As the basis between Libor and overnight index swap rates ballooned during the credit crisis, banks were forced to reassess methods for pricing collateralised and uncollateralised derivatives trades. The result is a move towards a new market standard in pricing derivatives backed by collateral.

The turmoil in financial markets over the past two-and-a-half years has led dealers to rethink the way they price trillions of dollars worth of derivatives. Since mid-2007, unprecedented volatility has caused banks to move away from discounting future derivatives cashflows using Libor. Instead, dealers now say cashflows in collateralised trades should be discounted at a relevant overnight index swap (OIS) rate, while future cashflows in uncollateralised trades should be discounted at the rate at which each bank can borrow.

It’s a significant shift. When the basis between the two benchmark rates widened during the crisis, continued discounting using far higher Libor rates would have produced swap prices that were too low. As a result, banks have had to overhaul their systems in order to price new trades properly and to revalue existing contracts. Leading dealers all claim to have completed that work, but say they still encounter lowball prices in the market – suggesting some banks have yet to make the switch and are enjoying a competitive advantage as a result. In addition, London-based clearing house LCH.Clearnet continues to calculate the present value of swap transactions using
Libor discounting. Dealers are petitioning for change, but the clearing house would need to do a significant amount of work to get up to speed.

“Banks have realised the difference between OIS and Libor is high, and it seems like it will remain very high. That is the new feature in the derivatives market over the past two years,” says Simon Wilson, head of euro swaps trading at Royal Bank of Scotland (RBS) in London.

Dealers say the discrepancy between pricing collateralised trades — those with a credit support annex (CSA) to the International Swaps and Derivatives Association master agreement — and uncollateralised trades was first spotted in the interest rate swap market. To price a swap, the dealer weighs the cashflows the counterparties have agreed to pay each other over the life of the contract. These cashflows should be discounted at the rate at which each counterparty will fund them. Prior to mid-2007, credit was easy and it was assumed all banks could borrow at Libor — an assumption that extended to the funding of cashflows in a swap, no matter how long-dated. As such, Libor was the standard discount rate for pricing purposes.

The credit crisis changed things dramatically. Capital became scarce and banks began to differentiate more between secured and unsecured borrowing — by the same token, they also began to differentiate between collateralised and uncollateralised trades. Specifically, dealers realised future cashflows in non-collateralised trades should be funded at the rate the bank’s treasury desk is able to borrow money in the market, rather than assuming Libor. The fact banks fund at different levels means there is no common benchmark for pricing uncollateralised trades (see box).

In contrast, a new standard has emerged for the pricing of collateralised trades. Collateral postings are one way in which a derivatives desk can fund its operations: instead of having to borrow the money for future cashflows in the market, the desk can use the collateral it receives from counterparties across its book. And, as collateral is posted to offset liabilities between counterparties in derivatives transactions, the desk can assume when pricing a collateralised trade it will always receive the money it is owed, even if its counterparty defaults.

At inception, most swaps tend to be at-the-market and the present value of the swap is zero. After day one in a collateralised swap, there should be daily collateral calls based on the revised value of the swap. If a party owes money under its swap contract, it must post an equivalent amount of collateral to its counterparty. CSAs stipulate that interest on collateral is paid at a relevant overnight rate — the rate in question varies depending on the currency of the collateral. Consequently, future cashflows in collateralised trades should be discounted at an OIS rate: the party that is owed money at the end of the swap will have been paying an OIS rate on the collateral it has been holding, and so the ultimate value of the cash it will receive will be the sum it is owed minus the overnight interest rate it has had to pay on this collateral.

For example, banks X and Y enter into an at-the-market swap. After one day, the present value of the swap has shifted and bank X owes bank Y $1 million. As a result, bank X will have to post $1 million worth of collateral to bank Y, which must pay bank X the relevant overnight interest rate (the federal funds rate in this example) on that collateral. If the market does not move for the rest of the swap’s life and bank Y is still owed $1 million, it will return the $1 million worth of collateral, while bank X pays bank Y the $1 million in cash it is owed. This $1 million payment has effectively been discounted at the federal funds rate, as bank Y has been paying bank X that rate on the $1 million of collateral it was holding.

“The pricing of collateralised trades needs to reflect how they are funded. A lot of collateral agreements are cash with daily calls and the rate of interest applied is OIS. OIS is the theoretically correct rate to discount trades collateralised in this way,” says Nick Hallett, director in interest rate swaps at Barclays Capital in London.

