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Margin Requirements for Non-cleared Derivatives

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Abstract

The advent of mandatory daily initial margin (IM) and variation margin (VM) requirements for non-cleared over-the-counter (OTC) derivatives transactions has raised many questions regarding the methodology that should be used for computing these margin requirements. Regulatory guidelines require IM levels for non-cleared contracts to cover a 99% loss quantile of the netting set over a horizon of 10 days, as opposed to 3 to 5 days for cleared OTC contracts. We discuss some features of the proposed framework for bilateral margin requirements and advocate an approach that better reflects the actual exposure during closeout in case of the default of a counterparty.

We argue that the liquidation horizon should depend on the size of the position relative to the market depth of the asset. This may be achieved by specifying a minimum liquidation horizon for each asset class associated with an asset-specific size threshold, and scaling the liquidation horizon linearly with position size beyond this threshold. A size-dependent liquidation horizon leads to a liquidity sensitive IM, which penalizes large concentrated positions without requiring any 'liquidity add-on'.

We also argue that the IM calculation needs to account for the fact that market participants hedge their exposures to the defaulted counterparty once default has been confirmed. As a result, IM should not be based on the exposure of the initial position over the entire liquidation horizon, but on the exposure over the initial period required to set up the hedge, plus the exposure to the hedged position over the remainder of the liquidation horizon.

Based on these observations, we propose a 'four-step approach' for the calculation of IM for OTC derivatives transactions. We argue that this approach yields a more realistic assessment of closeout risk for non-cleared transactions.

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1. Introduction

1.1 The advent of margin requirements for non-cleared derivatives

Following the 2007-2008 financial crisis, in particular the spectacular failure of AIG, mitigating the counterparty risk potentially associated with OTC derivatives has become a singular focus of regulators and has been one of the driving motivations behind many of the financial reforms introduced in the recent years, as formulated in the Pittsburgh G20 agenda for financial reform.[2] Following the introduction of clearing mandates for a large set of standardized OTC derivatives and higher capital requirements for non-cleared derivatives in the Basel 3 framework, regulators have followed up recently with the introduction of margin requirements for non-cleared OTC derivatives.

The new framework, described in (BCBS-IOSCO, 2015), mandates the use of VM and IM for all non-cleared OTC derivatives. In addition to daily posting of VM, both counterparties in a transaction are required to calculate IM on a daily basis at a netting set level and post it to a segregated account. While the use of VM for OTC transactions has been already fairly commonplace, although not universal, two-way posting of IM requirements represents a change in market practice for non-cleared derivatives, which previously involved either no IM or at most a one-way posting of collateral. Indeed, AIG, despite having sold protection through credit default swaps (CDS) on more than $410 billion notional of super-senior tranches of mortgage-backed securities (Stulz, 2010), was not required to post IM to its counterparties.

In providing guidelines for calculating IM levels for non-cleared contracts, regulators have adopted as a benchmark an approach used by some central counterparties (CCPs), which determines IM levels based on the market risk exposure of the position, defined as a 99% value-at-risk (VaR) over a fixed liquidation horizon that depends on the asset class. Regulatory guidelines (BCBS-IOSCO, 2015; CFTC, 2016) recommend the use of a 10-day horizon for non-cleared derivatives, as opposed to 3 or 5 days for cleared OTC contracts, based on a perceived higher risk of non-cleared transactions.

Given the large outstanding notional volume of non-cleared derivatives, the IM requirements implied by the new framework represent a substantial amount of collateral and may have considerable impact on the liquidity resources of market participants. The details of the proposed margin

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[2] https://g20.org/wp-content/uploads/2014/12/Pittsburgh_Declaration_0.pdf

framework for non-cleared derivatives have therefore attracted scrutiny and merit a closer examination.

1.2 Outline

This report examines some aspects of the regulatory proposal for non-cleared margin requirements, in particular regarding its adequacy for the intended purpose, which is to cover potential losses arising from counterparty risk in non-cleared transactions.

