THE NEW INITIAL MARGIN OBLIGATION FOR NON-CENTRALLY CLEARED OTC DERIVATIVES:

How ISDA's SIMM Methodology Really Works

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INTRODUCTION

The global financial market reforms in the wake of the 2008 financial crisis have significantly changed the way financial firms operate. It is not only a change in operational processes, but a fundamental alteration of core banking values and habits.

This paper provides insight into the methodology of the Standard Initial Margin Model (SIMM) developed by the International Swap Dealers Association (ISDA) in 2013 to establish a standardized method to calculate initial margin (IM) for non-centrally cleared over-the-counter (OTC) derivatives. While the model is still under revision, we describe the core principles of the model, outline the challenges financial institutions are likely to encounter upon implementation, and provide techniques to manage risk. Further, we present a front-to-back impact analysis—from pricing impacts over middle-office and reconciliation, to back-office and balance sheet management implications.

OTC derivatives are the subject of significant reform ambitions. For starters, regulators introduced mandatory clearing of standardized derivatives following the sub-prime crisis in 2008. Subsequently, they required counterparties to establish bilateral margin arrangements and enhanced operational risk procedures for non-standardized derivatives that cannot be centrally cleared.

Finally, in March 2016, the European Supervisory Authority (ESA) published the "Final Draft Regulatory Technical Standards," which outlines the requirements regarding collateral exchange to cover exposure arising from non-centrally cleared derivatives. However, the European Commission did not accept ESA's proposal, thus postponing the effective date for the regulation.

But delaying the European Union's (EU) regulation, especially the draft version of the European Market Infrastructure Regulation (EMIR), does not prevent financial institutions from moving forward with other regulators. The United States and Japan are on track with their original reform schedules, which will cause cascading effective dates for each local regulator and potential deviation in their respective methodologies.

Figure 1: Timeline of financial market reforms focused on margin requirements of non-centrally cleared derivatives.

2011	JULY 2012	MARCH 2016	SEPTEMBER 2016	SEPTEMBER 2017
› The G20 agreed to add margin requirements on non-centrally cleared derivatives to the reform program to reduce systemic risk from OTC derivatives	› The first BCBS-IOSCO consultation paper was published	› The ESA published the fianl draft of technical standards on margin requirements for non-centrally cleared derivatives, and annouced a delay for EU application	› The ESA introduced variation and initial margin for covered entities withan average notional amount of non-centrally cleared derivatives above 3 trillion EUR as of Mar 2017	› The next wave of application will take effect for banks with an average notional amount over 1.25 trillion EUR

