for a single deal is complicated because it must consider all the components needed to price the trade without CCR and, additionally, the credit quality of the counterparty. Since it is not uncommon to trade many different trade types with a single counterparty, there can be many different CVA calculations required for the various asset classes. Yet CVA is even more complicated than this because it requires that the netting and collateral benefits between different trades also be quantified in order to improve pricing. Finally, all CVA calculations must be available in real time to support deal-time decisions if the effects of CCR are to be included in economic trading decisions.

Therefore a key element in relation to quantifying CCR is incremental or "predeal" CVA. Since risk mitigation features such as netting and collateral are certain to cover many trades and often all trades with a given counterparty for several asset classes, the CVA of a new deal must consider all existing deals that are covered by the same risk mitigants. Considering a deal in isolation (standalone CVA) is conservative but can lead to lost opportunities because of an overstatement of the underlying risk. Predeal CVA is a complex calculation because it requires repricing of all existing deals with a counterparty and incorporating the impact of the proposed deal. A system framework for timely computation of predeal CVA is increasingly regarded as a standard requirement because this is the only way to properly account for risk mitigants and therefore charge appropriately for new business. Predeal CVA also enables an institution to naturally capture impacts such as trade unwinds, cancellations and optionality.

Unilateral CVA implicitly assumes that the institution making the computation will never default. A recent priority has been to relax this assumption and consider bilateral CCR. The contribution to CCR arising from an institution's own default is expressed by DVA a term that mirrors CVA. There are benefits to incorporating DVA in the risk framework, but there are some areas of DVA that can seem counter-intuitive and should be considered carefully.

DVA: The evil twin of CVA

The fair value of assets on an institution's balance sheet incorporates credit risk, which is appropriate because it accounts for the possibility that the institution might not receive future payments linked to those assets. The fair value of the credit risk attached to one's own liabilities is slightly more subtle. It is the only way to make a balance sheet actually balance,[5] but it also attaches value to an institution's future default, which might seem counter-intuitive. Indeed, this led to much debate during the credit crisis when banks made large profits from their credit quality deterioration, which led to gains as they effectively wrote down their liabilities. These gains are reversed when credit quality improves, and therefore this could be regarded as an accounting trick that stabilizes the earnings of a firm.

In the same vein, the evil twin of CVA is DVA, the component of CCR that stems from one's own default. Again, accountancy regulations allow the use of DVA adjustments (in fact, they specifically require it). As such, an institution may offset CVA "losses" against DVA "gains" (Figure 4). Indeed, a riskier than average institution[6] might have an overall DVA that is greater than the total CVA, reflecting a net gain because of CCR. DVA has many advantages; the main one is that market participants are more likely to agree on pricing. In a purely unilateral CVA world, market participants aim to charge for CCR and the risky value of a derivative, which is not equal and opposite. However, in a world including DVA, there is symmetry with CCR adjusted prices being equal and opposite[7] and therefore more risky parties pay less risky parties in order to trade with them.

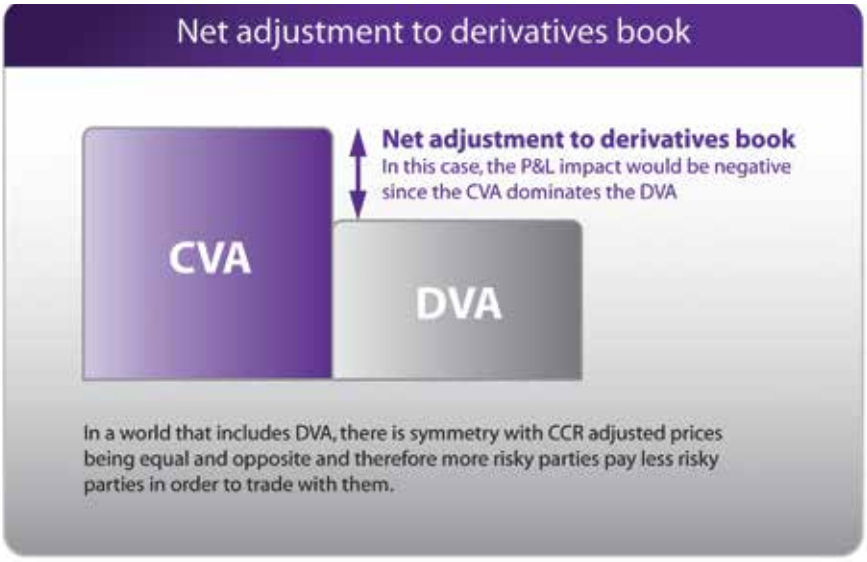

Figure 4: Net adjustment between CVA and DVA

While many practitioners agree that the use of DVA can be partly antithetic to the spirit of financial risk quantification and might simply not "feel right," many view it as having too many important features to be ignored. That said, a few European banks are indeed not quantifying DVA as a component of CCR (from the point of view of the CVA desk), and most banks have compromises over the use of DVA in line with the fact that gaining from one's own default, without actually defaulting, is rather difficult.[8]

Tackling wrong-way risk

Wrong-way risk has been a key focus in the recent turbulent markets. It refers to an adverse relationship between the exposure of a derivative and the credit quality of the counterparty to the trade. Wrong-way risk is potentially present in all asset classes, for example through a relationship between interest rates and default rates. Its impact on the credit derivatives market is particularly dramatic and is causing problems in CDS trading and huge losses associated with positions with monoline insurers.