After a brief overview of the regulatory guidelines on margin requirements for non-cleared derivatives (Section 2), we discuss, in Section 3, the choice of the liquidation horizon. We argue that using a fixed liquidation horizon does not take into account either the liquidity characteristics of the assets or the size of the position: it leads to an underestimation of collateral requirements for participants with large concentrated positions, while overestimating such requirements for portfolios with small positions.

We argue that the liquidation horizon should depend on the size of the position relative to the market depth of the asset. This may be achieved by specifying a minimum liquidation horizon for each asset class associated with an asset-specific size threshold, and scaling the liquidation horizon linearly with position size beyond this threshold (Section 3.3). Adopting such a size-dependent liquidation horizon leads to a liquidity sensitive IM, which differentiates between positions with similar market risk but varying liquidity risk and penalizes large concentrated positions without requiring any 'liquidity add-on' (Section 3.4).

Section 4 discusses the calculation of exposures over the horizon. We argue that the IM calculation needs to account for the fact that market participants hedge their exposures to the defaulted counterparty once default has been confirmed. As a result, IM should not be based on the exposure of the initial position over the entire liquidation horizon, but rather the exposure over an initial period of 2-3 days required to set up the hedge plus the exposure to the hedged position over the remainder of the liquidation horizon.

Based on these observations, we propose in Section 5 a 'four-step approach' for the calculation of IM. We argue that this approach yields a more realistic assessment of closeout risk for non-cleared transactions, whose outcome may be quite different from the risk exposure of the netting set over the liquidation horizon.

2. Margin for non-cleared derivatives: regulatory guidelines

The BCBS-IOSCO guidelines (BCBS-IOSCO, 2015) define the IM requirement as an amount that "covers potential future exposure for the expected time between the last VM exchange and the liquidation of positions on the default of a counterparty". It is further specified that the calculation of this potential future exposure "should reflect an extreme but plausible estimate of an increase in the value of the instrument that is consistent with a one-tailed 99% confidence interval over a 10-day horizon, based on historical data that incorporates a period of significant financial stress".

The guidelines propose two methods for computing IM requirements for non-cleared derivatives. The first method, called the *standard schedule* approach, computes IM proportionally to the notional size of the contract, applying pre-calibrated weights linked to the type and maturity of each asset. These weights represent conservative estimates for the 10-day 99% loss quantile for a directional position in a typical index in each asset class.

Regardless of how these weights have been calibrated, such an approach is clearly not risk-sensitive: it does not properly account for netting and hedging effects, nor does it distinguish between an at-the-money option from a deep out-of-the-money one. It therefore typically leads to an overestimation of margin requirements and, more importantly, as the level of IM does not vary proportionally with any reasonable risk measure of the position, it does not provide the correct risk management incentives to the counterparties. Presumably, its main purpose is to serve as a (costly) fallback option and motivate market participants to use the alternative *internal model* approach.

The internal model approach requires using a quantitative model for the risk factors affecting the positions, in order to estimate the 99th percentile of the 10-day potential future exposure to the counterparty across the netting set. ISDA has introduced the Standard Initial Margin Model (ISDA SIMM) for non-cleared derivatives, a sensitivity-based approach that defines the risk profile of a position in terms of its sensitivities ('delta', 'vega' and curvature) to a set of risk factors that cover different asset classes, tenors and maturities and computes the IM as a sum of the corresponding risk contributions (ISDA, 2014). However, market participants are free to use other approaches – for example, approaches based on full valuation rather than sensitivities – subject to validation and backtesting by regulators (see e.g. CFTC, 2016).

