The New Economics of OTC Derivatives:
MVA vs. CVA, FVA & KVA

The impact of Initial Margin

Part 1

March 2016
Version 1.0
Executive Summary

From September 2016 the financial industry is facing new regulation that is going to shape (again) the business of OTC derivatives: all tier-1 derivative dealers will have to post Initial Margin on their books of bilateral trades. From September 2020 nearly all financial institutions will have to comply.

The consequence is that, in the many netting sets affected by this change, counterparty risk mostly disappears and, hence, CVA and DVA go to nearly zero. Also, CCR and CVA capital should become negligible if we are able to simulate the Initial Margin in the IMM capital calculations. This positive impact is however achieved at a high cost: the funding cost of the Initial Margin that needs to be posted.

Our estimates indicate that the cost of trading will go up to the levels of pre-2008 uncollateralised transactions (but with the difference that XVAs were not known at the time, so they were not accounted for). By around 2020, tier-1 banks will easily have funding costs from Initial Margins in the order of many hundreds of millions each, and balance sheet impacts easily in the billion territory if nothing is done to manage them. This cost will gradually kick in from September 2016.

The pricing and balance sheet adjustment that accounts for the present value of the future funding cost of Initial Margin is being called by the industry “MVA”.

This new framework is going to have important implications for pricing, risk management, hedging, collateral management, regulatory capital, systems and operations.

Computing and hedging MVA seems most difficult at first glance. XVA desks need to run a Monte Carlo VaR-based Initial Margin calculation within the already existing XVA Monte Carlo simulation; that is, a VaR in each node of the Monte Carlo engine. Furthermore, in order to do this the engine needs to compute the Greeks of each derivative “on-the-fly” in each calculation node, as the Standard Initial Margin Model (SIMM) that is being adopted by the industry is a Greek-based VaR calculation. XVA engines can hardly cope with pricing; this adds a new edge to the computational challenge.

In addition, in order to benefit from the decrease in regulatory capital, banks also need to simulate the Initial Margin inside the IMM Monte Carlo engine.

These tasks, that seems most difficult at first glance, can be approached accurately and with high speed with a new algorithm that we introduce in this paper.

In Part 1 of this paper we introduce the details of the new regulatory framework and present computations of all XVAs (including MVA) under different trading conditions for an illustrative interest rate swap. We see how the cost of trading is going back to the old uncollateralised levels with the new regulation. We also show how banks now have a clear economic incentive to clear trades via CCPs, but also that there will still be a strong market for bilateral trading. We see how MVA can have strong Wrong Way Risk and how not only the actual value of MVA will be very high but its volatility will be very strong too in stressed markets as a result of the leverage mechanism that the regulatory €50m threshold
produces. Therefore, simulating the Initial Margin accurately within the XVA Monte Carlo engine is central for correct pricing and hedging.

In Part 2 we present a method that enables accurate and fast computation of MVA via a dynamic SIMM simulation inside the XVA Monte Carlo engine. We show how important a good SIMM simulation is by seeing its effect in an illustrative trade with strong Initial Margin funding Wrong Way Risk effects (a swaption). To our knowledge this is the only general method that exists to simulate SIMM dynamically (hence calculate MVA) in an accurate and timely manner.
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Introduction

In March 2015, the Basel Committee on Banking Supervision published the final version of the Margin Requirements for Non-Centrally Cleared Derivatives (Bank for International Settlements, 2015). In this document the committee sets the regulatory guidelines in regards to the upcoming mandatory exchange of margin between counterparties in the OTC derivatives market when those derivatives are not cleared. These guidelines are now being implemented in all jurisdictions around the world.