CVA desks must be able to tackle wrong-way risk in its two forms, so-called general and specific. General wrong-way risk requires accounting for macroeconomic effects such as the fact that corporate default rates are generally higher when interest rates are low. Such effects should be incorporated into models so that the impact on CVA costs and hedges is known for all relevant products (in this case all interest rate products with corporate counterparties). In addition, there must be the capability to capture specific wrong-way risk that occurs at the transaction level because of trade-specific links between variables (for example, foreign exchange or commodities) and the counterparty's credit quality. Specific wrong-way risk can lead to very high CVA charges as in the case of credit derivatives. Wrong-way risk can lead to severe negative gammas for CVA desks, which will lead to large losses (even if the counterparty does not default).

Quantifying residual risks

It is not possible to hedge CVA gains and losses perfectly. This has two implications. First, it is important to assess the magnitude of potential hedging slippages today and throughout the life of a set of exposures and determine an incremental risk premium in the CVA charge on top of the risk neutral price. Second, risk capital has to be set aside to cover the unhedged or unhedgeable portion of the CVA charge.

Setting up a CVA desk

The CVA desk faces a number of start-up challenges. Most of these stem from defining to what extent they are seen as a resource for a firm and to what extent they are seen as another trading desk in the firm. The general steps and mechanisms for a CVA desk to apply CVA changes to the CCR within a portfolio are outlined in Figure 5 and an example of applying CVA charges to specific instruments is covered in Figure 6.

The following key matters should be considered when structuring how the CVA trading desk will charge for counterparty risk:

- **Charging for existing CVA**. At inception, a CVA desk must take the existing CCR of all businesses and trading desks and should be compensated appropriately. However, to do this is not trivial because netting benefits should be recognized. Ideally, the marginal CVA should be allocated down to a trade level and the sum of these components will add up to the total CVA required. However, in reality the allocation can be done more approximately.
- **Unwinds and negative CVA**. Unwinds and trade cancellations can give rise to negative incremental CVA charges because an overall risk reduction arising from favorable (negative) correlation between trades with the same counterparty. A CVA desk has to decide whether to compensate those making these trades. They should be