Although the choice of the internal model is left to market participants, the horizon of the calculation, sometimes designated as the margin period of risk (MPOR), is not: it is fixed to 10 days, which is twice the horizon used for centrally cleared swap contracts (5 days). The rationale for this choice can be traced back to the minimum risk horizon of 10 days used in the Fundamental

Review of the Trading Book (FRTB) guidelines (BCBS, 2014) for the determination of bank capital requirements. As explicitly stated in the CFTC final rules: "To the extent that related capital rules which also mitigate counterparty credit risk similarly require a 10-day close-out period assumption, the Commission's view is that a 10-day close-out period assumption for margin purposes is appropriate." [3] It is noteworthy that the referenced capital rules do not offer a rationale for the choice of a 10-day horizon.

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[3] See remarks on p. 656 and 684 in (CFTC, 2016)

3. Choice of the liquidation horizon

3.1. Is a fixed (10-day) liquidation horizon reasonable?

It is not clear on what basis a 10-day horizon corresponds to the "*expected time* between the last VM exchange and the liquidation of positions on the default of a counterparty" as stipulated in (BCBS-IOSCO, 2015). In a survey of various buy-side and sell-side market participants conducted when preparing this study, respondents noted that in the vast majority of recent default cases involving OTC derivatives, the typical time required for financial institutions to unwind or replace derivatives positions with the defaulted counterparty are of the order of 2 to 4 days, usually counting one day after the last margin payment for confirmation of the credit event. Although we are not aware of any systematic study of the closeout horizons involved in major derivatives default events, a horizon of 10 days is considered by market participants as being closer to an upper bound than a typical or 'expected' closeout time. More importantly, we shall argue below that a realistic estimate for closeout time should depend on the size of the position and liquidity of the underlying instrument.

Some regulatory documents attempt to justify the choice of a 10-day horizon. The CFTC ruling (CFTC, 2016, p. 684-685) states that:

> "[…] a 10 day close-out period is necessary to ensure that the non-defaulting party has sufficient time to close out and replace its positions in the event of counterparty default.[...] The Commission recognizes that certain swaps may not require a 10 day period to liquidate or replace and hence a 10 day close-out period may lead to excessive initial margin. However, the Commission expects that most of the instruments that could be liquidated in less than 10 days are currently being cleared, and therefore, the impact of the requisite 10 day closeout period may be limited. Moreover, the Commission believes that under market stress, these same instruments that may be replaced or liquidated in less than 10 days may not maintain that same level of liquidity."

This text raises several points that deserve discussion. First, it recognizes that "a 10 day close-out period may lead to excessive initial margin". To get an idea of the magnitude of this effect, given the simplified approach used by many market participants for estimating loss quantiles, moving from, say, a 5-day to a 10-day horizon, the same calculation method being used in both cases, would have the effect of scaling the volatility of risk factors by:

$$\sqrt{(10/5)} \approx 1.41$$

This roughly corresponds to a 40% increase in margin, which represents a substantial difference. This shows the impact of liquidation horizon on the margin level.

3.2 Why the liquidation horizon should be liquidity sensitive

The second part of the CFTC text refers to the *liquidity* of the instruments involved, implying that the increase from 5 to 10 days is due to the lower liquidity of non-cleared derivatives and that somehow centrally cleared instruments are (twice?) 'more liquid' than non-centrally cleared ones.

First, let us note that the assertion that "central clearing increases market liquidity" is not supported by empirical evidence: data on trading volumes for index and single-name CDS contracts before and after the launch of central clearing does *not* reveal any notable increase in trading volume after the introduction of central clearing for CDS post-2009 (Slive et al, 2013). In fact, CCPs increasingly recognize the wide spectrum of liquidity of the instruments they clear; major CCPs have developed liquidity add-ons for IM taking this into account for swap contracts. What the CFTC text is presumably referring to is the selection bias inherent in central clearing – i.e. that CCPs select 'more liquid' instruments for clearing. This is certainly the case, and brings us to our next point: what is relevant for the determination of the closeout period is not the market liquidity of the instrument or asset class but the liquidity (risk) of the *position* being considered.