The Basel Framework

The new regulatory margining framework is based on eight principles. As a summary:

1. All non-centrally cleared OTC derivatives are subject to margining except a number of physically settled FX transactions.
2. The entities subject to this regime are called “Covered Entities”. In principle most players in the market of OTC derivatives are subject to being Covered Entities except corporates that are non-financial and non-systematically important, as well as sovereigns.¹
3. Counterparties trading OTC derivatives need to exchange both Variation Margin to cover current exposure and Initial Margin to cover potential future exposure. Basel proposes a “standardised schedule” to calculate Initial Margin in an easy way, as well as the guidelines of a more precise “model-based” method for it, which must be approved by local regulators. The standardised schedule is estimated to increase Initial Margin requirements around 7 times in contrast to the model-based method (ISDA, 2012).
4. There is a suggested list of permitted collateral, which includes cash and highly liquid risky collateral such as bonds, equity and gold. In the latter cases, it must suffer a haircut to account for its riskiness. There are also both a simple “standardised schedule” and a more sophisticated “model-based” method for the haircuts.
5. Variation Margin can be re-hypothecated, but Initial Margin cannot.² This is going to have very important risk management and cost implications for the banking industry; we are going to expand on it. Also, most importantly, there is a threshold of €50 million for the Initial Margin.
6. Affiliated entities do not need to exchange margin.
7. Cross-border transactions should be subject to the tightest of the margin requirements in all jurisdictions where it applies.
8. These margining requirements will be introduced during a phase-in period. Originally it was intended to start in December 2015, but this has now been pushed back to September 2016. Any Covered entity with a notional amount of non-cleared OTC derivative above €3.0 trillion must start exchanging margin from this date. This threshold level becomes gradually lower over a four year period, down to a level of €8 billion in 2020.

¹ Public entities, central banks, supra-national development banks, the Bank for International Settlements, etc.
² Initial Margin could be re-hypothecated under a number of special conditions that do not apply in general.
All jurisdictions are now putting in place legal frameworks to make this Basel proposal legally enforceable.

**Risk Reduction via Margining**

The basic idea of these new rules for the bilateral trading of OTC derivatives is that the counterparty credit risk that damaged the industry and the overall economy in 2008 should be wiped out as much as possible. This is achieved with two types of features: Variation and Initial Margins.

**Variation Margin**

This margin mitigates the counterparty credit risk that is faced due to the current exposure. Therefore the margin that needs to be posted is the current exposure itself. Many financial institutions have calculation engines that provide portfolio valuations and collateralised CSA with daily Variation Margin, this has been in place for quite some years now, so this margining requirement should not impose any extraordinary burden in the industry.

**Initial Margin**

In addition to Variation Margin, counterparties are now being asked to post Initial Margin to compensate for potential future exposure. The rational of this is pretty straightforward. A book of OTC derivatives is typically going to be hedged. If our counterparty defaults, it may take us some time to rebalance our hedging portfolio, and during that time the markets may move against us. So, even when the current exposure if fully collateralised, we may incur a loss as a result of the time it takes us to close the hedges or replace the defaulted positions. This is the so-called “gap” or “close-out” risk.

The Initial Margin is a protection against that risk. In the event of a default by one of our counterparties, the Initial Margin are assets that act as a cushion in our favour against the gap risk that we face. If the Initial Margin is sufficiently high, it removes the credit risk we have to a very large extent.

**Methods for Initial Margin**

There are two important points that are central to Basel’s framework for Initial Margin calculations. Firstly, the Initial Margin can be calculated at netting set level. This means that diversification effects can be accounted for within each netting set. This is important as, if imposed trade-by-trade, the required Initial Margin will surely be much higher than that actually needed for a desired level of protection.

Secondly, within a given netting set, the Initial Margin has to be calculated per asset class. Consequently, cross-asset class potential diversification effects are not considered. The asset classes where netting is allowed are currency/rates, equity, credit and commodities.

Basel provides two frameworks for the calculation of Initial Margin, one simple and punitive, one more sophisticated and accurate.
• **Standardised Schedule** – This is a framework intended to be very simple and easy to use so that unsophisticated institutions can calculate an Initial Margin compliant with Basel’s framework. It is based on a table (the Standardised Initial Margin Schedule) that assigns an Initial Margin per individual trade, as a percentage of notional. That table is available in the Appendix.

Firstly we need to calculate the Gross Initial Margin ($GIM$) which is the sum of the individual margins of all trades in a netting set. Then we calculate the Net Initial Margin ($NIM$, the actual margin to be posted) following the well-known diversification approach used for Counterparty Risk in the Basel I accord:

$$NIM = 0.4 \times GIM + 0.6 \times NGR \times GIM$$

where NGR is net replacement cost divided by the gross replacement cost of the netting set.