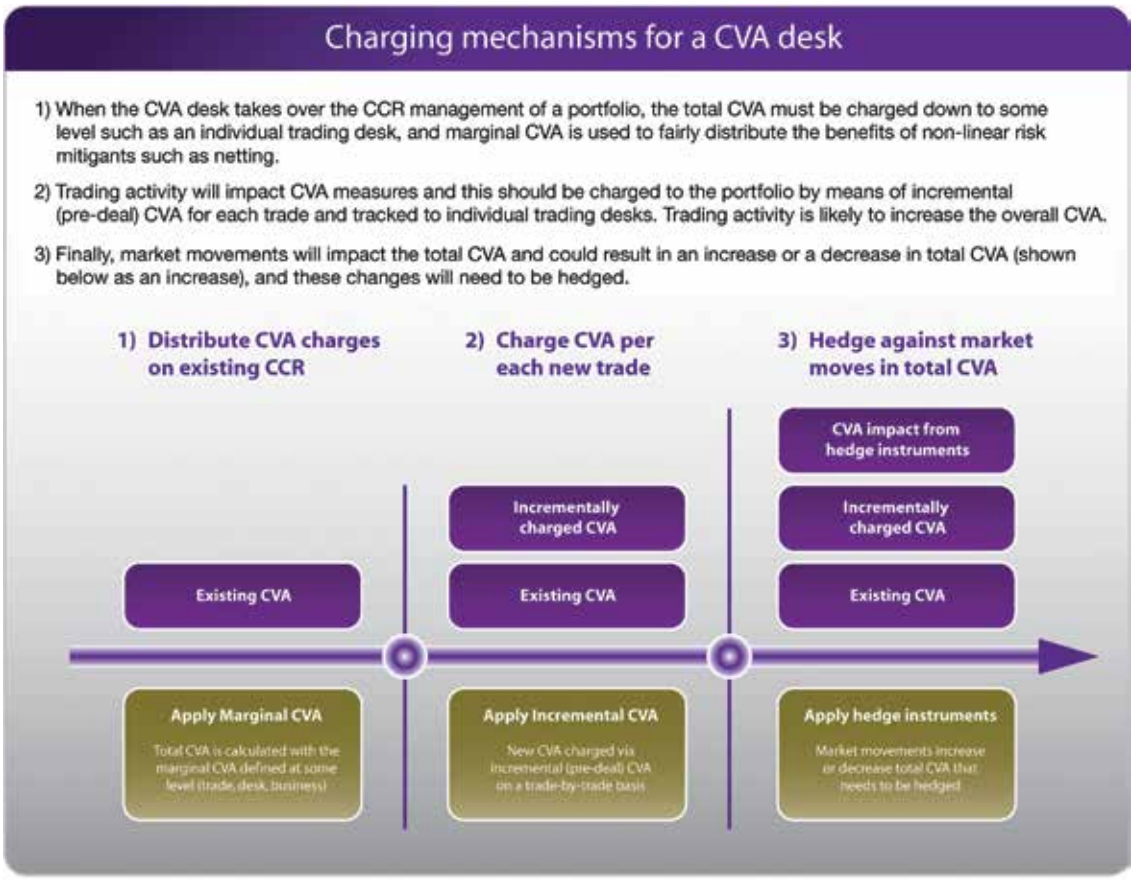

Figure 5: Charging mechanism for a CVA desk

reasonably happy to do so because the overall CVA they face is being reduced. Indeed, for a trade unwind, the trader might reasonably be expecting a refund[9] of some of the original CVA charge (Figure 7).

- **DVA**. Although paying traders who unwind trades or make CCR reducing trades seems reasonable, paying DVA-related benefits is harder to justify because a CVA desk then has to try and monetize the default of their own institution. This becomes particularly problematic for an institution whose relative credit quality is deteriorating because their CVA desk must then compensate traders to the extent that they can still be able to trade with less risky counterparties. CVA desks tend to give at most only a portion of the DVA gains back to the originators of each trade.
- **Additional termination events (ATEs)**. To mitigate future exposure for long-dated transactions, a common feature is an ATE (known also by other terms such as break clauses and mutual puts) that permits one or both counterparties to a transaction to cash terminate at mid-market at prespecified future dates. A CVA desk might therefore face the problem of pricing the CVA in a trade and asked to charge only up to the point where the transaction could be terminated. The problems here are that ATEs might be linked to certain events (such as ratings triggers) before they can be exercised and, even then, there might be other issues (such as maintaining good client relationships) to triggering. Therefore, a CVA desk might (unsurprisingly) refuse to give any credit for such features that might be regarded as simply "gimmicks."
- **Change in terms**. If the contractual terms relating to a transaction change during its lifetime, a CVA desk might reasonably argue that they should be permitted to redefine the price. However, how can one ensure that this is implemented? An obvious practice is to make any contractual changes invalidate the internal agreement. The CVA desk would not be responsible for any loss should a counterparty default in line with insurance contracts being void if contract terms are violated.
- **Cancellation features and optionality**. The CVA of derivatives with embedded optionality and cancellation features will naturally include the likelihood of those features being exercised. However, ideally traders should make the economic decisions regarding such features based on the CVA adjusted value. This can only be achieved by charging a CVA at inception and a further CVA when the feature is exercised (Figure 7).

CVA charging example

Standalone
Measure without any benefit from netting or collateral agreements

Incremental CVA
Provides a credit charge covering the increase in total CVA for a counterparty. It is an instantaneous measure, giving the current credit charge accounting for previous transactions, and not accounting for any transactions in the future. This can potentially create some unusual effects depending on the order of the transactions being executed.

		Basis points per annum	
		Standalone charge	Incremental CVA
1	5-year payer IRS	2.38	2.38
2	6-year payer IRS	3.44	1.54
3	6-year receiver IRS	2.35	-1.54
4	CCS	2.60	1.41
	Total	10.77	3.79

Figure 6: CVA Charging example

- **Regulatory capital**. Regulatory capital requirements for CCR are evolving,[10] and a CVA desk should be aware of the required capital held against the positions. Unfortunately, the lack of capital relief for any hedge other than single name CDSs means that CVA risk management and regulatory capital relief often do not amount to the same thing.

Managing the balance between risk taking and active hedging

A key role of a CVA desk is to attempt to neutralize the overall CVA (and DVA) of an institution with respect to market movements. To achieve this to even a moderate degree is a significant challenge. By the very nature of the instruments involved, CVA represents a cross-asset credit hybrid business where much of the risk is there by design and not choice. Consider, for example, two simple trades, an interest rate swap and foreign exchange (FX) forward contract. The interest rate swap trader is concerned with swaps, interest rate futures and forward rate agreements that define the yield curve and provide hedging instruments. The FX trader is concerned about spot and forward FX rates for similar reasons. However, the CVA desk is also concerned with the credit quality of the counterparties concerned, the volatility of the relevant interest rates and FX rates and the correlation between these variables. The CVA hedging problem is clearly dramatically more complex.

