INTERNATIONAL VALUATION STANDARDS COUNCIL

CREDIT AND DEBIT VALUATION ADJUSTMENTS

EXPOSURE DRAFT

Comments on this Exposure Draft are invited before 28 February 2014. All replies may be put on public record unless confidentiality is requested by the respondent. Comments may be sent as email attachments to:

CommentLetters@ivsc.org

or by post to IVSC, 1 King Street, LONDON EC2V 8AU, United Kingdom.

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Introduction to Exposure Draft

The increasing adoption of International Financial Reporting Standards (IFRS) around the world over recent years has led to a requirement for financial institutions and other entities to measure certain financial assets at "fair value". These include most types of derivative contract.

IFRS 13 *Fair Value Measurements*, published in April 2011 and effective from January 2013, clarifies not only the definition of "fair value" as applied generally in IFRS but also certain conditions and assumptions that apply when the fair value of certain types of financial assets and liabilities are measured. IFRS 13 provides that when the fair value of a liability is being measured that non-performance risk has to be reflected in the value. In the case of a liability held by an entity this includes its own credit risk. In the case of an asset this includes the counterparty credit risk.

While the need to reflect counterparty and own credit risks in the valuation of derivatives is a major concern for banks and other financial institutions it also affects many other types of corporate entity who may hold derivatives to hedge interest rate or foreign exchange risk in their business.

The objective of the International Valuation Standards (IVSs) is to help increase the transparency of valuation and to reduce diversity of practice across borders. The IVSC Standards Board's attention was drawn to the fact that the emergence of the requirement to reflect these credit risks in the valuation of assets and liabilities was exposing considerable inconsistency. It therefore agreed a project to examine the issues and identify general accepted approaches and principles for the making of the appropriate adjustments. In 2012 it formed a Working Group of experts to advise the Board.

This Exposure Draft is the result of input from the Working Group and outreach to various organisations identified as having an interest in this topic. It is now issued publicly to seek wider comment on the proposed guidance.

The objective of the guidance is to assist valuation and risk professionals by identifying principles of best practice and not to produce a comprehensive training manual. In pursuance of the objective of increasing valuation transparency it is also intended to assist senior management, auditors, analysts and others relying on valuations in better understanding the principles behind CVA and DVA.

Comments on this Exposure Draft are invited from all with an interest in this topic, whether they are valuation or risk specialists, investors, analysts, auditors and anyone else who needs to produce or rely on valuations adjusted for credit risk.

Questions for Respondents

The IVSC Standards Board invites responses to the following questions. Not all questions need to be answered, but to assist in the analysis of responses received, please use the question numbers in this paper to indicate to which question your comments relate. Further comments on any aspect of the Exposure Draft are also welcome.

Notes for respondents:

In order for us to analyse and give due weight to your comments, please observe the following:

1. Responses should be made in letter format, where appropriate on the organisation's letter heading. Respondents should indicate the nature of their business and the main purpose for which they either value, or rely upon the value of, credit and debit valuation adjustments.
2. Comments should not be submitted on an edited version of the Exposure Draft.
3. Unless anonymity is requested, all comments received may be displayed on the IVSC website.
4. Comments letters should be sent as an email attachment in either MS Word or an **unlocked** PDF format and no larger than 1MB. All documents will be converted to secured PDF files before being placed on the website.
5. The email should be sent to commentletters@ivsc.org with the words "CVA DVA" included in the subject line.
6. Please be sure to submit comments before 28 February 2014.

Questions

Paras 4 - 7 set out the proposed scope of the paper.

1. Do you agree that the proposed scope is appropriate? If you disagree, please indicate changes that you would recommend.

Para 8 sets out a series of proposed definitions for terms used in this TIP.

2. Do you agree with these definitions? If you consider an alternative or additional definition is appropriate then please provide this in your response.

The "Principles, Methodology, and Practical Application" sections all reference the Monte Carlo process as the most accepted method of exposure simulation.

3. Do you believe that other methods should be considered in addition to the Monte Carlo, such as binomial and trinomial trees?

The "Principles, Methodology, and Practical Application" sections all reference netting sets.

4. Do you believe that netting sets have been discussed to an appropriate level of detail?

Paras 79 - 83 discuss the importance of appropriate governance and controls around the process of calculating credit and debit valuation adjustments. They highlight this as a particular issue for financial entities which create and trade instruments but also for non-financial entities where there is also a need for systems to ensure that the data used is objective and reliable. Although the IVS Framework indicates that it is a fundamental expectation that adequate controls and procedures are in place to ensure objectivity in the valuation process, the standards do not otherwise expand on this.

The IVSC publishes a Code of Ethical Principles for Professional Valuers that can be applied to a wide range of valuation activity.

5. Do you consider that there is a need for the IVSC to augment this with more specific guidance on governance and controls in the financial sector?

6. Do you consider that there is a particular issue or issues that arise when considering a suitable governance and control protocol for calculating CVA or DVA that does not otherwise give rise to concern?

Paras 84 - 94 of the paper dealing with the Practical Application of the principles discussed previously proposes that entities adopt more complex methodology as the size or materiality of their derivative transactions increases.

7. Do you agree that it is appropriate to suggest that entities with less complex or smaller derivative holdings in relation to their overall business should adopt less complex methodology, or instead should all entities be expected to implement equally rigorous methodology?

The “Cost of Funding” section discusses Funding Valuation Adjustments (FVAs) and their relationship to CVA and DVA.

8. Does the discussion about the cost of funding contribute to the objectives of the TIP outlined in the “Scope and Purpose” section on p3?

The “Cost of Funding” section indicates that there is still an on-going discussion about how best to apply FVA, or whether it is even relevant to the calculation of market value, or fair value as defined in IFRS 13.

9. Given the current debate in this area, do you believe it is appropriate for this TIP to outline the main issues, or should this be removed altogether until there is greater consensus?

The TIP is not intended to be used as an educational resource; however one objective is to aid professionals who are not specialists in understanding the principles that underline credit and debit valuation adjustments.

10. With this in mind, are there any key principles that have been omitted or not fully explained?

Exposure Draft

Credit and Debit Valuation Adjustments

Technical Information Papers

Technical Information Papers (TIPs) support the application of the requirements in other standards. A TIP will do one or more of the following:

- provide information on the characteristics of different types of asset that are relevant to value,
- provide information on appropriate valuation methods and their application,
- provide additional detail on matters identified in another standard,
- provide information to support the judgement required in reaching a valuation conclusion in different situations.

A TIP may provide guidance on approaches that may be suitable but will not prescribe or mandate the use of a particular approach in any specific situation. The intent is to provide information to assist an experienced valuer decide which is the most appropriate course of action to take.

A TIP is not intended to provide training or instruction for readers unfamiliar with the subject and will be primarily focussed on practical applications. A TIP is not a text book or an academic discussion on its subject, and neither will it endorse or reference such texts.

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Introduction

1. The increasing adoption of International Financial Reporting Standards (IFRS) around the world has led to a requirement for entities to measure certain financial assets and liabilities at fair value. These requirements apply to derivative contracts, as well as cash instruments held at fair value. Under IFRS 13 *Fair Value Measurements*, which became effective in 2013, the fair value of a liability has to reflect the risk of non-performance, which includes an entity's own credit risk. In this paper the adjustment required to the value of a derivative to reflect counter party credit risk is termed a Credit Valuation Adjustment (CVA) and the adjustment to reflect own credit risk is termed a Debit Valuation Adjustment (DVA).

2. CVA and DVA are required not only for financial reporting under IFRS but are also required for other purposes, including establishing the regulatory capital of financial institutions and for management and investor information.

3. This Technical Information Paper (TIP) examines how CVA on derivative assets and DVA on derivative liabilities can be calculated. The guidance in this paper presumes that the reader is familiar with the International Valuation Standards (IVSs). This TIP is of particular relevance to the application of the IVS Framework, IVS 101 *Scope of Work*, IVS 102 *Implementation*, IVS 103 *Reporting*, IVS 250 *Financial Instruments* and IVS 300 *Valuations for Financial Reporting*.

