InteDelta
Risk Management Consultants

CVA and Counterparty Risk Management:

a survey of management, measurement and systems

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Executive summary

No area of risk management has undergone such change in recent years as counterparty risk management. This has resulted from both the organic development in methodologies and systems capabilities and regulation imposed as a result of the financial crisis.

This paper presents the results of our survey covering the management processes, measurement and systems that banks use to control counterparty risk. We focus in particular on two important metrics in counterparty risk: Potential Future Exposure (PFE) and Credit Valuation Adjustment (CVA).

In the survey we interviewed 19 banks across all geographies and sizes, ranging from some of the largest investment banks to small regional players.

Basel approach

We first asked banks which risk measurement approach they adopt for regulatory capital purposes under Basel II/III. 59% adopted the Current Exposure Method (CEM) with the remainder roughly evenly split between the Standardised Approach (SM) and the Internal Model Method (IMM). 40% of the banks that do not currently adopt the Internal Model Method (IMM) had firm or tentative plans to do so. Moving to the IMM requires significant investment in systems and policies but most banks that undertake this exercise consider it worthwhile in terms of regulatory capital reduction and enhanced risk management controls.

The new **standardised approach for measuring counterparty risk exposure** (SA-CCR) issued by the Basel Committee on Banking Supervision (BCBS) in March 2014 (and known as the Non-Internal Model Method whilst in consultation) will replace the CEM and SM and will make the regulatory capital calculation more risk sensitive. Given the resources required to implement the SA-CCR some banks may be motivated to instead move to the IMM. A number of banks have, however, reported that their regulators have become more stringent at approving internal models. The future balance between the SA-CCR and IMM remains to be seen.

Management of CVA

The sophistication of CVA practices varies considerably across banks and is highly correlated to the size of the institution. We categorised banks' practices as ranging from from basic (37%) where CVA is calculated for accounting, reporting and regulatory capital purposes only to very advanced (21%) where CVA is regarded as a tradable asset class and is actively hedged.

Just under half of the surveyed banks had established a CVA desk. Only 21% stated that they did not have a CVA desk and had no plans to establish one. The remainder either planned to establish a CVA desk or another desk had some CVA responsibility.

The function of the CVA desk varied across institutions. All of the desks in our survey were responsible for inception pricing (i.e. ensuring that new transactions fairly reflect CVA). The reduction of P&L volatility was the next most common function at 73%.

Just under half of the surveyed banks employed some form of hedging for CVA. Most common is the hedging of market risk sensitivities, i.e. hedging predominantly interest rate and FX risk to transform a volatile counterparty exposure into fixed quasi-lending exposure. Perhaps surprisingly, only about a third of CVA desks routinely hedge credit risk (i.e. the credit spread risk component of CVA as opposed to the market risk sensitivities previously described). For some banks this is due to the lack of liquid single name Credit Default Swaps to hedge a large portion of their portfolio (and an unwillingness to use proxy/index hedges which cannot hedge idiosyncratic risk). Other banks commented that they are in the business of taking credit risk and do not therefore wish to hedge this as a matter of policy.

Management of counterparty risk

Potential Future Exposure (PFE) is the metric used by most institutions to measure and control credit risk. There are two commonly used methods used to calculate PFE:

- Monte Carlo simulation (used by 53% of surveyed banks) – this is the most sophisticated method used to calculate PFE and fully takes into account portfolio effects, close-out netting and collateral
- Mark to Market plus add-on (used by 42% of surveyed banks) – this involves approximating PFE by multiplying the transaction notional by an add-on factor. The methodology varies from relatively simplistic (used by 21% of respondents) to advanced (also used by 21% of respondents). The advanced approach models transactions on a more granular level, creates PFE profiles over time and also takes account of close-out netting and collateral, albeit not on as sophisticated a basis as Monte Carlo simulation

In addition to the measurement of PFE institutions need to put in place a means of controlling exposure. In the most advanced institutions this involves the real time update of exposures and real-time of monitoring of exposures versus limits. We categorised 50% of the survey respondents as having such advanced practices with 39% and 11% with intermediate and basic practices respectively.

Another key control is pre-deal check whereby the front office can check whether a proposed trade fits under the credit limit prior to execution. Institutions that have implemented the most sophisticated form of pre-deal check (17% of our survey sample) are able to ascertain the effect of adding the new trade to the portfolio, taking into account portfolio effects and netting. The largest proportion of surveyed institutions (55%) have implemented a simpler version of pre-deal check (for example adding exposure for the new transaction on a gross basis) whilst 28% have only basic pre-deal check controls.

Systems platforms

The calculation and management of CVA, PFE and regulatory capital for counterparty risk all require a major investment in risk management systems. There are considerable synergies in having a common CVA and PFE systems platform:

- Elimination of duplication in data integration
- Consistent models between CVA and PFE platforms
- Possibility of pre-deal check/optimisation for both PFE and CVA in same deal entry screen

Despite these synergies only 17% of the surveyed banks used the same platform for PFE and CVA.

In terms of vendor versus in-house systems the situation was reversed between PFE and CVA. 72% of surveyed banks used a vendor system for the calculation of PFE versus 28% using an in-house solution. CVA showed the mirror image with 67% using an in-house tool and 33% using a vendor platform. This situation reflects the fact that CVA is a more recent innovation and in most banks is under the responsibility of the front office, many of which prefer to build their own models. In many banks the implementation of CVA appears to be a work in progress and the current infrastructure can be regarded as a prototype. We would therefore expect to see more banks moving to vendor platforms.

Model calibration

The majority of surveyed banks (62%) use real world calibrations for PFE and risk neutral for CVA. The most commonly cited modelling challenges were obtaining or deriving credit spread data where a liquid CDS does exist and the incorporation of "hard to model products" in the simulation environment.

Key challenges

Our survey asked banks what were the key challenges they faced in the measurement and management of counterparty risk.

The most commonly cited challenge (cited as a major concern by 35% of respondents and as a medium challenge by the remainder) was the evolving and unclear regulatory environment. Banks have had to contend with the implementation of Basel II/III, the CVA capital charge and further change looms with the replacement of the Current Exposure Method and Standardised Approach by the new SA-CCR.

Data issues was the second biggest category of challenge (cited as a major or medium challenge by 83% of respondents) followed by the fragmented nature of the IT infrastructure (67%).

1. Background and introduction

Counterparty risk management has experienced huge changes in recent years. This began when the most advanced banks started to invest in counterparty risk measurement and developed measures of Potential Future Exposure calculated using Monte Carlo simulation. Basel II further accelerated the move to a more sophisticated approach and under the Internal Model Method the most advanced banks were permitted to use their own models to calculate regulatory capital. The use of collateralisation also became more widespread as a mitigant for counterparty risk.

The 2008 financial crisis provided an enormous jolt to the financial system and shone a light on counterparty risk management practices. A plethora of financial regulation followed and in the counterparty space one of the most significant initiatives was the establishment of central counterparties (CCPs) through which a large proportion of OTC transactions would need to be cleared.

The approach to Credit Valuation Adjustment has evolved equally rapidly along a parallel path. The introduction of fair value accounting regulations required a Credit Valuation Adjustment forcing banks to Mark to Market their derivative portfolios, taking into account the credit riskiness of their counterparties. This introduced considerable volatility into banks' trading profits and increased the focus on the measurement of CVA and how it could be managed.

In its post mortem of the financial crisis the BIS observed that banks' losses from CVA exceeded credit losses from actual defaults but that banks failed to hold sufficient capital from losses derived from CVA. Basel III subsequently came forward with a capital charge which now requires banks to hold regulatory capital for CVA.

The above factors have combined to elevate the measurement and management of CVA from an activity exclusive to the world's largest banks to a mainstream practice which impacts even the smallest banks with or without a CVA management function.

Our survey is set in the context of the still evolving landscape of the measurement and management of counterparty risk and CVA. We have examined practices across a spectrum of banks of all sizes and geographies and have addressed questions such as:

- Have they established a CVA desk, and if so what is its mandate and how does it manage and hedge CVA?
- What is their approach to the management of counterparty exposure and how have they addressed specific issues such as pre-deal limit checks?
- What are the key modelling issues experienced in the calculation of PFE and CVA?
- What systems platforms are used for PFE, CVA and regulatory capital and what are the synergies between these systems?
- What are the key systems and data issues faced by institutions?

Key terminology

Potential Future Exposure (PFE) – the maximum expected credit exposure over a specified period of time calculated at some level of confidence. Confidence levels are normally set at levels such as 95% or 97.5% and the probability of the Mark to Market of a counterparty's portfolio exceeding the PFE is therefore low. PFE is typically used to calculate credit exposure which is measured against a limit.

Credit Valuation Adjustment (CVA) - the market value of counterparty risk. This can also be expressed as the difference in value between the risk free value of a counterparty's portfolio and the valuation taking into account the possibility of counterparty default. CVA is calculated for financial reporting purposes and more sophisticated banks actively manage their CVA positions.

Glossary

BCBS – Basel Committee on Banking Supervision
BIS – Bank for International Settlements
CCP – Central Clearing Counterparty
CCR – Counterparty Credit Risk
CEM – Current Exposure Method
CDS – Credit Default Swap
CSA – Credit Support Annex
CVA - Credit Valuation Adjustment
DVA – Debit Valuation Adjustment
EAD – Exposure at Default
EEPE – Effective Expected Positive Exposure
FVA – Funding Valuation Adjustment
GAAP – Generally Accepted Accounting Principles
GPU – Graphics Processing Unit
IFRS – International Financial Reporting Standards
IMM – Internal Model Method
MTM – Mark to Market
NIMM – Non-Internal Model Method
OTC – Over the Counter
PD – Probability of Default
PFE – Potential Future Exposure
SA-CCR – Standardised approach for measuring counterparty risk exposure
SM – Standardised Method
SME – Small and Medium sized Enterprise
VaR – Value at Risk

2. Survey composition

We interviewed a cross section of 19 banks between September 2013 and January 2014.
The types of institutions and the geographical locations of their home country are shown below:

Figure 2.1: Type of institutions in survey

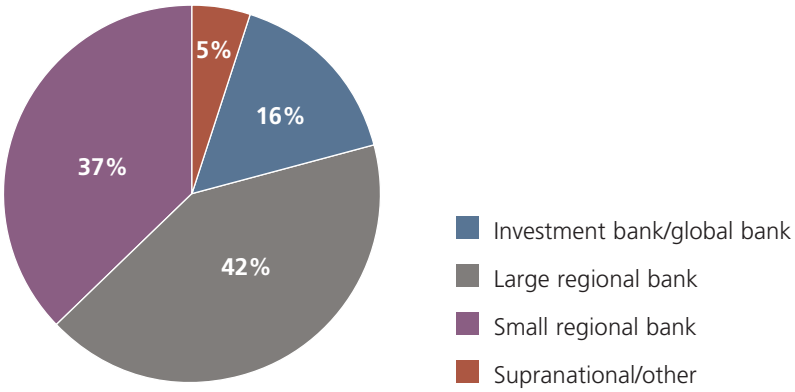
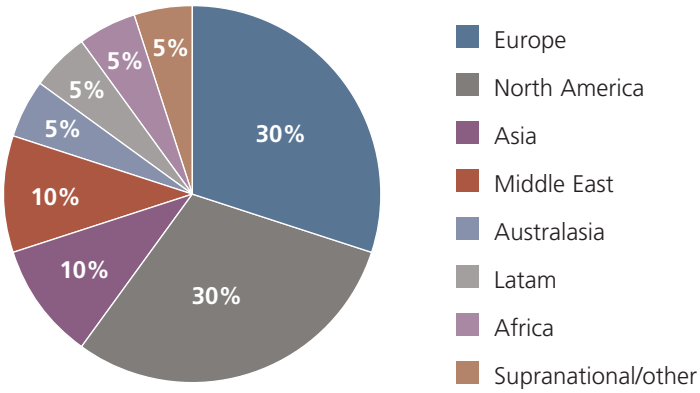


Figure 2.2: Location of institutions in survey (home country)



The investment and global banks were all North American and European headquartered institutions.

