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WHITE PAPER

DVA – THE CASE FOR THE DEFENCE

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Introduction

The Credit Valuation Adjustment (CVA) has been part of life for some time now, but that does not mean that everybody agrees on how it should be calculated. Apart from a fair number of practical issues which need deciding in order to calculate CVA, here is one of the fundamental questions: should it be calculated on a unilateral or bilateral basis? The former takes into account only the default probability of the counterparty, whilst the latter also considers one's own default probability.

The bilateral calculation has one particular counter-intuitive effect: when your own credit spread goes up, this decreases the value of your liabilities and increases the value of your assets, so it shows as a profit. In effect, you are discounting your outgoing cash flows with a higher discount factor. But a rising credit spread indicates that the market thinks you are now riskier than before, so how can the accounting effect show a profit?

This effect understandably has some commentators up in arms. One Bloomberg article pointed out that Morgan Stanley booked USD 5.1 Billion profit due to its own widening credit spreads in fiscal 2008, only to reverse them again in 2009 as the spreads tightened, and called it an 'abomination' [1]. When the Bank of America's credit spread went up in 2011 they not only booked a USD 1.7B profit due to DVA on traded derivatives, but also a USD 4.5B profit from 'fair value adjustments' to structured liabilities, which drew some rather sarcastic comments [2].

At least most practitioners agree on the terminology: Unilateral CVA is the cost of hedging the credit risk you have on a counterparty and the Debit Valuation Adjustment (DVA) is the cost they have of hedging the credit risk they take on you. Bilateral CVA is the Unilateral CVA minus the DVA, which can, of course, be a negative number [3].

Why credit risk matters for derivatives pricing

Let us go back to the very basics for just a moment: all derivatives pricing is built on a non-arbitrage argument: any derivative is worth what it would cost to hedge it. Find the cost of a portfolio to hedge all the effects of the derivative, and you have found the value of the derivative.

Hence an option can be priced with e.g. a Black-Scholes formula, which works out how much of the underlying (stock, currency, or whatever other asset the option is on) should be held or shorted in order to create the same economic portfolio as the option. The fact that the portfolio would have to be adjusted constantly as prices vary does not change the logic that at any point in time, it is worth exactly what the option is worth and hence allows us to price the option.

By the same logic an interest rate swap (IRS) is worth the net present value of all the cash flows (for both legs) and hence at any point in time the exact yield curve(s) are all that is needed to price the IRS.

This has been accepted wisdom for a long time. But the above only takes into account the hedges due to market risk factors and OTC derivatives create not just market risk, but also credit risk. Hence the full cost of the derivative should include the cost of hedging the credit risk. Early theory of derivatives pricing ignored this, partly due to the credit risk effect being considered being very small and partly because the instruments to hedge them did not exist. Both have changed, as will be pointed out in the next section. But even without these practical considerations there is no escaping the fact that only a portfolio which hedges all effects of the derivative is the right one to use for pricing.

Some would remark at this point that there is usually even more to a derivative than market and credit risk. What about, for example, funding and liquidity risk? This is an entirely valid point. Any additional effect of the derivative should be hedged, or more precisely: the cost of the hedge should be considered in the pricing. There is considerable debate at the moment about how that should be done and even whether the funding effects are any different from the credit effects. This discussion will be left for another paper, though.

A very brief history of CVA

So how did we get here? One of the first banks to calculate CVA was Bank One Corp in the late 90s. Of course, it wasn't even called CVA back then. Bank One Corp simply adjusted the value of its OTC derivatives portfolio for the perceived credit risk of their counterparties. This did lead to an immediate result: Bank One Corp promptly got sued by the IRS. The IRS claimed that this was only a clever scheme to understate profits and hence pay less tax.

The surprising outcome was that Bank One Corp won the court case. But the victory did come with strings attached: the ruling explicitly said that if you were going to adjust the value of a transaction for the counterparty credit risk then you also had to adjust it for your own credit risk. The details can be found in [4], p. 225.

This was in no small measure due to the expert report which had been commissioned by the court. It was written by Darrel Duffie, professor at Stanford University. His report stated: "the credit risk adjustment should reflect the credit quality of both parties to the swap transaction" [5].