Scope and Purpose

4. This TIP provides information and guidance on the following:

   - the principles of CVA and DVA, considering risk management practices observed in the market place,
   - techniques and inputs for making adjustments,
   - key challenges when calculating CVA and DVA and suggestions for generally accepted practices to address them, taking into consideration the market participant's level of derivative involvement and their context,
   - consideration of DVA and its link with cost of funding, and especially the Funding Valuation Adjustment (FVA) on uncollateralised derivative liabilities, and
   - practical implications in financial reporting (IFRS and US GAAP) and regulatory capital requirements (Basel III).

5. This TIP does not examine any specific statutory or regulatory requirements that may apply to the valuation of financial instruments under regulatory frameworks other than Basel III, and under accounting standards other than IFRS.

6. This TIP provides:

   - users of financial information and valuation professionals with clarification on the terminology used in regards to CVA and DVA and on the underlying concepts, given the number of different approaches in this field,
   - entities with larger and more complex derivative portfolios with an insight on how complex valuation challenges related to CVA and DVA are tackled in the marketplace, as well as generally accepted practice suggestions,

- entities with smaller and less complex derivative portfolios with generally accepted practice suggestions, and
- information on developments in the financial reporting (IFRS and US GAAP) and regulatory areas (Basel III).

7. Counterparty and own credit exposures on all derivatives are covered in this TIP, irrespective of whether they are collateralised or uncollateralised. Other financial instruments held at fair value follow a similar process, but are not specifically referenced here.

Definitions

8. The following definitions apply in the context of this TIP. Similar words and terms may have alternative meanings in a different context. The IVSC's International Glossary of Valuation Terms provides a comprehensive list of defined words and terms commonly used in valuation, together with any alternative meanings.

Basis Risk	The risk that the value of offsetting investments will not change in equal and opposite amounts.
Close-out Risk	The risk that adverse movements occur between the value of the derivatives and the value of the collateral held during the period that it takes to close-out exposures against a counterparty in a default situation.
Contingent Bilateral CVA	A bilateral CVA that takes into account the order of defaults of both counterparties (including joint default) by modelling the default relationship between both parties and applying this to the expected exposure.
Contingent Credit Default Swaps (CCDSs)	CDS contracts where the notional amount of protection bought or sold is fixed when a credit event occurs and is equal to the market value of a reference derivative transaction on that date.
Credit Risk	The risk that one party to a derivative will cause a financial loss for the other party by failing to discharge an obligation.
Credit Valuation Adjustment (CVA)	An adjustment to the measurement of derivative assets to reflect the credit risk of the counterparty.
Debt Valuation Adjustment (DVA)	An adjustment to the measurement of derivative liabilities to reflect the own credit risk of the entity.
Default Probability (DP)	The likelihood of a counterparty not honouring its obligations.
Expected Positive Exposure (EPE)	The discounted receipts and unrealised gains an entity forecasts to receive from the counterparty.

Expected Negative Exposure (ENE)	The discounted payments and unrealised losses an entity forecasts to pay to the counterparty.
Fair Value	The price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. (*IFRS 13*)
Funding Valuation Adjustment (FVA)	An adjustment to the measurement of derivatives to reflect an entity's funding cost.
Gap Risk	The risk that adverse movements occur between the value of the derivatives and the value of the collateral held during the period between two margin calls.
Loss Given Default (LGD)	The percentage amount that a party expects to lose if the counterparty defaults.
Market Value	The estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion. (*IVS Framework*)
One-way Collateral Agreements	Transactions covered by a one-way credit support annex (CSA), which means that one party is required to post collateral to its counterparty when the value of the trade is in the counterparty's favour, but the counterparty is not required to post collateral in the reverse situation.
Right-way-risk	When exposure to a counterparty or collateral associated with a transaction is positively correlated with the credit quality of that counterparty.
Wrong-way-risk	Occurs when exposure to a counterparty or collateral associated with a transaction is adversely correlated with the credit quality of that counterparty.

Principles of CVA and DVA

9. The purpose of a CVA is to consider the credit risk of the derivative counterparty within the value of an entity's derivative positions. Issuers of derivatives routinely do this in order to ensure they are adequately compensated for the credit risk that they bear.

10. In a DVA, an entity incorporates its own credit risk into its derivative valuation. This is done to reflect the fact that an informed counterparty would be expected to adjust for the entity's credit risk when valuing a deal, and hence would be prepared to close-out a position at a discount to par. The DVA therefore represents the CVA that a counterparty would be expected to hold against its exposure to the entity.

Differences between loans and derivatives

11. The same basic philosophy for assessing credit risk can be applied to loans and derivatives. Although there are some key differences established loan practices provide a good starting point for a discussion on derivative CVA and DVA calculations.

12. For loans, the initial cash flow is the full or partial drawdown of the amount lent, creating an immediate credit risk for the lender. This credit risk exists for the life of the loan and can increase as additional amounts are drawn-down by the borrower and reduce as principal is paid off. The credit risk exposure is predominately in one direction (unilateral) with the lender being exposed to the borrower. The variability in the lenders credit risk exposure to the borrower over the life of the loan depends on various factors:

- The Expected Positive Exposure (EPE) which is usually equivalent to the principal or drawdown plus unused firm commitments, as listed under the contractual terms of the loan, discounted to current date.
- The likelihood of the borrower not being able to repay amounts required by the contract is the Default Probability (DP).
- In the event that a borrower fails to repay their debt, the sum that is not recovered by the creditor as a percentage of the loan amount is the Loss Given Default (LGD).

13. For a loan, each of these potential future events can be estimated and the fair value of the credit risk calculated. This calculation can be performed at inception and updated at any point over the life of the loan. The credit risk exposure is:

$$\mathrm{CVA} = \mathrm{LGD} \int_0^{\mathrm{T}} \mathrm{DP_t} \cdot \mathrm{EPE_t}$$

14. For derivatives, the upfront cash flow will often be zero or a very small amount in relation to the notional referenced by the derivative. As a result the credit risk at the inception of a derivative contract will often be very small, particularly compared with that on a loan. The variability of derivative cash flows will depend on factors similar to a loan such as DP and LGD, however there are two important differences compared with loans:

- the credit risk exposure can switch between counterparties over the life of the derivative, ie, no one party is necessarily the borrower or the lender of the instrument, and

- the potential variability of cash flows can be much greater than those of a loan as derivative cash flows are usually linked to a much larger notional and are referenced to an underlying which can be volatile, eg, credit spreads for a CDS, equity prices for an equity option, and foreign exchange rates for a currency swap.

15. Other important differences include the extent to which loans and derivatives are subject to netting in the event of default:

    - A loan may or may not be offset with other exposures transacted with the same counterparty. If they are not, in the event of bankruptcy the claimants will rank alongside other creditors for any recovery as a percentage of the loan outstanding.
    - Derivatives are almost always transacted under a netting agreement (such as an ISDA[1]) or with a central counterparty (CCP), whereby all derivatives with the counterparty are offset in the event of default such that the net exposure is subject to a claim by the creditor. The nature and extent of these netting agreements are discussed further below.

16. For loans and derivatives, the credit exposure to the amount outstanding can be different:

    - For loans the current and future credit risk exposure is often forecast on the basis of principal repayments and drawdowns which are contractually determined at inception.
    - Derivatives do not necessarily involve the lending of an underlying amount, therefore identifying the underlying credit risk at current and future points in time can be more complicated.

17. A further difference arises in identifying when an event of default has occurred:

    - For loans, if a repayment of principal or interest required under the contractual terms of the loan is not made, the borrower will have defaulted. At this point the lender will take the steps laid down in the loan contract to recover amounts owing. This may involve seizing collateral, executing any charges over the entity's other assets or by initiating bankruptcy proceedings.
    - For derivatives, the events of default and termination events are predefined events which lead to the termination of transactions prior to their originally intended maturity. Events of default arise when one party fails to perform under the terms of the transaction, eg, failure to meet payment terms, breach of representation or warranty, insolvency and changes in legislation or regulatory requirements.

CVA in traded prices

18. The increase in the significance of CVA charges, accounting requirements and higher capital requirements proposed by Basel III for uncollateralised trades have all led to market participants incorporating counterparty credit risk into trade pricing. These all act to incentivise trading desks to choose stronger counterparties and for profit to be measured considering credit risk.