The composition of the portfolios for the larger institutions in the survey were broadly comprised of interest rate, FX and credit transactions. Smaller institutions tended to be more dominated by interest rate products.

Whilst all institutions in the survey were banks and therefore under the same Basel regulatory regime there are some regional differences in the implementation of Basel, for example the European exemption which does not require banks to calculate a CVA capital charge for corporates.

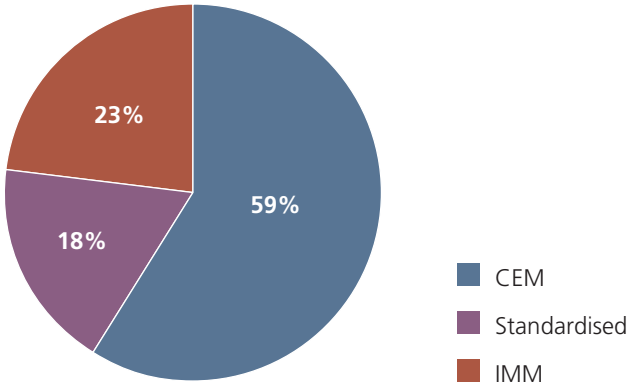
3. Basel approach for regulatory capital for counterparty risk

Regulatory capital has taken on an increased importance since the financial crisis. For counterparty risk Basel II/III permits three methods of calculating counterparty exposure which feeds into the regulatory capital calculation:

- **Current Exposure Method (CEM)** – banks apply a prescribed set of fairly crude add-ons to the nominal value of transactions. The method gives very limited benefit for netting and collateralisation and does not take into account portfolio correlation or diversification effects
- **Standardised Method (SM)** – a more risk sensitive methodology than the Current Exposure Method. Uses a formulaic approach prescribed in the Basel rules
- **Internal Model Method (IMM)** – banks may use their own risk models to calculate Exposure at Default (EAD).

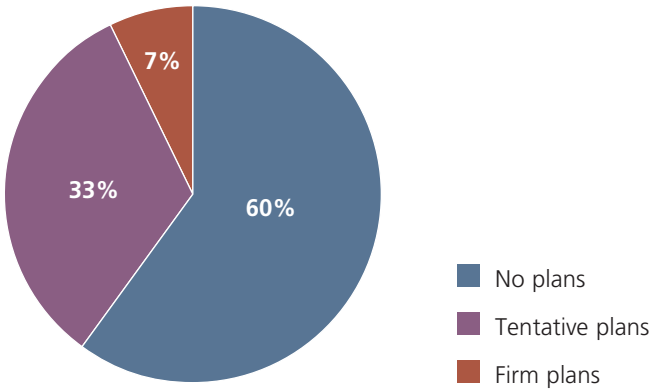
The Basel methodology adopted by the survey participants was as follows:

Figure 3.1: Basel methodology for counterparty risk



All of the banks adopting the IMM were in the investment bank/global banks category.
Of the banks that are not currently IMM compliant 40% had plans to move to move to IMM:

Figure 3.2: Plans for moving to Internal Model Method



A bank may only adopt the IMM after approval by their regulator and gaining this status requires a significant investment in policies, procedures, systems and quantitative analysis. Many banks which adopt the IMM see a significant reduction in their capital versus the CEM or SM but historically only the largest banks have chosen to implement the IMM, although this may change in the future.

In March 2014 the Basel Committee on Banking Supervision (BCBS) published its final standard on the **standardised approach for measuring counterparty risk exposure** (SA-CCR) which will replace both the CEM and SM with effect from 1 January 2017. The SA-CCR is intended to better recognise collateral and netting effects and periods of stress. At the time of conducting our survey the SA-CCR was issued for consultation but was referred to as the **Non-Internal Model Method** (NIMM). Of the banks in our survey that had reviewed the NIMM/SA-CCR proposals in detail there was a general consensus that it is an improvement upon the CEM/SM but there was concern at the complexity of implementation. Two banks had calculated that it would lead to a significant increase in capital compared to their current CEM methodology. Given the resources required to implement the SA-CCR/NIMM many banks may opt instead to move directly to the IMM which potentially gives more capital benefit. A number of banks have, however, reported that their regulators are becoming more resistant to approving internal models. The future prevalence of IMM versus SA-CCR is therefore highly uncertain.

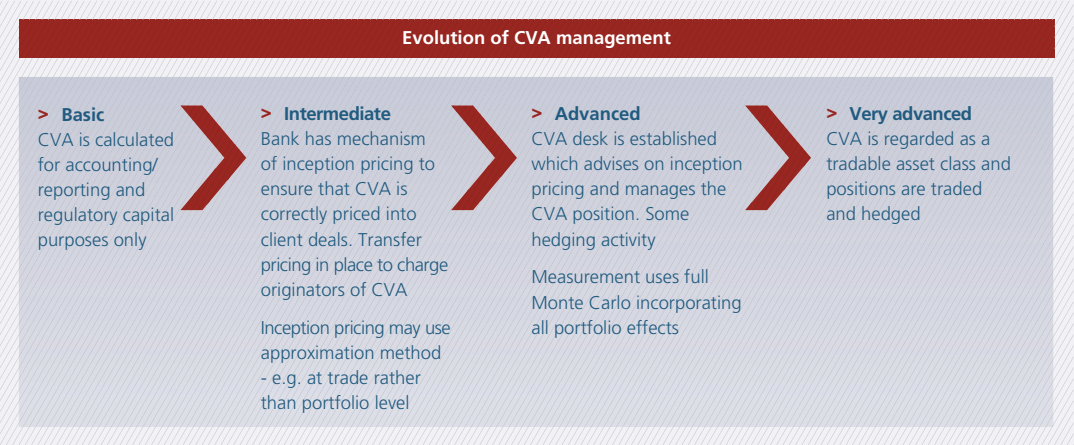
The December 2009 BCBS consultative document "Strengthening the resilience of the banking sector" noted that "Roughly two thirds of counterparty credit risk (CCR) losses were due to CVA losses and only one-third were due to actual defaults. The current CCR framework addresses CVA as a default and credit mitigation risk, but does not fully account for market value losses short of default". In response to this weakness the Basel III framework introduced the CVA Risk Capital Charge. Basel III prescribes two methods for the calculation of this charge: the Standardised Method and the Advanced Method. The Standardised Method is a variance type formula and provides some relief for CVA hedges. The Advanced Method is only available to banks with an existing IMM approval and uses the bank's VaR model for bonds to model spreads and requires an additional regulatory approval. This method provides more relief for CVA hedges and the combination of IMM and the Advanced Method can lead to a lower CVA capital charge.

In our survey all of the banks which had an IMM approval were also using the Advanced Method for the calculation of the CVA capital charge.

4. Management of CVA

The management of CVA varies considerably across institutions. Figure 4.1 shows the evolution in the sophistication of CVA management:

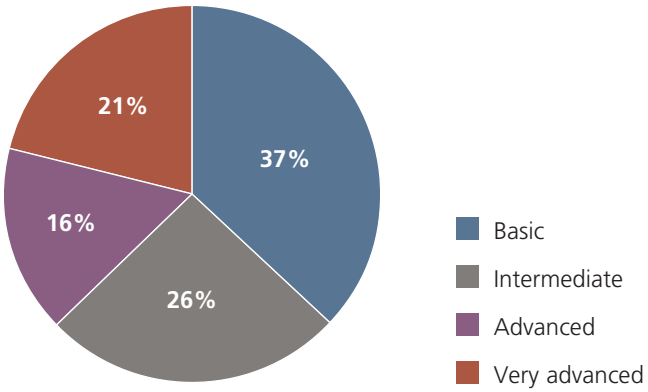
Figure 4.1: Evolution of management of CVA



Although some banks have features which may place them in more than one category, we were able to relatively easily categorise the banks in our survey by considering:

- Organisational structure and whether or not bank has a CVA desk and if so does it have an active or passive mandate
- Sophistication of risk measurement approach and whether bank has advanced analytics to measure CVA and determine appropriate hedges

Figure 4.2: Sophistication of CVA management



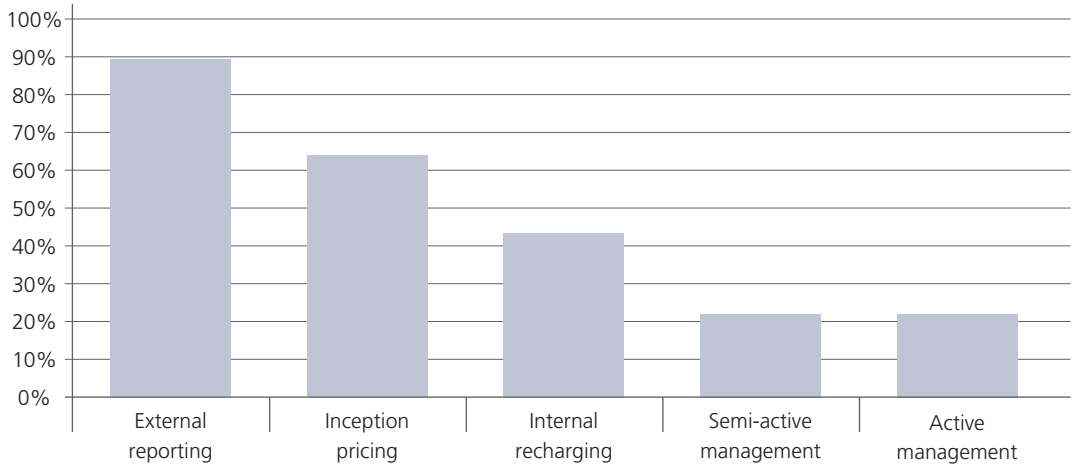
The surveyed banks showed a high degree of correlation between the size of the bank and the sophistication of CVA management as shown below.

