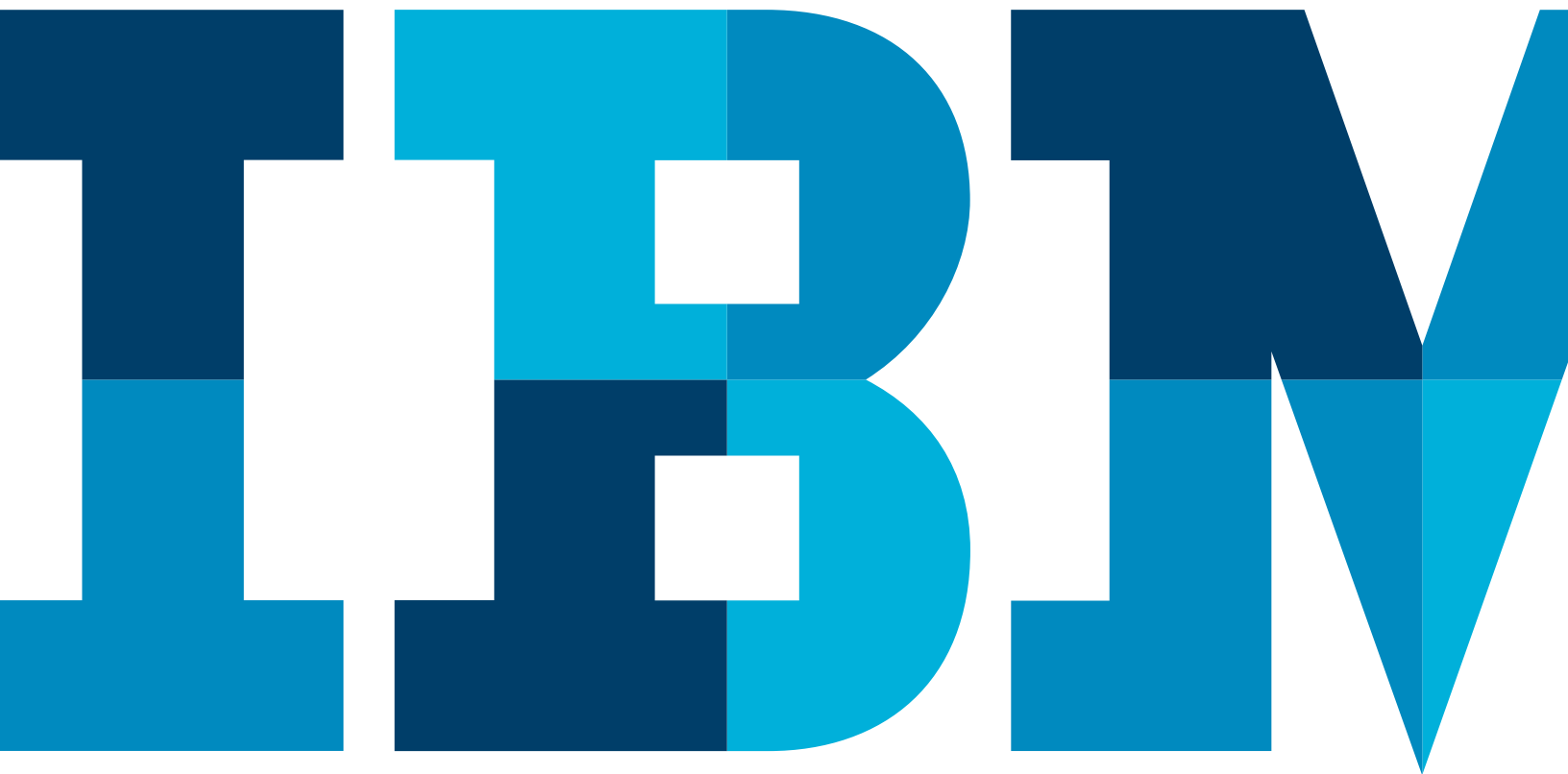


The optimization of everything: OTC derivatives, counterparty credit risk and funding



The global financial crisis has created much excitement over counterparty credit risk (CCR) and, in recognition of this, banks have been improving their practices around CCR. In particular, the use of credit value adjustment (CVA) to facilitate pricing and management of CCR has increased significantly. Indeed, many banks have CVA desks that are responsible for pricing and managing CVA across trading functions. In addition to CVA, debt value adjustment (DVA) is often used as recognition of the “benefit” arising from one’s own default and funding aspects may be considered via funding value adjustment (FVA). Also, the impact that collateral has on CVA, DVA and FVA is important to quantify. Finally, there is a need to consider the impact of the funding requirements and systemic risk when trading with central counterparties (CCPs).

