OPENGAMMA | GUIDE

A HOW-TO GUIDE:

Margin Best Practices

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INTRODUCTION

Firms are used to the fact that if they trade derivatives then they will have to pay margin. Each may have their own reasons for trading and the way in which they cover the margin requirements. Energy firms, for example, use derivatives to hedge their physical positions. They are generally using working capital to fund the margin requirements on these derivatives positions. Hedge funds use derivatives for leverage and exposure, and will typically use the fund's assets to cover margin requirements.

In normal times this wouldn't create any issues, but recent market volatility has seen margin requirements spike, creating a threat to liquidity and forcing firms to post tens of millions in additional cash, depleting working capital otherwise deployed for revenue generating opportunities. Now, more than ever, active management of derivatives margin has become critical to the success of these firms.

As an example, the volatility resulting from the COVID-19 pandemic has required one large firm to increase their liquidity buffer by 50%. This increase was an order of magnitude greater than any normal variation margin calls and shows the opportunities available for reducing costs in volatile markets, based on a better understanding of margin and the ability to predict requirements ahead of time.

With this much capital at stake and with the ongoing volatility of the markets, there are a number of key questions that firms need to ask themselves:

- **Are we being called for the right amount of margin?**
- **What is driving the daily margin changes?**
- **How can we optimise the amount of margin we are called for?**
- **How much of a cash buffer do we need to maintain, including during another market shock?**

To answer these questions firms will need to put in place solutions which can perform the necessary calculations and provide the necessary analysis and data.

In this piece we will look in more detail at the problems that market volatility is creating around margin. We will provide pointers and examples to help answer those key questions. And finally, we will look at the potential solutions that can be used, and the advantages and disadvantages of each.

About Jo Burnham

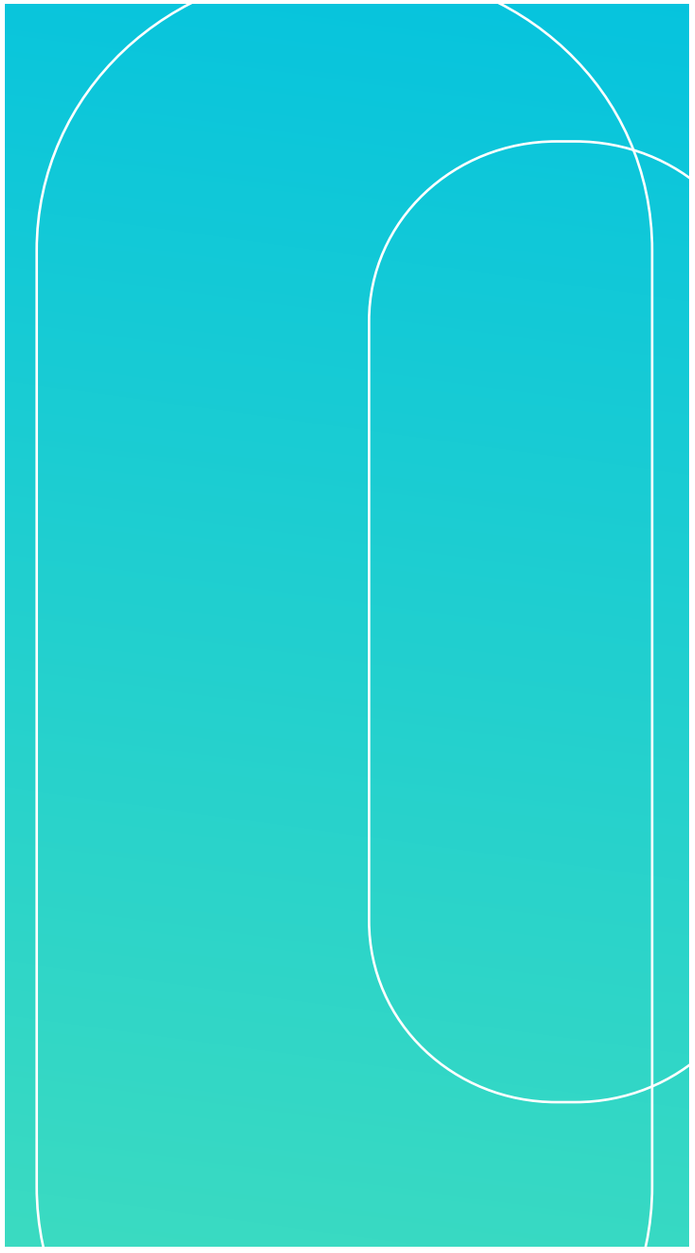
Jo Burnham has over 25 years of experience in futures and options risk management working for clearing houses, banks and software vendors.

Jo worked in risk management at LCH.Clearnet and LME. At LCH she was Director of Risk Management where she was responsible for the introduction of margin models for new exchange-traded products. Prior to this, she was a Risk Subject Matter Expert for LMEClear, ensuring adherence to regulation across all areas of risk management.

She was one of the authors of the London SPAN methodology which was the original margin model for the London Exchange Traded Derivatives markets, including commodities. Jo played a pivotal role in the implementation of margining and clearing solutions for OTC products at LME.

She has worked at OpenGamma for the last 5 years as a Subject Matter Expert. She has worked directly with CCPs on projects to help implement their move to VaR based methodologies.

THE PROBLEM



Because of the recent volatile market conditions, both hedge and speculative traded positions have had to change dramatically, placing enormous pressure on the treasury departments providing the capital to fund the margin calls against these positions. The past 12 months have demonstrated the urgent need for treasurers to make sure that margin calls are anticipated and prepared for. A fully viable plan is required to manage the unexpected margin spikes, including liquidity requirements and understanding of potential future costs that could impact returns.

There have been many examples of market volatility impacting margin requirements:

LARGE MOVES IN OIL PRICES

In early March 2020, the stand-off between Russia and Saudi Arabia came together with the spread of COVID across Europe, resulting in a 30% collapse in oil prices. Worries about global storage capacity becoming full because of the reduction in demand meant that oil firms resorted to renting tankers to store the surplus supply, causing WTI prices to turn negative. Initial margin requirements climbed within days, with increases of up to 21% (equivalent to more than $13,000 per lot on Brent contracts):

- **Monday 9th March - Clearing Houses immediately reacted to the volatility in the market. Intra day variation margin calls were made to cover the drop in prices, impacting all long position holders.**
- **Tuesday 10th March - Extreme price moves led to emergency margin reviews at both ICE and CME resulting in increases in initial margin impacting both long and short holders.**
- **Wednesday 13th March - Initial margin parameter changes continued throughout the week. ICE issued further updates to oil margin parameters, adjusting some of the changes made on Monday and adding some changes for calendar spreads.**

The new market volatility and economic environment created heightened industry-wide concern over the possibility of unexpectedly large future margin calls.

This volatility has had an impact on margins with rate changes happening, at times, on a near daily basis. The increases in margin have caused more volatility in the market, especially where firms have been forced to close positions to reduce margin levels or to generate liquidity to cover margin calls. These squeezes on liquidity have shown that it is more important than ever that firms are managing their margin effectively.