Table 4.1: Sophistication of CVA management by size of institution

	Investment/ global banks	Large regional	Small regional/ other	Overall
Basic	0%	25%	63%	37%
Intermediate	0%	37.5%	25%	26%
Advanced	33%	37.5%	12%	16%
Very advanced	67%	0%	0%	21%
Total	100%	100%	100%	100%

Figure 4.3 provides more detail on the specific activities undertaken by the surveyed banks in the management of CVA.

Figure 4.3: Activities in managing CVA

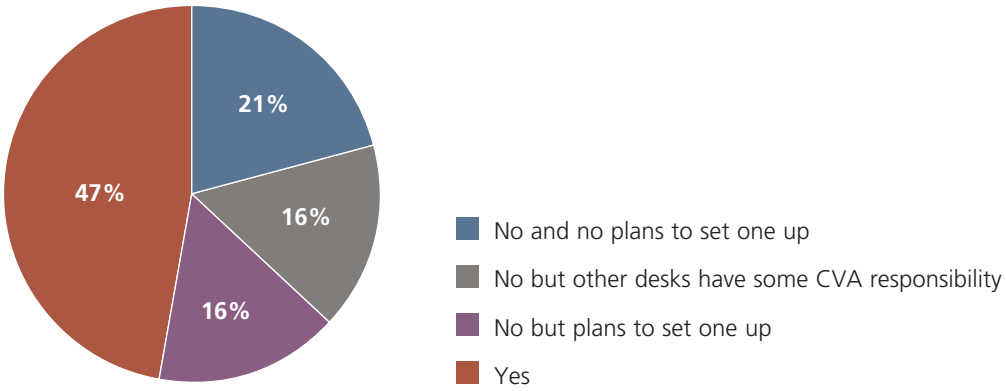


- **External reporting** (88%) – CVA is calculated for inclusion in external accounts
- **Inception pricing** - (63%) – the institution has a process in place for calculating CVA on new counterparty deals to ensure fair pricing
- **Internal recharging** (42%) – the bank recharges CVA back to the originating product line. This aims to incentivise the business to adequately compensate for counterparty risk. The most advanced institutions apply the charge at the desk level so that individual traders and salespeople suffer a P&L charge for the trades they undertake. In smaller institutions the recharge may be to the product or even dealing room level so that the business as a whole suffers a P&L charge but this is not allocated down to the individual deal originators. In larger institutions originating desks typically pay the internal CVA charge for the CVA desk to assume their counterparty risk. The CVA desk is then responsible for managing the CVA position and any counterparty losses are borne by the CVA desk rather than the originating desks
- **Active management** (42%) – the bank uses hedging techniques to actively manage the CVA positions. This divides equally into semi-active management where some exposures are actively hedged and active management which makes more extensive use of hedging. Hedging techniques are discussed in more detail in Section 6.

5. The CVA desk

In order to actively manage CVA a bank needs to establish a front office CVA desk.
Figure 5.1 shows the proportion of banks in our survey which have established a CVA desk.

Figure 5.1: CVA desk in place

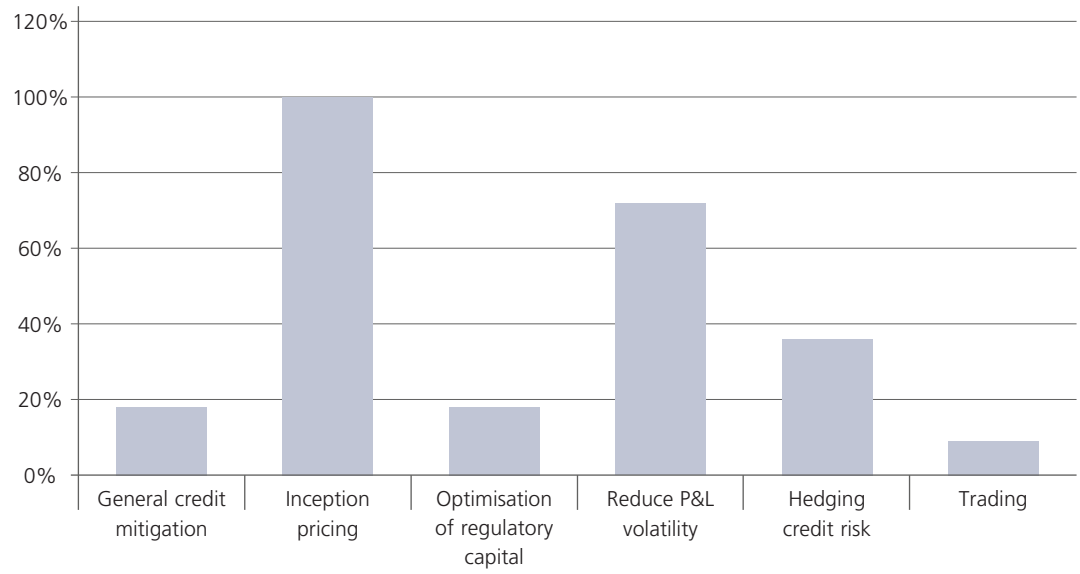


47% of our surveyed banks already have a CVA desk in place. Of the remainder 21% have plans to establish a desk and in 16% of banks another desk already has some CVA responsibility. This most often occurs in small institutions which cannot justify setting up a dedicated CVA desk. For example, for one of the smaller banks in our survey the vast majority of CVA came from interest rate exposure and the interest rate desk was given responsibility for the management of the market risk sensitivities of CVA. The bank did not hedge the credit risk component of CVA.

Less than a quarter of survey respondents do not have a CVA desk and have no plans to establish one. These responses all came from the small and large regional bank categories.

The mandates of CVA desks vary considerably across institutions. The results of our survey showed the following different functions of CVA desks:

Figure 5.2: CVA desk functions



In 18% of the surveyed banks the CVA desk had a role in **general credit mitigation**. This includes functions such as managing the signing of ISDA masters and putting CSAs in place. In most banks, however, such functions remain the responsibility of risk management or the middle office.

The mandate of all of the surveyed desks included advising on **inception pricing**, i.e. ensuring that new transactions fairly reflect CVA.

Only 18% of surveyed banks cited the optimisation of **regulatory capital for credit risk** as one of the main mandates of the CVA desk. The **reduction of P&L volatility**, however, was a major component of the CVA desk mandate for 73% of banks.

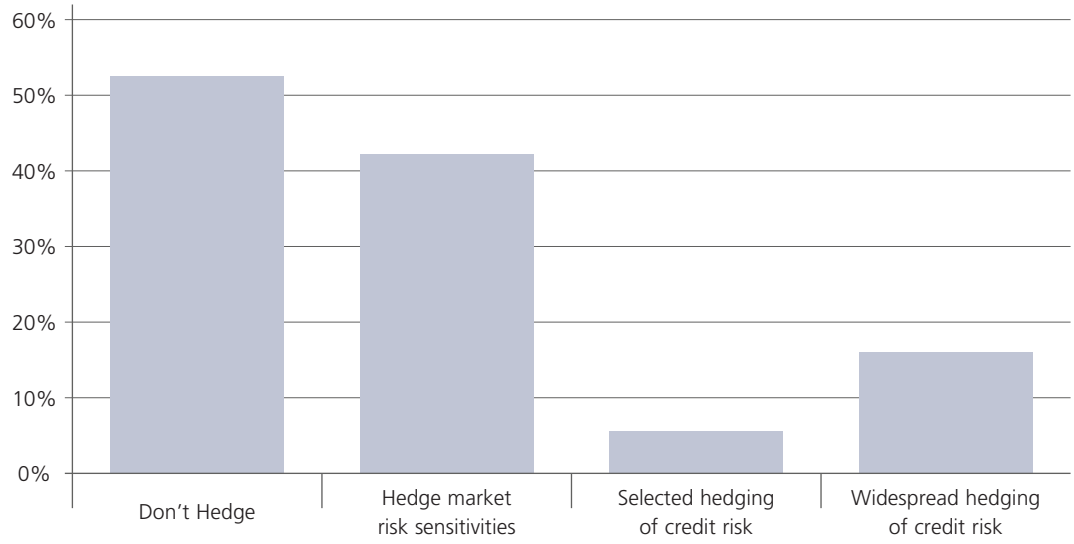
Perhaps surprisingly, only about a third of CVA desks routinely **hedge credit risk**. The unavailability of liquid single-name Credit Default Swaps (CDS) to hedge most of their counterparties is cited by most banks as the major reason for not hedging credit risk. The ability of banks to hedge corporate names by using the sovereign as a proxy has also diminished as a result of less liquidity in the sovereign CDS market, notably in the EU following the ban on purchases of naked sovereign CDS protection. A number of banks also commented that they are in the business of taking credit risk and that they have lending exposure to most of the corporate names for which they also have counterparty exposure. Their aim is to remove the volatility of credit exposure but not to eliminate it. Hedging techniques are described in Section 6.

9% of surveyed banks regard CVA as a tradable asset and the desk has an outright P&L motive. Most banks do not, however, regard their CVA desks as a pure profit centre.

6. Hedging CVA

One of the main functions of the CVA desk is to hedge CVA exposure. The extent of hedging and the techniques employed vary considerably across banks. Figure 6.1 shows the extent of hedging in our surveyed banks.