[1] The ISDA master agreement, developed by the International Swaps and Derivatives Association is the most commonly used master contract for derivative transactions.

19. The introduction of CVA charges to trade pricing however has created a number of difficulties for both banks and other entities. This can be seen in the wide range of derivative quotes, even for relatively vanilla trades. This dispersion in quotes may stem from a number of sources including:

- The CVA a bank charges a counterparty will vary depending on that bank's existing portfolio of trades with the counterparty. As such the CVA is not specific to the derivative instrument and will vary from bank to bank.
- Some entities may not be charging a representative CVA. There could be many reasons for this however, such as undercharging for competitive advantage or because they lack the technology to compute an accurate charge per trade.
- There are a variety of approaches used in CVA calculations across banks which can result in different CVA charges, eg, a bank that includes their own credit risk within the CVA calculation will be able to offer a lower CVA charge to a client than a bank that does not include this risk.

20. In liquid markets the CVA being priced into trades can be implied from traded levels. In the event that this materially differs from that produced by a bank's internal model a review of assumptions used in the calculation should be performed to highlight incorrect assumptions. In practice given the wide range of assumptions and parameters within CVA models, calibrating to market levels can be a complex task. Moreover as previously mentioned, the CVA charge may not be wholly included by entities that are seeking a competitive advantage, making a conclusive review difficult.

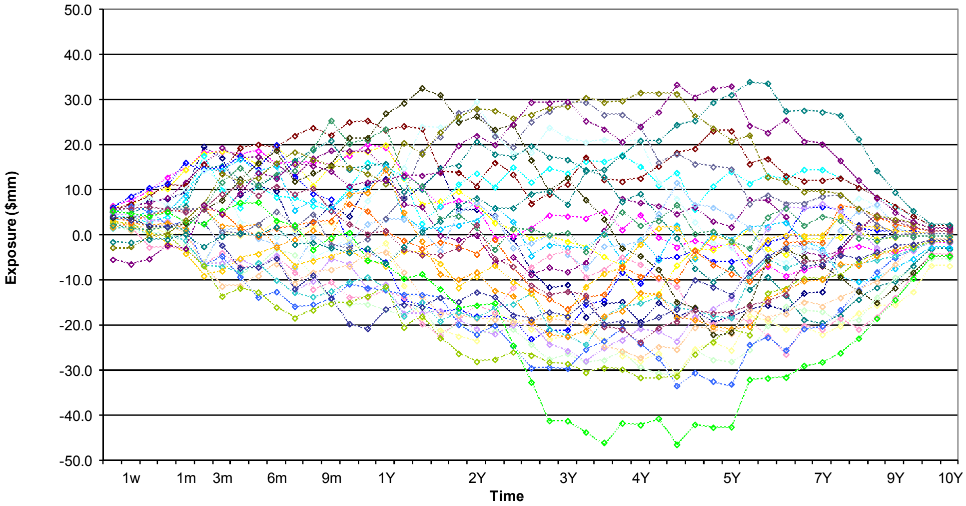
21. Whilst including CVA charges into trade pricing is an effective tool for counterparty risk management it should not be seen as a replacement for other sound credit risk management techniques. CVA charges are based on many assumptions and unobservable parameters and as a result may not correctly capture the full credit risk of a counterparty. Also CVA is based only on expected loss; sound credit risk management should also consider scenarios where unexpected losses may occur.

Expected Exposures

22. As mentioned above, both parties to a derivative have potential future credit risk exposure to the other. EPE measures payments and unrealised gains an entity forecasts to receive from the counterparty and Expected Negative Exposure (ENE) measures payments and unrealised losses an entity forecasts to pay to the counterparty. When valuing the derivative each party therefore considers the EPE to calculate CVA but must also consider the ENE as well as their own DP and LGD to arrive at the counterparty's credit risk exposure to them (DVA).

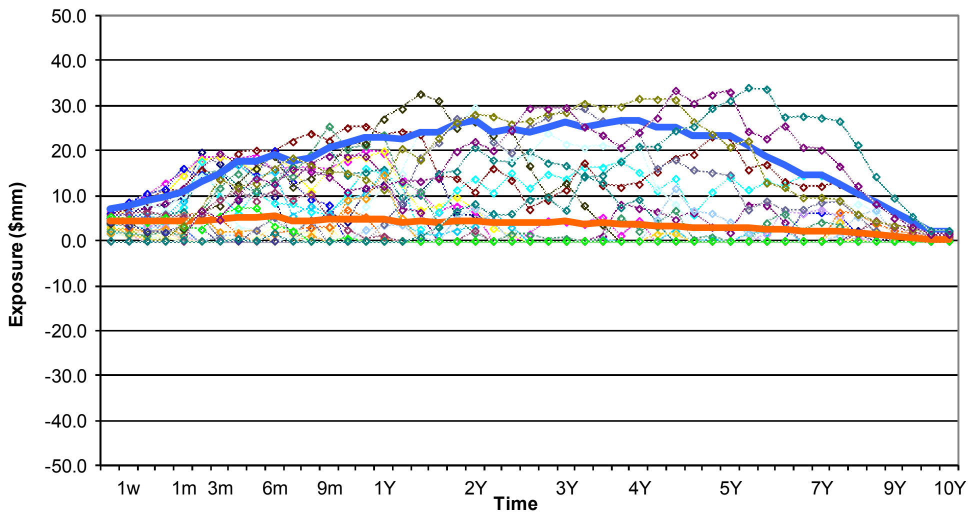
23. At any point in time, the expected future volatility of the underlying asset will be the primary driver of EPE and ENE. One approach for calculating EPE and ENE is to model changes to the referenced underlying using Monte Carlo simulations. These simulations identify multiple different paths for the value of the derivative over its life, assign a probability to each path and identify the expected average path. Figure 1 shows example paths for the EPE and ENE of a derivative over time.

Figure 1: Simulated Exposures



24. When calculating CVA only the EPE is identified, as in Figure 2. The blue line represents the peak exposure which is assessed to a high confidence level and may be used to monitor counterparty exposure limits. The orange line represents the average exposure over multiple simulations to provide expected exposure. The average exposure is used for EPE. The reciprocal process to Figure 2 is performed using negative exposures to calculate DVA.

Figure 2: Simulated Exposures – Positive Values Only



Master Netting Agreements and Collateral

25. Master Netting Agreements (MNAs) are legally binding contracts between two counterparties that allow the aggregation of exposures in the event of bankruptcy. Upon default the agreement allows a counterparty to collapse all its offsetting positions into a single receivable or payable claim. Included in the MNA is the netting set, which stipulates which exposures can be netted down and any collateral that can be deducted. Given the extensive use of the MNA across the financial markets most CVA calculations will be performed at the counterparty level and not at the derivative deal or contract level. However it is important that entities seek legal advice on the enforceability of these agreements internationally.

26. The CVA charge for a new transaction should be equal to the incremental contribution to the CVA for the counterparty, ie, the CVA of a new transaction is equal to the CVA on a portfolio with new transaction minus the CVA on a portfolio without new transaction. It is possible for the new transaction CVA to be negative where the new transaction reduces the net expected exposure to the counterparty.

27. The CSA to an ISDA Master Agreement further reduces credit risk by setting terms for posting collateral relating to positions traded under the agreement. The key terms reflect the:

- direction of the collateral posted, ie, whether one or both counterparties are required to post collateral,
- type and quality of acceptable collateral, eg, particular currencies or securities with certain levels of haircut,
- conditions for what can be done with the collateral, eg, rehypothecation, and
- frequency and trigger events for a collateral posting, eg, collateral may be posted daily, but only when the size of the balance to be covered exceeds a certain minimum threshold amount.

28. Where collateral is posted on a daily basis and the minimum threshold amount is sufficiently small, an agreement is generally described as being “strongly collateralized”. This does not eliminate credit risk as an entity is exposed to various kinds of “gap” risk on default, eg, that collateral may fluctuate in value. A major default event might be expected to be concurrent with a period of market turmoil or contagion, so this effect could be significant.

29. It is common practice to make exclusions for CCPs, on the grounds that the clearing houses themselves are so well collateralized, that the default of individual members would not result in the default of the CCP. Specific exclusions for other sets of entities may be justified if it can be shown that the market does not price them.