“If you had a collateralised book and made money on it, the book would always be self-funded. If the market moved, any money you made or lost on positions would automatically go into your book, and the rate of return you would have to apply to the cash for that funding would be OIS, because those are the terms of the collateral agreement,” he adds.

This revelation came out of the crisis. Prior to July 2007, Libor tended to be about 7 basis points above OIS. With the basis between the two benchmarks so small, dealers say there was a tiny economic difference when discounting at Libor or OIS. But the Libor-OIS basis began to inch up as the subprime crisis intensified. By the time Lehman Brothers collapsed in September 2008, the basis had widened to 102bp, and it peaked a month later at 366bp (see figure 1).

“Until 2007, the issue never really surfaced because the collateral people paid for the underlying portfolio wasn’t really considered a risk. Then, with credit spreads widening so dramatically, the funding of collateral was at a different level to the present value of the derivatives trade. All of a sudden, dealers needed a different way of pricing than assuming Libor-flat discounting curves,” says Jason Cohen, head of the euro swaps desk at Citi in London.

Mis-pricing

At the height of the crisis, the impact on pricing could be substantial. Things have since calmed down, with the Libor-OIS basis dropping back to a low of 7bp on December 30, 2009. Barclays Capital’s Hallett says current levels of difference between using the euro overnight index average (the OIS rate for euros) and three-month Euribor as a discount rate on par, spot-starting euro interest rate swaps is currently up to 0.65bp on the swap rate, depending on the exact tenor of the swap (with the Euribor-discounted price being lower). For off-market trades, the pricing differences can be materially greater, he says.

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So, could a bank unwittingly build up risky positions by mispricing trades? Christophe Coutte, deputy global head of flow fixed income and foreign exchange at Société Générale Corporate and Investment Banking in London, says that would depend on the volume and type of derivatives transactions the bank engages in, as well as the change in funding levels over the life of the trade.

“Lower-tier banks may be mis-pricing, but you could argue that maybe the level of volumes and types of trades they are doing should not create a serious problem. If the level of rates is unchanged for a while and you don’t have out-of-the-money trades for a very long period of time, you could say there is a sort of maximum level above which the number of additional trades you’re doing is not going to increase your risk,” he says.

The same considerations apply when re-marking legacy collateralised trades. Revaluing a portfolio at OIS rather than Libor could theoretically have an effect on a desk’s profit and loss. But again, the scale of the impact would very much depend on the balance of the derivatives book and the types of positions in it. Fredrik Gentzel, head of credit portfolio management and prime brokerage for global rates and commodities at Deutsche Bank in London, estimates the revaluation of collateralised trades could potentially have a “meaningful impact” on the profit and loss for individual trading desks, but says it is unlikely to be an issue for a bank as a whole.

The major dealers all claim to have re-marked their collateralised books appropriately. When asked whether it was necessary to absorb losses, most claim to run balanced books that mitigated the effects of re-marking – although some admit to having hedged exposure to the OIS curve prior to revaluing collateralised books. One head of swaps trading at a major US bank says the firm carried out extensive analysis of the potential risk and mark-to-market effect of revaluing trades prior to adjusting its books. The bank then executed hedges on a holistic basis for all its exposures.

“We had quite a big curve position in terms of OIS, which we hedged. If we had done nothing, we probably would have saved a little bit of money. If we had hedged when we first noticed the Libor-OIS divergence, we would have lost a lot of money versus current market levels. So, the way we hedged it was actually pretty prudent and I think we did a good job on it,” he says.

Developing the infrastructure to appropriately price new collateralised trades and revalue pre-existing contracts is complex and time-consuming. An integral part of the process is rebuilding forward curves to take into account the new discount rate. Having accurate forward curves is vital to price any off-market swap, whether it is valuing a new, non-standard tenor or re-marking legacy trades on a dealer’s book.

“You have to account for the curve you’re discounting at when you build forward rates from swap rates. You also have to use the forward rate curve to price off-market swaps,” says Vladimir Piterburg, head of quantitative research at Barclays Capital in London, who has written an article on pricing collateralised trades, which was published in the February issue of Risk (Risk February 2010, pages 97–102³).