The dynamics of trading OTC derivatives is becoming increasingly driven by the components mentioned above. Such a trend can only grow as regulation arising from Basel III creates the need for significantly increased amounts of capital to be held against CCR. It therefore seems likely that banks will not only invest significantly in building knowledge around the aforementioned concepts, but will also optimize their trading decisions. For example, should one trade through a CCP or not? Is it preferable to trade with a counterparty via a 2-way collateral agreement (CSA)? Should we collateralize via cash or other securities? What currency should I post cash collateral in?

There are a number of considerations around optimizing OTC derivatives trading with respect to CCR, funding, and systemic risk. From the point of view of a bank, an OTC derivative transaction depends very much on the type of counterparty to the trade. Many unsophisticated users of OTC derivatives will not post collateral against positions while more sophisticated users will post collateral or trade through a central counterparty. This creates a wide spectrum of behavior with respect to CCR and funding aspects that we will discuss. A bank then has the issue of determining how best to optimize their trading across this spectrum.

The impact of regulation

The Basel III rules will be phased in from the beginning of 2013 and will force banks to hold a lot more equity capital, much of which is due to CCR requirements. Ballpark estimates are that most large banks will have to more than triple the amount of equity held compared with pre-crisis. Loopholes to reduce capital requirements, such as off balance-sheet entities, are being closed. A trillion dollars or so of extra equity will need to be raised by American banks by the end of the implementation of Basel III (2019) with European banks needing to raise a similar figure. Basel III will have a profound effect on banking patterns. The changes tend to make all banking activities more expensive, in particular exposures held in the trading book.

Under Basel III, the changes around CCR (that will apply to banks from 1 January 2013) are particularly significant and include:

- Stressed Expected Positive Exposure (EPE). Banks which have permission to use the internal models method (IMM) must calculate exposures using data that includes a period of stressed marketplace conditions, if this is higher than the standard calculation.
- Wrong-way risk. Banks must identify exposures that give rise to a greater degree of “general” wrong-way risk and must assume a higher exposure for transactions with “specific” wrong-way risk.
- Systemic risk. Banks must apply a correlation multiplier of 1.25 to all exposures to regulated financial firms with assets of at least \$100 billion and to all exposures to unregulated financial firms.
- Collateral. A “margin period of risk” of 20 days must be applied for transactions where netting sets are large (i.e., over 5,000 trades), have illiquid collateral, or represent hard-to-replace derivatives. The current time frame on such transaction is 5-10 days. No benefit can be achieved from downgrade triggers (e.g., receiving more collateral if the rating of a counterparty deteriorates). In addition, additional haircuts for certain securities and the liquidity coverage ratio

will limit the amount of rehypothecation (reuse of collateral) and encourage the use of cash collateral. This ratio aims to ensure that a bank maintains an adequate level of unencumbered, high-quality liquid assets that can be converted into cash to meet its liquidity needs.

- CVA VAR. Banks must hold additional capital to capture the volatility of CVA. This is in addition to the current rules that capitalise default risk.
- Central counterparties. A risk weighting of 2 percent will be given to exposures to a CCP, not only via margin posted, but also via the default fund contribution that must be made. In addition, the CCP must meet various rigorous conditions, including the establishment of a high specific level of initial margin and ongoing collateral posting requirements, and that it has sufficient financial resources to withstand the default of significant participants. While this represents an increase (from zero) in capitalization of CCP exposures, it is intended to incentivise the clearing of OTC derivatives through CCPs.

Collateral and CCPs

Collateral arrangements involve parties posting cash or securities to mitigate counterparty risk, usually governed under the terms of an International Swaps and Derivatives Association (ISDA) Credit Support Annex (CSA). The typical frequency of posting is daily and the holder of collateral pays an (typically overnight) interest rate such as Eonia or Fed Funds. The use of collateral has increased steadily as the OTC derivatives market has developed. The 2010 ISDA margin survey reports that 70 percent of net exposure arising from OTC derivatives transactions is collateralized.¹ A typical CSA converts some (but not all) of the underlying CCR into funding liquidity risk.