So from its very inception CVA was meant to be a bilateral measure, at least, as long as you were going to use it to account for the value of derivatives on the balance sheet. This principle found its way into FASB 157 which governs how OTC derivatives are accounted for in the US and the International Financial Reporting Standard 13 which is due to come into force in 2013 [6].

The impact of DVA on decision making

Accounting regulation is an important reason to calculate CVA on a bilateral basis, but a more important question is: how does it affect decision making?

Let us take a simple example. Suppose we enter into a plain vanilla interest rate swap with a counterparty. In order to make the example very straightforward we will assume that this is the only transaction we have outstanding with the counterparty and that there is no collateral agreement. At the time of the transaction both our credit spread and the counterparty's credit spread are quite low and they are almost exactly equal. The bilateral CVA will hence be close to zero, as the unilateral CVA and the DVA are both low and almost exactly cancel out.

Now assume that just after entering into the swap the counterparty's credit spread stays the same but ours goes up massively. The unilateral CVA does hence not change, as it depends only on the counterparty's spread, not on ours. But the bilateral CVA has changed significantly. In fact it will be negative now. The bilateral CVA will hence increase the value of the swap to us.

If, for whatever reason, the counterparty now wants to terminate this swap, then we would have to agree what a fair price would be to close it out now. Assuming there is no early termination option on either side, the price is the result of a negotiation. But that should not stop us from asking ourselves how we would calculate the fair price at any point.

Let's look first at the price without any CVA. Assuming interest rates did not change the swap should be 'at the money', and we should be able to terminate it without any payment being made in either direction. If the counterparty wants us to terminate the swap without any payment being made, on the grounds that we can enter into an equivalent swap with another counterparty, is that a fair deal? The answer would be no. Any other counterparty would not want to enter into a swap with us at the going swap rate. They would take the CVA they calculate on us into account as well, as, in effect, they are taking a significant credit risk on us and our credit spread is quite high in this example.

We should, in fact, require the counterparty to pay us an amount equal to the bilateral CVA. It is at that price we can enter into a replacement swap. Any other measure of the swap's value just does not provide the right decision support in case we need to close out the transaction.

Of course, we all know that closing out transactions does not happen all that often. But the least one could expect of any calculation is to supply the right decision support when such opportunities do arise. This is the single most important argument in favour of calculating CVA on a bilateral basis.

For those interested in a more rigorous treatment of swap pricing, a more detailed explanation, including the effects of CVA and DVA can be found in [7]. For the mathematically inclined, an analysis of how early termination options are affected by bilateral CVA is available in [8].

Closeout convention

An additional argument in favour of including DVA in the transaction price comes from looking in detail at what happens when a counterparty defaults. This time it is not about how long it takes to close out, that subject was addressed in another paper [9], it is about the cost of the replacement transactions. Replacing the transactions means entering into new contracts with a different counterparty, which will take into account your own default probability.

If you have a closeout netting agreement under the standard ISDA terms, then you can take the DVA amount into account when calculating the closeout price. The ISDA protocol does stipulate that the price "may take into account the creditworthiness of the Determining Party" [10]. Gregory and German have pointed out in [11] that there is still legal uncertainty around this closeout convention. Not all court rulings have honoured the principle that the DVA can be subtracted from the amount owed to the counterparty, but it seems to have worked well during recent cases such as the Lehman bankruptcy.

The effect of including the DVA in the closeout amount is to increase the amount the counterparty owes us and to decrease the amount we owe them. So this effect is always beneficial.

In [12] more theoretical arguments can be found on why DVA should be taken into account when closing out a counterparty.

Solomon's judgement

The view of a prudential regulator is very different from how a bank or even an accountant views the calculation of CVA. A prudential regulator's main concern is for a bank to be sufficiently capitalised, so it can absorb losses. But that does not mean that a CVA calculation doesn't matter for a regulator.