As pointed out in (Avellaneda & Cont, 2013) and (Cont, 2015), the appropriate closeout horizon for a position depends on the size of the position *relative* to the daily trading volume or, for an OTC contract, the typical trade size. For example, if the size of the position is of the order of magnitude of a typical trade or less than, say, 10% of daily volume, it may be feasible to unwind it in a single day. On the other hand, if a market participant has accumulated a very large position in some instrument, corresponding to, say, 5 times the average daily trading volume, it may not be feasible to unwind it in 5 or even 10 days, *whether or not this instrument is cleared* by a CCP. So, the determinant of the liquidation horizon is not the 'market liquidity' of the asset viewed in isolation, but the size of the position *relative* to the market depth.

Such examples of large concentrated positions are not hypothetical and have been associated with large liquidation losses in financial institutions (see e.g. Cont & Wagalath, 2016). Our point is that the liquidation horizon should not be fixed in advance, as in the current regulatory guidelines, but should be determined by the *size of the position relative to the market depth* for the instrument, as measured, for instance, by the average daily trading volume or the typical trade size. Assuming a uniform liquidation horizon, independently of the position size, will lead to an overestimation of IM for small positions or an underestimation of IM for large, concentrated positions.

The liquidation horizon for a position should be determined by the size of the position relative to the market depth of the asset. Assuming a uniform liquidation horizon independent of the position size leads to an overestimation of IM for small positions or an underestimation of IM for large, concentrated positions.

Example 1. Consider two protection-seller CDS positions, with respective notional sizes of \$10 M and \$300 M, in the same non-cleared single-name CDS contract, whose average daily trading volume is estimated to be \$200 M notional. The \$10 M position is small (5%) compared to daily trading volume, and it is safe to assume that it can be liquidated in one day, while the second one exceeds daily trading volume and, in order to avoid market disruption, may require several days to unwind: unwinding at 10% of daily volume leads to a 15-day liquidation horizon. So, while a 10-day liquidation horizon for the \$300 M position seems too short, a reasonable liquidation horizon for the \$10 M position would be 2 days (assuming one day for confirmation of the credit event). In this example, using the same 10-day horizon for calculating IM for both positions leads to an unnecessarily large IM for the smaller position and underestimates the liquidity risk of the larger one.

This example also shows that using a constant liquidation horizon, independently of position size, overestimates collateral charges for market participants with small positions, while under-collateralizing those with large concentrated positions.

3.3 Adapting liquidation horizon to position size

Having shown why a fixed liquidation horizon fails to give a correct representation of the liquidity and concentration risk, we now present a simple approach to remedy this issue (Cont, 2015).

Instead of the proposed one-size-fits-all approach of a uniform 10-day horizon for all IM calculations, regardless of position size and liquidity of the underlying instruments, the idea is to set a *floor* T_{min} for the horizon, applicable to positions with size below a threshold N_0 corresponding to a fraction of average trading volume over this horizon. For practical purposes, this floor can be set to $T_{min}=5$ days, to be in line with cleared instruments, in which case the size threshold would correspond to the position size deemed reasonable to liquidate over a 5-day period. For example, if one retains 10% of daily volume as a reasonable liquidation threshold, then for a 5-day period the size threshold N_0 corresponds to 5 x 10%=50% of average daily volume.

For positions whose size exceeds this threshold, the liquidation horizon should be scaled proportionally to position size. This yields the following liquidation horizon for a position of (notional) size N:

$$T(N) = T_{min} \max(1, \frac{N}{N_0})$$

If the netting set contains multiple positions, the liquidation horizon is then the maximum of liquidation horizons across all positions in the netting set.

This scaling of the liquidation horizon is similar in spirit to the threshold-based approach adopted in the ISDA SIMM framework for computing liquidity add-ons for large positions, although in the SIMM, the threshold is applied to the net delta per currency rather than the initial position size.