THE QUESTIONS FIRMS NEED TO BE ABLE TO ANSWER

We've already mentioned the questions that firms should be asking themselves to ensure that they understand their margin requirements and are actively managing their use of capital:

1. **Are we being called for the right amount of margin?**
2. **What is driving the daily margin changes?**
3. **How can we optimise the amount of margin we are charged?**
4. **How much of a cash buffer do we need to maintain, including during another market shock?**

In the next sections we will look in more detail at each of these questions and the best practice required to answer them. What drives the answer to each question and what impact does getting it wrong have on requirements - and ultimately profits?

BEST PRACTICE #1 - ENSURE YOU ARE CALLED FOR THE RIGHT AMOUNT OF MARGIN

Many firms don't validate their margin requirements. For cleared derivatives they assume that the broker or CCP are always correct, and pay the margin requested. But this can be a big mistake as errors occur and these are often long term issues resulting in margin being wrong over an extended period.

In times of stress, the processes used to call margin have reached breaking point, leading to late calls and significant increases in error rates. There were particular issues in March when spikes in trading combined with the practice of waiting until the end of day before allocating trades to clients, to allow for average pricing, led to back-office system failures. Some trades were left on the books of the wrong clearing broker leading to disputes over margin payments, and firms trying to meet unexpected margin calls.

We summarise below the frequency and cause of errors in the margin calls, based on data collected from clients using OpenGamma to validate their margin requirements:

Issue types		Impact of margin	% of total errors	Frequency in 2020
Account set-up	Master vs sub-account structure, CCP account settings	5-10%	5%	1 in 20 accounts onboarded on OpenGamma
IM add-ons	Spec vs hedge, broker multipliers	10%	5%	
Data issues	Delayed market data, wrong settlement prices, delayed batch cycles	No visibility of margin call (uncapped margin)	30%	10 occurences across brokers in Q1/Q2
Missing Trades	Unallocated or misallocated trades	Unhedged strategies (uncapped impact)	60%	Up to weekly for some clients

The only way for firms to ensure that they are being called for the correct amount of margin is to validate the numbers that they are being told by the broker or CCP. The issue here is that just validating the final margin number isn't enough. To fully understand why a number may be wrong, it is important to validate the inputs as well as the outputs. In effect, this means that validation is required in each of the following areas:

- **Positions**
- **Fees and Commissions**
- **Variation Margin and OTE**
- **Initial Margin**
- **Collateral**

In the sections below we will look at each of these areas, how they can be validated, the types of issues that can occur, and probably most importantly the impact any errors can have on margin requirements. We will show why, each day, firms should automatically validate the variation margin, initial margin, fees and commissions posted to each clearing broker and CCP by calculating the expected margin call against the actual call received.

The following examples show why it is important to check the numbers:

- **Incorrect margin calls due to settlement prices being incorrectly scaled which resulted in a $500 million VM discrepancy for a commodity trading firm.**
- **Overcharging of fees leading to a $1.2m fee rebate for a NY-based hedge fund.**
- **Incorrect account setup at the clearing house (spec vs hedge) reducing margin by $12m for a London-based multi-strategy fund.**

POSITIONS

Validating positions would at first appear to be the easiest step in any validation process. However, in some ways it is the most complex, not least because of the numerous ways in which different systems represent a portfolio.

CONTRACT CODES

Each exchange traded product will have its own contract code. The issue is that there isn't just one version of the code.

- **Exchanges often have multiple codes based on the different systems involved in the lifecycle of a contract, for example a trading code and a clearing code.**
- **Back office systems suppliers, such as GMI and ION, each have their own contract codes.**
- **Market participants often use Bloomberg codes to identify products.**

Before any validation can take place these alternative codes need to be normalised to a standard code. On the assumption that this validation is ultimately going to extend into margin requirements, then it is important to map the various contract codes to the clearing codes used in the margin parameter files.

CONTRACT EXPIRY

Once contract codes have been normalised to allow validation, the next issue is the "expiry" of the positions within the portfolio. The issue here is the different dates that can be used to identify the same contract.

Each future or option will have an expiry by which it is known to the exchange or CCP. Historically this has been easy to understand, with contracts being identified by the month in which delivery or final settlement takes place. This provides an easy mapping between the different representations, for example the Bloomberg delivery month letters to the YYYYMM format used by the CCPs.

However, with the introduction of new contracts, which more closely reflect OTC markets, has come new contract types, for example daily and BALMO contracts. These mean the "delivery month" is no longer sufficient to identify a specific contract.

The issue becomes how to describe the expiry in question. Unfortunately, not everyone has used the same solution. The exchanges have their own definition, usually related to the date of the underlying price used to derive the settlement value of the derivative. Other firms have often used different key dates to define the contracts, for example last trading date, final settlement date, or delivery date.

Mappings are required to match up the alternative dates associated with contracts. This requires understanding of the contract specifications and the type of date manipulation more commonly seen when generating cash flow schedules for OTC products.

TRADES VERSUS POSITIONS

Once the contract code and expiry date have been sorted, the next issue is the level at which the positions are provided, for example:

- **As the original trade**
- **All trades for the same instrument and trade price rolled together**
- **As a position with all trades for the same instrument rolled together**

To validate the positions it is necessary to understand the relative level of detail in the files to be compared, and sum up the quantities as required.

IMPACT OF DISCREPANCIES

Validating positions may be a difficult step, but it will drive much of the impact on the requirements as the positions will affect the subsequent calculations. In our experience, over 50% of margin call disputes are caused by a mismatch between either the actual trades and positions, or their precise definition as seen by each side, on which margin should be calculated.

FEES AND COMMISSIONS

Fees are driven by:

- **The number of trades**
- **The number of position actions, for example option exercise**
- **The level of margin**
- **The amount and type of collateral lodged**

All of these are likely to be specific to the individual participant, with adjustments being made, for example, for additional volume or account type. A fixed fee may be charged instead for certain firms based on an expected minimum volume of business.

Some fees may be based on CCP defined requirements, so access will be required to these rates. Other fees and commissions will be determined by the broker so details of these schedules will be needed.

To calculate and validate the requested fees and commissions it is also necessary to have access to all the detail that goes into the calculation, including validated positions, margins and collateral inventory.

IMPACT OF DISCREPANCIES

As the level of fees and commissions charged depends on a number of inputs there are many chances for discrepancies to occur. Each of these may have a different level of impact on overall costs:

- **Execution fees at exchanges can be 5 to 10 times higher dependent on the membership type.**
- **Fixed fees can vary by large multiples dependent on volume, so being charged at the wrong level would have a significant impact on costs.**
- **Fees may be wrongly calculated, for example a trading fee that should be applied at a contract level is wrongly multiplied by the contract size. For a Natural Gas contract this could result in a fee being applied to each day in the contract month, rather than for the month as a whole, resulting in the amount charged being 30 times too great.**

VARIATION MARGIN AND OTE

Once positions are validated, then you can move on to validating Variation Margin and OTE.

PRICES

For both of these it is important to ensure the prices associated with the position are correct:

- **For Variation Margin the price required is going to be dependent on when the trade was executed; for today's trades you need the trade price whereas for older trades you need the previous close price.**
- **For OTE, it is always the original trade price that is required, or alternatively an average trade price for all positions within the portfolio.**

The next step is to make sure that the closing price used in the calculation of Variation Margin or OTE is the one that would be expected. It should match the settlement price published by the CCP. OpenGamma clients have typically introduced a reconciliation of settlement prices as part of their daily margin call process.