Hedging CVA

30. There are numerous ways that an entity can hedge CVA. Assuming that there is an active market for the counterparty, one of the most straightforward methods is to use CDS contracts. The entity purchases a CDS referencing the counterparty, which offsets the CVA exposure for the corresponding maturities. In the event of the counterparty’s default, the CDS will offset the losses suffered by the entity. This is a risk replication approach where the CVA is equal to the cost of the hedge. Any hedges will need to be closely monitored so that the maturity and amount of CDS protection required to offset the CVA can be regularly rebalanced.

31. Implementing the risk replication approach presents a number of challenges as the hedge can be uncertain, imperfect and complex;

- Unlike a loan, the exposure to a derivative is market dependent. Wrong-way-risk arises when the counterparty’s DP is dependent on the market level referenced by the derivative. This can make it difficult to maintain an efficient hedge if a complex hybrid risk is being hedged.

- When there is a default, the CDS provides a payment that may not match the loss suffered on the derivative portfolio. This is because, unless the CDS is referenced on a derivative portfolio, the recovery rate of the CDS will be determined independently of the entity's loss, eg, by The ISDA Credit Derivatives Determinations Committees.

32. An alternative to a CDS hedge portfolio is to enter into a CCDS. Predefined contingencies are agreed, which may include a market risk such as changes in interest rates or the occurrence of events such as a merger or acquisition. If a contingency occurs, the notional credit risk exposure of the instrument is adjusted accordingly. Given the bespoke nature of contingencies, the CCDS market is not well developed.

33. Calculating CVA is less straightforward for counterparties whose credit risk is not traded in a liquid market. The calculation is more subjective, depending on judgements and estimates to identify the cost associated with the counterparty credit risk. Various approaches are used to estimate the cost of buying protection against illiquid counterparties:

    - Individual liquid proxies; proxies are selected to closely match the counterparty including credit rating, industry, country, and capital structure.
    - Traded credit indices; these may be industry, market or ratings based, eg, iTraxx Europe consists of 125 investment grade names, ABX HE consists of 20 US residential mortgage backed securities, and Dow Jones CDX NA HY consists of 100 high yield names.
    - Actuarial models; run using proprietary credit risk models that use an entities' historical loss data (if available) and can be combined with similar data from credit rating agencies. The credit charge will depend on the internal credit rating assigned to the counterparty and will update accordingly should this rating change.
    - Managed basket; construct a managed basket replicating the underlying risk for a portfolio of counterparty credit risk exposures, using a collateralized debt obligation type of structure transacted in derivative form or through a structured note.

34. Individual liquid proxies and traded credit indices capture market wide changes in the price of credit protection but do not necessarily match counterparty specific factors. Neither approach specifically addresses the cost of protection for example against jump-to-default risk for the counterparty, for which additional adjustments to CVA are required. Actuarial models are gradually being replaced by market based approaches. They identify the expected credit loss exposure in a hold-until-maturity type of analysis, rather than estimating the current market price.

35. It is important to emphasise that CVA represents a component of a portfolio's market value, the purest measure of which is the cost of assigning a derivative portfolio to another entity, ie, simulating a transfer due to counterparty default. This is rarely an observable price but indications may exist, eg, if a derivative portfolio is deep in the money (similar to a pure asset), the portfolio is similar to a loan and the credit spread should not diverge significantly from the credit spreads of loans with that counterparty. However, situations can arise where the CDS spread is, for example, well above the spread at which loans are traded with counterparties. This is because the CDS spread can contain a speculative element unrelated to the credit

exposure of a derivative portfolio. It is therefore important to consider these factors when choosing the most appropriate method.

Methodology

Key Inputs

Default Probability

36. It was common to use a historical approach, similar to the calculation required to generate the counterparty credit risk capital charge under Basel II. A historical approach uses analysis of realised defaults to ascribe DPs to counterparties as a function of an internal credit rating. This approach utilises historical data, experience with certain counterparty types/regions and peer analyses, however it is now less used.

37. Generally, market best practice for large financial entities with significant counterparty risk exposure is to actively hedge the CVA risk whilst maximising the use of market observable inputs. A CDS market implied approach uses counterparty CDS spreads, or suitable proxies, to imply a DP. As this method makes use of market CDS instruments, it can be used as a way to hedge counterparty risk and recognise P&L through the hedging strategy. Given the requirements of fair value in various accounting standards, this approach is now more common than the historical approach.

38. Implied DP can be estimated using various techniques, dependant on the counterparty:

- Market observable CDS spreads. This method requires an observable and liquid CDS market for the counterparty. Single name CDS protection can be bought to hedge counterparty risk in an amount commensurate with the exposure profile. It is worth noting that a recovery assumption has to be used along with the CDS to imply the DP.
- Market implied CDS spreads (proxy spreads). This method derives implied CDS spreads for unobservable issuers through the interpolation or extrapolation of observable CDS. The "macro surface"' method is commonly used. It is a factor model that constructs CDS spread surface as a function of credit rating and maturity. These grids can be formulated by industry sector, geography or other criteria provided sufficient data is available. This can be done by performing a regression-based analysis of a set of curves per rating derived for each region. Counterparties can then be mapped to the appropriate proxy CDS curve, based on their rating and region of domicile for the DP to be calculated. An example might be to map European Investment Grade counterparties to an appropriate iTraxx Europe index, with a weighting to represent the dispersion of the counterparties rating from the weighted average of the index, eg, if the average of the index is BBB- then a higher rated counterparty would be a multiplier greater than one multiplied by this index; these multipliers require calibration.
- Market implied risky bond or debt spreads. This method derives a credit spread from available debt instruments for an issuer that does not have an active CDS market. This is usually the case for non-investment grade or distressed names and is often used in conjunction with observable and implied CDS to formulate a macro surface for proxy spreads. It can be complex and introduces uncertainty in the form of basis risk which can be significant and must be taken into account when assessing the reliability of the

inputs. DP can be modelled using implied market data (eg, CDS spreads), adjusted or actual historical realised rates, or equity based approaches (eg, Moody's KMV's "distance to default").

39. It is important to note that historical realised rates of default are significantly less than those implied in market observable CDS spreads, eg, because they can have other drivers such as risk taking. This has implications on the calculation of CVA because hedging of CVA requires an implied view of the risks present, whereas if an entity does not plan to hedge CVA, a historical estimation approach may be feasible.

Exposures

40. Expected exposures are some of the most complex elements to model within the CVA framework due to the sheer breadth of products traded, the forward path-dependent analytics required, and the fragmented technology infrastructures often present in most financial entities. This was historically calculated as the current market value plus an entity specific add-on amount that took into account the nature of the transaction, the asset class, pricing behaviour (eg, volatility) and the time horizon. This is now generally viewed as insufficiently sophisticated for larger financial entities and one of two methods below are commonly employed:

a) Semi-analytical methods. These are more sophisticated and define specific risk factors that impact the expected exposures over the life of the trade. The expected distribution of those risk factors is then characterised using a semi-analytic expression. An example would be to model the impact of forward prices using a normal distribution and then characterising the distribution in terms of mean and standard deviation, instead of randomly selecting values from the distribution as is required for simulation based approaches. While generally viewed as being more sophisticated and useful for quick calculations, such as those required in pricing decisions, semi-analytic methods cannot typically incorporate important credit risk mitigants such as netting and collateral or factor in path dependent features such as "after the event" or exercise decisions.

b) Simulation based methods. The most sophisticated approach and generally viewed as a standard requirement for production level processing of CVA/DVA at large financial entities.