Example 2. Let us reconsider the single-name CDS contract in the example above. If we fix the floor for the liquidation horizon to be 5 days, and the threshold to be 10% of the average trading volume over this 5-day period, this amounts to a notional threshold of 5 x 0.1 x 200 M= \$100 M. Therefore, applying our approach yields that:

- For a positions with notional size N< \$100 M, we apply a 5-day liquidation horizon: T(N)=5 days;
- For positions with notional size N > \$100 M, we scale the liquidation horizon proportionally to the position size:

$$T(N) = 5 \frac{N}{100} \text{ days}$$

For instance, for a position with notional size \$240 M, this leads to a liquidation horizon of:

$$5 \frac{240}{100} = 12 \text{ days}$$

The following example illustrates why metrics of liquidity for the asset, such as trading volume or market depth, cannot be the sole basis for choosing the liquidation horizon: the horizon needs to depend on the size of the position.

Example 3. Consider two non-cleared single-name CDS contracts: A with daily trading volume of \$200 M, and B with daily trading volume of \$50 M.

Based on these numbers, most observers would argue that A is 'more liquid' than B.

Consider now two protection seller positions:

- A \$200 M notional position in A; and
- A \$20 M notional position in B.

The first position corresponds to 100% of daily trading volume. Assuming one can unwind in an orderly fashion at 10% of daily volume, it would require around 10 days to unwind. In contrast, the second position corresponds to 40% of daily volume and it is feasible to unwind in 5 days.

So here we have an example where a position in a less liquid asset requires less time to unwind. This example shows why the liquidity of the asset class is not a sufficient criterion for fixing the liquidation horizon: one must consider not just the market depth itself but the position size relative to market depth.

3.4 Margin requirements for large concentrated positions: the 3/2 rule

Using a size-dependent liquidation horizon affects how the IM level varies with the size of the position. When the liquidation horizon is fixed, as in the current regulatory guidelines, IM increase proportionally to the notional size of positions: if we multiply by 4 the size of all positions in the netting set, all loss calculations increase fourfold and the IM requirement also increases by a factor 4. In our proposed approach, this is only the case for small positions. For positions comparable or larger than the size threshold N_0, any further increase in the size of positions, say by a factor 4, has two effects:

- It scales the loss at the liquidation horizon by a factor 4.
- It scales the liquidation horizon itself by a factor 4; as explained in Section 3.1. This leads to an increase in the IM by a factor roughly equal to $\sqrt{4} = 2$.

So, overall, increasing the size of an already large position by a factor 4 will lead to an increase in IM by a factor $4\sqrt{4} = 8$.

As this example shows, for large concentrated positions, the IM is not proportional to the notional size N but to $N\sqrt{N} = N^{3/2}$. By correctly scaling the liquidation horizon, we automatically induce a penalty for large concentrated positions without requiring the introduction of any ad-hoc 'liquidity add-on' as often done in margin calculations.

Size-dependent liquidation horizon and the 3/2 rule

- Determine a minimum liquidation horizon $\mathbf{T}_{\min}$ applicable to positions with size below a threshold $\mathbf{N}_0$ corresponding to a fraction of average trading volume over this horizon.
- For positions with size above the threshold $\mathbf{N}_0$, scale the horizon proportionally to position size:

$$T(N) = T_{min} \max(1, \frac{N}{N_0})$$

- This leads, for large, concentrated positions with $N > N_0$ to an initial margin level that increases proportionally to

$$N\sqrt{N} = N^{3/2}$$

Let us stress that this scaling rule is not an ad-hoc adjustment for computing a 'liquidity add-on', as done in some current margin calculation methods. It is simply a consequence of a correct scaling of the liquidation horizon with position size.

Variants of this approach have been put to use by some derivatives CCPs for listed and OTC derivatives. It leads to more realistic liquidation horizons, IM levels that scale properly with position size and naturally accounts for concentration and liquidity risk without requiring additional 'liquidity add-ons'.