CONTRACT SIZE

Even if you have the correct prices and positions, it is still possible that there will be problems when validating the calculations. There are often issues around the contract size used when scaling up any calculations. Contracts which have non-standard tick sizes can create issues, so for anything that doesn't have minimum price movements of pennies or cents there is the possibility that there may be a mismatch.

However, the majority of issues are likely to be for contracts with variable contract sizes, for example monthly gas and power contracts, or equity contracts following corporate actions.

IMPACT OF DISCREPANCIES

Depending on the error, the impact of the differences in contract size and prices can vary from below 1% to differences of around 100 times. Examples include:

- **Using the wrong contract size for monthly contracts (28 days compared with 31 for example) can lead to errors of up to 10%.**
- **Although it depends on the size of the difference, price errors, such as rounding or using the previous day's price, are likely to result in differences of a few percentage points.**
- **The biggest errors can come from misunderstanding the way to interpret contracts with a small tick size. For example using a contract size presumed from a tick size of 0.01 when the actual tick size is 0.0001 can result in a 100 times error.**

What should be noted is that where the error is large for a single position this can be lost if validation is conducted at a total portfolio level, assuming a small margin of error. This is a mistake as small errors can mount up, and any change in portfolio could mean that the error becomes significant. It is important to validate at the lowest level.

INITIAL MARGIN

Calculating Initial Margin correctly is dependent on having the correct positions, so it is important that these are validated first. However, there are still many reasons why Initial Margin may be incorrect.

PARAMETER DATA

To calculate Initial Margin you need the parameters provided by the CCP. The potential here is that the way in which the CCP identifies contracts is not the same as the way in which they are identified in position reports. This is basically the same issue that can lead to errors in OTE or Variation Margin calculations, but can be much harder to identify because of the portfolio nature of margin calculations.

The first step in any Initial Margin calculation is to calculate a series of theoretical profits and losses, be it the 16 SPAN scenarios or the numerous VaR scenarios. This requires matching the positions to these scenarios. There are two potential issues that can occur:

- **The wrong parameters are selected and used within the calculation.**
- **No matching parameters are found and whole parts of the portfolio are excluded from the Initial Margin calculation.**

Either way, this can have unpredictable and significant impact on the margin calculated.

CALCULATION ERRORS

Obtaining the correct parameters isn't the end of the story when it comes to validating margin. Over the years, margin algorithms, in particular SPAN, have become more complex. This has been driven by new contracts, for example monthly, daily and BALMO gas and power. The result is that there are many opportunities for getting the margin calculation wrong:

- **Not taking into account the reducing size of BALMO contracts can lead to over-stating of the risk.**
- **Reduction in margin based on offsets between contracts can be excluded because the particular method is not implemented.**

MARGIN MULTIPLIERS

The calculated margin, according to the CCP algorithm, isn't necessarily the final amount requested. Margin multipliers are often applied to arrive at the eventual requirement.

Some multipliers are specified by the CCP dependent on the account type. CME, for example, generally applies a 1.1. multiplier to what it classes as Heightened Risk Profile (HRP) or speculator accounts, compared with Non-Heightened Risk Profile (NHRP) or hedge accounts.

Other CCPs may apply a specific multiplier to client accounts, usually using a scalar to increase the effective margin period of risk. Usually two days are added to take into account the possible delay if a client tries to port their position following a member default, only for this to fail. For example a scalar of sqrt(4/2) to increase the period of risk from 2 to 4 days.

EMIR add-ons use the same principle to increase a margin calculated on a one day holding period basis to the 2 day period required by EMIR for exchange traded products.

Brokers may then apply their own multipliers on top of those mandated by the CCPs. These can have a significant effect on margin requirements, so understanding them is key to a firm ensuring that it is not being overcharged.

IMPACT OF DISCREPANCIES

The most obvious errors are those where an incorrect multiplier has been applied, although this can be complicated if the multiplier only applies to a proportion of the portfolio. This can occur if the portfolio includes positions for more than one CCP. Not all CCPs apply multipliers for client accounts and a broker may choose to pass on the exact calculation, meaning that parts of the portfolio will be treated differently. Additionally CME, for example, has the ability to apply specific multipliers by contract based on the account type.

Other errors can be larger depending on the cause. However, errors amounting to up to 50% for a particular product or account have been known to occur.

COLLATERAL

Any margin call is obviously going to be dependent on the collateral already lodged, either with a broker or direct with a CCP. And when it comes to collateral, it is not just the inventory of collateral that needs to be validated. How that collateral is priced and any haircuts applied to the collateral value will make a difference to the resultant margin call.

INVENTORY

As with positions, validating collateral can prove to be difficult. Hopefully, a consistent set of identifiers is being used, for example ISINs for bond collateral. If not, then mapping will be required, and dependent on the range of collateral this could be a big exercise.

The next issue to resolve is the amount of collateral held. Validating this depends on each side having the same view of how to report the amount. As long as this is something constant, for example notional of bonds, then this is relatively simple. But if you are trying to reconcile based on value then you need to take into account both pricing and haircuts.

There are a number of reasons why this reconciliation may fail, but settlement fails (i.e. a different view of what securities have settled) is the most. common cause of collateral disputes.

PRICING

Each clearer, be they a CCP or a broker, will have their own way of determining the price of collateral. Even if they are choosing the same source, for example Bloomberg, there are different ways that a "good" price can be determined; which quotes to choose, how to top and tail, and average. It is also important to confirm whether the clean or dirty price is being provided. And if collateral is not in the same currency as liabilities there will be FX rates to consider.

All of this could mean significant differences in the valuations given to the same collateral. Understanding these differences would give firms the ability to question the way in which their collateral is valued, potentially increasing the assumed value and therefore decreasing margin calls.

HAIRCUTS

All collateral is subject to haircuts, to allow for potential adverse moves in the value. CCPs will publish the haircuts that they apply to each different type of collateral, but these same levels may not be used by clearing brokers. FX haircuts will also be used where collateral and liabilities are in different currencies.

The challenge here is normalising the rates across CCPs or brokers, and applying those rates correctly to the right collateral categories. Being able to validate the haircut being applied provides firms with the opportunity to challenge the haircut levels that brokers are using, especially where they differ from the values used by the CCPs.

IMPACT OF DISCREPANCIES

Obviously, any differences in the collateral inventory will impact margin calls, with the discrepancy dependent on what is missing. However, these are issues that should be easily remedied.

More important is to understand the way in which collateral is being priced and haircuts applied to the value.

- Pricing differences are likely to be small, unless errors have been made in the way that prices are sourced or particular collateral is valued. These issues are similar to those seen for calculating variation margin or OTE on portfolios.
- Excessive haircuts are more likely to have a significant impact on margin calls. For an example if a 10% haircut is applied across the board on all non-cash collateral, when the CCP may be using a level of around 3% for the same collateral, then firms will be losing a considerable proportion of their collateral value. This value could be being used to offset liabilities and reduce margin calls.