• **Quantitative Initial Margin Model** – As said, the Standardised Schedule calculation is intended to be simple but punitive in order to provide incentives to do proper risk-sensitive Initial Margin computations. Accordingly, Basel allows financial institutions to build their own models for Initial Margin, subject to the following guidelines:

  - The Initial Margin model must be approved by its regulators
  - It must be based in a one-tailed 99% over a 10-day period
  - It must be based on historical data
  - The calibrating historical period must include one period of financial distress
  - The maximum length of the calibrating period is five years
  - The historical data must be equally weighted at calibration

In other words, we need to calculate a 10-day 99% historical VaR.

It is important to note that Basel emphasises that institutions cannot “cherry-pick” between the Standardised and the Quantitative model as found convenient. The approach must be consistent across all trades for each asset class. However, an institution can use one approach for some asset classes and the other approach for some other asset classes.

A central question is how punitive the simple Scheduled approach is compared to the Quantitative Model one. This surely depends on lots of factors highly specific to the netting set, but ISDA has estimated that the Initial Margin benefit of one over the other is of 86% on average (ISDA, 2012).

It therefore makes obvious sense to invest in systems and processes to use the model-based approach. We will illustrate this with cost estimates in later sections.

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3 This is for daily margining. If longer margining frequencies, to this number we must add the number of days between margin calls.
Two-Way Posting & Re-hypothecation

A feature of the framework that will have most important risk management and cost implications is that Variation Margin is exchanged between counterparties in a one-way fashion: whoever has the netting set in its favour (in value) must receive the Variation Margin. However, Initial Margin is posted in a two-way fashion: both counterparties must post Initial Margin and those two margins cannot be netted off.

Furthermore, the Variation Margin can be re-hypothecated, but the Initial Margin cannot. Indeed, the Initial Margin must be held in such a way that can be promptly made available to either party in the event of a default. In practice, this means that most likely it will be held in segregated accounts by a third party.

Most importantly, given that Variation Margin can be re-hypothecated, we should expect that we will receive the risk-free OIS rate on any collateral we post in the context. However, the case of Initial Margin is different, as it cannot be re-hypothecated, and so the custodian third party will be very unlikely to give any interested on it. Indeed, if bonds or equity are posted we will still be entitled to their coupons or dividends, however a conservative haircut is applied to them and, consequently, the value we received from them can decrease notably compared to outright bond repo or equity lending.

The Standard Initial Margin Model (SIMM)

This framework raises an interesting problem: Two institutions that have to exchange Initial Margin, firstly have to agree to how much they need to exchange. How can they calculate it so that the chances of having a dispute is low?

On the one hand, we could use the standardised-scheduled approach as it will be simple to reconcile, but it has substantial funding cost implications that nobody wants to suffer from. On the other hand, we could use the model-based approach; Basel’s directives for the Quantitative Initial Margin Model are quite restrictive in many ways but they still leave enough scope for different entities to come up with different Initial Margin numbers. In such cases agreements could be tricky.

It seems that the industry agrees that we would all be better off if there were an industry-wide technique to calculate Initial Margin via the advanced model-method.

Indeed, thinking along those lines, ISDA has pushed for a Standard Initial Margin Model (SIMM) (ISDA, 2013). One of the key recommendations that ISDA introduces is that an industry-wide SIMM should be based on Greeks, as opposed to full revaluation.

If we use a 5-year historical period for the VaR calculation that leads to the Initial Margin number, we have around 1,300 daily data points. If we use the widely used Historical Simulation methodology for VaR, very often VaR engines calculate 1-day VaR and extrapolate it to the necessary time scale. An

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4 10-days in this case, by multiplying the 1-day VaR by \( \sqrt{10} \).
alternative approach is to use overlapping daily 10-day returns, and then correct the obtained VaR to account for the auto-correlation (P. Bod, 2002). In any case, for each Initial Margin calculation we have around 1,300 re-valuation points.