4. Exposure during closeout: the role of hedging

Much of the discussion on the non-cleared margin framework has focused on the sole choice of the liquidation horizon (which, as we observed, has far reaching consequences). Yet, even more important than the choice of horizon is the method for computing the exposure to the defaulted counterparty over this horizon. Since the intended purpose of IM is to cover the potential cost of closing out a position, the methodology for computing the IM should be based on a realistic assessment of the actual exposures during this closeout phase. This point, already raised in (Avellaneda & Cont, 2013), has recently come to the attention of practitioners and regulators (Andersen et al, 2017; ECB, 2017) and calls for a better modelling of what occurs after default. Such a model should be based on the default management procedure adopted by the non-defaulting party.

Let us go back to the core of the BCBS-IOSCO requirement – that the IM should correspond to an "estimate of an increase in the value of the instrument that is consistent with a one-tailed 99% confidence interval over a 10-day horizon". When does this definition actually correspond to the exposure incurred by the non-defaulting party? To answer this question, it is important to compare the case of clearing member default in a CCP with a default event of a counterparty in a bilateral non-cleared transaction.

When a clearing participant in a CCP defaults, the default management procedure requires the CCP to liquidate the position of the defaulted clearing participant, usually through an auction procedure. The liquidation horizon considered for IM calculations is supposed to correspond to the duration required for the CCP to take notice of the default and set up the auction process. The auction usually needs to take place in the week following the default event and the CCP does not have the option of retaining these positions beyond the liquidation horizon, as stipulated in the CCP's default management procedure. Any market loss incurred on the positions of the defaulted member between the default date and the liquidation date thus flows to the CCP. Therefore, a measure of the market risk exposure of the member's portfolio over the liquidation horizon, for example using a 99% VaR or expected shortfall measure, seems a reasonable basis for quantifying the actual exposure of the CCP during closeout. Indeed, this approach is used by many CCPs for computing IM.

The story is somewhat different when a default occurs in a bilateral non-cleared transaction. In such cases, the counterparty usually takes notice of the credit event following a missed margin call or missed trade payment. Following such missed payments, there is usually a grace period of 1 or 2 days, during which the counterparty investigates the cause of the missed payment and seeks to confirm whether a credit event has occurred. Once the credit event has been confirmed, the counterparty evaluates its remaining exposures and decides on a plan of action to mitigate eventual losses.

In general, there is *no requirement* for the surviving counterparty to liquidate the position immediately. In fact, in most cases, this may not be a good option at all, especially if the default occurs in a market stress or leads to further market stress. Instead, a common procedure, as confirmed by several buy-side and sell-side major swap participants interviewed for this study, is to hedge the remaining exposures against any further market moves, using liquid hedging instruments such as futures or liquid swaps.

Once the credit event is confirmed, assessing the exposure and setting up the hedge usually takes one business day, unless the hedge requires entering a very large position in the hedging instrument, which would then require several days to ramp up. Once the hedge is set up, from this point onwards the counterparty is exposed not to the initial position with the defaulted entity, but to the hedged position. This hedged position may still carry some residual risk, since it may not be possible in general to perfectly hedge the exposure to the defaulted counterparty using standard instruments such as futures or indices.

This hedged position is eventually replaced or liquidated over some liquidation horizon that, as discussed in Section 3, may depend on the size and complexity of the positions. But, importantly, the exposure during this period is not to the initial position at default, but to the residual exposure of the hedged position.

Table 1: Timeline of default management procedure

$t=0$	Last variation margin payment
$t=1$	Counterparty misses variation margin payment
$t=2$ or 3 days	Confirmation of default event. Evaluation of exposures to defaulted counterparty
$T_1=3$ or 4 days	Hedging of exposure to defaulted counterparty
$t= T_1$ to T	Surviving counterparty exposed to residual risk of hedged position
T	Liquidation

This remark has important consequences for the calculation of the risk exposure. If we follow the timeline described above (see Table 1):

- During the first phase, from the last VM payment (t=0) to the time T_1 (typically 3-4 days) when the counterparty takes note of the default and sets up a hedge, the counterparty is exposed to the initial position. Let us denote by $L_1$the potential loss of the initial position over the horizon $[0, T_1]$.