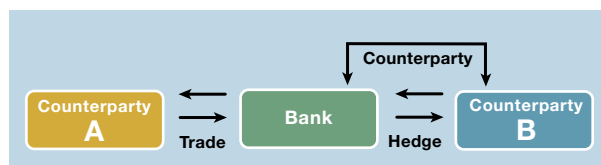


Figure 1: Illustration of the typical way in which CCR and funding are important in OTC derivatives. A bank trades without Counterparty A with no collateral arrangement, but must enter into a collateral arrangement (CSA or CPP) with the trade used as a hedge.

Despite the increased use of collateral, clearly a significant portion of OTC derivatives remain uncollateralized. This arises mainly due to the nature of the counterparties involved, such as corporates and sovereigns, without the liquidity and operational capacity to adhere to daily collateral calls. In such cases, a bank must consider the full impact of CCR and funding of the transactions in question. Since most banks aim to run mainly flat (hedged) OTC derivatives books then funding costs arise from the nature of hedging: Figure 1 illustrates a non-CSA trade being hedged via a trade done within a CSA arrangement.

When a counterparty does sign a CSA then the type of collateral is important. As Table 1 illustrates, the type of collateral must have certain characteristics to provide benefits against both CCR and funding costs. Firstly, in order to properly mitigate CCR, there must be no adverse correlation between the collateral and the credit quality of the counterparty. The posting of Russian government bonds by Long-Term Capital Management (LTCM) was a real life illustration of the dangers of this form of wrong-way risk.² Secondly, for collateral to provide benefit against funding costs, then it must be usable (since the economic ownership remains with the collateral giver) via rehypothecation which means it can be posted as collateral or pledged via repo.

		Is collateral in cash or can be rehypothecated?	
		YES	NO
Is collateral subject to adverse correlation?	YES	Funding benefit only	No benefit
	NO	CVA and funding benefit	CVA benefit only

Table 1: Impact of collateral type on CCR and funding.

Collateral in securities that cannot be rehypothecated reduces CCR, but does not provide a funding benefit. A sovereign posting their own debt in a CSA (as discussed recently when both Ireland and Portugal agreed to sign CSAs with some counterparties) would give the opposite effect, i.e., providing a funding benefit, but not satisfactorily reducing CCR. Clearly cash collateral provides benefit against both CCR and funding.

Collateral posting through CSAs is becoming more widespread and streamlined (e.g., more cash usage), but there is another force that will create even more funding requirements for CCR. The Financial Crisis that developed from 2007 onwards suggested that better ways of controlling CCR needed to be found. Policymakers have identified the widespread adoption of central clearing of OTC derivatives as one means of achieving this. Legislation such as the Dodd-Frank Wall Street Reform and Consumer Protection Act (passed by the US Congress in 2010) and the new European Market Infrastructure Regulation (EMIR) mandate that certain OTC derivatives transactions be centrally cleared through CCPs.

CCPs must have strong risk management practices to help ensure that they can come close to their perceived role as being a panacea for CCR. In order to facilitate this, OTC derivatives clearing will focus on liquid, standardized products. From a collateral point of view, a CCP will go much further than the typical terms in a CSA. Most notably, CCPs require “initial margin” which is effectively an overcollateralization to provide a buffer against potential close-out costs if a CCP member defaults. Further to this, CCPs will generally require more frequent collateral posting (intra-daily in some cases) and require more liquid collateral (cash only in many cases). Finally, CCPs will be able to essentially change collateral rules at will (equivalent to re-writing a CSA without a counterparty’s consent) such as was recently observed when European clearing house LCH.Clearnet doubled its margin requirement on Irish government bonds.³

The spectrum of OTC derivatives trading

Figure 2 illustrates the different collateral arrangements that can be present when trading an OTC derivative, ordered by their increasing impact in reducing CVA. Generally, two trends are important. Firstly, the ability of a bank to receive collateral. This is most limited with a 1-way CSA against the bank (since they must post and not receive collateral) and is at a maximum with a 2-way CSA. The impact of collateral when the transaction is centrally cleared is not as beneficial due to the

need to post initial margin. However, since CCPs are supposed to be of excellent credit quality (or too-big-to-fail) then central clearing may be viewed by many as providing the maximum reduction of CVA. Indeed, it is unlikely that the CVA to a central counterparty will even be quantified.

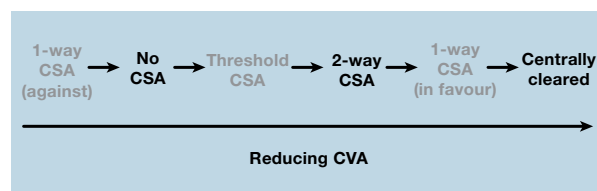


Figure 2: Illustration of the various collateral terms when trading an OTC derivative.