41. The most common simulation based method is the Monte Carlo. Exposure profiles can be simulated and split into a term structure of positive (used in CVA) and negative (used in DVA) exposures. The EPE term structure for each simulated exposure time can be calculated using the formula below and in practice, at least ten thousand iterations are considered a minimum.

$$EPE(t) = \frac{1}{N}\sum_{1}^{N} Max\left(\sum_{s \in NettingSet} MV_{1,t}^{s} \cdot d_t \text{ ,0}\right)$$

Where: $N =$ number of simulations;

$t =$ time;

$MV_{1,t} =$ collateral adjusted market value of each trade within netting set s at t;

$d_t =$ discount factor

42. Collateral agreements and netting rules help to reduce counterparty credit risk and affect the fair value of the portfolio under a market participant approach. This means that the degree of offset such as netting and collateral agreements between derivatives should be considered when assessing and pricing counterparty risk. Legal opinion may be needed to determine the netting set, ie, what may net within an ISDA Master Agreement. Definition of the netting set will significantly impact the level of exposure feeding into the CVA/DVA calculation. Netting set is typically aligned with legal scope ascribed to a master service agreement such as the ISDA CSA. Exposures falling within the scope of the master service agreement netting provisions would be offset to the extent feasible prior to applying DP and LGD assumptions.

43. Average Expected Exposures are the fundamental measurement of the economic exposure over the life of a specific trade or a defined group of trades (ie, “netting set”). It is important to recognise the incremental nature of the CVA and DVA; a new trade with a counterparty can therefore be risk-reducing on a portfolio basis, eg, by refinancing to extend or decrease the duration in a favourable way to the existing exposure profile with that counterparty.

44. Collateralisation of exposures represents an additional level of complexity that is best supported by simulation based methods where the market value of collateral can be offset against the calculated net exposure over the life of the trade or the netting set. To the extent that collateralisation eliminates counterparty exposure, some entities will exclude the trade population from the calculation of CVA altogether. Even under these circumstances, however, it is imperative to understand the impacts of the re-margining period and potential lack of liquidity as this may give rise to residual exposure in the close-out period. In addition, the impact of threshold levels and minimum transfer amounts need to be addressed within the expected exposure modelling framework.

45. The choice of discounting affects the exposures. Regulatory rules require these to be “risk free”, ie, excluding any counterparty risk. This has typically been done using a LIBOR-based discounting assumption, however many have since moved to OIS as a better approximation to the risk free rate. Moreover, FVA (the funding cost of the derivative) may also be considered and, if so, could impact the exposure calculation; typically by reducing the exposures as the term funding spread is now positive above LIBOR. This would mean that not only the market value of the trades change (a cost for assets and a gain for liabilities), but also the exposures feeding a CVA (and any DVA) would reduce also. There is debate about the interpretation of regulatory rules in light of FVA, given that term funding is not strictly risk free; it is implicitly dependent on liquidity and/or credit depending on how the FVA is represented. The relationship between CVA, DVA and FVA will be discussed in more detail later on.

46. Structured or exotic derivative entities may be forced to adopt a stand-alone measurement environment that combines the analytical flexibility to correctly model complex future exposures with processing power to support the large number of calculations required. In some instances simplifying assumptions may need to be employed to enable the CVA to be calculated within a realistic time scale, having regard to the purpose of the valuation and the size of the exposure relative to the total assets of the entity. Consideration may also need to be paid to establishing CVA “add-ons” or a valuation adjustment on CVA to address these modelling limitations.

Loss Given Default

47. The LGD assumption is used to estimate the expected loss in percentage terms upon default. Market assumptions for the LGD can be determined from the CDS curve as equal to one minus the recovery rate. The LGD may also take into account the type of counterparty (corporate, financial, sovereign, insurance, etc), legally enforceable terms such as seniority and break clauses/termination triggers, as well as any collateral held. It is very difficult to view LGD on an implied basis and given the relationship between credit spreads, DP and LGD, it is typically based on an assumed level that is commonly used in the industry in order to isolate the DP. These are available from credit rating agencies and an example assumption would be a 60% LGD, ie, a 40% recovery rate for corporate bonds.

48. Historical data shows that recovery rates vary significantly across industries. This level of diversity in recovery rates can be incorporated by taking into account the industry sector of the borrower and therefore assigning different levels to financials, non-financials and municipals for example.

49. Judgment may need to be used to cluster similar counterparties to reflect other things that could affect the LGD, eg, that recoveries may not be equal for bonds and OTC derivatives contracted under ISDA terms. Such judgements should be based on market data that is observable to market participants.

50. It is also important to differentiate between the implied recovery assumption used to generate the DP term structure and that used to calculate the amount recovered in default within the CVA calculation. In the first instance, this assumption is critical to the calibration of the DP term structure and due to a strong negative correlation between recovery rates and default probability, can have a significant impact on the resulting CVA. In the second instance this assumption is generally set equal to that used to determine the DP term structure, unless the observable market data used to calibrate DP is meaningfully different to the exposure to the counterparty, eg, senior debt implied spreads versus derivative exposure.

Modelling

51. There are a number of ways to calculate CVA, but they principally fall into three categories: unilateral, contingent bilateral or non-contingent bilateral.

52. Unilateral CVA is applied to the positive exposures to calculate the value of the portfolio of derivatives after adjusting it for potential counterparty default. This risky valuation is always a charge relative to a counterparty risk free valuation. An extension to this approach is to weight the positive exposures using own DP. Calculation of the DVA (ie, application to the negative exposures) is not performed.

53. Non-contingent bilateral models compute the CVA as described in the unilateral case and compute a symmetrical unilateral-style DVA in an analogous manner. In essence the CVA and DVA are calculated independently of each other (ie, there is no implicit relationship) and then added together at the end to arrive at a net impact.

54. Contingent bilateral CVA calculates a net number at each time step, based on the difference between the entity's CVA and DVA, corresponding to positive and negative exposures

respectively. Both the entity's CVA to its counterparty and the counterparty's CVA to the entity are netted for time buckets, resulting in a series of net CVA or DVA. The net amount can be positive or negative depending on whether the counterparty or the entity is most likely to default first and may take into account the order of default and the relative exposures entities have to one another. Finally, the total net CVA/DVA for the portfolio is calculated by summing (integrating) the time buckets.

55. Jump to default models are used by some entities to reflect a gapping scenario, ie, where the counterparty suffers a sharp deterioration of creditworthiness rather than the gradual decline that might be implied by an alternate model. However, these models are difficult to calibrate.

56. The models used may also include credit simulation modelling which can be used to calculate the impact of ratings downgrades on the CVA. In addition, some of the models feature collateral modelling which can be used to calculate the impact of collateral thresholds. As part of the modelling, or through additional scenarios, the effect of break clauses such as mandatory terminal clauses, mutual termination clauses and automatic termination events may be used in the CVA calculation.

57. Wrong-way-risk and right-way-risk can be classified as general or specific and may be incorporated into the relationship model framework and/or gap risk models. General wrong-way-risk can be included by introducing a relationship between the exposure and counterparty risk, for example the exposure increases as FX rates move and also the counterparty becomes more risky as it cannot export as much as it needs to stay solvent. This is done at the portfolio level. Specific wrong-way-risk arises through poorly structured transactions, for example where an entity writes put options on its own stock; this would therefore apply to specific trades.

Reconciliation

58. Depending on the modelling approach taken, it may be necessary to make additional adjustments to calibrate the CVA (and potentially the DVA) to market value. For instance, empirical market evidence may suggest that a theoretical unilateral calculation of market implied CDS may overstate the CVA. A bilateral approach may have a reducing effect on the CVA either by combining with a unilateral DVA term, scaling the probability of counterparty default by the probability of own default or truncating (or not taking at all) the CVA where probability of own default is higher than that of the counterparty. This is consistent with IVS 102 *Implementation* which encourages the use of more than one valuation approach or method, especially where there are insufficient factual or observable inputs for a single method to produce a reliable conclusion. Where more than one method is used, the resulting indications of value should be analysed and reconciled."[2]

59. In addition the CVA can be quantified in different ways, for example through the use of rating dependent weightings, related to assumed changes in the portfolio and/or LGD assumptions used, particularly in relation to proxies. It is important that whichever method is chosen that these assumptions are a reflection of the normal supply and demand driven by the effect of

[2] See IVS 102 para 7

competitively pricing and risk managing counterparty credit exposures so that a market value is achieved.