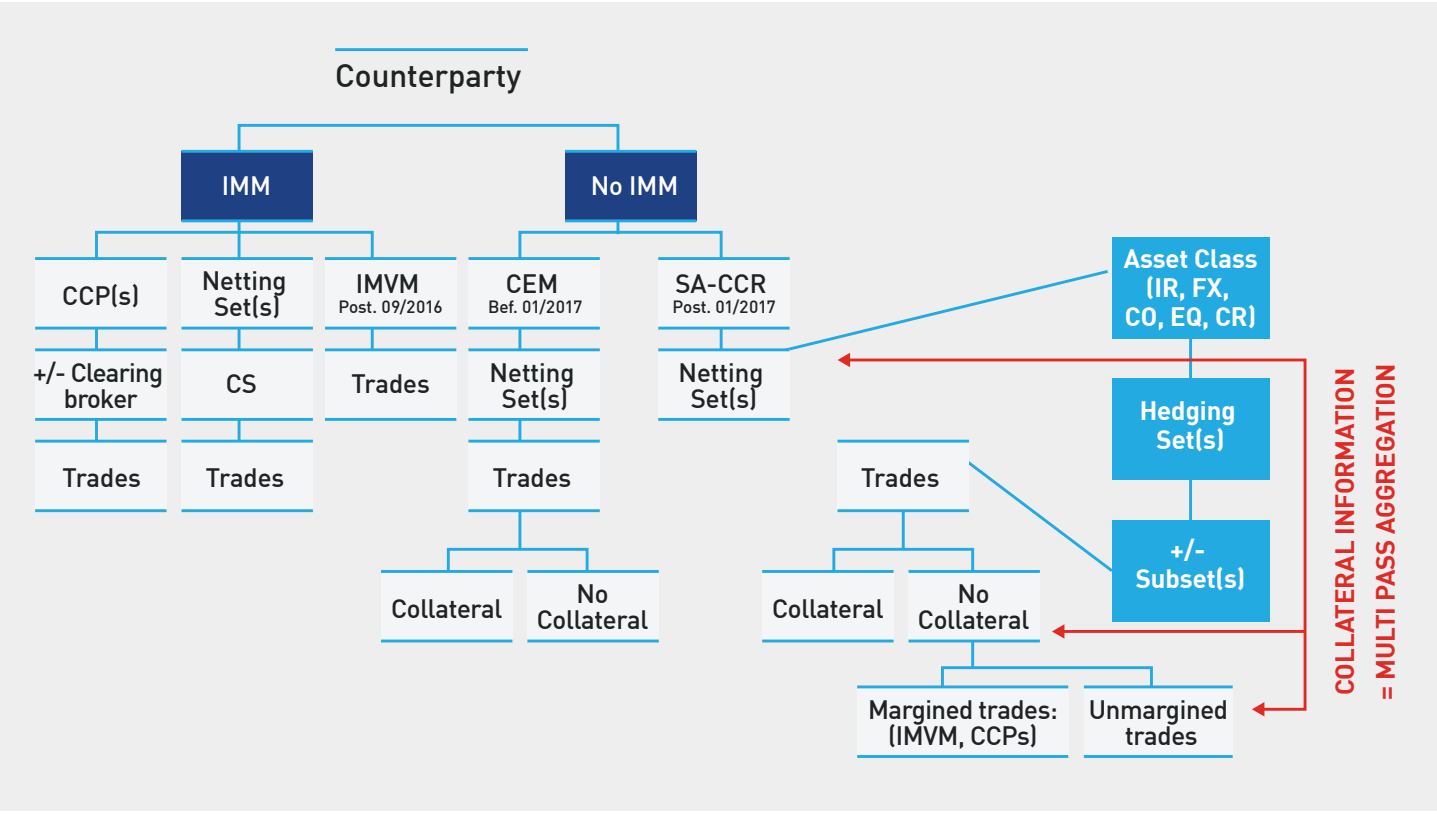
The overall purpose of this regulatory overhaul is to reduce systemic and counterparty risk by forcing market participants to exchange initial and variation margin and to apply appropriate valuation measures for all OTC derivative transactions. Banks active in derivatives trading will have to make significant adjustments to their business processes and system infrastructures in order to comply with the new rules. Mathematical issues tied to initial margin calculation can be solved quite easily. However, the true challenges lie in applying the SIMM methodology specifically for regulatory compliance and obtaining the right input data.

Further, complex rules related to extraterritoriality and netting jurisdictions will be challenging to implement in a flexible way. The case becomes quite different when the true costs of collateral are calculated and allocated back on the transaction level.

SIMM implementation in a broader regulatory context

With SIMM going live in September 2016 and the new standardized approach for Counterparty Credit Risk (SA-CCR) expected in January 2017, banks are facing increased complexity for handling collateral information in a multi-faceted regulation framework. Portfolio managers will have to handle the IM for eligible trades and in-scope counterparties (so-called covered entities), centrally-cleared derivatives and un-margined positions at the same time, making calculation process and aggregation a challenge.

Although each individual regulation looks affordable from a process perspective, considerable transformation must occur at a more strategic level within the bank. For the first time in the banking industry, the CTO, CFO, CRO and CDO will have to jointly contribute to the definition of a heavily-optimized risk management framework, where each xVA has an impact in the global front-to-back environment. This will be the unique way in which CxOs will rebuild return on equity (ROE) for their investors.