Figure 6.1: Hedging CVA

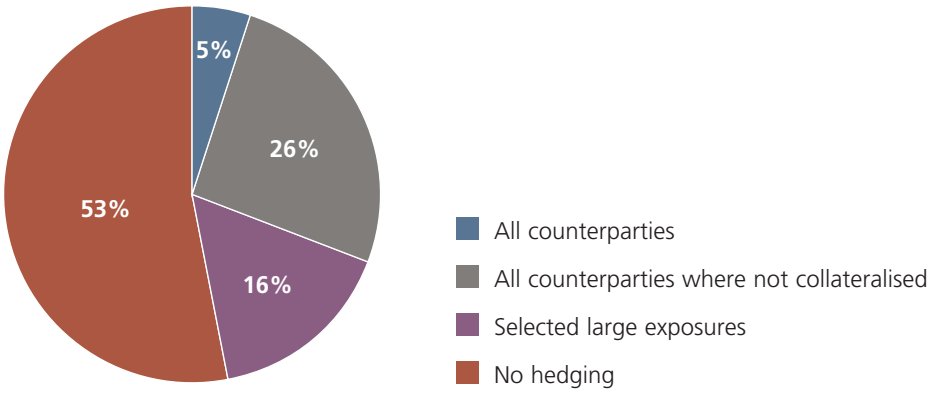


The hedging of **market risk sensitivities** (42% of respondents) involves reducing CVA volatility by hedging the risk factors (predominantly interest rate and FX) that give rise to counterparty risk. For example, if the MTM of a counterparty portfolio will increase if, say, the EUR appreciates against the USD, a trade will be entered into with the counterparty which eliminates this sensitivity thereby reducing the counterparty exposure and CVA. Similar trades will be put on to hedge interest rate sensitivity. If the hedging of market risk sensitivities is fully successful volatile counterparty exposure is transformed into fixed quasi-lending exposure. 5% of banks then go on to undertake selective hedging of credit risk, for example, when a particular single name limit or country/sector concentration limit is reached. To hedge market risk sensitivities a bank will typically calculate the market risk deltas (DV01 etc). The frequency of this calculation and hedging will depend on the mandate of the desk.

16% of surveyed banks engage in widespread hedging of credit risk. As previously noted single name CDSs are frequently not available for many of the names in banks' portfolios, particularly where the banks focus on SME exposure. Hedging techniques therefore rely on the use of proxy CDSs and/or index CDS. The construction of proxy hedges is more of an art than a science and involves trying to replicate the reference credit as closely as possible with credits for which a liquid CDS is available in terms of parameters such as sector, country and rating. Such techniques may be successful in hedging the systemic component of credit risk but the idiosyncratic component cannot be hedged. As with market risk hedges the frequency of credit risk hedging and the calculation of credit sensitivities will depend on the CVA desk mandate. A desk which has a mandate to optimise regulatory capital or ensure that concentration limits are not breached may hedge on an infrequent basis, say monthly. A desk that uses proxies to dynamically reduce P&L volatility will likely be hedging on a daily basis.

Where a bank hedges CVA it may not do so for all counterparty types as shown in Figure 6.2.

Figure 6.2: Types of counterparties for which CVA is hedged

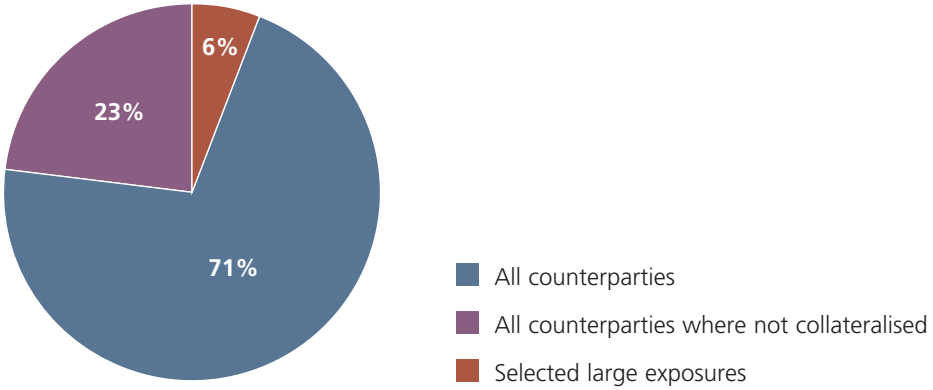


Of banks that hedge CVA the largest number hedge counterparties that are not collateralised under a CSA. In practice this means hedging corporate names (typically not collateralised) and not hedging exposure to financial institutions (usually collateralised under a CSA). Collateralising a counterparty significantly reduces, but does not eliminate, counterparty exposure. This can leave significant counterparty exposure, particularly with large financial institutions portfolios. Nevertheless, only 5% of banks hedge such exposures. A number of banks commented that they do hedge collateralised exposure where the CSA does not provide maximum protection, for example if there is a significant threshold or the collateral call frequency is not daily.

16% of surveyed banks hedge exposure on a more selective basis, for example large exposures or exposures which are close to counterparty, sector or country limits. In one of the banks which has a CVA desk mandate to optimise regulatory capital the focus is solely on counterparties which are subject to the CVA capital charge. As this is a European bank this excludes corporates but includes financial institutions, even where collateralised (as noted in Section 2, European banks are exempted from calculating a CVA capital charge for corporates).

Practice differs amongst banks as to whether CVA is calculated for all counterparty types, irrespective of whether it is hedged:

Figure 6.3: Types of counterparties for which CVA is calculated (for CVA management purposes)



More than two thirds of banks calculate CVA for all counterparties even though as described in the previous section CVA is typically not hedged for all counterparties, with collateralised counterparties usually excluded. 23% of banks do not calculate CVA for collateralised counterparties with a further 6% only calculating CVA for the largest exposures. It should be noted that whilst banks may not calculate CVA for certain classes of counterparty for CVA management purposes they may still need to calculate CVA for a broader range of counterparties for accounting and regulatory purposes.

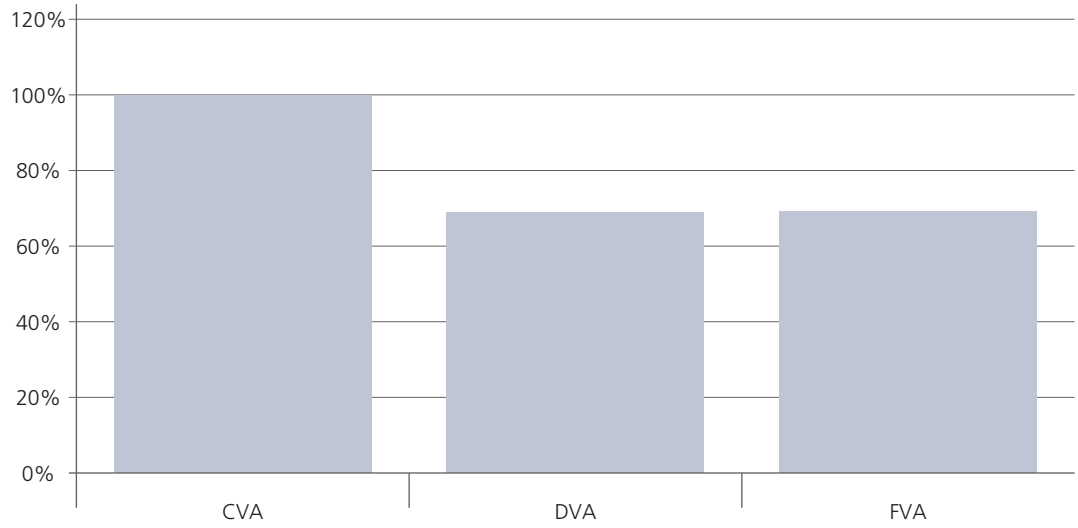
7. DVA and FVA

In addition to the calculation of CVA a majority of banks calculate Debit Valuation Adjustment (DVA) and Funding Valuation Adjustment (FVA). DVA is an adjustment to reflect the bank's own credit riskiness on its liabilities and is the mirror image of the CVA on the bank as measured by the bank's counterparties. DVA has proved to be a controversial metric in academic and accounting circles and there has been much commentary on banks which recognise a DVA gain due to their deteriorating credit quality.

FVA can be defined as the difference between valuing a portfolio of (uncollateralised) transactions using the bank's assumed "risk free rate" and valuing it under the bank's average funding cost. The management of a derivatives position requires cashflows to be funded, either from the bank's internal treasury desk or from the market, and the FVA can also be thought of as the cost of funding these cashflows. FVA has been the subject of intense debate between practitioners and academics. Many practitioners have embraced the principles underlying FVA and banks such as Deutsche Bank, Barclays and Goldman Sachs are now reporting FVA[1]. Certain academics, notably Hull and White, have argued that FVA flies in the face of financial theory and that under a risk free world it should not be incorporated into pricing although in later papers this view was refined to accept that a portion of FVA could be recognised when the CDS spread is out of line with the PD[2].

Figure 7.1 shows the extent to which DVA and FVA were calculated by our surveyed banks alongside CVA.

Figure 7.1: Extent of CVA, DVA and FVA calculation



1 See http://www.risk.net/risk-magazine/feature/2335564/the-black-art-of-fva-part-ii-conditioning-chaos

2 See http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2245821&download=yes

All of the banks which calculated DVA did so for reporting purposes. None of the banks attempted to hedge DVA although one global bank had a DVA desk which pays originating desks for their DVA positions and then centrally calculates and reports on DVA. One bank commented that DVA is a natural hedge for its CVA positions because it is net short of credit exposure due to the large number of structured notes issued by the bank. The issuance of a structured note creates no counterparty risk and therefore no CVA for the issuing bank because the counterparty fully pays for the notes at the time of issue. The note buyer, however, has counterparty risk on the issuing bank because it is dependent on the bank's creditworthiness to repay the notes. From the bank's perspective this therefore translates into a DVA position but with no CVA.

Only two of surveyed banks that calculated DVA included this in their internal management accounting. None of the banks routinely included DVA in inception pricing although one commented they make a "DVA adjustment" if a client trade does not otherwise meet the bank's CVA hurdle.

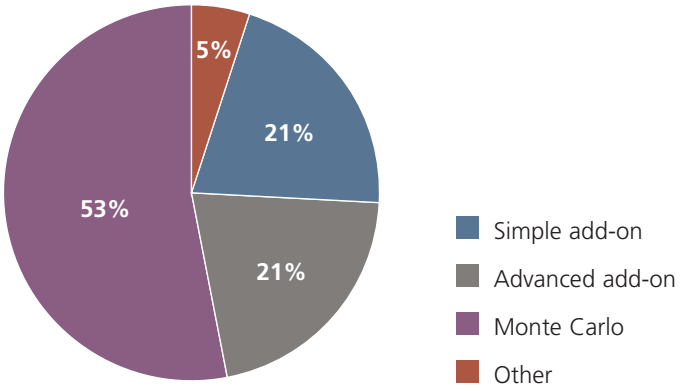
There is a disconnect between the treatment of DVA under accounting rules (IFRS and US GAAP) and under Basel III. Accounting rules make it mandatory to calculate CVA on a bilateral basis, i.e. by offsetting DVA, and by the application of PDs implied by CDS market spreads. This can give rise to the often controversial result that a bank makes a P&L gain when its credit quality falls – for example in October 2011 JP Morgan booked a USD1.9 billion DVA gain as a result of its widening credit spreads[3]. The Basel III treatment is to exclude DVA from the calculation of capital ratios and the CVA capital charge, thereby significantly increasing regulatory capital requirements.