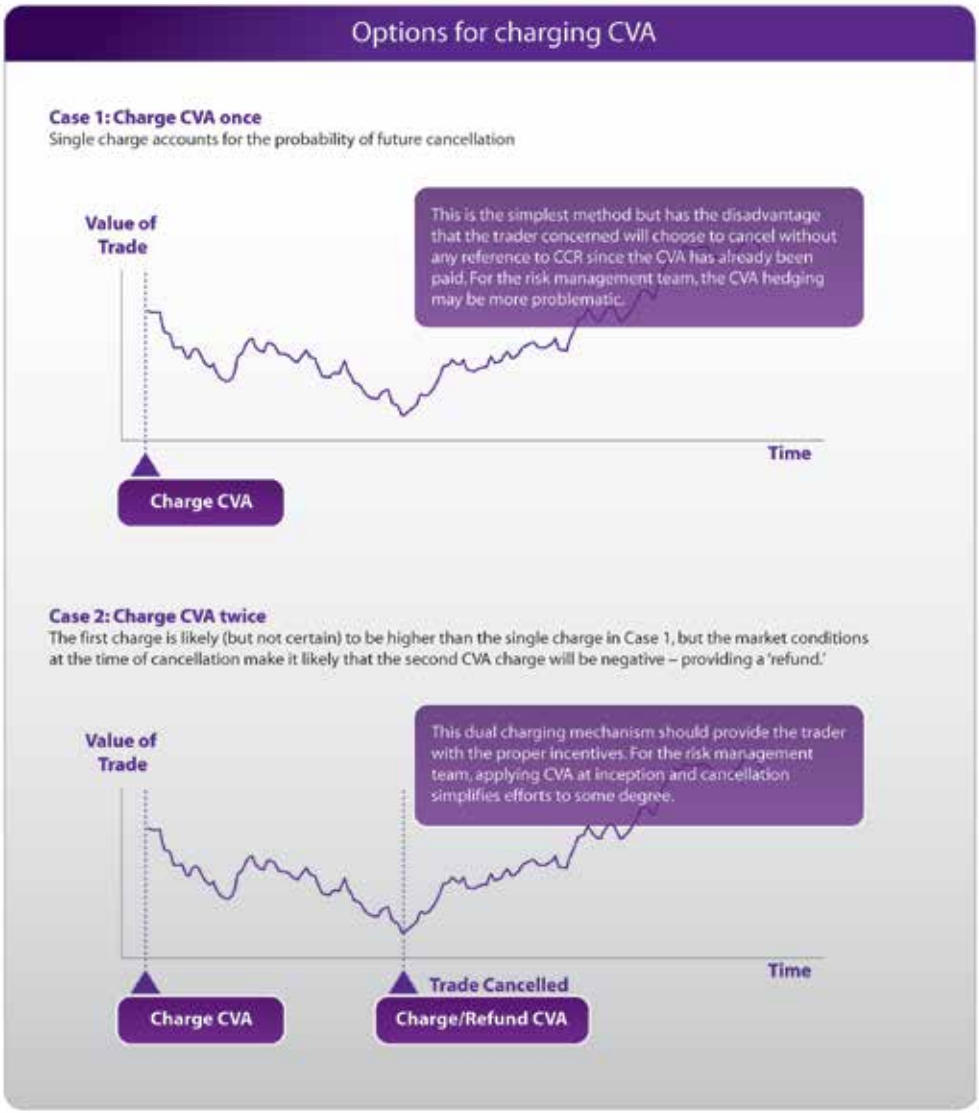

Figure 7: Options for charging CVA

The key to running a successful CVA desk will be to find the right balance between risk taking and active hedging. The hedging instruments will be:

- **Single-name credit hedges**. The single-name CDS market is limited and illiquid with the exception of a minority of heavily traded reference credits. Even if the counterparty in question does have a traded CDS, it will likely be concentrated on only a single maturity instrument (typically 5 years), which means that hedging credit spread sensitivity and so-called "jump-to-default risk" is not possible. CCDSs are yet more illiquid than CDS.
- **Index credit hedging**. The main credit indices (for example, the investment grade corporate of iTraxx IG and CDX NA IG) are liquid and provide the ability to hedge systemic credit spread changes. Other credit indexes are less liquid but offer the potential for more specific sectorial and regional hedging.
- **Volatility hedges**. A key component of CVA is the sensitivity to volatility and this requires a CVA desk to buy volatility in the form of option products across the relevant asset classes.
- **Correlations**. CVA desks are exposed to a vast matrix of correlations between different market variables. Largely these are unhedgeable although there may be extreme cases that can be handled such as in the case of wrong-way risk.