60. The adjustments may be more apparent for certain classes of counterparty that have a specific type of exposure or restrictions around their treatment, for example sovereigns, where there is some evidence that could be extrapolated to suggest that the CVA should be lower than implied from the theoretical calculation. Sovereign exposures are typically one-way, where the entity posts collateral but the sovereign does not. However, it could be argued that higher rated sovereigns should have a smaller CVA than theoretical levels would imply. Recent sovereign volatility has driven a significant amount of the volatility in CVA for banks. Some sovereigns are looking at the prospect of posting collateral to reduce their cost of funds on these one-way exposures, which would also reduce the CVA a bank would have to hold.

Scenario analysis

61. Scenario analysis is required to calculate expected exposures. This uses calibrated models to reflect potential future dynamic changes to the multiple risk factors inherent in the derivatives. The dynamics factored into modelling techniques for the purpose of scenario analysis are frequently less sophisticated, with fewer inputs and adjustments, than those used for pricing. This can result in problems with accurately modelling the risk of exotic products whose valuations can be sensitive to higher order risks and nuances which can only be captured in more sophisticated models. For example, a common approach is to use historical data for the purpose of calibrating the modelling dynamics since many volatility and relationship parameters do not have market observable data from which inputs can be obtained. Alternatively, use may be made of implied levels where they are available.

62. The scenarios for individual derivatives are generated using Monte Carlo valuation techniques. These run multiple valuations for each instrument, changing risk inputs with each of the iterations to appropriate alternative values that are identified using statistical techniques. The scenarios calculated for each derivative are then aggregated by counterparty, with the average forecast value in each future time period reflecting the EPE and ENE.

63. Some examples of particular modelling approaches for different risk types as well as some of the common limitations are provided below.

Interest rates

64. The simulation of interest rates lies at the heart of the Monte Carlo technique which is often used for the purpose of scenario modelling. The interest rate simulation is used both to determine the value of interest rate derivatives and to determine the discount factors in the valuations.

65. Forecast zero coupon interest rates at different tenors are the building blocks for constructing interest rate curves. The modelling techniques most commonly used assume that potential future interest rates are normally distributed and revert towards the current forward rate curve.

66. Common limitations include that some models assume changes in rates at different points on the interest rate curve will always move in the same direction. This can make it difficult to fully capture the risk in spread trades, eg, trades which are long in one section of the curve and

short in another section. Also, some models have difficulty anticipating negative interest rates, which although rare, are of particular interest for the CVA and DVA calculation as tail events can have significant profit and loss effects.

Equities

67. Black & Scholes based valuation tools are normally used since these are well established and widely understood. For the purpose of scenario modelling, equities will often be split into broad portfolio types, by industry or country, with equity returns simulated as one factor Brownian Motion assuming normally distributed variables. These variables are subject to “drift” to influence the random variable, taken from various sources including the dividend adjusted risk free rate. The risk free rate is the simulated interest rate in the equity’s currency.

68. The volatility input will normally mimic the historical volatility for the previous corresponding time period; eg, for the next three month period the volatility for the previous three months is used, for the next three years the volatility for the previous three years is reproduced. This is more straightforward than identifying implied volatility and is normally considered sufficient for the purpose of scenario generation for CVA.

69. Potential model limitations include that simulated equity returns are approximately log-normally distributed, but empirical research shows that the actual distribution of equity returns has higher occurrence of extreme returns, such that tail events are more important in practice than the statistical data suggests. Also the mapping of equities to certain broad portfolios such as by industry or country is a heavily simplifying assumption. Ideally more detailed economic factors would be considered that relate specifically to the entity in question. Lastly, accurate assumptions of the relationship between equities are difficult to capture, given the size of the portfolio and the high number of inter-relationships. As a result this relationship is often ignored or very approximately estimated.

Foreign Exchange

70. Scenario modelling techniques for spot FX rates are usually simulated according to a Geometric Brownian Motion (ie, FX spot returns are normally distributed). The drift factor which influences the distribution is normally equal to the difference between the spot interest rates of the two currencies in question and constant volatility. The volatility input is calibrated similar to equities, ie, against the historical time series of different lengths which correspond to the future forecast time period. The drift term of the FX process (derived from short term rates) links the FX process to interest rate models.

71. Potential model limitations include that since FX modelling is inherently linked to the underlying interest rate models, any short comings in the interest rate models carry over to the FX model. Also, the volatility calibration is often quite simplistic and tends to overestimate volatility. However, the increasingly widespread use of multifactor interest rate models, such as the Libor or Heath-Jorrow-Morton methods addresses the shortcomings on the interest rate calculation with knock-on benefits for the FX process.

Credit derivatives

72. Various techniques are used to model potential future credit spread dynamics. The short credit spread for the forthcoming three months provides the starting point for the simulation. It will often follow a mean reverting model to estimate the spread development in future periods. The volatility can be calibrated, normally to the most liquid point on the credit curve, which tends to be five years. To generate the complete credit curve the simulated short spread is extended based on the assumption that the general shape of the credit curve will not change over the life of the simulation.

73. Various methods are used to measure the impact of potential default events. A widespread approach is to use a one factor model, which indicates an entity will default when its asset values become too low, eg, a Merton model. These default thresholds are calibrated based on the historical DP for counterparties with a similar credit rating.

74. Model limitations include that where one factor models are used, since they are quite simplistic they cannot reproduce all shapes of credit curves seen historically. In particular they cannot make the long end of the curve decrease while the short end remains constant (ie, a flattening of the curve). This can make it problematic to accurately estimate the risk for trades with long dated credit exposure. Also, credit spreads and default events are only indirectly correlated rather than derived from one another so unrealistic scenarios can be generated and included in the end result, eg, where an entity defaults even though its credit spread is very low. However, it is important to note that across the market place numerous new models are under development which will go some way to addressing these shortcomings.

Monetisation and hedging DVA

75. One of the main issues with the profit and loss effect of DVA is its monetisation, which can be realised by termination of the contract or by hedging.

Termination

76. For the case of debt, a bond repurchase allows an issuer to record a capital gain if the price has fallen since issuance. It should be noted that cash will generally have to be raised to fund this repurchase, so the economic benefit may be illusory. For derivative contracts, the closest thing to repurchase is termination, either bilaterally or via novation to a third party. In theory, a sophisticated counterparty would be prepared to consent to the novation of a contract to a less risky counterparty or into a collateralised agreement, at a discount reflecting its CVA to the risky counterparty; though in practice it may be difficult to calculate this rate.

Default

77. Another way to monetise the own credit profit is by defaulting and not repaying the full liability. Although the creditor has made a loss, the defaulted debtor has not made a contractual gain as he still owes money. If the entity has unlimited legal liability, the default would not prevent the repayment of the debt. Limited liability is a specific feature of the shares that embed the right not to repay the liquidation shortfall and the entity does not benefit from the default as it has failed on its contractual obligation. In this respect, an alternative accounting convention representing liabilities at their claim value and allocating a negative equity would provide useful

information about the true economic situation of the entity and the responsibility and performance of its management.

Hedging

78. An entity can attempt to hedge its credit risk by selling self-referencing CDS, but this is not generally considered practical. So long as the transaction is sufficiently over-collateralised there should be no wrong-way-risk to the buyer, whilst, at the other extreme, the default pay-out of an uncollateralised claim will be reduced by the recovery factor. As long as the recovery is not nil, such a contract can be sold at a non-zero premium. As an alternative, entities may look to hedge the market value P&L volatility of DVA as well as they can, without matching cash flows in the event of default. Practically, CDS can be sold on a set of correlated entities, either individually or via Credit Indices. Considerable basis risk may exist between these proxies and the entity's' own credit spread, leading to reduced hedge effectiveness and significant profit and loss moves.

Governance and Controls

79. The IVS Framework states that it is a fundamental expectation (of applying the standards) that appropriate controls and procedures are in place to ensure the necessary degree of objectivity in the valuation process. The IVSs do not prescribe what constitutes appropriate controls and procedures, recognising that these will vary greatly between different valuation purposes, market structures and jurisdictional requirements.

80. IVS 250 *Financial Instruments* recognises that this can be a particular challenge when valuing financial instruments due to the fact that pricing, valuation and risk functions are integral to many entities' trading activities. IVS 250 highlights the need for an adequate control environment to minimise threats to the objectivity of valuations where these are to be relied upon by external parties, eg, for inclusion in financial statements or regulatory returns. It expounds the general principle that valuations produced by an entity's front office involved in brokerage and market making activities should be subject to scrutiny by back office operations and that ultimate authority for approving reported valuations should be separate from, and independent of, the risk taking functions.