BEST PRACTICE #2 - UNDERSTAND THE DRIVERS OF MARGIN CHANGE

If everything has been validated, and no obvious errors have been found in positions, prices, parameters or calculations, but large changes in daily margin are being seen, it is important to understand where these changes are coming from. Senior management and risk managers need a view of liquidity, especially in volatile markets when they may be being asked to fund increasing margin levels. They need an understanding of which PM or position is driving the consumption of capital. This requires delving into the drivers of margin.

There are a number of areas that can impact margin requirements:

- **Changes in position will obviously impact the calculations.**
- **Changes in prices will impact variation margin levels, but they can also impact initial margin directly. Moving underlying prices will change the scenario losses seen for option positions under the margin scenarios, whilst if VaR margin is being used, each day new scenarios will be added based on the previous day's price moves.**
- **Changes in parameters will change the initial margin calculated, even if all other things remain the same.**

CHANGE IN POSITION

Changes in positions will impact the margin requirements. However, there are two different cases that need to be considered:

- **Changing the overall risk level of the portfolio.**
- **Adjusting the position but keeping the risk level the same - for example when rolling a contract.**

The first of these will obviously impact the initial margin as the calculation is directly related to the risk of the portfolio.

The reason why margin may change even though the risk level remains the same is less obvious. It is related to the way in which the various margin algorithms work and how the parameters are set. They make assumptions about the way that spreads between different contracts behave over time, particularly as a contract approaches expiry. This is important, especially for the treasurer, who will be impacted by any sudden changes in margin and the need to provide collateral to cover the requirement.

ROLLING TOO EARLY

The choice of date when you roll contracts can have a significant impact on the total margin. In extreme cases, a short term doubling of margin has been seen from rolling too early. Even a smaller percentage increase in margin can impact the bottom line, for example, one fund that rolled too early was subject to a 40 million Euro increase in margin.

Firms may choose to roll early because the price available is good, but they need to weigh up the cost benefits of rolling early versus the liquidity impact on free cash. This impact is difficult to predict without a detailed understanding of the various margin algorithms, and it is advisable to simulate margin impact pre-roll.

In the case above, the margin change was caused by the CCP liquidity charge; this is higher if the position is no longer in the liquid front month. In addition, the base margin can be impacted by the use of different VaR scenarios or SPAN parameters based on expiry.

CHANGE IN PRICES

The most obvious impact of price changes is on variation margin. In volatile markets it is this that will be driving any margin calls. But price changes can also impact initial margin, even in the absence of any change in positions or parameters.

With SPAN, initial margin for futures is generally independent of prices as scanning ranges - the main SPAN margin rates - tend to be set as an absolute amount per lot. This is not always the case. The margin rate for some contracts is defined as a percentage of the price, and in this case changing prices will have a similar impact on the margin requirements.

For options, however the margin parameters are set, changes in prices will impact the margin. Scanning range is essentially an implied move in the underlying price. The theoretical loss under this move for options will be dependent on the underlying price. Potential shifts in market volatility are also considered which means a volatile market will have an additional impact on the margin calculated.

The option value of premium paid up front options, that is netted against initial margin to determine the final collateral requirement, will also be impacted. This can have a significant impact on any margin call for any portfolio with a high concentration of options.

CHANGE IN PARAMETERS

It is interesting to understand how the CCPs set these parameters. The majority are now using some form of VaR to determine the appropriate values, in particular, calculating the VaR of selected price moves at a chosen confidence level to determine the scanning range - which is an estimate of the likely move in the underlying price.

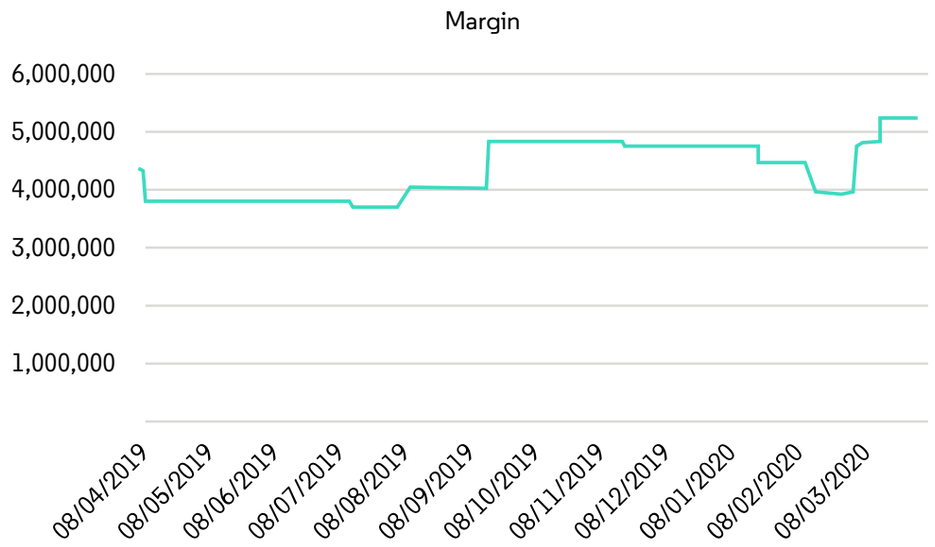
ICE actually publish the methodology that they use for each of their different markets: Clearing Risk Management for Futures, Options & CDS

Market	VaR Model	Confidence Interval	Look-back period
Energy	Filtered Historical Simulation	99%	500 days
	Historical Simulation	99%	100, 250 and 500 days
Financials and Softs	Parametric VaR	99%	60, 250 and 525 days
	Historical Simulation	99%	100, 250 and 525 days

This means that for each contract they will determine multiple potential values, using different styles of VaR and parameterisation, in order to set the SPAN parameter at the desired level.

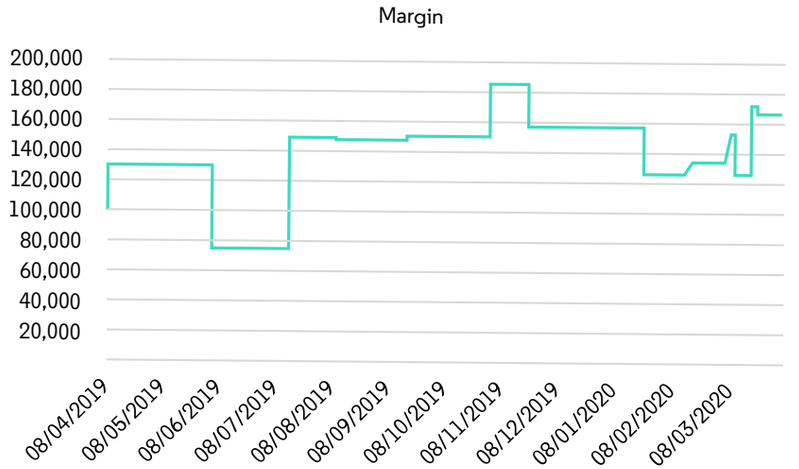
The CCPs are continually monitoring the appropriateness of the SPAN parameters, checking for breaches (of which they will expect a certain number over the course of a year given the confidence interval). In general, parameters are adjusted on a periodic basis, but any major breach or increase in volatility will lead to an immediate review.