It is also necessary to consider the extent that the DVA component is incorporated into hedging. There are hedging benefits of using DVA, at least in normal times. For example, the size of long volatility and long protection credit index hedges will be reduced as the DVA hedges will act in the opposite direction, which is in line with reducing charges according to DVA. However, DVA hedging will clearly fail in abnormal markets. For example, as an institution's credit quality declines, they will become net sellers of volatility and credit protection (as the DVA component dominates), which eventually will not be possible to execute. Most firms incorporate DVA in their hedging; however, some are trying to remove the moral hazards associated with needing to monetize their own default.

Systems considerations for an evolving risk culture

Given the business benefits of providing traders with predeal CVA, it might seem natural to extend existing front-office trading systems to calculate CVA. However, because front-office systems are designed to value at the trade level only, these systems are not equipped to produce counterparty-level exposures for different asset classes because this fits with the terms 'cross-asset' concepts and 'cross-asset' system, along with other risk mitigants such as collateral agreements. CVA is inherently a cross-asset concept and must therefore be supported by a cross-asset system.

In fact, the requirements for CVA are better met by risk systems than their trading or front-office equivalents. Over the last decade or more, significant resources have been spent by many firms and vendors to build sophisticated systems that quantify potential future exposure (PFE). A PFE system would seem to be the ideal starting point for a CVA system platform because it already handles much of the complexity in calculating exposure and, through predeal credit limit checks, might already have functionality related to computing predeal incremental CVA.

In theory, a required CVA system and an existing PFE system have much in common; however, building out an existing PFE engine to cover CVA is not proving to be the ideal solution for some institutions. A common challenge is how to extend older architectures that were designed for more passive risk management in a timely, cost-effective way that will meet the performance requirements to support the active pricing and hedging needs of a CVA desk. As financial institutions explore the feasibility of extending current simulation-based exposure models to calculate CVA, care must be taken to ensure that the straightforward conceptual extension is in fact a straightforward practical extension. Given the considerable investment of both time and money that would be needed to overhaul existing systems to yield the business benefits of active CCR, many institutions are investing in new systems, either built in-house or with external software vendors.

Firms should strive for a properly engineered CCR system that can support accurate CVA measures by modeling the required risk neutral scenarios for all risk factors and all trades with a counterparty. They should also be able to deliver these CVA measures to the front office at the performance levels required to perform predeal checks. A firm should consider the following topics and factors when developing their key requirements for a counterparty credit risk system that can handle emerging CVA needs:

- **Exposure simulation**. The core of the CVA system will be Monte Carlo-based exposure generation similar to that required for PFE. This must be able to run a large number of scenarios for each variable of interest with flexibility over parameterization of processes and treatment of correlation between underlying variables. Inevitably, there will be some compromise of matching models with their front-office equivalents. Generic choices of models and associated calibrations will be necessary rather than the vast menu of different models and calibrations applied within the front office for a given asset class and trading desk. American Monte Carlo type features might be required for a reasonably fast treatment of exotic trades. Furthermore, simulations should be run under the real-world and risk-neutral measures to support both PFE and CVA requirements respectively.
- **Pricing functionality.** CVA systems require a full revaluation of all trades at all relevant dates in the future. The result of this is a massive number of single instrument valuations, which will likely require financial and computational optimizations. Again, this might limit the ability to match the model choice in the front office. The CVA system must be able to handle "aging" of positions by resolving cashflows, exercise decisions, resets and more for times many years in the future. The incorporation of new pricing models must also be relatively easy. Software vendors should provide the flexibility for a client to be able to use their own proprietary pricing models in at least some cases.
- **Performance**. A recent survey identified computation speed as the most significant weakness in their current CVA calculations[11] (Figure 8). The calculation of counterparty-level PFE requires revaluation of all derivative transactions over a few thousand Monte Carlo scenarios and a hundred or so time steps. The CVA calculation doubles this computational load because the same set of trades must be revalued for all corresponding risk-neutral scenarios. To make matters worse, to hedge the P/L swings associated with CVA changes, the CVA desk needs to understand the sensitivity of CVA changes to all relevant market and credit risk factors. This might mean that the entire Monte Carlo simulation needs to run not just once or twice but rather hundreds of times per nightly batch run. Although there are numerical techniques that can be used to speed up this process, the computational load is still dramatically increased.
- **Hedging**. Given the many challenges in hedging CVA gains and losses, systems should provide a powerful "sandbox" environment where the benefits and potential shortcomings of different hedging strategies can be assessed carefully.
- **Credit and recovery**. Unlike accessible market information such as interest rate curves and volatilities, credit information is entity specific and often hard to obtain. However, the definition of credit spreads and recoveries is crucial to the default probability component in the CVA calculation. These will be ultimately defined either directly with CDS market data or more indirectly by borrowing credit spreads on currently outstanding debt and/or mapping procedures. Given the lack of single-name CDS data, the choice of credit spreads still remains subjective and therefore there needs to be flexibility regarding parameterization. Determining the correct credit spread (and indeed the term structure thereof) can be very much an art rather than a science.