81. The calculation of CVA/DVA is complex and in an entity such as a bank that trades and invests in significant portfolios of derivative contracts, it is likely to require input from many different parts of the entity. In a large bank there may be separate departments or functions involved in the CVA/DVA process such as trading desks, credit risk management, quantitative analytics, model validation and finance. An adequate control environment for calculating CVA/DVA for inclusion in published financial statements or for regulatory returns is likely to involve ensuring both adequate information flows between these different functions but also adequate barriers to avoid functions that have conflicting incentives having influence over the final adjustment. Banking and other financial regulators and supervisors may stipulate that an entity has specific functions or controls in place.

82. The prime responsibility for developing, maintaining, controlling and governing the model for calculating CVA/DVA will normally lie, with the group that transacts external business, which in a bank is the trading desk or front office. In an ideal situation the methodology used for pricing

CVA/DVA into new transactions will also be used with only minor adjustment for other purposes, including on-going risk management and external reporting to regulators and shareholders.

83. Non-financial entities that are not involved in the creating and trading of derivative products will not be subject to the same concerns over avoiding conflicts of interest between different activities within the organisation. However, it is important that there are appropriate systems in place to ensure that the data sources relied upon are both objective and reliable.

Practical Application

84. The extent to which the various methods and models discussed are applied in practice will vary according to the size and sophistication of an entity's holding of derivatives. The time and investment in systems to manage and calculate CVA and DVA has to be proportionate to the importance of the entity's derivative portfolio to its overall operations and financial performance. Outlined below is a series of suggested procedures for varying sizes of derivatives operations.

Entity with significant investment and regular trading of derivatives

85. CVA is calculated as a hypothetical derivative that is contingent on the default of the counterparty and the payoff a function of the expected value and the recovery rate of the impacted trades at the time of default. Depending on the asset class and product type the market simulation will follow different simulation or diffusion models.

86. Generally accepted algorithms use a Monte Carlo approach to generate stochastic paths for market variables. The portfolio EPE is calculated at the counterparty level for each generated path, taking into account netting rules and collateral agreements. Finally, in order to reflect the counterparty default, weight the paths by the DP and the interest rate.

87. The EPE to a counterparty is the market value of trades with positive positions at time t as highlighted below.

$$EPE_t = max(MV_t, 0)$$

88. Since the expected exposure is conditional upon the counterparty defaulting at time t, it should also account for the relationship between the exposure and the counterparty default time. The exposure is then adjusted for the expected recovery of the reference derivative, and the LGD is obtained.

89. It is worth highlighting that the most appropriate recovery rate for CVA is that obtained on the derivative's market value; however this can be difficult to observe and estimate. As such general practice is to use the more observable CDS or bond implied recovery rate.

90. An example of this algorithmic relationship discussed above is shown below in a simplified and discrete form.

$$CVA = \sum_{0}^{T} (1 - R_t) \cdot EPE_t \cdot DP_t$$

Where: R_t = Recovery rate at time t

91. Algorithms should also account for mechanisms to reduce counterparty risk including netting, collateral, Special Purpose Vehicles (SPVs) and CCPs. Specifically these should be accounted for in the following ways. The availability or amount of netting should be modelled at the time of default. In respect to collateral, CVA algorithms should account for specific details in the CSA agreements including thresholds, unilateral versus bilateral collateral posting, collateral call frequency or gap risk, and rating triggers. For SPV facing trades, the CVA is a function of the collateral held by the SPV and how accessible this is upon default. It is then important to reflect in the algorithm whether the credit holds a junior or a senior claim to SPV collateral.

92. In addition to the approaches outlined above for certain derivatives, calculated exposures, whether expected or current, can be replaced with a closed-form method that utilises option pricing methodology, such as the Black-Scholes formula. An example of such an algorithm is displayed below.

$$CVA = (1 - R_t) \cdot BS_{call}(K, S_t, \sigma, t) \cdot DP_t$$

Where: $K = \text{Strike price}$,
$S_t = \text{Spot price}$,
$\sigma = \text{Volatility}$,
$t = \text{Time}$

Entity with medium holding and less frequent trading of derivatives

93. When fewer transactions are conducted on a regular basis the algorithms should continue to account for netting, collateral and SPVs. However, given the very small DP the CVA on CCPs is generally considered to be equal to zero. An example algorithm would be similar to that presented previously.

$$CVA = \sum_{0}^{T} (1 - R_t) \cdot EPE_t \cdot DP_t$$

Entity with limited holding and infrequent trading of derivatives

94. Where transactions are relatively infrequent, CVA calculations can be based on spot levels of exposure or on closed-form approaches that use option pricing.

95. The spot approach utilises the current market value of positions, instead of EPEs within CVA calculations. This approach effectively takes a snapshot of today's credit risk with the implied assumption that this will not change materially in the future. An example of such an algorithm is displayed below.

$$CVA = (1 - R_t) \cdot MV \cdot DP_t$$

96. In smaller entities the option pricing approach, as detailed above, can be extended to cover more types of derivative and is relatively quick and straightforward to calculate.

Current Issues

97. There are a number of topics where there is continuing debate between academics and practitioners alike and for which it is not currently possible to identify generally accepted principles or procedures, however, some key aspects of the debate are discussed here.

    a) the cost of funding,

    b) the link between CVA, DVA and FVA, and

    c) the bilateral nature of CVA and DVA and the effect of the close-out method.

Cost of Funding

98. There are several distinctions between types of funding cost that need to be considered. FVA may be the pure funding cost or the funding basis, the difference of which is explained below.

    a) Full funding cost (aka full financing cost or all-in financing cost) is the spread at which a bank can issue debt (it can be vanilla or structured, public or private, so different costs are possible). There is a distinction between primary market and secondary market, the buyback spread from investors who need to sell may not be an exit cost.

    b) Pure funding cost is a generic cost that is not entity specific and excludes any credit risk. It could be approached by secured funding such as a covered bond. It could be the cost of term funding by an entity with no credit risk if the funding instrument was illiquid ie, difficult to sell or repo.

    c) Funding basis is the full funding cost minus pure credit risk. Pure credit risk is the cost of the likelihood that the issuer may default, excluding any general funding cost. The current debate is concerned with whether this is equivalent to the CDS spread or the full funding cost minus the pure funding cost.

99. On the asset side, the CVA is a pure counterparty credit risk. The question is whether we should add to it the pure funding cost or the full funding cost, as full funding cost plus CVA is the minimum spread at which a bank may lend without losing money progressively. It is also worth noting that in the case of liabilities FVA plus DVA is equal to the full funding cost, after eliminating any double counting.

100. The impact of the funding cost on assets is dependent on whether finance can be secured against the asset itself via the repo (repurchase agreement) market, or through general bank borrowing. In the latter case, the value of the asset will depend upon the cost at which a party can borrow, which may vary among peers. This could lead to different asset values and contradict the definition of fair value.

101. Derivative assets cannot be the underlying of a repo as a master agreement specifies that derivative assets can only serve as collateral for derivative liabilities (that arise through the netting agreement). Therefore derivative assets cannot be brought as collateral to a counterparty to provide funding.

Link between CVA, DVA and FVA

102. Derivatives can be both assets and liabilities. A highly out of the money derivative behaves like a liability and as such it is reasonable that it would have a comparable value to that of a debt instrument. In particular, the own credit adjustment and funding cost that are relevant to debt can also apply to derivatives as DVA and FVA. There is currently considerable debate as to how the cost of funding can be taken into account in the valuation of derivatives, and no consensus has yet been reached.

103. The interaction between DVA and FVA is complex. DVA can be seen as the pure credit component and FVA as a pure funding component that would exist if there was no credit risk. By measuring DVA and FVA separately there is a risk of double-counting the same economic effect.

104. Although debate is on-going, some entities have moved to incorporating FVA in the valuations prepared for inclusion in financial statements. In so doing, a number of practical decisions need to be made, including:

- Whether to use the entity's own curve for assets and liabilities, a counterparty's curve, or a blended curve that is reflective of the industry cost-of-funds.
- Whether to calibrate that curve to primary issuance, secondary trading, CDS or an internal assessment of funding levels.
- Whether the full contractual maturity of the derivative should be used in any calculation or if an expected holding period should be used instead, and if so, how to calculate the latter.