The following graph shows the change in margin requirement for an outright position of 1000 lots of ICE Brent Crude expiry August 2020 over the year up to expiry.



This shows how the margin can change, and particularly how many times the margin rate changed during March compared with previous periods.

The next graph shows how the margin on a spread position (1000 long August 2020 Brent versus 1000 short September 2020 Brent) changed over the same period.



It can be seen that this margin, although considerably lower, is more volatile. This is mainly because of the way that SPAN margins spread positions rather than because of changes in the margin rates. The rate used for a spread will be based on the bucket that each of the expiries falls into. Over time the buckets will change and therefore the charge rate applied to the spread will change.

WHY IS IT IMPORTANT TO UNDERSTAND THE DRIVERS OF MARGIN?

It is clear that there are a number of factors that can impact margin. Positions, prices and parameters all play their part in determining the final margin requirement. But understanding this means that firms can better manage their liquidity requirements and ensure that they are not subject to any shock margin calls.

Understanding the drivers also means that firms can adjust their behaviour to ensure that they are not paying too much. Being aware of the implications of certain trading choices (rolling positions too early, the way in which margin is charged on spread positions and the impact of option value on total net margin) can help firms to modify their behaviour to optimise margin without impacting the levels of risk that they hold within their portfolios.

BEST PRACTICE #3 - MINIMISE THE MARGIN YOU POST

Nobody wants to pay too much margin. Reducing margin requirements, without changing trading, is an easy way to increase return on capital. And the benefits can be significant. Savings of up to 50% on total margin can be achieved by making changes to behaviour, with savings of around 10% to 20% being easily achieved by moving a small number of trades.

There are a number of ways in which it is possible to optimise margin requirements, without changing the risk of a portfolio:

Choice of CCP

- Equivalents for most major exchange traded contracts are listed on multiple venues.
- Clearing for OTC products is available at multiple CCPs
- Differences in margin algorithms and allowable collateral will result in different margin costs based on the same portfolio.
- Offsets with existing portfolios will impact the costs of adding new trades.

Choice of Broker

- Correct choice of broker will maximise offsets for new trades and hence reduce margin requirements.
- Splitting positions between brokers can be used to minimise the liquidity risk component of the margin that is calculated.

We will consider each of these in more detail.

CHOICE OF CCP

Most exchange traded contracts will have one major exchange on which they are traded. But competition means that other exchanges will list copies of these contracts in order to extract business away from their rivals. What this means is that there is a choice of trading venue, and hence CCP and margin calculation, for these contracts.

Examples of choices included Brent and WTI, which are available on both ICE and NYMEX (CME), and European interest rate products that can be traded on Eurex and ICE. However, the choice of venue cannot be based on just margin, as open interest and other costs need to be taken into account.

The same is true for OTC products. LCH offers clearing for swaps in all major currencies, but it is also possible to clear these through a combination of CME and Eurex. Again, trading costs will differ between the CCPs, but these may be acceptable if there is a significant reduction in the required margin.

Choosing the trading or clearing venue to reduce the overall risk is an obvious way to reduce margin requirements. What is less clear is how the choice of CCP can impact the margin calculated, given that the point of initial margin is to cover likely losses over a prescribed number of days and to a given confidence level.

WHY IS IT NOT EASY TO CHOOSE THE OPTIMAL EXCHANGE OR CCP?

It is not always easy to identify potential savings due to a number of hidden complexities:

- **Offsets with other positions: while there may appear to be obvious savings from moving front-month contracts between exchanges, it is hard to understand the impact of offsets with other delivery months, spread contracts or options.**
- **While contracts may be dual listed, there may not be sufficient liquidity in one of the contracts, leading to higher costs (such as bid-offer spreads) and objections from traders.**
- **Practical operational constraints may mean that positions can only be optimised on a desk-by-desk basis, avoiding moves that require two different desks or traders to agree.**
- **Fees and commissions can easily add up, making a suggested move uneconomic to execute even though there would be a margin reduction.**

WHY ARE MARGINS NOT THE SAME IF THEY ARE COVERING THE SAME AMOUNT OF RISK?

In theory, the same amount of risk should be covered by the same amount of margin, even across different CCPs. They have, after all, been developed to meet the same or similar regulation.

As an example, we consider the margin calculated on an OTC swap portfolio. Regulation states that the margin needs to:

- Be based on a 5 day holding period.
- Not be lower than calculations using volatility over a 10 year historical lookback period.
- Cover a confidence level of at least 99%.
- Include components to cover concentration and liquidity risk.

In addition, the majority of CCPs base their algorithms on the same Filtered Historical VaR methodology. With this in mind, it's surprising how different margin charges can be. There are a number of factors that can explain these differences:

- Each CCP has their own methodology used for creating base curves.
- Stress periods need to be included in the margin to avoid procyclicality, and each may select different scenarios.
- For liquidity, CCPs generally consider the cost of hedging the portfolio, but each will have their own view on market spreads and capacity.

So what does this mean in practice?

The following table shows, as percentages of notional, example margins calculated on a series of par swaps at the major CCPs clearing interest rate swaps for a given day.

EUR		CCP 1		CCP 2		CCP 3	
Tenor (year)	Pay Rate	Pay	Receive	Pay	Receive	Pay	Receive
2	-0.15%	0.46%	0.45%	0.44%	0.26%	0.39%	0.37%
5	0.12%	1.29%	1.58%	1.24%	0.96%	1.07%	1.16%
10	0.65%	2.59%	3.05%	2.74%	2.03%	2.13%	2.78%
30	1.24%	9.31%	6.48%	9.64%	6.71%	10.98%	7.27%
50	1.20%	14.01%	10.40%	18.84%	10.44%	18.28%	12.43%

Our findings

In the OTC example, where CCPs stand in relation to one another is dependent on the tenor of the swap. For example, CCP3 margin is less than CCP1 for a 2 year swap, but more than CCP1 for a 30 year swap.

And looking specifically at the margins calculated, for a EUR 100 million notional 20 year swap this could mean a saving of over 14 million Euros clearing through CCP2 rather than CCP3.

Obviously it's not quite so simple in real life scenarios. Margin is calculated at portfolio level, so the actual margin that you pay will be dependent on all of your trades; where it is cheapest to clear a new trade will be dependent on your existing portfolio too.

It's also important to bear in mind that the above table is just a snapshot, and that the values will change over time. While margin charges may be highest at one particular CCP one month, the next month it could be an entirely different CCP. From the analysis that we have done, there is no consistent ranking; no same CCP staying higher or lower.

What about exchange traded contracts

The same applies to exchange traded contracts. With the planned moves from SPAN to VaR, CCPs will be using the same or similar margin algorithms to those currently used for OTC. The only real difference will be in the holding period, which will be 1 or 2 days rather than the 5 days required for OTC.

Even for those CCPs that are currently using SPAN as their margin algorithm, there can still be differences. Comparing the SPAN scanning range is a good indicator of comparative margin, but these are generally set using VaR style analysis, so the same differences in levels may occur as with the full VaR based algorithms. In addition, there could be big differences in the spread rates for each CCP dependent on the method used to determine them.