To rebuild forward curves, most banks say they have resorted to bootstrapping techniques, although Piterburg reveals Barclays Capital developed and implemented an entirely new curve-building framework. But not all banks have grasped the nettle.

“Although I think everyone agrees this should be done, I don’t think everyone is doing it. This does require a reasonable change to people’s systems and it’s not clear over the past two years that everyone has managed to do this. Even now, you occasionally see forwards trading with dislocations: some people are still pricing these forwards as if they’re discounting at Libor, which shows we’re still in a transition period,” says Wilson at RBS.

Collateral calling

Top dealers suggest lower-tier banks may quote fresh trades with OIS discounting, but may not have overhauled their systems to be able to revalue legacy trades – a shortcoming that could have wider repercussions. Without updated systems, a dealer would be discounting existing trades with Libor, creating a discrepancy between the present values market participants use. This could cause disputes over the valuation of positions when there is a collateral call.

“We believe that, for most of the collateral calls that are going on between banks, the actual physical cash amount is still discounted at Libor. All the prices we show out for dealing are reflected on OIS, but we feel we’re more constricted by market convention for things like calculating present values for the exchange of collateral,” says the head of rates trading at a major European bank.

The head of swaps trading at a large US bank tells a slightly different story. “We used to have quite regular disputes over the correct mark-to-market when it came to collateral calls, with other dealers wanting to discount at Libor. We haven’t had one of those for around a month though, and I would be surprised if everyone was not discounting correctly in the interdealer market now,” he says.

Dealers say LCH.Clearnet will need to make changes to support the establishment of the new pricing standard. The interest on collateral posted at LCH.Clearnet is paid at OIS. However, the LCH.Clearnet systems calculate the present value of derivatives trades by discounting at Libor.

“Counterparties in general are calling collateral on Libor curves – it’s fairly inconceivable we would call collateral differently to LCH.Clearnet as we do to the interbank market,” says Wilson at RBS.
Dealers say they have approached LCH.Clearnet with the issue, which has acknowledged the industry's concerns. However, a considerable overhaul of the clearing house’s systems and models is needed. “We will seek to provide a solution to any issues in a way that is effective for us in terms of risk management, and effective for the market,” says a spokeswoman for LCH.Clearnet.

In the meantime, dealers estimate the difference between pricing at one level and calculating the exchange of collateral using another discount rate should not be overly dangerous, provided such discrepancies are monitored.

“The discrepancy will manifest itself in the fact the collateral you hold is not equal to the value of your books, so there will be a mismatch between collateral you hold and ultimately what you will get if your counterparty defaults. The other thing is this slippage of collateral versus value, which in theory has to be included in pricing. In an ideal world you should account for that, but frankly the difference is relatively small,” says Piterbarg at Barclays Capital.

Pan-asset

Adjusting discounting for collateralised trades began in rates and spread across to other derivatives desks. Many traders say some asset classes such as equities, credit and commodities have been slower to put theory into practice.

David Herzberg, global head of equity derivatives at JP Morgan in London, believes the “serious houses” are discounting collateralised trades at an OIS rate, although the task of implementing the new pricing and valuation methodologies into systems is a big challenge for less sophisticated equity derivatives players.

“My view is that few houses have actually implemented this into their systems, but probably a lot of them understand this problem now and ask the trader to adjust prices slightly. However, I doubt whether new entrants into the exotics business have carefully examined some of their more exotic, longer-dated trades, which could cause problems,” he says.

Similarly, the extent to which credit traders have overhauled systems to appropriately price collateralised trades is not clear. The London-based head of credit at a large US bank says it is difficult to gauge which dealers are discounting collateralised trades at an OIS rate rather than Libor due to the amount of other factors being considered in credit pricing at the moment.

“I think there is a market consensus it will be relevant, and that the regulation will change, but it’s certainly not the case that it’s been priced up everywhere and being traded like this. It’s probably less of an issue for short-dated trades but, if you’re pricing a relatively large 10- or 20-year trade, then I think it’s unwise to assume capital charges are going to remain the same,” he says.

www.risk.net/risk-magazine/technical-paper/1589992/funding-discounting-collateral-agreements-derivatives-pricing

Uncollateralised trades

Appropriately pricing uncollateralised trades has become a vexed issue. Having assumed for years future cashflows in non-collateralised trades could be funded at Libor, dealers now have to factor in their own cost of funding. Top banks maintain they have been aware of this for a while, but admit it’s a tough nut to crack.