Doing a full revaluation for each of these points can be quite lengthy if we do not have any special ultra-fast method, so what ISDA proposes is to use the portfolio Greeks instead of a full revaluation approach. These Greeks are typically computed for each derivative in an over-night batch, so that they are readily available to risk managers every morning.\(^5\)

The subsequent problem

The method suggested by the ISDA makes sense. However, it is not the end of the story: how do we calculate the future cost of funding of Initial Margin? We know that cost is going to be very high and we should be hedging it. In order to do this we need to simulate the deltas of each derivative dynamically inside a Monte Carlo simulation... Can we do a dynamic SIMM simulation in an efficient manner?

Indeed, this is possible for nearly any OTC derivative with the right techniques, as we will see in detail in the second part of this paper.

\(^5\) Other key elements of a SIMM are how to pick the historical period for the VaR calculation and what kind of daily-return models should be used: normal or lognormal? On the first topic, an obvious candidate should be the 5-year period starting in 2007. On the last one, it is particularly relevant for interest rates, as historical evidence shows that rates tend to behave approximately in a lognormal fashion when away from zero, but they become “normal” as they approach zero. Being a very relevant topic, we will not expand on this as it is beyond the purpose of this paper.
The New Economics of Trading

The consequences of the new trading landscape are quite profound. This new framework is going to change deeply the way we price and manage OTC derivatives as it substantially changes their economics. Let’s see this with a few illustrative examples.

Traditional bilateral uncollateralised trading

The trading framework in an uncollateralised netting set, without the upcoming Initial Margin requirements, is displayed in the following diagram

![Diagram](image)

*Figure 1: Economics of bilateral uncollateralised trading without Initial Margining*

We have a book of OTC derivatives with a Counterparty. We are a derivatives dealer, hence we want to be market-risk neutral. We achieve this by having an equivalent and opposite trade with a Hedging Institution. Traditionally, the hedging positions have been collateralised with a Variation Margin. For any cash Variation Margin that we post, we are going to receive the risk-free OIS rate. That Variation Margin collateral needs to be borrowed from a Funding Institution that is going to charge us the risk-free OIS rate plus our own funding spread. Therefore this set up is costing us our own funding spread. We account for this with the FVA_{VM} (sometimes called CollVA (Collateral Value Adjustment) or just FVA (Funding Value Adjustment)).

Traditional bilateral collateralised trading – only Variation Margin

The trading framework in a collateralised netting set without Initial Margin is now displayed.

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6 Let’s assume for simplification that we have a back-to-back identical trade with the hedging institution. If this is not possible the dealing desk at the Derivatives Dealer is going to hedge the P&L of the derivative via delta-hedging as per the well-known Black-Scholes framework.
In this set up, the Variation Margin that needs to be posted to one side of the deal is the same but in the opposite direction than the Variation Margin in the other side of the deal, hence the funding costs are zero as long as the collateralisation agreement in both sides are symmetric.\textsuperscript{7,8}

**New bilateral uncollateralised trading – with Variation and Initial Margin**

Under the new margining rules, the economics of trading change. This is illustrated in the following Figure.

\textsuperscript{7} The trades with the Counterparty is one side and the trades with the Hedging Institutions are the other side of the deal.

\textsuperscript{8} Strictly speaking, there is a 1-day funding cost, as that is the time it can takes us to receive the collateral from one side to post it to the other side... but this refinement is typically ignored.
In this case, the cost for the Dealer is

- On the Variation Margin, the cost is going to be driven by the Dealer’s own funding spread.
- On the Initial Margin, the Custodian is not going to give any risk-free OIS rate on it given that it cannot be re-hypothecated. Hence the cost that the Dealer is driven by the whole funding rate, i.e. IOS plus its funding spread.

New bilateral collateralised trading – with Variation and Initial Margin

The economics of trading in a collateralised way under the new margining rules also change, as illustrated in the following Figure.