To sum up

The only way to ensure you are choosing the best clearing venue is to calculate what-if margins for each CCP. Comparing their margin costs with a view to trading through those with the lowest requirements frees up previously tied up capital, maximising your returns.

HOW DO COLLATERAL COSTS IMPACT MARGIN COSTS?

Generally when you think about margin optimisation you think "how can I lower the level of margin I am required to post?", for example, by moving positions between brokers to lower liquidity charges or by taking advantage of the savings offered by margin algorithms for offsetting positions. But, it is equally important to consider the impact of the collateral posted to cover that margin.

Choosing the right collateral to cover your liability can have a big impact on the amount that needs to be provided and the overall cost of margin. The way CCPs compare margin requirements to collateral, the haircuts applied and the interest paid or charges applied to the collateral all need to be taken into account.

Even if you're not directly clearing your business, your clearing broker will probably be passing on the costs, so it's worth knowing the rules.

What collateral can I use?

Each CCP will have a list of collateral that is eligible to cover margin liabilities. All CCPs allow cash and government bonds. Some also allow other assets to be used as collateral, for instance, equities or metal warrants.

Cash

CCPs will generally accept cash collateral in any currency that they also clear products. However, there are often restrictions in accepting cash that is not in what would be considered a major currency for the exchange. LCH, for example, accepts GBP, EUR and USD, but in specific circumstances – for instance, if the clearing member is from that country – will also accept small amounts of cash collateral in AUD, JPY, CAD, SEK, DKK or NOK.

These rules for accepting cash to cover margin liabilities are independent of the Variation Margin payments which must be made in the currency of the trade/position, as these are cash flows.

Each CCP has its own "direct debit" system which allows them to take money from the bank accounts of clearing members as required to cover margin liabilities. This cash is usually taken in the margin currency for the CCP. However, the CCP may also have the ability to take cash in an alternative currency. Looking at LCH again, after a cut-off point in the afternoon they will take USD from US bank accounts, rather than GBP from UK bank accounts, to cover any intra-day additional liabilities.

Bonds

As with cash collateral, CCPs will generally accept bonds denominated in the currencies in which they clear products – these will normally be Government issued bonds. However, this is often extended to include Government Agencies and even Corporate bonds if they meet certain criteria.

Other

Some CCPs have a wider range of acceptable collateral, beyond cash and bonds. CME, for example, will accept stocks and gold whilst LME Clear allows metal warrants to be used as collateral under particular circumstances.

However, although these alternative collateral types are allowed, because of the generally higher haircuts and larger operational overhead of lodging the collateral they are not widely used.

What does it cost to lodge collateral with a CCP?

Where Cash is provided as collateral then CCPs pay interest on this cash. Where Non-Cash collateral is provided then a charge will be made to cover the costs of the custody for that collateral.

And as with haircuts, the rates applied can vary between CCPs, resulting in a potentially unexpected cost of providing collateral.

Interest on Cash Collateral

CCPs will pay interest on any Cash collateral that they are holding, using an interest rate set at a spread from the standard overnight rate. In addition, the spreads can vary depending on the account type.

The spreads may be anywhere between 10 and 50 basis points, which makes a lot of difference to the return on capital.

In addition, the cash balance on which the interest is paid may be limited to the utilised collateral i.e. the amount required to cover the margin requirement. This is to prevent clearing members from leaving cash with the CCP for them to manage. In addition, in the current environment the interest rate may actually be negative, which means it will cost to post cash collateral. So it's important to be aware of any excess cash left with the CCP and have it repaid as soon as possible.

Charges on Non-Cash Collateral

Where Non-Cash Collateral is lodged then charges will be made to cover the costs to the CCPs of holding this collateral, for example, to cover the Euroclear costs for custody of bonds. As for paying interest on Cash, the rates charged by each of the CCPs will differ for the same collateral.

The charges may also be adjusted to encourage a particular type of collateral to be lodged, for example, having a lower charge where the clearing member has deposited a larger percentage of their collateral as cash or adjusting their fees dependent on whether the collateral is lodged bilaterally or via a tri-party arrangement.

So what does this mean in practice?

To understand the full cost of margin you need to consider all aspects of the costs:

- **Margin level**
- **Collateral haircuts**
- **Collateral interest and charges**

In the worst cases we have seen examples where the total margin costs can nearly double between one CCP and another when all haircuts and charges are taken into account, particularly where margin is not in the same currency as the collateral.

It pays to proactively and systematically manage down costs that can be controlled.

CHOICE OF BROKER

In the same way that choice of CCP can impact margin requirements, choice of broker can also have a major effect on costs.

Optimising the level of broker costs is obvious. Each will have its own schedule of charges and also multipliers that will be applied to calculated margin. What is not so obvious is the way that choice of broker can impact the actual margin level. Taking into account existing positions held with the broker is important so that any offsets can be maximised. But the biggest savings can be made by splitting positions between brokers to minimize the liquidity charge.

With the introduction of the non-linear liquidity add-on, the traditional way of allocating business between clearing brokers, putting all positions from one market at the same broker, is now sub-optimal. Any large outright position will incur significant margin in order for the CCP to cover the risk of close out on default. If you allocate your trades by market it may give the maximum position offset, but also maximum liquidity charge.

Assume you have the following Eurex positions - a combination of fixed income and equity, with the fixed income positions allocated to broker 1 and the equity positions allocated to broker 2:

Instrument	Position	Broker
March 2018 Bund 164 Call Option	Long 1,000	Broker 1
March 2018 Bund 163 Put Option	Long 1,000	Broker 1
June 2018 DAX 16500 Call Option	Long 1,200	Broker 2
June 2018 DAX 16000 Put Option	Long 1,200	Broker 2

The initial margin calculated will be as follows:

	VaR Margin Component	Liquidity Add-on	Total IM
Broker 1	998,305	531,518	1,529,823
Broker 2	5,316,915	2,367,634	7,684,550
Total	6,315,220	2,889,152	9,204,372

A more efficient way of allocating positions needs to be found which will minimise the margin calculated by clearing brokers. This means maximising the offsets between contracts and minimising positions for a given product allocated to a broker.

A simple split of the positions between the 2 clearing brokers could be as follows:

Instrumental	Position	Broker
March 2018 Bund 164 Call Option	Long 500	Broker 1
March 2018 Bund 163 Put Option	Long 500	Broker 1
June 2018 DAX 16500 Call Option	Long 600	Broker 1
June 2018 DAX 16000 Put Option	Long 600	Broker 1
March 2018 Bund 164 Call Option	Long 500	Broker 2
March 2018 Bund 163 Put Option	Long 500	Broker 2
June 2018 DAX 16500 Call Option	Long 600	Broker 2
June 2018 DAX 16000 Put Option	Long 600	Broker 2

This will result in the following initial margin:

	VaR Margin Component	Liquidity Add-on	Total IM
Broker 1	3,157,610	764,644	3,922,254
Broker 2	3,157,610	764,644	3,922,254
Total	6,315,220	1,529,288	7,844,508

This is a margin saving of EUR 1,359,864 or 15%. And if there were four clearing brokers available the total margin would be reduced to EUR 7,159,572 which is a 22% margin saving.