“For uncollateralised derivatives transactions, the initial funding levels can be fixed with the bank’s treasury desk. However, the quantity of funding needed will change with the level of the equity market over the life of the trade. The trading desk will have to unwind or increase its funding position at a future unknown level and you can’t hedge that perfectly,” says David Herzberg, global head of equity derivatives at JP Morgan in London.

Banks’ costs of funding can vary substantially: the cost of five-year protection on Citi in the credit default swap market stood at 233.1 basis points on February 15, compared with 86.6bp for JP Morgan. “When there is a credit support annex (CSA), traders will know what type of discount curve to refer to. When there is no CSA, each trader will discount at the level where he is able to fund or the level the firm is ready to lend money to the counterparty. However, this discount price varies from bank to bank, meaning you would never be able to find the exact same price for an uncollateralised trade in the market,” says Christophe Coutte, deputy global head of flow, fixed income and foreign exchange at Société Générale Corporate and Investment Banking in London.

However, dealers say it has been difficult to pinpoint the extent to which this added cost of funding has been showing up in prices. “For the past year, it’s been very difficult to differentiate the impact of different funding levels because the biggest element of pricing volatility has been banks’ credit charge. This year, you may find that the noise on credit is less and therefore the funding impact becomes more visible,” says Clive Banks, head of corporate derivatives marketing at BNP Paribas in London.

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Coutte suggests some banks are not fully factoring their cost of funding into each non-collateralised trade, instead opting to tackle the issue on a more holistic basis. “Many players have made the choice to hedge the funding gap scenario at the portfolio level instead of the individual trade level. In a flow model, the global approach of the derivatives portfolio seems more appropriate and less costly. When your funding gap starts to widen at the portfolio level, you physically borrow from your treasury department to reduce or close this gap,” he says.

CSA complications

In the interdealer market, the International Swaps and Derivatives Association’s credit support annex (CSA) normally allows counterparties to post cash collateral or government bonds from Group of Seven nations – assets dealers say are treated as cash for discounting purposes. The currency of the collateral should determine which overnight interest rate is used: euros at the euro overnight index average (Eonia), sterling at the sterling overnight index average or US dollars at the federal funds rate, for example.

As the currency of the collateral can vary, dealers say the collateralised book gets divided into different buckets. For example, counterparties with CSAs that only allow US dollars to be posted will go into the federal funds rate bucket, while those that only permit the posting of euros will go into the Eonia bucket.

Things start to get complicated when there is optionality in the currency of collateral that can be posted. This is often the case in CSAs between European and US banks, which tend to allow collateral postings in US dollar cash and euro cash, as well as the equivalent currency’s government bonds. For a UK bank, this would probably include sterling cash and UK government bonds as well. Pricing in this kind of optionality is complex, and dealers disagree on the best method for doing so.

“Technically, to price that you should assume the counterparty is going to post the collateral that is economically the most beneficial to them once they have taken into account the cost of funding that collateral and any interest that may be applied to that collateral,” says Nick Hallett, director in interest rate swaps at Barclays Capital in London.

Fredrik Gentzel, head of credit portfolio management and prime brokerage for global rates and commodities at Deutsche Bank in London, disagrees. He says some market participants may not post collateral efficiently and thinks looking at what collateral a counterparty has historically posted can be a meaningful consideration. Others say dealers should assume the cheapest type of collateral will be posted.

“It might not always be the most efficient way of doing it, but you would assume the counterparty is going to use whichever collateral is cheapest to post,” says Christophe Coutte, deputy global head of flow fixed income and foreign exchange at Société Générale Corporate and Investment Banking in London.

Many traders claim pricing in optionality is more fine-tuning than a crucial component of the discounting methodology. However, such considerations around multi-currency CSAs could prove important for longer-dated trades, dealers say. Further complications arise when CSAs incorporate thresholds or only call for one of the two counterparties to post collateral. As a result, dealers are hoping for greater standardisation in collateral agreements.

“This focus will see people pressing for simpler collateral agreements. In the past, people agreed a wide variety of collateral agreements because the focus was on the credit protection provided by the collateral, not on the funding costs or benefits provided by that collateral. Now, there is a lot of pressure for standardisation,” says Hallett.