There are significant factors to be considered between the main ways in which OTC derivatives may be traded, namely with no CSA, a 2-way CSA and via central clearing (Figure 3). CVA is most significant when there is no CSA and least significant under central clearing (assuming the default remoteness of the CCP). DVA, being the opposite of CVA, shows the reverse trend (most beneficial with no CSA and least beneficial under central clearing due to initial margin). Funding is least problematic with no CSA and becomes increasing intensive under a CSA (collateral) and central clearing (over collateralization). The assumption that CSA trades are more funding intensive is based on the understanding that a completely uncollateralized book of OTC derivatives would require no funding, but a fully collateralized book would require funding even if perfectly hedged, due to the mismatch between receiving and posting collateral. Finally, capital charges will be highest for uncollateralized trades while benefit can be achieved for collateralized trades and the requirements are smallest for centrally cleared trades.

	Uncollateralized No CSA	Collateralized 2-way CSA	Overcollateralized CCP
CVA	←		→
DVA		←	→
Funding		←	→
Regulatory Capital charge	←		→

Figure 3: Illustration of the impact of various factors on different OTC derivative trading arrangements. The arrows denote the relative increasing cost (or benefit reduction) of each factor. For example, CVA is largest in the No CSA case and smallest under central clearing.

From Figure 3 we can see that there is a balance that does not lead to one form of trading being obviously most beneficial. Uncollateralized trades generally have the best funding and DVA situation, can be the most expensive in terms of CVA and regulatory capital charges. Centrally cleared transactions have the smallest CVA and regulatory capital charges, but costly funding and no benefit from DVA. CSA trades are intermediate in virtually all senses. It is therefore not clear what is the most beneficial trading arrangement for a bank. Furthermore, there are some additional points within each category that should be considered:

- Uncollateralized trades. The advantage of uncollateralized trades is that the main issue is CVA (and the associated regulatory capital charges) which a bank can attempt to quantify and manage. This makes it most straightforward to identify the cost of trading at inception and incorporate this into prices. However, CVA hedging is far from trivial as, under Basel III, capital relief is not achieved on market risk hedges and only a limited relief is given for credit index hedging (commonly a single-name CDS market does not exist for the counterparty in question).
- CSA trades. A CSA has the impact of converting CVA into funding and liquidity costs. These are more opaque and may be harder to quantify than CVA. This has an obvious negative impact as costs are harder to define at inception, but may have a positive effect that such opaque risks are by their nature less well capitalized and regulatory capital is therefore lower. Another important aspect to look at is the “cheapest-to-deliver” collateral. The cost of posting collateral is the difference between the funding of that collateral and the return paid under the CSA (normally the overnight indexed swap rate). Multi-currency CSAs give optionality over collateral posting and with the differences between the major rates significant, choosing the best collateral is important. This is consistent with the change of derivatives valuation to be based on the cheapest-to-deliver collateral: that since a rational counterparty will almost always deliver the cheapest collateral then the implicit assumption that one’s counterparty will act in the same way is made.
- Centrally cleared trades. In addition to the considerations mentioned above for CSA trades, CCP trades must be assessed based on the reduced capital and initial margin requirements. CCPs also have different collateral practices, for example requiring variation margin to be posted in cash of the currency of the underlying transaction (with the relevant overnight indexed swap rate used to discount the trade). This implies a change in NPV for a book of OTC trades migrated to a CCP as the potential cheapest-to-deliver collateral terms from the CSA in question are essentially given up. For clearing members acting as intermediaries for non-clearing members and essentially providing margin lending (collateral facility), the long term cost of this must be considered.

The tools required

It is clear that there is much optimization possible in the trading of OTC derivatives contracts with respect to CCR, funding and regulatory capital. This can be seen from the activities of banks, such as a closer integration between collateral teams and trading desks. The precise optimization is clearly a huge challenge due to the complexity in defining costs associated with CCR and funding together with the cost of holding the required regulatory capital.

The next step for banks is to make sure they have the tools in place to help optimize their OTC derivatives trading as much as possible. As such, banks require sophisticated systems for quantifying and managing CVA, which should be able to also consider the related impact of DVA and FVA. There is a lot of effort in revisiting derivatives valuation (for example, using OIS discounting), which should be aligned with more efficient collateral management systems to achieve the most efficient collateral posting in each situation. Dealers are currently working with the ISDA on a more standardized CSA (so that Euro swaps would be collateralized with Euros, for example) which would lead to a decline in SCA optionality. Finally, the current capital charges and future rules defined under the new Basel III regime should be factored into virtually all trading decisions. While regulatory requirements encourage the use of collateral and CCPs, banks may not view the additional funding challenges and systemic risk that this leads to as the most preferable economic outcome.