BEST PRACTICE #4 - MAINTAIN OPTIMAL CASH BUFFERS

Getting the amount of cash buffer required correct is key to successfully managing your margin requirements. Too small and firms won't be able to meet margin calls, which have become larger and more frequent under current market volatility. But getting it too large is depleting working capital and inhibiting revenue generating opportunities. Firms need to be able to forecast liquidity requirements to optimise their use of derivatives and ensure they are not forced to close out positions in times of stress.

Both variation and initial margin can impact the margin call, and firms need to be able to predict how they might be impacted by any changes, be that in market prices, margin parameters, or their own positions. There are techniques that can be used to do this:

- **Intraday margin calculation - using changing levels of requirements during the day as an estimate of the margin call for the next day.**
- **Margin at Risk - using a VaR methodology to predict likely margin calls at a defined confidence level.**
- **Backtest these scenarios against actual margin changes to determine the required size of the liquidity buffer**
- **Stress test margin requirements to prepare for extreme volatility**

Each of these is described below in more detail.

INTRADAY MARGIN

To be able to predict your margin first of all you need the current position - all existing positions and any new trades from that day.

Then to calculate the variation margin you need the latest available prices. These can be obtained from any suitable market data source, for example Reuters. They won't necessarily be exactly the same as the exchange closing prices, but they will be close enough.

After that you need the necessary market data and parameters to calculate the initial margin. The CCP may only publish these figures well after the close of the market when it will be too late, so as a proxy the previous day's margin data will have to be used. Actually, this is a perfectly good proxy as daily initial margin change is mostly impacted by change in position.

Put all these things together, calculate the total change in margin compared with the previous day, and the result will be a good prediction of your margin call for the next day.

MARGIN AT RISK

Stress testing (see below) provides you with an estimate of the worst case margin requirement, but this is generally looking at extreme events. What might be more useful is a way of predicting a likely requirement under normal circumstances.

VaR is used to estimate potential market losses, based on historical price moves and the same technique can be used to estimate potential margin levels. First of all you need to calculate margin on the current position using historic margin data. This sounds like a relatively easy process, even if it does involve a lot of number crunching. However, there are a few things that need to be considered:

- How do you map current expiries to those that existed on historic dates?
- What about options; what method do you use to map strike prices?
- And how do you deal with contracts that are newly introduced?

Once you have solved these problems you will be left with a series of potential initial margin numbers for the current portfolio. You can then use these to predict the next day margin requirement for a given confidence level by using VaR.

And given that IM is a measure of a potential loss over a given holding period (one or two days for ETD, five days for OTC), you can use this number to determine a possible VM call as well.

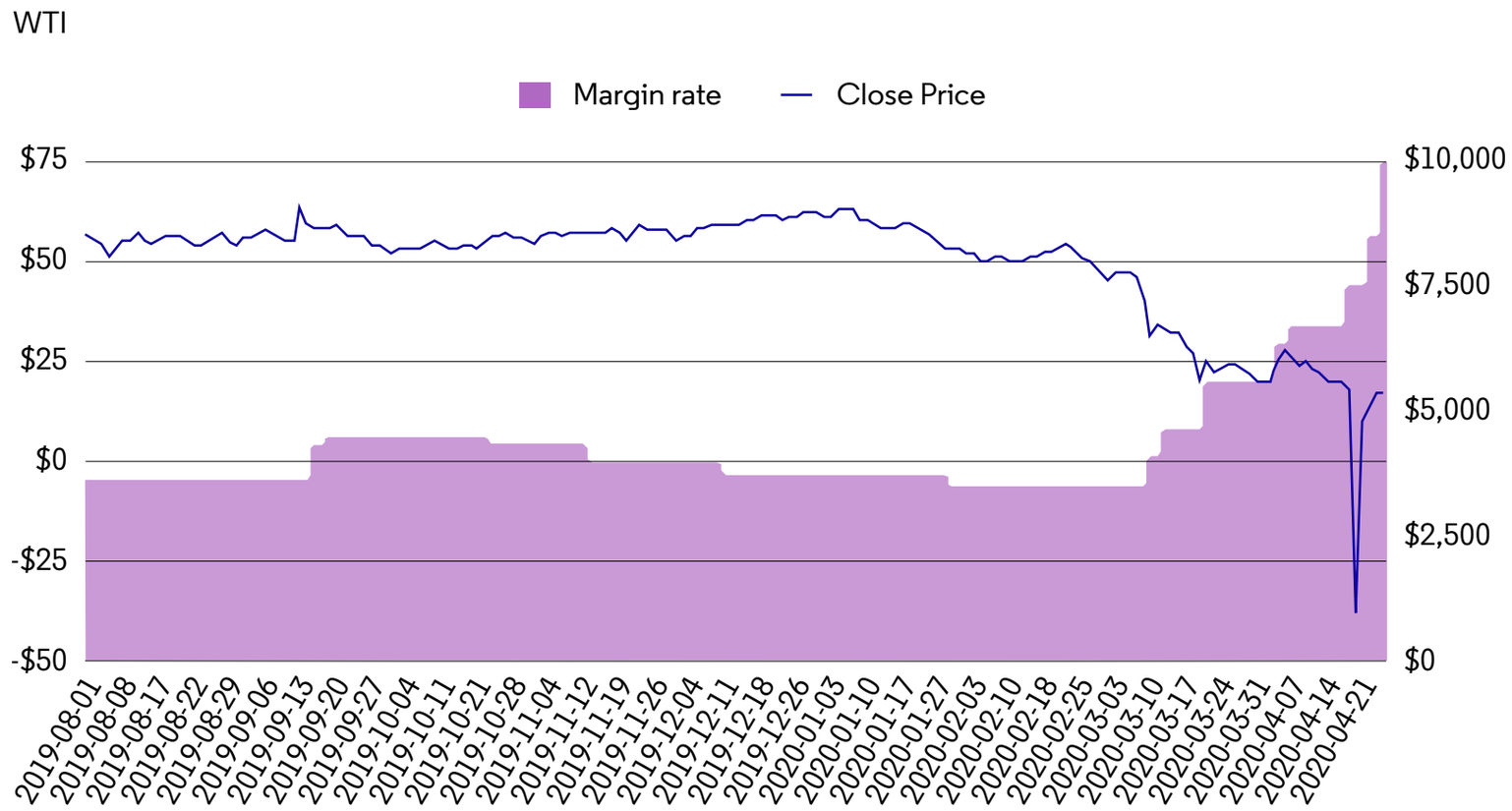
BACKTESTING

The best way of making sure that you get your liquidity requirements right is by backtesting the results obtained from each of the methods above against the observed initial and variation margin. This will show the number of times that actual margin breached the predictions.

Given your risk appetite, this analysis can be used to size the liquidity buffer going forward. The backtesting allows you to test which scenario gives the optimum size of liquidity buffer. There is a balance to find between a scenario which covers the worst case margin increases but without leaving too much excess, which would incur a drag on returns.

STRESS TESTING

The graph below shows the way in which prices and margin rates for WTI changed both before and during the worst of the volatility in 2020.From the graph it can be seen that both the price and the margin rate changed significantly.