3 http://ftalphaville.ft.com/2011/10/13/701766/how-one-banks-default-is-the-same-banks-gain/

8. Counterparty risk measurement and management

Whilst the active management of CVA is a relatively new innovation, for many years banks have been managing counterparty risk on a "traditional" basis by setting credit limits for each counterparty and measuring and managing exposure against these limits. The market standard measure of counterparty risk is Potential Future Exposure – PFE. The diagram below shows the methodologies used by the surveyed banks for the calculation of PFE.

Figure 8.1: PFE methodologies



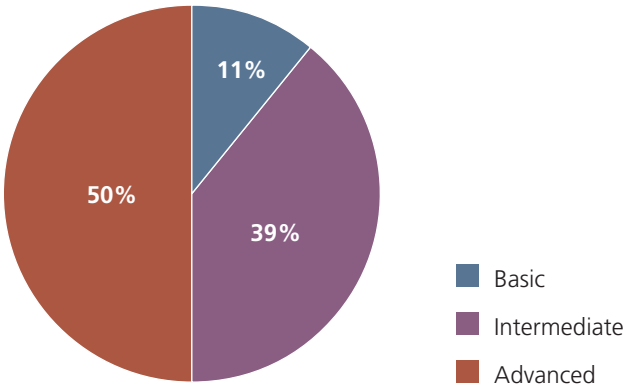
- The **simple add-on approach** uses, for example, BIS 1 add-ons[4], and does not generally apply *portfolio aggregation* algorithms to incorporate the effect of close-out netting or fully model the effects of a CSA. Where collateralisation is taken into account it is often achieved in a simplistic way, for example, by applying reduced add-ons. In our survey the simple add-on approach was confined to the small regional banks and one large regional bank
- The **advanced add-on methodology** uses a granular set of add-on factors which are a function of the product type, underlying, tenor and potentially other features such as the "in-the-moneyness" of options. Advanced add-on methods apply a term structure of add-ons rather than a single value which generates a PFE time profile. Simple add-on approaches tend to apply a single value which creates a flat structure over time. Add-ons may be calculated using sophisticated analytical models or even Monte Carlo simulation[5]. Portfolio aggregation techniques are applied to model the effects of close-out netting and the features of CSAs are fully taken into account. In our survey the advanced add-on methodology was confined to the large regional banks and one global/investment bank
- **Monte Carlo simulation** is the most sophisticated method for the calculation of PFE. In our survey all but one global/investment bank applied this method and a selection of banks in all of the other categories
- A minority of banks used **other** techniques to calculate PFE. For example, one small bank had a portfolio that was dominated by interest rate exposure and calculated PFE using an approach based on interest rate sensitivities.

PFE is measured to a statistical confidence level. 80% of the surveyed banks reported a 97.5% confidence level and the remaining 20% calculate PFE to 95%. Once PFE has been calculated banks need an operational framework to measure exposure against credit limits and to promptly follow up on any breaches. We have categorised the approaches of the surveyed banks into **basic, intermediate** and **advanced** as opposite:

4 Add-on factors specified in the first Basel Accord issued by the Bank for International Settlements (BIS). These are very simplistic add-on factors intended for the calculation of regulatory capital for counterparty risk which some institutions use as a proxy for PFE

5 In this context Monte Carlo simulation is used to calculate the add-on factors but Monte Carlo is not used to simulate the trades in the portfolio

Figure 8.2: Sophistication of counterparty exposure management



Banks categorised as **advanced** have a sophisticated system to actively identify and manage limit excesses. Banks categorised as **basic** have a much more informal approach to managing exposure against limits, for example PFE may only be calculated on a monthly basis or exposure reports may be sent to account managers but with no independent follow up by risk management. Banks categorised as **intermediate** have some but not all features of the advanced approach.

Features of an advanced approach to counterparty exposure management include:

- Real-time or near real-time update of exposures
- Real time monitoring of exposures versus limits and alerts/automated workflow so that excesses can be elevated to appropriate credit officer
- Ability to establish complex limit hierarchies and structures appropriate to business
- Advanced functionality to react to a crisis situation – e.g. reduce all limits for banks in given country

One of the key controls to counterparty exposure management is **pre-deal check**, i.e. the ability to check limits prior to trading to determine if there is sufficient limit availability. Banks' approach to pre-deal check varies considerably. At the most sophisticated end of the spectrum a pre-deal check calculation is run which determines the effect of adding the new trade to the portfolio, taking into account netting and collateralisation. If a trade forms a hedge to the existing counterparty portfolio the new trade may actually reduce the counterparty's exposure. For banks which use an add-on methodology performing a pre-deal check is not computationally difficult as PFE under an add-on approach is fast to calculate. PFE calculated under Monte Carlo simulation, however, is much more computationally intensive. Banks using Monte Carlo that require a pre-deal check which takes into account netting effects use techniques such as marginal Monte Carlo which stores simulation paths from the previous batch run to be able to very quickly calculate the effect of adding a new trade to the portfolio. Once a new trade has been executed the most sophisticated practice requires that the trade is immediately reflected in the exposure, or that limits are blocked, to prevent limit breaches by another new trade. Pre-deal check functionality is generally carried out in the front office trading system so that potential trades do not need to be re-keyed into the counterparty risk management system. We have categorised this sophisticated approach to pre-deal check as **advanced**.

Acceptable response times for pre-deal check vary according to product. For high volume products such as FX a response time of, say, three seconds may be required. For structured products longer response times may be acceptable. E-trading platforms are particularly challenging as these often require a response time in milliseconds.

Some of the most advanced banks incorporate optimisation and CVA functionality into their pre-deal checks, e.g. identification of optimal counterparty to deal with to minimise PFE/CVA.

The implementation of advanced pre-deal check makes a number of technology demands:

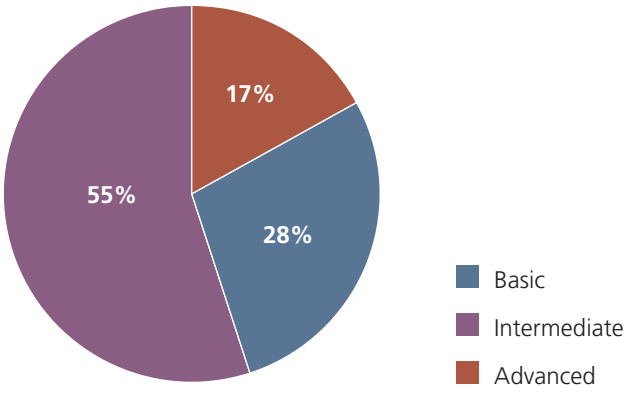
- Efficient analytics (e.g. American Monte Carlo for exotics)
- Caching of PFE vectors, in-memory aggregation, vectorisation and parallel computing
- Efficient data integration

Many banks, including some of the largest, take a more relaxed view of pre-deal check than the advanced approach described above. Such banks may calculate PFE using end of day Monte Carlo simulation but use a simpler methodology such as add-ons for pre-deal check. Such banks recognise that the pre-deal check may not take into account portfolio effects, but for them the cost of implementing marginal Monte Carlo is not justified and they will implement workaround solutions such as requiring the front office to call risk management to perform an offline Monte Carlo simulation if the pre-deal check shows that a transaction is declined. Banks that have implemented such an approach report that there is generally sufficient limit availability and that it is a fairly infrequent occurrence for the front office to need to make such a request. Many banks are also more relaxed than the advanced category in terms of newly executed transactions immediately reflecting transaction exposures. They regard the risk that excesses occur due to newly approved or executed trades not immediately updating exposure as a largely theoretical risk that they are prepared to tolerate. We have categorised banks with this general approach to pre-deal check as **intermediate**.

Many smaller banks have yet to implement formalised pre-deal check. This may be because, for example, their trading activities are on such a small scale that pre-deal check is not justified or they do not calculate PFE on a daily basis. We have categorised banks with this approach as basic. We would expect such banks to place more emphasis on pre-deal check in the future and this is borne out by the system enhancement work carried out by InteDelta in which the pre-deal check is often one of the key areas which banks wish to improve.

The surveyed banks fell into the above categories for pre-deal check as follows:

Figure 8.3: Approach for pre-deal check



Across the survey group the approach for pre-deal check is typically less rigorous than for exposure management in general. For example, a bank that uses Monte Carlo simulation for PFE, has highly developed exposure management procedures, but uses a gross add-on approach for pre-deal check would be categorised as advanced for exposure management but intermediate for pre-deal check. Whilst there were no investment/global banks in the basic category and no small regional banks were categorised as advanced, the sophistication of pre-deal check approach did not generally correlate with size of institution. The results show no clear correlation in sophistication by region although the institutions classified as advanced were confined to Europe, North America and Asia.