![Diagram showing the economics of new bilateral collateralised trading with Initial Margining](image)

Figure 3: Economics of new bilateral collateralised trading with Initial Margining

The costs will be driven by

- Regarding the Variation Margin, things stays the same compared to the traditional case (without Initial Margining) so no added cost or benefit from it.
- Regarding the Initial Margin, the Dealer will have to pay its whole funding rate (i.e. IOS + funding spread) on the Initial Margin that it needs to post on both sides.

Trading through a Central Clearing Counterparty
Another possibility is trading via a Central Clearing Counterparty (CCP). In fact, this is becoming compulsory for a number of trade types.

In this case the economics of the trades are similar to those of the new bilateral trading with Initial Margin, but it should be cheaper for a couple of reasons:

- Regarding Variation Margin, the effective flow of those margins will be the same as in the case of bilateral trading, but in this new case we typically receive OIS minus a spread on the collateral posted, hence making it more expensive compared to the bilateral situation.
- On the Initial Margin there are a number of considerations. On one hand, the calculation of Initial Margin that CCPs do is more aggressive than the SIMM, hence the Initial Margin to be posted to a CCP should be lower than if we had the same trades in a bilateral basis. Also, it will be lower via a CCP because the netting sets with them comprise a very large number of trades that correspond to lots of different counterparties, and so multilateral netting effects kick in. On the other hand, in the bilateral case we have a €50 million threshold which will lower the actual Initial Margin to be posted.

Some Extra Considerations

Here we are assuming that a Dealer posts cash. However, very often it posts other assets like bonds. In these cases the institution posting bonds receives its coupon payments as they are the legal owners. We are reducing this analysis to the case of cash as payments are more easily tractable and it should offer an upper limit to the cost of trading given the haircut that risky collateral suffers. If that is not the case, we would be better off repo-ing the bonds that we have and posting the cash we get for them. However, a more refined analysis could be done in which the economics of posting bonds and its liquidity can be taken into account.

Also, we have considered two cases for bilateral trading for illustrative purposes, uncollateralised and collateralised. However, there are a number of hybrid interesting case.

- If the counterparty is a non-covered entity (i.e. it does not need to post or receive Initial Margin) but it is happy to post Variation Margin, it could do so and then the CVA and KVA charge will decrease substantially and the FVA_{VM} will go to zero. However we may want to attribute an FVA_{IM} to this counterparty as a result of the Initial Margin posted in the hedging positions.
- If the counterparty is a covered entity and we hedge the netting set with products that can be cleared, if only partially, the whole economics of trading can benefit from the multi-lateral netting that takes place in our nettings set with the CCP, as well as from the lower cost of funding Initial Margin in this context.

In the next section we are going to see how the XVAs of these trading conditions change for a few representative examples.
A New Degree of Complexity

The clear conclusion from this section is that the business of OTC derivatives becomes highly sophisticated in the new world. If we want to optimise the efficiency of our OTC books we must be able to analyse its costs and impact on liquidity when trading through a number of venues, understand different hedging strategies and optimise collateral utilisation. In particular, understanding the future cost of Initial Margin will be at the very core of this new analysis process.

MVA vs. CVA, FVA & KVA

So, a central question is... how much is all this going to cost financial institutions? And how can that cost be managed?

A number of estimates indicate that tier-one financial intuition will have annual funding cost from Initial Margin in the order of a few hundreds of USD millions once most trades are subject to it, only in a few years. This estimate is in line with the Fed estimates of an annual cost of $2.5b in the US alone (Madigan, 2015) and ISDA estimates of a low number of $tr of global Initial Margin (ISDA, 2012). The subsequent balance sheet impact in a tier-1 bank should be well in the $bn territory in the longer term if nothing is done to manage it. (See Appendix in Part 2 for details)

The Funding Cost of Initial Margin (MVA)

The risk transformation from credit to funding that is introduced with the mandatory two-way Initial Margin can, arguably, make sense for global financial stability, but it creates a real headache for a financial institution that wants to control its costs and risks well.