- Once the hedge has been put into place, the counterparty is now exposed to the residual risk of the hedged position up to the liquidation horizon T. Let us denote by L_2 the potential loss of the hedged position over the remaining horizon $[T_1,T]$.

An estimate of the overall exposure of the counterparty over the liquidation horizon is then given by the 99% quantile of the total loss $\mathbf{L=L_1 +L_2}$:

$$\mathbf{VaR_{99\%}\,(L_1 + L_2)}$$

It is this quantity, and not the risk exposure of the initial position over [0,T], which should serve as the basis for calculating the initial margin requirement. A conservative estimate of the overall exposure is given by the sum of the respective 99% VaR estimates for each component. This estimate corresponds to *co-monotonic* losses across the two periods – i.e. when the losses before and after hedging are caused by a large move in the same risk factor.

In principle, one should also incorporate the cost of setting up the hedge. We have implicitly assumed here, without loss of generality, that hedging instruments are liquid futures or swaps, entered at zero initial cost at T_1.

Obviously, if one assumes no hedging takes place, then $L_2=0$ and L correspond to the risk exposure (99% VaR) of the initial position over the liquidation horizon. This corresponds to the (BCBS-IOSCO, 2015) regulatory guidelines. But this is by no means the most plausible assumption and does not correspond to a realistic description of the default management procedures used by major swap participants.

As the following example illustrates, ignoring the impact of hedging may lead to a significant modification in the outcome of the calculation, especially for positions with a significant directional exposure.

Example 4. Consider a bank buying protection from a counterparty on a $50 M portfolio of non-cleared single-name CDS on 10 high-yield US names. Assume the underlying CDS are not very liquid and consider a liquidation horizon of 10 days. If the counterparty defaults, the bank sets up a hedge for its exposure by selling protection on the CDX High Yield (HY) index for the same notional amount. Given typical trading volumes for CDX HY, entering such an index trade is feasible within one trading day following notification of default, so we may assume the hedge can be put in place after $T_1=3$ days. This does not provide a perfect hedge due to the mismatch between the initial portfolio and the composition of the HY index, but it does provide a partial hedge against unfavorable credit spread movements in the portfolio due to the high correlation between the HY index and single names. Assume that the residual basis risk corresponds to 20% of the volatility of the initial portfolio (i.e. substantial basis risk).The bank is then exposed to:

- The market risk of initial portfolio over the first 3 days;
- The basis risk between the index and the single-name portfolio over the remaining 7 days.

Assuming normally distributed returns, this corresponds to a reduction in risk exposure through hedging by a factor

$$\frac{VaR(L_1) + VaR(L_2)}{VaR(10\ days)} = \frac{\sqrt{3}\ + 0.2\,\sqrt{7}}{\sqrt{10}} = 70\%$$

So, in this example, using the risk of the initial position over the 10-day liquidation period as basis for IM calculation ignored this reduction and leads to an overestimation of margin requirements by 30%.

We therefore see that the issue is not just the length of the liquidation horizon, but the details of loss and exposure calculation over the liquidation horizon. On this point, we can only concur with (Andersen et al, 2017) who further emphasize this point by analyzing the timeline of events during closeout in even greater detail.