105. FVA affects both assets and liabilities and therefore when applied to derivatives it will affect both the EPE and ENE. The EPE position may attract both a CVA and FVA. What is debatable is whether the full funding cost is also allocated to EPE/ENE in addition to CVA/DVA. This would make the asset value dependent on both the counterparty credit risk and our own credit risk. This negates the principle that the value of an asset should not depend on the credit quality of the holder of this asset. However, assets that are not easily transferable or cannot be funded using them as collateral (rehypothecable) need to be funded by the liabilities of the holder with its full funding cost. As derivatives are neither freely transferable (this would require the agreement of the counterparty) nor rehypothecable (derivative assets are encumbered by derivative liabilities through the MNA and cannot be given as collateral to a third party). Therefore the valuation of derivative assets could depend on the total cost of funding including own credit risk component.

Close-out method

106. Due to the bilateral nature of derivatives, CVA and DVA are interlinked and do not exist in isolation. Dependant on how a portfolio is valued at the time of default, the choice of close-out method will affect the magnitude of CVA and DVA.

107. The simplest approach is to only measure CVA and ignore own credit risk by removing DVA. This is known as the unilateral CVA method. One drawback is that it can be difficult for two

entities to agree on a single value of a financial instrument at inception, eg, with a swap, as it is unlikely one counterparty will view the other as credit risk free.

108. Another approach is the symmetric method which measures CVA assuming that the first party cannot default and then independently measures DVA assuming that the counterparty cannot default. This approach is simple but not economically consistent as CVA and DVA are measured under different hypotheses that cannot coexist. Such an approach allocates value to the event of successive defaults of the two counterparties, each having liabilities at the time of default (this assumes a change of sign in the value of the derivative portfolio between the two default times). The problem is that the claim on first default excludes any possibility of a future claim by the other party on a subsequent default.

109. The bilateral method requires a simultaneous measure of CVA and DVA. The bilateral contingent method assumes that after the first default, all contracts are valued as if there were no subsequent credit risk, ie, risk free valuation after the first default. This method reduces the amounts of CVA because they are weighted by the survival probability of the entity and a symmetric effect applies to DVA. This method is known as the risk free close-out method.

110. This bilateral method raises issues because it assumes that if a party defaults on an asset, it will be able to transfer it, assuming that the other counterparty is default free, which is not correct in practice. It has the consequence that a pure asset (exposure that has always a positive value) would have a value depending on the holder of the asset, increasing its value when the holder DP increases. A second issue is that this method is very sensitive to the relationship between the defaults of the counterparties, and the order in which these can occur plays a critical role.

111. More sophisticated methods take the remaining credit risk after the first default into account and may even consider the credit risk of a new party to which the rights and obligation of the defaulted party have been assigned.

112. There is currently no consensus as to which of the methods is the most appropriate, as all have weaknesses and this area is the subject of extensive research.

CVA and DVA in Financial Reporting

113. Accounting standards which require fair value measurements of derivative instruments may have specific stipulations with regard to CVA and DVA. As elsewhere in the IVSs this paper references the requirements of IFRS, but other standards may be applicable. IVS 300 Valuations for Financial Reporting contains requirements for valuations produced for financial reporting and guidance on common valuation requirements under the IFRSs. This paper focuses only on requirements of IFRS 13 that are of particular relevance to the measurement of CVA and DVA.

114. IFRS 13 Fair Value Measurement is the result of a joint project undertaken by the International Accounting Standards Board (IASB) and the USA national accounting standard setter, the Financial Accounting Standards Board (FASB). IFRS 13 came into effect in 2013 and explains how to measure fair value for financial reporting under IFRS. It does not require fair value measurements in addition to those already required or permitted by other IFRSs and is not

intended to establish valuation standards or affect valuation practices outside financial reporting. IFRS 9 requires many financial assets and all financial liabilities under derivative contracts to be measured at fair value.

115. IFRS 13 states that the fair value of a liability reflects the effect of non-performance risk. Non-performance risk includes, but may not be limited to, an entity's own credit risk. Although IFRS 13 does not use the term DVA, the requirement to consider the entity's own credit risk when valuing any liability means that the fair value of a derivative has to include an appropriate DVA.

116. This requirement is consistent with the requirement for entities holding those obligations as assets to consider the effect of the entity's credit risks and other risk factors when pricing those assets. IFRS 13 includes the assumption that the credit risk incorporated in the valuation of a liability should reflect a hypothetical transfer price involving a market participant of equal credit standing to the entity on the measurement date.

117. Some consider there is an apparent conflict between the requirement to reflect own credit risk when measuring the fair value of liabilities under a derivative and the requirement elsewhere in IFRS 13 for fair value to reflect the exit price in the principal market for the derivative liability. The market participants for OTC derivatives are likely to be dealers and it is questioned why non-performance risk can be assumed to be unchanged, particularly where the entity exiting a contract is below investment grade.

118. However, the IASB concluded that an entity's own credit risk would affect the pricing of its liability because:

- a creditor would not generally permit the entity to transfer its obligation to another party of lower credit standing without reflecting that change in the price of the obligation;
- a transferee of higher credit standing would not be willing to assume the obligation using the same terms negotiated by a transferor whose credit standing is lower.[3]

119. While fair value as defined in IFRS 13 is based on the assumption of a market transaction and therefore is generally consistent with the definition of market value in the IVSs, it is intended as an accounting measure that can be applied consistently across different accounting standards, is compatible with requirements in other standards and that can be applied by a wide range of different types of entity. IFRS 13 fair value does therefore require some assumptions and hypotheses that might not be applicable when estimating market value for a purpose other than financial reporting.[4]

CVA and DVA in Regulatory Capital

120. This paper only references the requirements in the Third Basel Accord (Basel III) agreed by the Basel Committee on Banking Supervision in 2010 - 11. Basel III is implemented through legislation or regulation in each jurisdiction where it is adopted which may contain additional requirements that are not referenced in this paper.

[3] IFRS 13 BC 94
[4] See also IVS 300 G3

121. Basel III introduced a specific requirement for a capital charge for potential losses due to risks associated with deterioration in the credit worthiness of a counterparty ie, a CVA. The methods for calculating this charge are set out in the Accord and differ depending on whether a bank has regulatory approval for using the internal model method for risk management or not.

122. The Basel Committee does not consider it appropriate that own credit adjustments (DVA) should be reflected in calculating a bank's common equity as part of its required capital. If a bank's credit rating has declined, the application of a DVA to its liabilities would reduce the value of those liabilities and therefore increase its equity. However, as the creditors' claims have not reduced in size the increase in common equity has not improved the bank's solvency or created a capital buffer that protects the creditors.

123. Basel III para 75 requires banks to "de-recognise in the calculation of Common Equity Tier 1 all unrealised gains and losses that have resulted from changes in the fair value of liabilities that are due to changes in the bank's own credit risk"[5]. This means that any DVA reflected in the fair value of liabilities included on the bank's balance sheet has to be disregarded when valuing those instruments for regulatory capital purposes under Basel III.

[5] © Basel Committee on Banking Supervision

Appendix

Glossary of Acronyms

CCDS	Contingent Credit Default Swap
CCP	Central Counterparty
CDS	Credit Default Swap
CSA	Credit Support Annex
CVA	Credit Valuation Adjustment
DP	Default Probability
DVA	Debit Valuation Adjustment
ENE	Expected Negative Exposure
EPE	Expected Positive Exposure
FASB	Financial Accounting Standards Board
FVA	Funding Valuation Adjustment
FX	Foreign Exchange
IASB	International Accounting Standards Board
IFRS	International Financial Reporting Standards
ISDA	International Swaps and Derivatives Association
IVS	International Valuation Standards
LGD	Loss Given Default
LIBOR	London Interbank Offered Rate
MNA	Master Netting Agreement
OTC	Over The Counter
SPV	Special Purpose Vehicle
TIP	Technical Information Paper
US GAAP	US Generally Accepted Accounting Principles