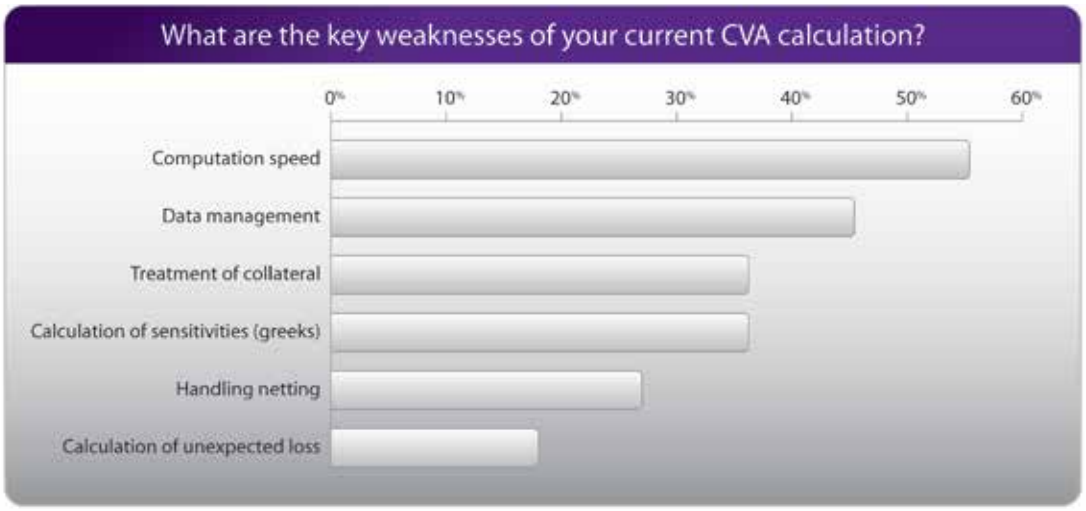

Figure 8: Current weaknesses in CVA calculation

- **Risk-neutral scenario generation**. For the purposes of calculating CVA, risk-neutral scenarios are used rather than scenarios calibrated to historical data. The exposure model must be able to generate consistent risk-neutral scenarios all asset types – interest rate, equity, FX, credit, and commodity.
- **Risk mitigants**. A CVA system must handle all forms of risk mitigants. This includes netting, collateral and ATEs (where deemed appropriate).
- **Predeal CVA**. The ability to generate predeal (incremental) CVA in real time is highly desirable, especially when the CVA might heavily influence the profitability of the transaction in question. It must therefore be possible to reaggregate exposures and compute CVA on a real-time basis, including the effect of newly simulated trades to look at the incremental pricing impact. This is normally achieved by storing existing trades from an overnight batch and rerunning the new trade(s) in real time. Rapid data retrieval and reaggregation is then extremely important. Trades must be immediately "bookable" in the CVA system to avoid misrepresentations when there is more than one trade with a counterparty in a given day. Rerunning existing trades at the counterparty level is also desirable for situations when the markets might have moved significantly. It might be also beneficial to calculate CVA components linked to other economic decisions such as option exercise with physical delivery and cancellation. A recent survey identified that less than 25 percent of firms were able to deliver predeal CVA metrics[12] (Figure 9).

Sensitivities. CVA traders require a vast number of sensitivities covering credit risk, other underlying market variables, volatilities and correlations. Although the credit calculations may be quite inexpensive to calculate, most other sensitivities will require multiple Monte Carlo paths to be run. Efficient generation of Monte Carlo-based sensitivities is therefore critical. Aggregation of sensitivities at various levels, for example by counterparty or product type, is also required. The impact of hedges should be recognized fully, for example, a CDS protection position will reduce the sensitivity to the credit spread of the relevant reference entity or entities but itself will give rise to additional sensitivity to the counterparty of the CDS contract.