Trade flows and ‘spikes’ in exposure

In the above examples, to simplify the discussion, we have focused on the market risk of the position between default and closeout, implicitly assuming that this the only – or main – source of exposure. As emphasized in several recent studies (Andersen et al, 2017; Henrard, 2018), trade payments, such as coupon payments, scheduled inside the liquidation horizon may also have a large impact on the exposure during closeout, leading in particular to spikes in exposure at each payment date. As shown by (Andersen et al, 2017), in a typical swap transaction the contribution of trade flows around coupon dates may exceed by several multiples the daily volatility of the market value of the position, on which IM calculations are based. This point again emphasizes the correct calculation of cash flows and exposures during closeout, rather than extending the horizon to provision for such omissions. Regarding the impact of trade flows, the proposal put forth by (Andersen et al, 2017; Henrard, 2018) is to base VM calculations on variations of (2-day) forward values, which include adjustments for coupons, dividends and other trade payments. Such features may be included in terms of the credit support annex (CSA).

5. A four-step procedure for evaluating closeout risk

We summarize the points raised above in terms of a four-step procedure for calculating initial margin requirements for OTC derivatives exposures.

Table 2: A four-step approach to the evaluation of closeout risk for OTC transactions

Step 1: Determine appropriate liquidation horizon

- If position size < threshold: use minimum liquidation horizon T_{min}.
- If position size > threshold: use scaled horizon

$$T = \max(1, \frac{Position\ size}{Threshold}) \text{ x } T_{min}$$

Step 2: Compute macro-hedge for positions in netting set

- Compute sensitivities of netting set to key risk factors
- Determine macro-hedge for position based on sensitivities and choice of hedging instruments
- If size of hedge is below liquidity threshold for hedging instrument use standard hedging horizon $T_1=3$ days.
- If size of hedge exceeds liquidity threshold for hedging instrument use scaled hedging horizon.

Step 3: In each (historical or simulated) risk scenario:

- Compute loss $\mathbf{L}_1$ of netting set over hedging horizon $[0,T_1]$
- Compute loss $\mathbf{L}_2$ of hedged position (netting set+hedge determined in Step 2) over remainder of liquidation horizon $[T_1,T]$

Step 4: Compute 99% loss quantile of total loss $\mathbf{L} = \mathbf{L}_1 + \mathbf{L}_2$ over liquidation horizon:

$$\text{IM} = \mathbf{VaR}_{99\%}\ (\mathbf{L}_1 + \mathbf{L}_2)$$

At first glance, this seems more complex than simply computing the risk exposure of the initial position with the counterparty over the liquidation horizon. However, many of the ingredients, namely the sensitivities, are already computed in the ISDA SIMM framework, which may be used for executing Step 2 of the procedure. The ISDA SIMM specifies a range of risk factors for various asset classes and computes sensitivities to these risk factors. These sensitivities may then be used to set up a macro-hedge as required in Step 2.

In practice, all the steps in the four-step procedures may be implemented using a simulation-based approach. The risk measures (whether loss quantiles/VaR or expected shortfall) computed in Steps 3 and 4 may be estimated using the same set of historical or simulated risk scenarios and simply correspond to loss computations for two different portfolios – the initial and the hedged position – across the same scenarios. The computational burden is thus only double the one required for a standard VaR calculation.

6. Conclusion

We have argued that the market risk exposure over a fixed liquidation horizon – whether 5 or 10 days – does not provide a good basis for the calculation of IM requirements for non-cleared derivatives, especially given the wide range of liquidity covered by this universe of instruments. In particular, it leads to an underestimation of collateral requirements for large concentrated positions. while overestimating these requirements for portfolios with small positions.

The time required for the orderly liquidation of a position cannot just depend on the asset class under consideration, but should be proportional to the size of the position relative to the market depth. This simple scaling of liquidation horizon leads to the '3/2 rule': the risk exposure of a large position of size N scales as $N^{3/2}$.

Using this idea, we propose a 'four-step' approach for the computation of closeout risk, and argue that this approach provides a more realistic assessment of exposures during the closeout of a position and can, thus, provide a meaningful basis for the evaluation of IM requirements for non-cleared derivatives and, more generally, for portfolios in which liquidity risk is an important concern.

About the author

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