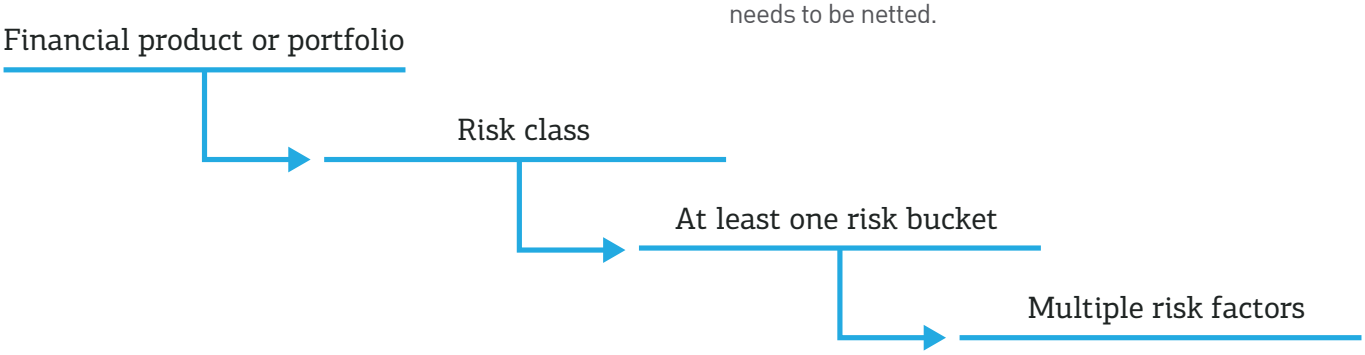
HOW SIMM WORKS

The goal of the SIMM is to establish a standardized method for IM calculation of non-centrally cleared OTC derivatives that enables replication and minimizes disputes.

The SIMM methodology is not focused on the product or transaction itself, but on portfolio risk factors for which the IM shall be calculated. In general, the SIMM methodology can be split into two major steps:

1. Decomposition of a financial product or portfolio in risk factors, including net exposure on a risk factor level
2. Calculation of IM requirements (determination, scaling and gradual aggregation of sensitivities)

Step 1: Decomposition
The decomposition of a portfolio or a single financial product is conducted at the following levels:



In the first step, the product or portfolio is broken down into one or more of the following risk classes:

- General interest rate risk (GIRR)
- Equity risk
- Credit spread risk (Qualifying)
- Commodity risk
- Credit spread risk (Non-Qualifying)
- Foreign exchange (FX) risk

In the second step, the risk classes are allocated to one or more risk buckets depending on the criteria such as currency, rating, duration and so on. Those risk buckets can be separated into risk factors, which constitute the foundation for the calculation of IM, according to the SIMM methodology. ISDA is responsible for disclosing all acceptable risk categories, buckets and factors.

When the process of decomposing the financial product or portfolio is completed, the exposure per risk factor needs to be netted.

EU vs. US netting approach

In addition to the model described in this paper, ISDA proposes an alternative approach for the calculation of IM. The alternative approach targets specific netting rules in the US and initially groups the exposure into one of the four "product classes," which include:

- Interest Rate and FX
- Credit
- Equity
- Commodity

Within these, decomposition takes place and is isolated for each product class. This means that netting does not occur portfolio-wide, but within the individual product classes.

What's more, each regulator (EU, Japan, US, Australia) is providing its own requirement with a slightly different product scope and methodology. As a result, it will become exponentially difficult for the collateral team to manage different collateral policies within a single netting set.

When it comes to transaction decomposition into sub-pieces, cross-currency swaps illustrate this challenge well, since banks will have to isolate the notional exchange from their risk calculations. Some large US banks are already threatening smaller counterparties in case the latter cannot remove this FX component from their margin calculations.

Step 2: Calculation of IM requirement

The delta, vega and curvature sensitivities are calculated based on the net position for each risk factor. The delta sensitivities are then scaled with the prescribed risk weights, and aggregated to the level of risk class using correlations according to SIMM methodology. The risk weights and correlations are published and updated by ISDA on a regular basis. Figure 2 describes the gradual approach of aggregating the sensitivities.

Figure 2: The SIMM methodology prescribes a gradual approach for aggregating delta, vega and curvature sensitivities.

RISK FACTOR	RISK BUCKET	RISK CLASS
rate curves, tenors, maturity of the option (MO)	currency	GIRR
credit spread curves, tenors, MO	rating	CSR
equity ppot preis, dividends, MO	region, sector	EQ
commodity spot preis, MO	commodity type	COM
currency, MO	matruity	FX

HOW SIMM WORKS

CONTINUED

Scaling (only applicable for delta sensitivities)
The delta sensitivities are scaled with the prescribed risk weights in order to weigh the individual risk factors based on their potential impact to the overall risk of the risk bucket. For example, the GIRR risk weight is defined by currency and the underlying tenor. Thus, the risk weight of a currency with a relative high volatility in this risk bucket is factored by a higher risk weight than a currency with a relative low volatility. For example, the risk weight for a six-month tenor for a "regular" currency (e.g., EUR, GBP) equals 64, while the risk weight for a six-month tenor for a "high-volatility" currency (e.g., ZAR, BRL) is 94.