Any price move will impact the variation margin requirements. In this case the sudden drop in prices impacted all long position holders, but then the jump back up impacted short position holders. It can be seen that in April 2020 these moves were way beyond the normal price moves that had been seen historically.

In this case, the increase in volatility caused CME to adjust the margin rates. The graph clearly shows how these moves were far larger and more frequent than those that are normally seen. Were a VaR based algorithm being used, this volatility would similarly have resulted in an increase in margin. The large price moves would become new historical scenarios and the increase in volatility would have been used within the Filtered Historical VaR used by most CCPs to scale up any assumed losses within the VaR calculation.

This extreme volatility creates two challenges for treasurers:

- The first is price volatility itself, which makes it very difficult to predict variation margin requirements and therefore cash outflows;
- The second is the change in margin rates by clearing houses in response to price volatility, which results in higher initial margin requirements.

Quantifying the potential initial and variation margin impact of these extreme scenarios is critical to managing credit lines and liquidity buffers. These needs to take into account the way in which margin is calculated:

- CCP margin models have undesirable characteristics in volatile markets, where high price volatility leads to increases in initial margin rates regardless of the direction of the position, exacerbating the inevitable impact of variation margin.
- Intraday margin calls are one way only, with any excess margin not being paid back to firms. This can cause intraday cash flow issues.

To try and estimate how bad the margin call might be then it is necessary to look at what the requirement could be under a number of different scenarios. These could be based on historic stress events, or theoretical scenarios - this is similar to the stress testing conducted by CCPs to size their default funds.

A simple way of defining theoretical scenarios is to look at a series of user-defined moves in a key risk factor (for example USD interest rate) and then assume that the correlations between this and other risk factors remain unchanged. Using these price moves you can then calculate predicted margin requirements under different levels of moves in the market.

And a small variation on this is to choose historical correlations between the different risk factors, say from a particular period of market stress. Or alternatively to define your own correlations to determine what would happen if there was a breakdown in the normal relationship between different contracts.

Alternatively, you can look at the potential margin requirement under various historic stress scenarios, for example the 2008 financial crisis. This type of scenario allows a firm to understand how the market price and margin rate shocks that occurred historically would impact initial margin or variation margin calls tomorrow if they were to happen again.

CONCLUSION

Taking all of the above into account, there are a number of actions that should be considered “Best Practice” to answer the key questions:

1

Best Practice #1 - Ensure you are called for the right amount of margin

Action #1 - Validate initial and variation margin requirements systematically, to ensure you are not over-posting.

2

Best practice #2 - Understand the drivers of margin change

Action #2 - Understand the drivers of margin, how they evolve over time, and be prepared to explain why initial margin does not behave in the ways traders expect.

3

Best practice #3 - Minimise the margin you post

Action #3 - Automate the process to free up cash by optimising your derivatives portfolio.

4

Best practice #4 - Maintain optimal cash buffers

Action #4 - Forecast next day margin calls and determine the right amount of cash to leave at clearers and exchanges to avoid getting called for margin too often or having to liquidate positions in times of stress.

1

Best practice action #1 - Validate initial and variation margin requirements systematically, to ensure you are not over-posting

Best practice expands the scope of the daily reconciliation process beyond basic position reconciliation to include:

- Settlement price reconciliation to ensure the broker / CCP is correctly sourcing settlement prices
- OTE / Variation Margin reconciliation to ensure the settlement prices are being applied to the correct positions
- Initial Margin reconciliation based on a fully independently calculated margin, to ensure that the margin computed in legacy systems is correct
- Independent checks of cash balances and collateral value to validate the final call amount.
- Independent checks of fees, interest and commissions to identify errors.

Best practice action #2 - Understand the drivers of margin, how they evolve over time, and be prepared to explain why initial margin does not behave in the ways traders expect.

Best practice requires that the firms have the capability to:

- Calculate margin at sub-account (typically provided by the clearer) but also desk/trader/product levels to assess their contribution to the overall margin requirement.
- Allocate margin shifts to changes in positions, prices and margin rates - the main drivers of margin change

In stressed markets, firms need to be able to suggest positions to liquidate that maximise margin reductions, and then be ready to defend why the proposed unwinds may not be obvious or intuitive to the traders. These conversations require a deep understanding of the nuances of clearing house margin models (like SPAN and VaR), backed up by reports that turn subtle complexities into clearly explained outcomes.

Such reports typically show the margin impact on the account of removing individual positions and strategies, with the required level of detail (such as SPAN delta, inter and intra-commodity offsets) to explain to traders and senior management the resulting change in margin.

2

Best practice action #3 - Automate the process to free up cash by optimising your derivatives portfolio

The best practice is to develop a fully automated daily process that factors in all costs and constraints to provide actionable recommendations that deliver real world savings.

In calm markets, margin optimisations directly reduce financing costs. In stressed markets, freeing up cash may allow the firm to avoid the need to liquidate hedges or profitable speculative trades, directly impacting the P&L of the business.

This is typically done by running simulations for moving the largest positions between exchanges and clearing brokers, ranking each move by the largest margin reduction.

Treasurers who regularly optimise their cleared portfolio reduce their overall margin requirements by 10% to 20%.

3

4

Best practice action #4 - Forecast next day margin calls and determine the right amount of cash to leave at clearers and exchanges to avoid getting called for margin too often or having to liquidate positions in times of stress.

Best practice is to fully recalculate initial margin and variation margin intraday based on the latest positions and prices. The calculations should be run before any funding cut-offs and before the market close so that firms can take any necessary action to reduce margin. The calculation should include both initial and variation margin forecasts that are then compared to the liquidity available to the firm, as well as current cash balances at the clearers and exchanges, so that any margin deficit can be met.

In addition, firms should calculate projected initial and variation margin requirements, based on an agreed confidence level, for the current portfolio – comparing this report to actual cash balances allows treasurers to ensure that they are leaving sufficient cash to meet margin calls, without incurring unnecessary financing costs (buffer too large) or operational costs (buffer too small, requiring cash transfers to meet margin calls).

A commonly-used approximation technique is to calculate the "sensitivity" of margin to predefined price moves in key underlying commodities, based on the most recent correlation between market prices. Firms will then be able to quickly predict how much extra margin they would need post, based on the actual intraday price moves. Such forecasts have proven to be reliable, and are typically reviewed by senior management on a regular basis in times of market volatility.

Firms need to be prepared for volatile markets by planning for extreme events well in advance. Best practice is for firms to replay historical prices and margin rates to see how initial and variation margin would have changed for the current portfolio. With this information firms can then review their current liquidity to ensure that even under extreme market conditions they would have sufficient resources to cover the volatility.

OPENGAMMA

OpenGamma is a derivatives analytics firm with unparalleled expertise in OTC and ETD margin methodologies, backed by CME, JSCC, Accel and Dawn. Our teams bring together a unique mix of practitioner, quantitative and software engineering expertise. Today, we are trusted by the largest and most sophisticated global banks and fund managers, with thousands of users depending on our analytics. Our product coverage spans across margin solutions (validating and optimising cleared and bilateral portfolios), UMR or SIMM processing and regulatory reporting.

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