About IBM Business Analytics

IBM Business Analytics software delivers data-driven insights that help organizations work smarter and outperform their peers. This comprehensive portfolio includes solutions for business intelligence, predictive analytics and decision management, performance management, and risk management.

Business Analytics solutions enable companies to identify and visualize trends and patterns in areas, such as customer analytics, that can have a profound effect on business performance. They can compare scenarios, anticipate potential threats and opportunities, better plan, budget and forecast resources, balance risks against expected returns and work to meet regulatory requirements. By making analytics widely available, organizations can align tactical and strategic decision-making to achieve business goals.

For further information please visit
ibm.com/business-analytics.

Request a call

To request a call or to ask a question, go to:
ibm.com/business-analytics/contactus. An IBM representative will respond to your inquiry within two business days.

Notice

The information contained in this documentation is provided for informational purposes only. Although efforts were made to verify the completeness and accuracy of the information contained in this document, it is provided “as-is” without warranty of any kind, Express or Implied. In addition, this information is based on Algorithmics’ current product plans and strategy, which are subject to change by Algorithmics without notice.

Algorithmics will not be responsible for any damages arising out of the use of, or otherwise related to, this document or any other materials. Nothing contained in this document is intended to, or shall have the effect of creating any warranty or representation from Algorithmics (or its affiliates or their suppliers and/or licensors); or altering the terms and conditions of the applicable license agreement governing the use of Algorithmics software. References in this publication to Algorithmics products or services do not imply that Algorithmics intends to make them available in all countries in which Algorithmics operates.

For any reference to an Algorithmics software program, the software program can be used to help the customer meet compliance obligations, which may be based on laws, regulations, standards or practices. Any directions, suggested usage, or guidance provided by the software program, or any related materials, does not constitute legal, accounting, or other professional advice, and the customer is cautioned to obtain its own legal or other expert counsel. The customer is solely responsible for ensuring that the customer and the customer’s activities, applications and systems comply with all applicable laws, regulations, standards and practices. Use of the software program, or any related materials, does not guarantee compliance with any law, regulation, standard or practice.

Any information regarding potential future products and/or services is intended to outline Algorithmics’ general product and service direction and it should not be relied on in making a purchasing decision. Any information mentioned regarding potential future products and services is not a commitment, promise, or legal obligation to deliver any material, code, functionality or service. Any information about potential future products and services may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for Algorithmics’ products or services remains at Algorithmics’ sole discretion.



© Copyright IBM Corporation 2013

IBM Corporation
Software Group
Route 100
Somers, NY 10589

Produced in the United States of America
March 2013

IBM, the IBM logo, Algorithmics and ibm.com are trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at ibm.com/legal/copytrade.shtml

The content in this document (including currency OR pricing references which exclude applicable taxes) is current as of the initial date of publication and may be changed by IBM at any time. Not all offerings are available in every country in which IBM operates.

The performance data and client examples cited are presented for illustrative purposes only. Actual performance results may vary depending on specific configurations and operating conditions. It is the user's responsibility to evaluate and verify the operation of any other products or programs with IBM products and programs. THE INFORMATION IN THIS DOCUMENT IS PROVIDED "AS IS" WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTY OR CONDITION OF NON-INFRINGEMENT. IBM products are warranted according to the terms and conditions of the agreements under which they are provided.

The client is responsible for ensuring compliance with laws and regulations applicable to it. IBM does not provide legal advice or represent or warrant that its services or products will ensure that the client is in compliance with any law or regulation.

- 1 "ISDA Margin Survey 2010". International Swaps and Derivatives Association, Inc. Accessed January 30, 2013. http://www.isda.org/c_and_a/pdf/isda-margin-survey-2010.pdf.
- 2 Downing, J. "Long-Term Capital Management". PRIMIA. Accessed January 30, 2013. http://prmia.org/pdf/Case_Studies/Long_Term_Capital_Management_Shory_version_April_2009.pdf
- 3 Dobson, Phil. LCH Clearnet Doubles Margin Requirement for Irish Government Bonds to 30%. Bloomberg. November 17, 2010. <http://www.bloomberg.com/news/2010-11-17/lch-clearnet-raises-margin-requirement-for-irish-bonds-to-30-of-positions.html>



Please Recycle