First of all, CVA is a source of risk in its own right, because the changing spreads will introduce more volatility in the overall profit and loss. Hence the Basel Committee decided that as CVA increases market risk, it increases the regulatory capital requirement. The calculation can be found in [13] p. 31-39. Interestingly enough the CVA used here is the unilateral CVA. Only the counterparty's spread is being taken into account, not the bank's own spread.

For DVA the proposed treatment is different: the DVA amount is quite simply to be deducted from the eligible capital. That means that any bank with rising credit spreads can book the accounting profit resulting from it, but then needs to deduct that same amount from its Tier 1 capital base, which neutralises the effect. The Basel Committee in [14] implicitly admits this rule is a bit crude, but at least it is conservative.

It is unfortunate that this treatment is different from what is now the accepted accounting practice, which does not adjust capital, but it does make sense if one keeps the prudential regulator's priorities in mind: a sufficient capital level is the main concern. One wonders how king Solomon, had he been alive now, would have judged in this case. What will need to be implemented though is the judgement of the Basel Committee, which is arguably the closest thing the modern world has to king Solomon.

First to default adjustment

An additional complexity is created by the fact that, if both parties to a trade can default, the order in which the default happens matters. Contrary to what some seem to assume, this is true even when calculating unilateral CVA.

Suppose that we buy an option from a counterparty. There is no deferred premium, and hence the counterparty does not have any exposure on us, but we have exposure on the counterparty. The CVA calculated would have to be adjusted for the fact that if we default first, the CVA from that point onwards no longer matters. You do not care about what happens after you are dead.

The size of this effect depends on the CVA calculated without the adjustment, our own default probability, and, most crucially, on the correlation between the default probabilities of us and our counterparty. If that correlation is high then the likelihood of us defaulting when the CVA is high increases. This would typically happen if we are affected by the same risk factors. In [11] an analysis can be found of the sensitivity of CVA to this correlation.

If unilateral CVA is adjusted this way, then the same has to happen for DVA. So in transactions which can have credit exposures both ways (e.g. an FX Forward, which can be in or out of the money at any point in time) the CVA would need to be adjusted for the cases where we default before the counterparty does and the DVA would need adjusting for cases when the counterparty defaults before we do.

Can it be hedged?

The sensitivity of uni- or bi-lateral CVA to market risk factors can definitely be hedged. The sensitivity of CVA to the counterparty's credit spread can be hedged as well, through the use of Credit Default Swaps (CDSs) or other credit derivatives with the counterparty as the reference entity. Matching the counterparty's exposure profile with a string of CDSs may be a fine art, and there may be other practical issues, but at least in principle a hedge can be put in place.

But can DVA be hedged? The analogy with CVA hedging would require one to sell CDS protection on one's self, which is impossible, as any potential buyer would realise that you cannot pay out after your own default. A number of 'workaround' strategies have been proposed, including the sale of protection on a highly correlated counterparty and buying back your own bonds. A paper by Antonio Castagna [15] argues why it is impossible to replicate DVA through any of these strategies. This does not, of course, change the fact that it will still be reflected in the price of the transaction.

Which banks use DVA?

Data on how many institutions actively use a DVA calculation and reflect the result in the reported value of their derivatives are still hard to find.

A survey from Fitch Solutions of different types of financial institutions (Asset Managers, Investment Banks, Securities Firms and Others) finds that only a minority currently have a DVA calculation, but some are planning to look at it in the future [16].

A survey from CAPCO covering mainly industry practitioners but also some academics states that for institutions using a basic or the standard regulatory approach to CVA only 28% calculate DVA, but for those on an advanced calculation or with regulatory approval for the credit exposure simulation over 75% do so [17].

A recent survey done by Ernst & Young of 19 major banks concludes all of them calculate CVA and that 13 of them also calculate DVA [18].

None of these surveys disclose exactly which institutions were surveyed, but the picture which emerges shows that the banks with the more sophisticated models have a DVA calculation in place already and actively use it.

Conclusion

For all counterintuitive effects DVA may have it is now a fact of life. Not only is it a regulatory requirement in many countries, but more importantly, as pointed out in section 4 above, anybody who hopes to use their derivatives pricing models for decision making will have to include it within those models, or end up making the wrong decisions.

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