The funding cost of the Initial Margin (MVA) at a point in time \( t_0 \) is going to be given by

\[
FVA_{IM,t_0} = E \left( \int_{t_0}^{T} (r_t + s_t) \cdot DF_{t_0,t}^* \cdot IM_t \cdot dt \right)
\]

where \( E(\cdots) \) is the expectation operator, \( r_t \) is the risk-free rate, \( s_t \) is our funding spread, \( DF_{t_0,t}^* \) is the risky discount factor from time \( t_0 \) to \( t \), \( IM_t \) is the Initial Margin with our counterparty at time \( t \) and \( T \) is the maturity date of the portfolio under consideration.\(^9\)

In order to calculate MVA, we need to run a Monte Carlo calculation, compute the Initial Margin in each time step and scenario, plug it into the MVA equation, multiply by its given level of risk free rate and

\(^9\) It is important to emphasise that we need the risk-free rate in addition to our funding spread because the Initial Margin that we post to a custodian cannot be re-hypothecated and, consequently, we should not expect to receive any risk-free OIS rate on it.
funding spread at that scenario, and compute the integral. It is important to do it like this as otherwise we will be missing an important funding Right and Wrong Way Risk in the calculation, as explained below.

Each Initial Margin calculation is a Monte Carlo simulation in itself, with 1,300 scenarios, and we need a value of the Greeks of the portfolio in each time step and scenario in order to do a SIMM simulation.

Right and Wrong Way Risk in MVA

To make things a bit more complicated, the FVA of Initial Margin has right and wrong way risk (RWWR) all over it.

Most of the times that we encounter an XVA formula, we tend to take the expectation operator into the integral and consider then that the value of the portfolio is approximately independent from all other terms in the integrand. For example, in the case of CVA,

\[ CVA_{t_0} = \mathbb{E} \left( \int_{t_0}^{T} (1 - R) \cdot PD_t \cdot DF_{t_0 \rightarrow t}^* \cdot V_t^+ \cdot dt \right) \approx \mathbb{E}(1 - R) \cdot \int_{t_0}^{T} \mathbb{E}(PD_t) \cdot \mathbb{E}(DF_{t_0 \rightarrow t}^*) \cdot \mathbb{E}(V_t^+) \cdot dt \]

In this way the computation tends to be reduced to marking the expected recovery rate \((R)\), default probability \((PD)\) and discount factors to the levels seen in the market, and the only real computational challenge comes when calculating the expected exposure \(EPE_t = \mathbb{E}(V_t^+)\). When we cannot do that we say that we have right or wrong way risk, typically when the default probabilities and the exposures are correlated.

In MVA we actually face a right-and-wrong-way-risk effect as in many cases there is an important dependency between \(r_t\) and \(IM_t\).

For example, let’s say that today we are long an at-the-money call swaption. In future scenarios where the swaption moves into the money, \(r_t\) will be high and also the trade’s delta will be close to one, which means that its Initial Margin will be high when the cost of borrowing is also high. However, when it ends out of the money, \(r_t\) will be low and its delta will be close to zero, which means its Initial Margin will be very low when we hardly need to borrow any collateral. This is an example of funding wrong-way-risk.\(^{10}\)

\(^{10}\) Similar effects can, arguably, take place with the funding spread. One could take the view that if risk-free rates get too high, that is an indication of a high inflation or general economic difficulties, hence implying high funding spreads.
In most cases, each netting set will be comprised of several trades, so the directionality and intensity of the right-and-wrong-way-risk effect cannot be determined generally. Therefore, the only apparent way to measure and manage this well is to calculate the Initial Margin case-by-case in the Monte Carlo simulation and pull statistical metrics like MVA considering the cost of funding in each scenario.

That example illustrated right and wrong way risk for a very simple interest rate product, but similar features will exist in many other products, complex netting sets, credit trades via the correlation with our own funding spread, etc.

This funding right and wrong way risk should not be left aside. If ignored, FVA will be wrongly marked, trades wrongly priced and hedging will be off from the actual funding costs that we encounter as trades mature. By this it is meant that if RWWR effects are not accounted for we will find ourselves in situations in which our real funding costs could exceed the expectations and, consequently, the hedges that we have in place do not deliver the P&L that we need (or vice-versa, we would have constrained the business unnecessarily). These mistakes may have mild effects in quiet periods, but will surely show up in full force when we least need them: in the next crisis.