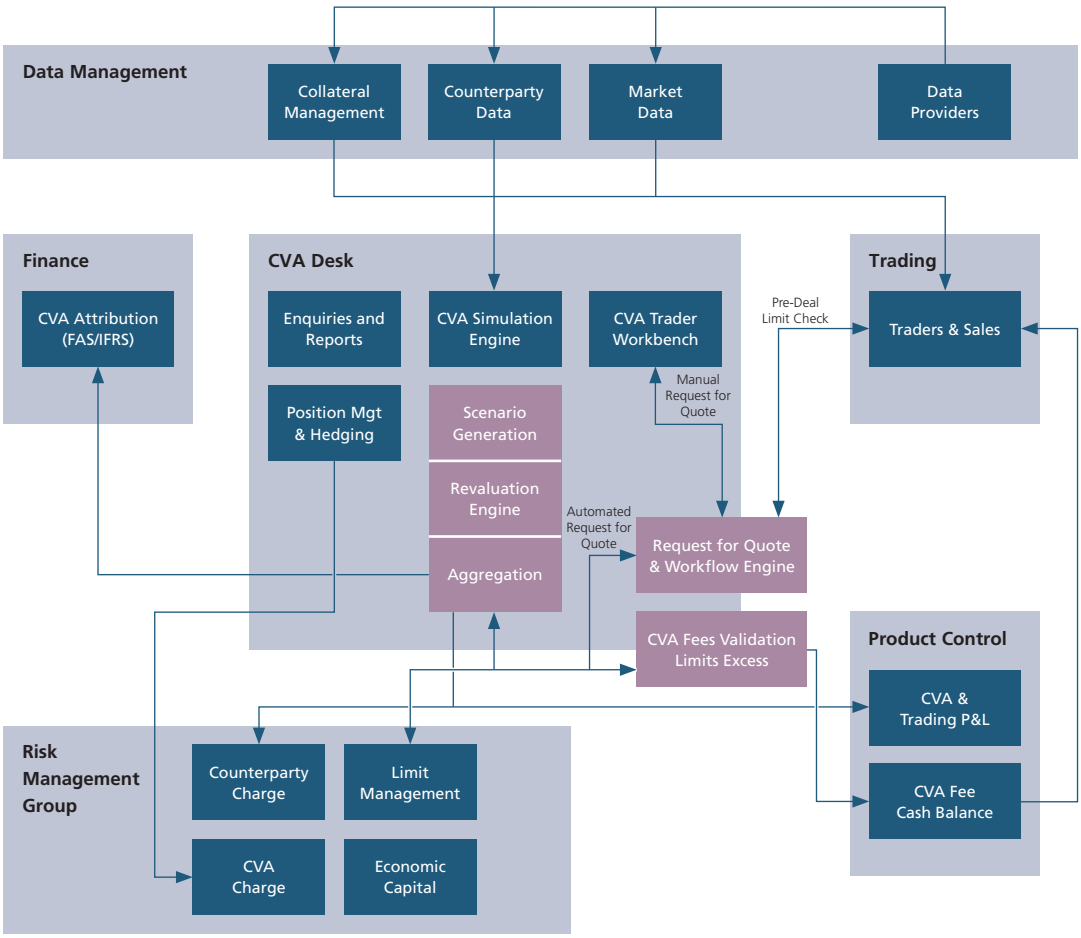
9. Systems platforms

9.1 Systems synergies

The calculation and management of CVA, PFE and regulatory capital for counterparty risk all require a major investment in risk management systems. Given the synergies between the calculations of these three metrics we might expect common systems platforms in their calculation. This was not, however, observed in the survey. Infrastructure is somewhat fragmented and surprisingly only 17% of surveyed banks used the same platform for the calculation of PFE and CVA. A common platform for PFE and CVA nevertheless give rise to significant benefits:

- Elimination of duplication in data integration (trade, counterparty, legal, collateral and market)
- Consistent models between CVA and PFE platforms (notwithstanding the fact that CVA and PFE are subject to risk neutral and real world calibrations respectively)
- Possibility of pre-deal check/optimisation for both PFE and CVA in same deal entry screen
- Reduced hardware and IT costs

Figure 9.1 shows a typical architecture for a PFE/CVA solution.



PFE is a longer established measure than CVA and its calculation is typically under the responsibility of the risk management function whereas CVA is usually managed by the front office. When CVA emerged as an important metric many banks reviewed the suitability of their existing PFE platforms and concluded that they were not fit for purpose for the calculation and management of CVA. The impact of internal politics should also not be underestimated. Bank front office and risk management functions often simply fail to agree on a common systems platform and business priorities. This situation may be changing. In systems selection work carried out by InteDelta we see a significant proportion of banks wishing to purchase a joint PFE and CVA engine and over time we would therefore expect the proportion of banks using a common platform to increase. We have also observed a number of institutions developing a combined front office/risk management trade repository and also integrating collateral management/margining functionality more closely with risk management.

Another potential synergy is between the systems used to calculate PFE and regulatory capital for counterparty risk. This synergy is only strong, however, for banks which calculate regulatory capital under the Internal Model Method. The calculation of regulatory capital under the Current Exposure Method and Standardised Methods is very different from the calculation of PFE and most banks using CEM/SM therefore use different platforms for PFE and regulatory capital. Under IMM, the measure of Exposure at Default (EAD) which feeds into the regulatory capital calculation is the Effective Expected Positive Exposure (EEPE). For banks using Monte Carlo to calculate PFE (which is almost a pre-requisite for IMM), EEPE is a similar calculation and there is a strong argument for these metrics to be calculated from the same platform. This was borne out by our survey in which 80% of IMM approved banks use the same platform for PFE and EEPE.

9.2 Key systems attribute

Table 9.1 shows a number of attributes of analytics systems for CVA/PFE and the relative importance of these to large and small banks.

Table 9.1: Attributes of CVA/PFE analytics systems

		Importance to large banks	Importance to small banks
Implementation	State-of-art methodologies and proven technology	High	High
	Ability to customise solution to specific business requirements	High	Medium
	Transparent infrastructure, avoiding "black box" components	High	Medium
	Availability of quantitative resources	Medium	High
	Availability of IT resources	Low-High	Medium-High
	Implementation time	High	Medium
Business as usual	Total Cost of Ownership	High	High
	Data management – data sources, data sources integration and cleansing, reconciliation, data validation and remediation	High	Medium
	Speedy incident resolution	Medium	Medium
	Dependency on external providers (data, software, hardware)	Varies	Varies
	IT security	Medium-High	Medium-High
	Capacity to keep abreast of quantitative market evolutions	High	Medium
	Ability to adapt to regulatory changes	High	High
	Ability to keep infrastructure aligned with industry inter-operability and interfacing	High	Medium
Long term evolution	Alignment of platform investment with institutions' strategic priorities	High	High

A key infrastructure decision that banks need to make is whether to build, buy or a combination of the two. The following are some of the common criteria that banks consider when deciding whether to build or buy:

- **Bank policy** – many institutions have a preference for either building in-house or buying vendor solutions. The policy is often not clear cut and a bank with a preference for building may nevertheless opt for a vendor solution if circumstances dictate, but the case for a vendor solution would need to be much stronger. In our experience, for risk management systems, large banks are more likely to prefer to build in house
- **Uniqueness of requirements** – a bank which has very unique requirements is less likely to find a vendor solution which meets their requirements and is therefore more likely to develop in-house. In our experience requirements for risk analytics tend to be less unique than requirements for risk control systems, which have to cope with each bank's very specific policies and procedures around risk limits and control
- **Availability of quantitative and IT resources** – the more constrained a bank's quantitative and IT resources the more likely it is to prefer a vendor solution. Smaller institutions often lack the depth and breadth of quantitative resources necessary for the development of risk analytics and may therefore be more likely to prefer a vendor solution
- **Transparency** – banks may regard in-house systems as more transparent or less of a "black box" than vendor solutions. Many vendors are aware of this criticism and incorporate features to increase transparency such as the exposition of intermediary calculations, data analysis tools and model sensitivity analysis
- **Total cost of ownership** (TCO) – TCO can be measured in many different ways but as a general rule a vendor implementation which does not require extensive customisation or **development will** be more cost effective than the equivalent in-house build
- **Implementation time and project risk** – expected implementation times for vendor solutions are generally considerably much less than for an in-house build since the vendor has a working solution. The project risk that implementation times and costs go significantly over budget are also lessened with a vendor solution
- **Ongoing enhancements** – banks will require that their systems are able to keep pace with changes in the bank's internal requirements and external regulatory and market developments. Vendors periodically release new versions of their software which they believe will provide new useful functionality to a large proportion of their clients. General market developments are therefore often well provided for by vendors. Specific internal enhancements, for example the addition of a new product that is not supported by the vendor solution, may be more flexibly and rapidly incorporated with an in-house solution. To address this some vendors have incorporated features such as pay-off language into their solutions to make it faster and easier to incorporate new products in their framework

In terms of vendor versus in-house systems the situation was reversed between PFE and CVA. 72% of surveyed banks used a vendor system for the calculation of PFE versus 28% using an in-house solution. CVA showed the mirror image with 67% using an in-house tool and 33% using a vendor platform. This situation reflects the fact that CVA is a more recent innovation and in most banks is under the responsibility of the front office, many of which prefer to build their own models. In many banks the implementation of CVA appears to be a work in progress and the current infrastructure can be regarded as a prototype. We would therefore expect to see more banks moving to vendor platforms as they wish to take advantage of a broader range of analytics and functionality. As previously noted we may also expect a move to vendor platforms as a result of banks selecting platforms to manage both PFE and CVA.

10. Modelling issues

Our survey focused on a number of modelling issues involved in the calculation of PFE and CVA.

Hard to model products

Exotic and structured products are difficult to include in a PFE/CVA simulation framework for a number of reasons:

- Trade mapping is difficult
- PFE/CVA system may not include pricing model and if it does this may not agree with the front office pricing model
- Computation speed may be slow

The cost/benefit of implementing simulation for complex products that represent a very small proportion of the portfolio may not be justified and many banks adopt a pragmatic approach. For PFE this often means using an add-on approach for products that are not included within the simulation and a CEM approach for regulatory capital. IMM approved banks may, however, face pressure from their regulators to incorporate a minimum proportion of trades within the simulation environment. Where exotic products represent a significant proportion of the portfolio most banks incorporate them within the simulation environment and this requires advanced analytics to produce a reliable PFE/CVA within an acceptable timeframe. To achieve this techniques that may be utilised include:

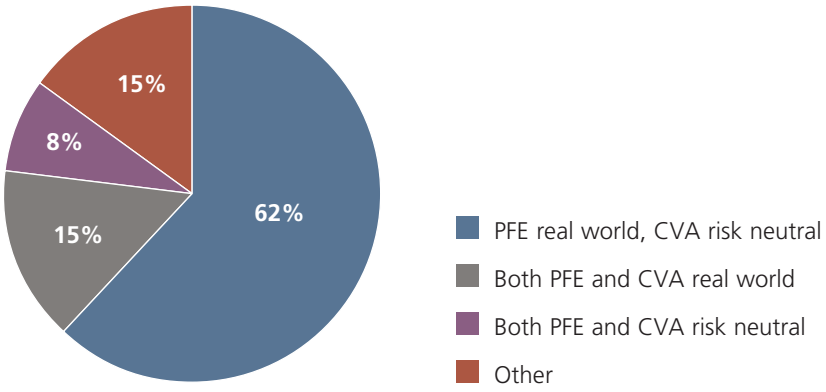
- Calls to external pricing libraries
- Generalisation of American Monte Carlo
- Use of user pay-off language
- Proxying of exotic structures by simpler trades

For CVA the option of a cruder calculation method such as add-ons does not make sense particularly where an accurate measure is required for active management. Banks are therefore more likely to exclude hard to model products from the scope of CVA all together. In our survey 83% of banks made some product exclusions from their CVA calculation. Excluded products tend to be exotics and structured products but also entire asset classes such as equities and commodities that are not significant in the overall level of exposure. Of the banks that currently exclude products from the scope of CVA 60% plan to bring more products under the scope of the simulation, although complete coverage is generally not thought to be realistic. It is doubtful that the most complex exotics will be brought under the scope of CVA and none of the surveyed banks had resorted to making calls to front office systems to value exotics.