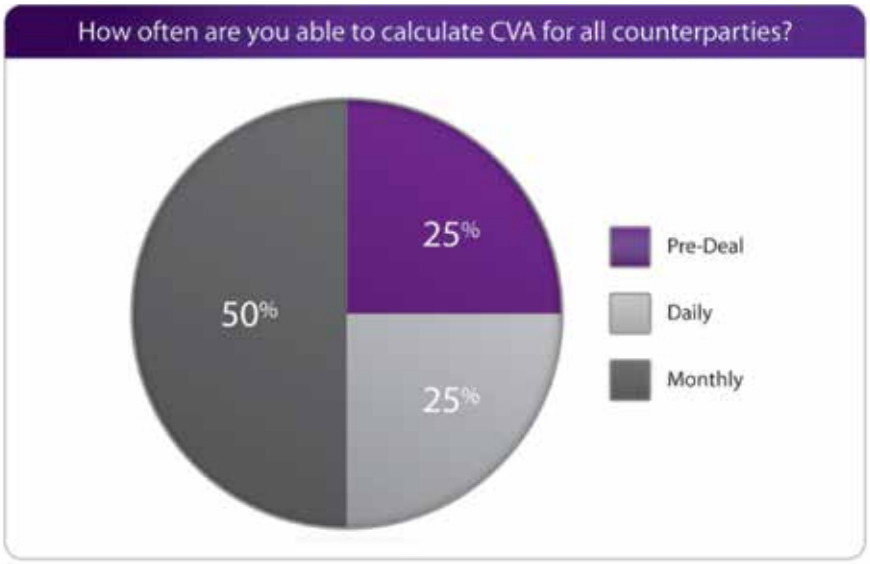

Figure 9: Frequency of CVA calculation

- **CVA allocation**. A CVA system must not only be able to compute the overall CVA (and DVA) for all counterparties but must also drill down the CVA to understand the key drivers and provide an allocation of CVA at the trade level for reporting purposes. Note that the allocation of CVA to each trade in this context is different from the incremental CVA that would have been charged when the trade was actually executed.
- **Wrong-way risk**. CVA systems must be able to handle wrong-way risk. Given the vast number of requirements, this probably needs to be incorporated simply and pragmatically for an intuitively correct impact on the CVA numbers and associated sensitivities at a predeal level. In order to understand where wrong-way risk might have the potential to cause the most devastating CVA losses, an integrated bottom-up simulation of market and credit risk drivers would be required. To make such an integrated approach feasible, careful thought has to be given to structuring the core simulation model for computational efficiency.
- **Risk capital**. Determining the appropriate risk capital to cover the volatility in P&L caused by CVA is computationally highly challenging. This determination requires a combination of efficient simulation methodologies, high performance analytics that are scalable and approximations that are carefully chosen to be advanced enough to reflect market conditions (for example, more advanced than the bond equivalent method that was put forward in the December 2009 Basel guidelines).

  The scope and complexity of developing a system that meets the best practices for counterparty credit risk management often requires phased implementation where elements of the system are developed and deployed to meet emerging needs of specific teams as the risk culture in the firm evolves from passive to active management of CCR. Effective project management requires specific project goals and milestones with implementation timeframes that allow for validating system elements at each step along the way. The goals and milestones towards establishing the emerging CCR management standard of the CVA desk is outlined in Figure 10 which lists the supporting systems at each phase that are required to deliver the right analytics to the right people at the right time.