Numerical Examples

A central question is how do the different sources of cost of trading (credit risk hedging, funding cost and capital cost) relate to each other under the different trading set up that we have now? To answer this question we have worked out two numerical examples. In this section we show results for a 10-year USD interest rate swap. In Part 2 of this paper we show results for a 2y10y USD swaption.

10-year Swap
The following figure shows the new balance of XVA under the new regime. We show these numbers for a 10-year swap as an illustration. In order to calculate the funding cost of Initial Margin, SIMM was simulated dynamically in each single path and time step of the simulation. This was possible, perfectly and without any proxies, via de Algorithmic Pricer Acceleration (APA) and Algorithmic Greeks Acceleration (AGA) methods described in Part 2 of this paper.

CVA is taken in the unilateral case as it represents the actual (credit hedging) cost that a financial institution faces. FVA represents the actual funding cost from two sources: from Variation Margins (FVA\textsubscript{VM}, sometimes called CollVA, of simply FVA) and from Initial Margins (MVA). KVA is taken as the present cost of future capital of both the CCR and CVA regulatory capital under the IMM advanced approach.

We can distinguish the following cases

- **Bilateral Uncollateralised, before Initial Margin rules**: this is the way OTC derivatives have been traded mostly up to 2008. Since there is no collateral being exchanged at all, counterparty credit risk is high and, hence, CVA is substantial. Funding risk is also important as these trades have been typically hedged with collateralised positions that require Variation Margin. Finally, capital is also strong because of the high counterparty credit risk that we face. It must be noted that, even though those trading costs have always existed, most banks started to compute them only after the 2008 events.
• **Bilateral Collateralised, before Initial Margin rules:** this is the set up under which a large proportion of bilateral trading activity takes place now. Counterparty credit risk gets reduced to the gap risk, hence it decreases most substantially. Funding risk disappears because collateral needs are matched back-to-back with the hedging positions. Capital also decreases substantially following the decrease in default risk.

• **Bilateral Uncollateralised, with Initial Margin rules:** this is the new framework that corporates will be facing if they prefer to trade bilaterally in an uncollateralised manner. The counterparty credit risk does not change compared to the old framework, hence CVA and KVA remains the same as before. However, those trades will now be typically hedged with collateralised positions that require Initial Margin that needs to be funded. Consequently, the funding requirements become very large: in addition to the cost of funding the variation margin there is the added cost of funding the Initial Margin.

• **Bilateral Collateralised, with Initial Margin rules:** in the old world, when moving to collateralised there would still be some counterparty risk coming from the gap risk. However, under the Initial Margin framework we have an Initial Margin waiting for us at the custodian segregated account so that, should our counterparty default, it will cover for our gap risk with a high level of certainty. Therefore, CVA goes to near zero. Also, if we have the SIMM model implemented and approved in the advanced capital calculation, capital and KVA will go down to negligible levels (if that is not the case, we have to add a KVA on top of these XVAs). In the case of funding, the funding cost coming from variation margin disappears similarly to the old framework if we have the same variation margin requirements (but symmetric) with the hedging institutions. However, we still need to post Initial Margin to the custodian, which creates an important funding cost.

• **CCP:** finally, if we trade via a CCP, counterparty risk and capital also go to near-zero, but in this case we need to fund the Variation and Initial Margin that we are asked for. In this case we must remember that CCPs can generally re-hypothecate collateral, and so they return OIS on posted collateral minus a spread that they charge. Also, the Initial Margin that CCPs ask for tends to be lower than that given by SIMM and they also benefit from a multilateral netting effects.

To be noted, we have not considered the €50m threshold in this analysis, as in this way we can do like-for-like comparisons. However, when an institution does this kind of analysis for its book of trades, it should consider that threshold as highlighted in the next section.

### Consequences

11 We assume this is done via an un-cleared trade.

12 We assume that the hedging positions are cleared.

13 We assume that the IM of CCPs is around 80% of SIMM, and that the multilateral netting reduces exposure by 50% of the equivalent bilateral positions.