Risk neutral vs real world

Most practitioners would argue that PFE should be calibrated using historic data but that CVA should be risk neutral. This is borne out by the survey results although a significant minority did not adopt this approach.

Figure 10.1: Risk neutral vs real world calibration



Most banks that did not adopt the real world PFE/risk neutral CVA combination did so for practical reasons rather than making this choice from a methodological perspective. Most commonly such banks use their real world calibrated PFE framework for CVA because they have not invested in risk neutral calibrations exclusively for CVA.

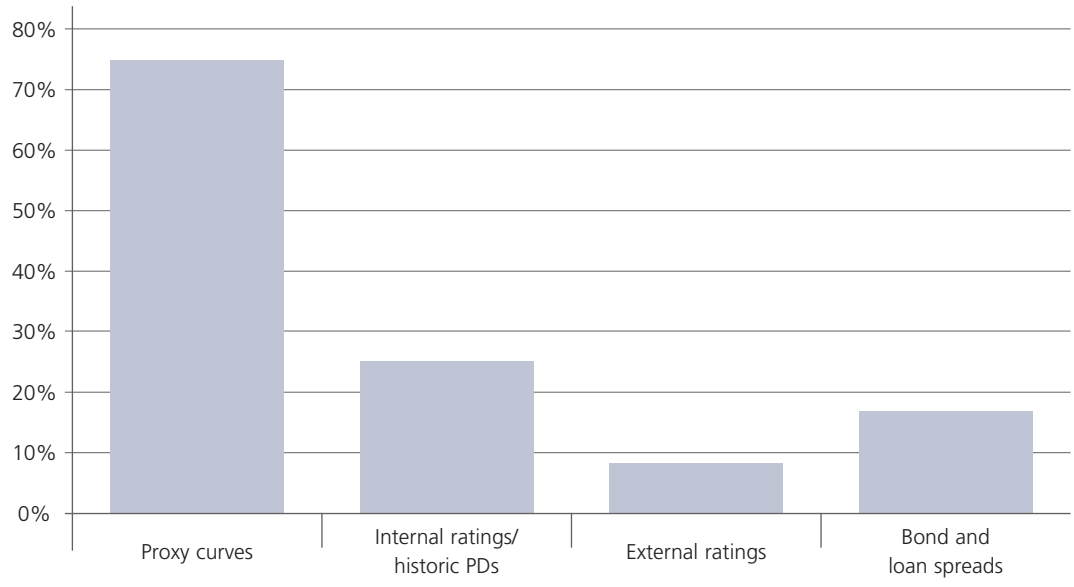
Credit spread data

The calculation of CVA requires the application of market implied default probabilities which should ideally be derived from CDS spreads. In reality, only a small proportion of a bank's CVA portfolio is likely to be composed of counterparties for which there is a liquid single name CDS, particularly when, as previously noted, many banks do not manage CVA for collateralised counterparties which are the counterparties most likely to have a liquid CDS. Banks employ a variety of techniques where there is a lack of CDS data:

- **Proxy curves** – using curves for CDSs which do exist with the same or similar country, sector and/or rating to construct a proxy curve for the counterparty where there is no CDS
- **Internal ratings/historic PDs** – banks typically map historic PDs to internal ratings for Basel purposes. The PDs are derived from the banks' analysis of historic default rates based on their own data. Some banks apply such historic PDs in their CVA calculations
- **External ratings** – where a counterparty has an external rating the PDs published by rating agencies may be used to assign a PD based on the rating
- **Bond and loan spreads** – where a counterparty has external debt or loan spread data is available, a PD may be calculated based on the bond or loan spreads

The European Banking Authority (EBA) has issued a draft technical standard on the calculation of CVA when the counterparty has no liquid CDS[6]. This favours the proxy curve approach and the standard provides guidance on how proxy curves should be constructed.

Figure 10.2: Methodologies for deriving default probabilities



6 http://www.eba.europa.eu/regulation-and-policy/credit-risk/draft-regulatory-technical-standards-in-relation-to-credit-valuation-adjustment-risk

11. Key challenges

We asked our survey group to rank a number of potential challenges that they may be facing on scale of 1-10 where 1 represents that they have absolutely no concerns and 10 is a major problem.

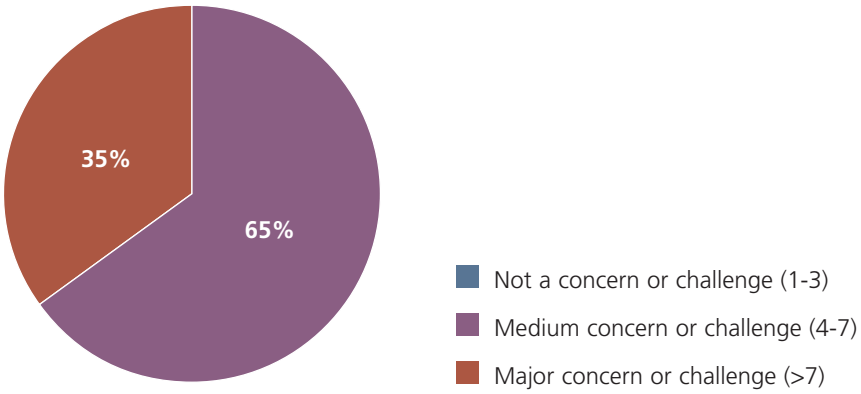
Most challenging areas

The areas cited by the survey participants as giving them the biggest challenges were as follows:

- Evolving or unclear regulatory environment
- Data issues
- Fragmented IT architecture
- Modelling collateral and credit mitigation

The unclear or constantly evolving regulatory environment is the biggest challenge cited by the survey respondents with not a single bank stating that this is not a concern or challenge.

Figure 11.1: Evolving/unclear regulatory environment

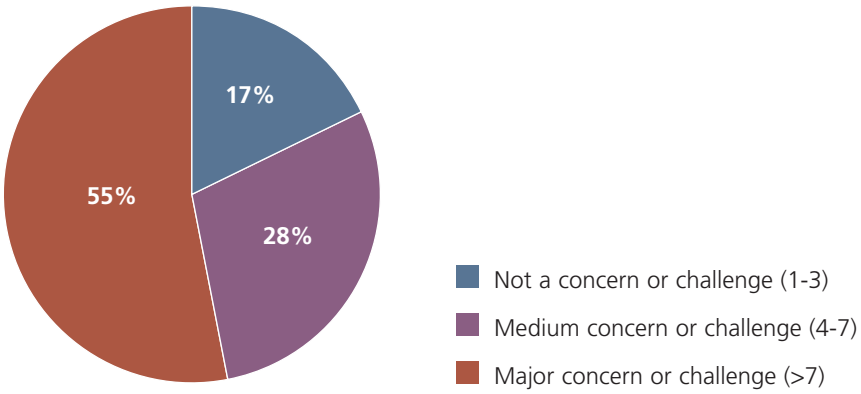


The changing regulatory landscape is one of the biggest general issues cited by risk managers and the comment is frequently heard that they spend more time managing regulatory demands than managing their institutions' risk. In the area of PFE/CVA banks have had to implement the provisions of Basel III, including the CVA capital change, and accounting rules for the calculation of CVA (which as noted in Section 7 differ from the Basel rules). Further change looms with the standardised approach for measuring counterparty risk exposure (SA-CCR) as described in Section 3. The implementation of regulatory changes inevitably has major implications for a bank's processes and systems.

Obtaining quality data for the PFE/CVA calculation was the next biggest challenge faced by the banks we surveyed. Whilst most banks faced data issues there was little consistency in the types of data that were cited as being the most challenging. Survey respondents reported different types of data such as:

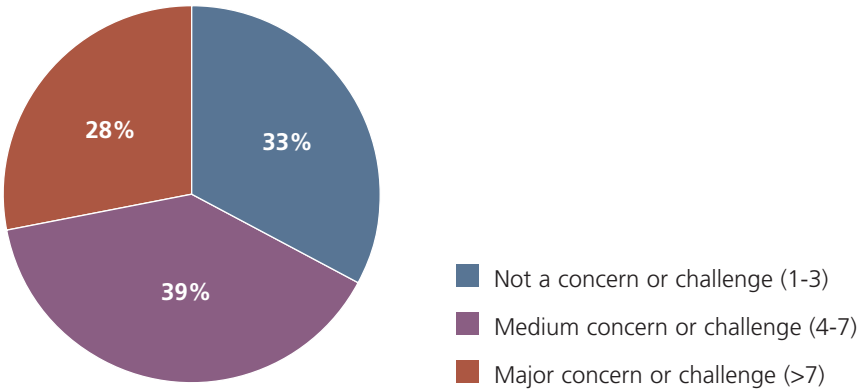
- Internal credit mitigation data – e.g. break clauses, terms of CSA
- Trade mappings
- Market data – particularly CDS and bond spreads

Figure 11:2: Data issues



The calculation of PFE/CVA requires bringing together data from a variety of front office and other systems and is one of the biggest challenges of implementing a risk management platform. The survey responses show that the fragmented nature of IT systems continues to be an ongoing challenge for a large number of banks. As would be expected, citing this as a challenge was correlated with size of institution, although a number of smaller banks in the survey also reported this as a particular challenge. An additional challenge is the reporting of data to banks' regulators as noted in the January 2014 Senior Supervisor Group (SSG) Progress Report on Counterparty Data[7], particularly in respect of the reporting of CVA exposure for large institutions. The SSG noted that the challenge comes from both the scale of banks' operations and the fragmented nature of their IT infrastructure.