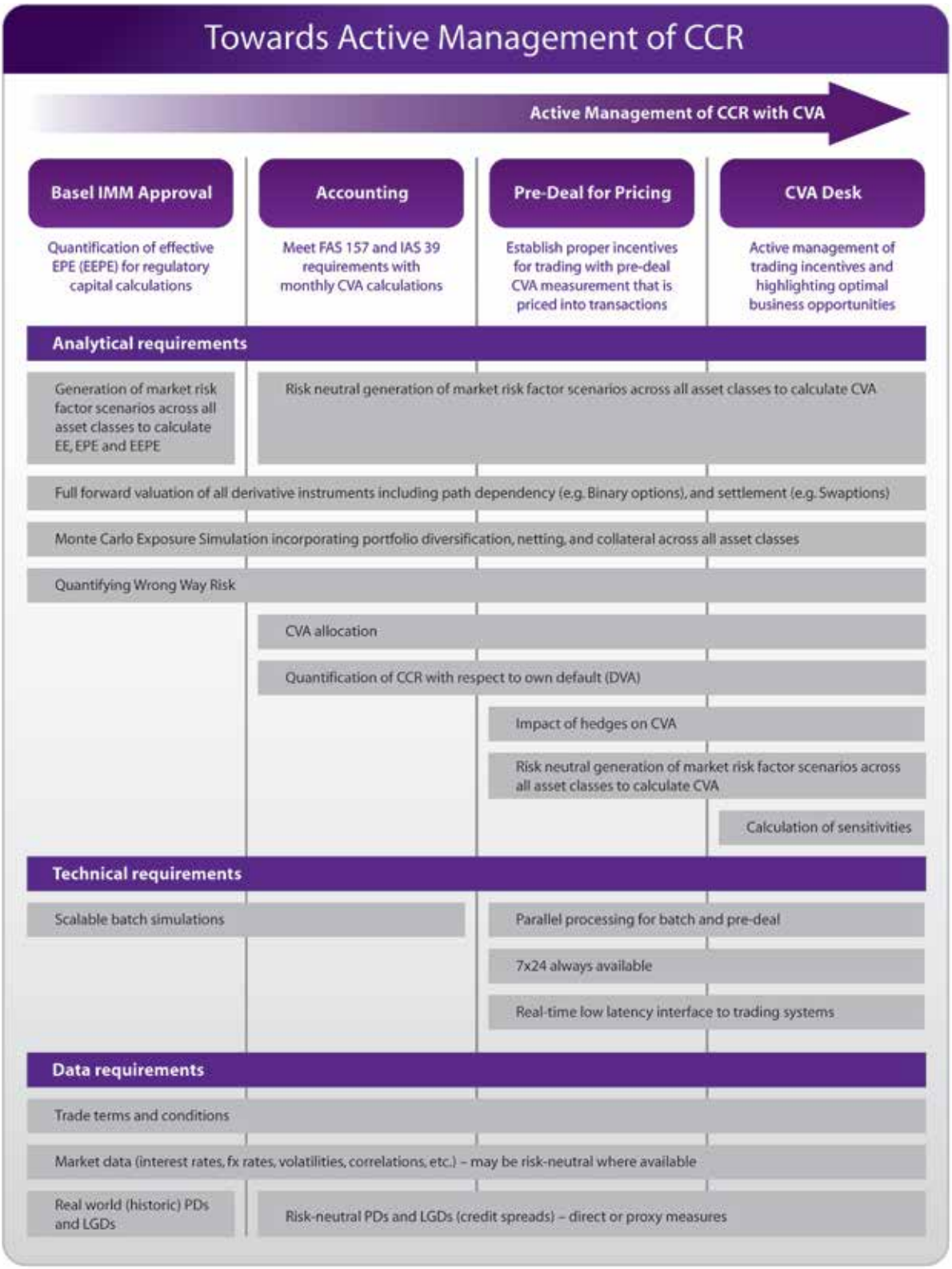

Figure 10: Towards Active Management of CCR

Summary

Financial institutions are tackling the difficult problems associated with CCR and many are seeking to evolve their risk culture by centralizing the quantification, pricing and management of their CCR. The use of CVA and CVA-adjusted VaR concepts will enable financial institutions to develop an integrated perspective of market and credit risk using consistent metrics. These metrics and the systems that deliver them will become the foundation for active management of CCR, and will support many business needs along the path to establishing the emerging best practice of centralized CVA trading desks.

There are currently many challenges for CVA trading desks, such as the lack of hedging instruments, continually evolving systems and the incorporation of sometimes counter-intuitive measures like DVA and wrong-way risk. To support this new and rapidly developing trading function, organizations must invest in flexible systems that can adapt to incorporate CCR best practices.

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1 For a review of counterparty credit risk see Gregory, J., 2009, *Counterparty Credit Risk: The new challenge for global financial markets*, John Wiley and Sons.

2 Netting permits derivative contracts with positive and negative values to be offset in the event the counterparty to the contracts is in default. Collateral is cash or other securities legally held against an exposure that may be used to cover that exposure in the event a counterparty defaults. Netting and collateral significantly reduce CCR by minimizing the exposure in the event a counterparty was to default.

3 The concept of asking for a two-way price in order to achieve transparency does not apply to CVA desks.

4 Central counterparties, like exchanges, intermediate derivatives contracts, essentially providing a guarantee against the CCR.

5 In other words if a risky firm issues a bond that is priced below par due to their credit risk, they record the price of the bond as a liability on their balance sheet rather than the face value.The latter approach would create a loss associated with raising debt.

6 In relation to their counterparties and assuming exposures are approximately symmetrical.

7 This assumes that the parties concerned agree on pricing models and parameters.

8 For a more detailed discussion see Gregory, J., *Being two faced over counterparty credit risk*, Risk 22 (2), pp 86-90.

9 Unwinding a trade will not guarantee a negative incremental CVA since there may be other favorable interactions that are lost.

10 See *Strengthening the resilience of the banking sector – consultative document*, December 2009, available from www.bis.org.

11 *Credit Value Adjustment:and the changing environment for pricing and managing counterparty risk*, Algorithmics, December 2009, www.algorithmics.com/EN/CVA.cfm.

12 *Towards Active Management of Counterparty Credit Risk with CVA*, as published by Algorithmics, July 2010.

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