14 Nor any minimum transfer amount, rounding, etc.
This analysis shows that under the new regulations, the cost of trading captured in the XVAs is going to increase substantially even for institutions that are not directly affected by the new Initial Margin rules. We can see clearly how credit risk is being wiped out the system at the expense of funding cost.

A second conclusion of this analysis is that the complexity of the calculation has now increased substantially. In this illustrative example we make some assumptions so we can compare “apples with apples”, but the reality is more complex that this as collateral management, liquidity and multilateral netting effects will play an important role in the real world.

How to Minimise this Cost

The natural following questions are: how can we minimise the new very high cost of trading? How can we control the risk introduced by the swings in the cost of funding?

The first obvious answer is to clear as many trades as possible via CCPs, as the cost of trading is smaller in that framework. If one of the main goals of regulators with this new margining regime is to incentivise clearing... it has been very much achieved. Having said that, it must be remembered that the demand for bilateral trading will keep on existing as not all trades are suitable for clearing: many international corporations rely on non-vanilla trades to hedge their FX exposure, non-vanilla interest rates options are needed in the mortgage market, pension funds and insurance companies rely in specific solutions tailored to their needs, corporates and energy suppliers need tailored derivatives to manage their energy and commodity risks, etc. Indeed, the demand for bilateral trading is so important that the market has been constantly growing nearly non-stop in the past twenty years in spite of the 2008 banking crisis and its aftermath.

So, with regards to the bilateral trading business that will continue to exist

- **Threshold management**: Each pair of counterparties will enjoy a collateral threshold of €50m. In order to minimise the upcoming funding costs we want the book of trades with each counterparty to be as close as possible to that threshold. In fact, anecdotal evidence that we have been able to gather indicates that all market players intend to do so as much as practically possible. However, it must be remembered that this is a double-edge sword as the closer a netting set is to the Initial Margin threshold the more difficult it will be to manage its swings in stressed markets, precisely when market players least need extra problems.
- **Collateral Management**: Optimal collateral management is already important but it will become even more central. Optimising the collateral to be posted, in different currencies, in different forms (cash, government bonds, corporate bonds, equities, etc), and always within the constraints of the LCR and NSFR, will be critical.
- **Funding Hedging**: We have seen that the cost of funding coming from Initial Margin will be very large. In addition, its swings in turbulent markets will also be most substantial. We can easily
expect balance sheet swings very well in the excess of $100m for many institutions. Therefore, controlling and locking that cost is going to be central. Obviously, this can only be achieved if we have a good idea of what those costs could be in the future and how much they can swing. Those that are willing to live with “simplified” calculations of these costs could be exposed to critical balance sheet losses in turbulent times. Hence...

- **Investment in risk monitoring tools**: Those that invest in good accurate calculations of the funding costs of Initial Margin will be in good shape to handle the instability of stressed markets. Those that hedge the real costs they expect to have, as opposed to hedging vague approximate numbers that a poor model gives, will be in good shape to sail through stormy periods.

- **Trade compression**: This is a solution that definitely needs to be considered, but perhaps it will have limited effect at present as most institutions have already gone through trade compression exercises in the context of capital optimisation. Also, there is a limit to the benefit of these exercises as end derivatives users tend to be directional in their exposure as they use derivatives to hedge the directional physical risk they face in their business activities.

- **Trade novation**: We may see that financial institutions go through regular novation exercises as a way to minimise risk and its consequent Initial Margin costs.

**Conclusions of Part 1**

We have seen how, under the new Initial Margin regulation, the OTC derivatives business becomes highly complex. That is because credit risk is greatly erased from the financial system at the expense of a most substantial funding cost. Those costs are going to be highly dominated by Initial Margins. Also they are going to be very volatile, especially in periods of market distress. Consequently, measuring and hedging its cost is going to be central to the business of derivatives. In addition, other effects like multi-lateral netting, collateral optimisation and liquidity constrains will be most important too.

This new environment can only be managed well if we can calculate MVA promptly and accurately, including its sensitivities, with realistic models.

Part 2 of this paper show how this can be achieved.

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15 See Part 2 of this paper for more details.
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