Figure 11.3: Fragmented IT infrastructure

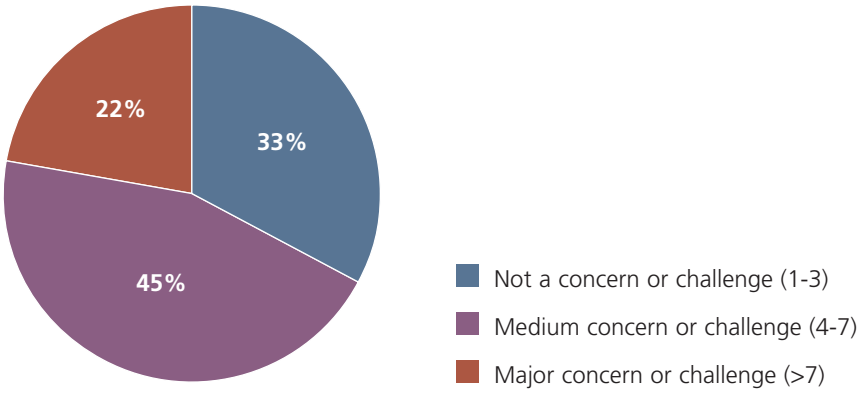


7 http://www.bankofengland.co.uk/pra/Documents/supervision/ssgprogressreportjan14.pdf

There was no particular correlation between the perceived fragmentation of IT systems and the size of institution.

Modelling collateral or other credit mitigation in the PFE/CVA calculation was the final issue that many banks cited as a particular challenge. Again, it was the data issues, such as obtaining reliable break clause and CSA data that was the major concern rather than the quantitative aspects.

Figure 11.4: Modelling collateral and credit mitigation



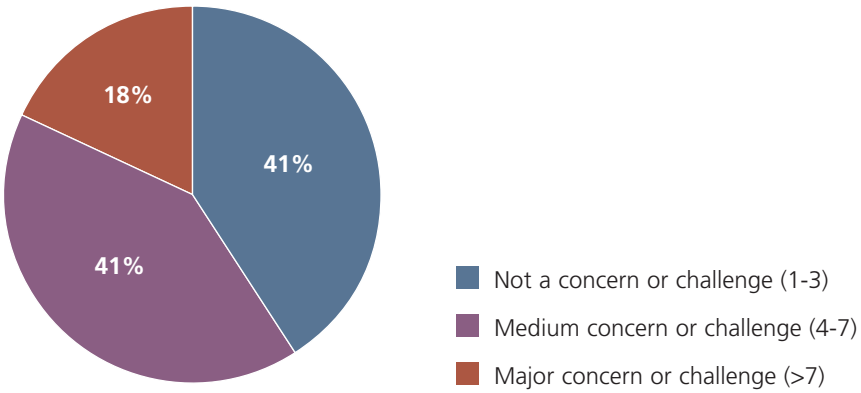
Other challenging areas

It was encouraging that many of the areas we asked about in our survey were not cited by a majority of banks as being major challenges although a significant number of respondents nevertheless regarded these as challenging. These were:

- Evolution of risk factors
- Simulation product coverage
- Reconciliation with front office systems
- Computation speed
- Drill down/aggregation ability

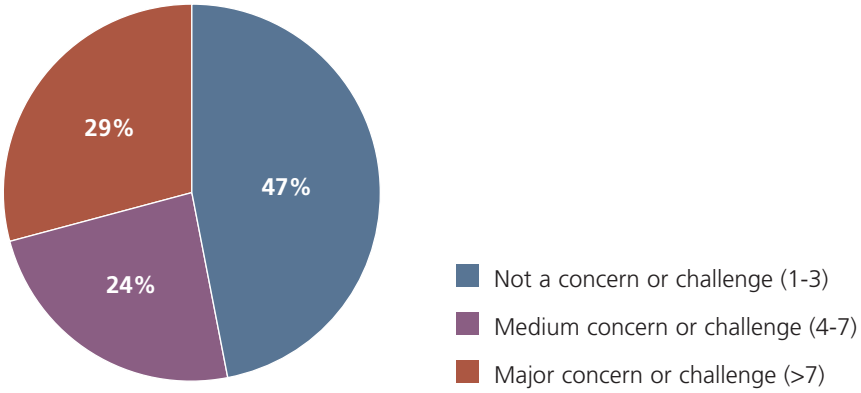
The **evolution of risk factors** refers to the modelling techniques for evolving interest rates, FX rates etc over time. Overall, this area is one of the least concerning to the surveyed banks. The answers did not correlate to the size of institution although no investment/global banks identified this as a major concern or challenge, probably reflecting their range of quantitative expertise.

Figure 11.5: Evolution of risk factors



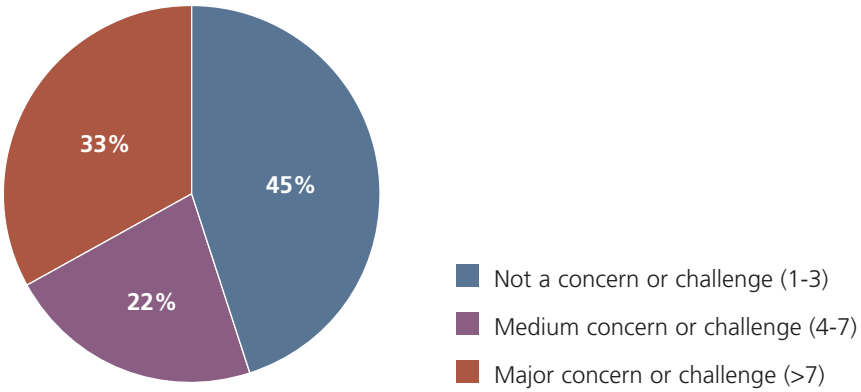
The coverage of products in the CVA simulation environment was not seen as a major issue. As noted in Section 6 it is relatively common for products such as exotics and structured products to be excluded from the simulation because they are difficult to model and they only represent a small proportion of the portfolio. As also noted in Section 6 many banks are nevertheless planning to incorporate more products under the CVA simulation. Where exotics and structured products represent a significant proportion of a portfolio they are invariably prioritised for inclusion in the simulation.

Figure 11.6: CVA simulation product coverage



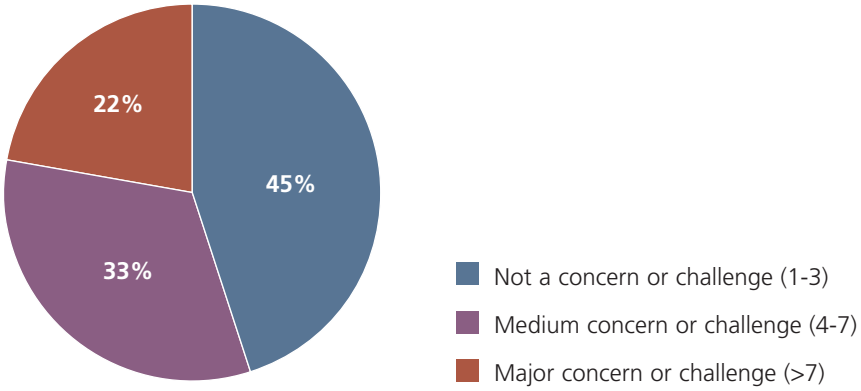
An essential control in the calculation of PFE/CVA, particularly under simulation, is to ensure that the current MTM of the transaction in the risk system agrees to the MTM in the front office system to a reasonable tolerance. The MTMs may disagree due to differences in pricing models, calibrations or market data. Most banks did not cite reconciliation with front office systems as a particular concern.

Figure 11.7: Reconciliations with front office systems



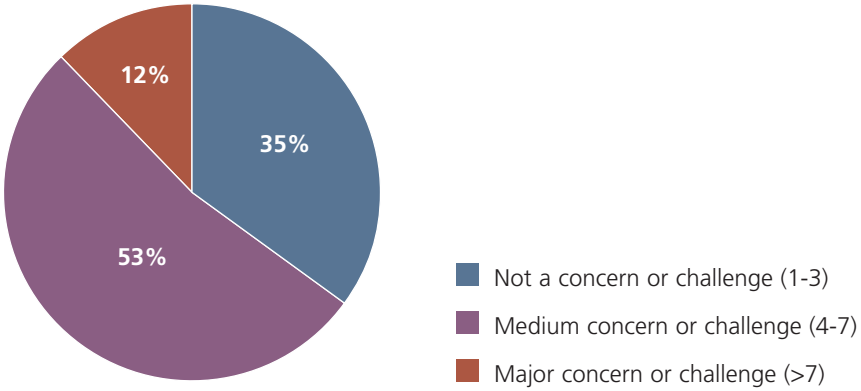
The calculation of PFE/CVA, particularly under Monte Carlo simulation, requires a large amount of computational power. Nevertheless, computation speed was not one of the most reported challenges in our survey, probably reflecting the huge increase in processing speeds seen in recent years as well as the use of GPU chips which were used by at least one of the survey participants. There was no apparent correlation between institution size, despite the larger banks' much larger portfolios, and a number of the smaller banks cited computation speed as a particular concern.

Figure 11.8: Computation speed



The practical use of both PFE and CVA requires not only a single result but the ability to drill down into how the result is arrived at and also to aggregate PFE/CVA at various different levels, i.e. being able to "slice and dice" PFE/CVA results whilst maintaining portfolio effects, and being able to run marginal and incremental attributions. The survey indicates that most banks are satisfied with their ability to perform the necessary level of drill down and aggregation.

Figure 11.9: PFE/CVA Drill down and aggregation



12. Conclusion

The measurement and management of PFE and CVA has been an area on which many banks have focused and we expect that this will continue as banks respond to external regulatory pressures and a desire to better manage their business. We expect CVA in particular to be an area of growth, with many banks that do not have a CVA desk setting one up, although many banks will stop short of fully hedging their CVA positions.

Systems platforms will form a key part of banks' strategies for PFE and CVA. Many banks' CVA platforms are a work in progress and we expect to see an investment in new CVA systems. This will likely involve more emphasis on the implementation of joint PFE/CVA platforms and as part of this we would expect to see a greater proportion of vendor solutions as is currently the case for PFE. Whatever solutions are adopted, good quality counterparty, trade and market data will continue to be one of the major issues faced.

About InteDelta

InteDelta helps financial institutions better manage their risk. Through our range of consulting and associated products we provide assistance in areas such as:

- Risk management policies and methodologies
- Target operating model design
- Technology selection and implementation
- Market intelligence and benchmarking

Our areas of expertise cover the major risk categories faced by financial institutions: credit, market, liquidity and operational risk. We have advised a diverse portfolio of financial institutions located across the world, at different levels of sophistication on counterparty risk methodology and more widely around the systems, processes and policies required to manage counterparty risk. Our global client base includes large US, European and Asian investment banks, asset servicing providers, regional banks, institutional investors and hedge funds.

InteDelta applies subject matter expertise through our core consulting approach to deliver change across all aspects of risk management.

Further Information

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Implementations powered by the MXpress™ approach leverage the wealth of business content accumulated by Murex over the two decades through pre-packaged components of the platform while offering an accelerated process of delivery.

Further Information

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