In addition to the risk weights, the "concentration risk factor" is applied to the equation. A quantitative threshold is introduced that applies required concentration limits per risk factor. Even if the formula for the calculation is already known, the applied threshold for the concentration risk factor needs to be defined (ISDA is expected to disclose this soon).

Aggregation to risk bucket
Each single sensitivity (delta, vega and curvature) based on a single risk factor is now aggregated to an overall risk bucket. This takes place within predetermined correlations between the single risk factors. ISDA provides correlation matrices which indicate how aggregated, risk-weighted sensitivities can be combined on a risk bucket level. Correlations for interest rate exposure are solely based on the tenor. According to the current ISDA publication, a correlation of 61.8 percent would have to be applied when combining a one-month tenor with a one-year tenor.

Definition of applied sensitivities

Delta sensitivity: Measures the change of an instrument's price against a change in value of the underlying

Vega sensitivity: Measures the change of an instrument's price against a change in volatility of the underlying

Curvature: Measures the change on the instrument's delta against a parallel shift of the underlying

Aggregation to risk class
In the final step, for each risk class, the delta, vega and curvature margins are added across all risk buckets under consideration of the redefined correlation parameters to the overall IM for each risk class:

$$IM_X = DeltaMargin_X + VegaMargin_X + CurvatureMargin_X,$$

and the overall margin requirement for the particular portfolio:

$$SIMM = IM_{IR\&FX} + IM_{Credit} + IM_{Equity} + IM_{Commodity}.$$

IMPLEMENTING ISDA'S SIMM

Most institutions that are impacted by the mandatory collateralization of non-cleared derivatives post collateral for different transactions and use established systems and processes to manage collateral. These processes usually range greatly, from spreadsheet-based or manual processes using semi-automated solutions, to fully integrated and automated collateral management and optimization engines. Independent of the level of sophistication, processes within the collateral management solution need to be adapted in order to allow for the IM calculation for non-centrally cleared products or portfolios in the future environment, according to ISDA's SIMM.

Additional challenges emerge in the process chain where banks are required to implement dynamic aggregation rules across different product scopes, IM calculation at the group level and the cost allocation at the entity level. All of this must be secured in a fully auditable environment with the ability to quickly react to a counterparty dispute (in ISDA terms: 3 days + 20M USD + 20% difference) and sort them out diligently.

Finding the right solution for SIMM calculation

To implement the SIMM, the first decision a financial institution needs to make is whether to build or buy. Buying includes installing an entirely new solution that can natively perform the SIMM calculation and provide routine updates for risk weights and correlations. This significantly impacts the financial institution's IT infrastructure as well as enhances cost and time requirements. Alternatively, outsourcing the IM calculation functionality to an external service provider (typically running a Risk-as-a-Service process) can offer institutions a solution that is less time consuming and less costly over the long term.

Building a solution, which will then constitute an integral part of the institution's collateral management landscape, or adding a SIMM module might be the preferred option for only the largest financial players while the majority of financial counterparties may opt for an external industry solution such as AcadiaSoft. However, regulators are expecting each institution to validate externally calculated margin requirements. Regardless, the sensitivity-based approach for determining IM requires extensive data.

When adding SIMM calculation functionality, firms are faced with the following challenges:

1. **Choosing the right system and importing OTC exposure**
   Financial institutions tend to have different systems for different asset types and a variety of trading books. In order to enable the IM calculation, all trades must be consolidated and fed into one system that can perform the IM calculation. Typically, a risk or front-office system is the best option for such a task since it may provide a portion of the necessary data. Depending on a financial institution's IT infrastructure and level of system fragmentation, this data import can require enhancements to existing interfaces, the creation of completely new interfaces, data consolidation and cleansing, as well as testing in order to ensure trade data is efficiently communicated. Using ISDA's Common Risk Interchange Format (CRIF) will be advantageous, due to its standardization, harmonization and ease of implementation.

2. **Managing counterparty collateral and disputes**
   After the risk or front-office system has performed the decomposition of the instruments or a portfolio and aggregates the sensitivities to the overall IM, the information must be sent to the respective collateral management systems. In those systems, adequate workflows for processing the IM requirement need to be established. Mechanisms also need to be implemented to allow for robust and efficient dispute management and resolution.

3. **Importing dynamic right risk weights and correlations**
   ISDA derives essential input factors for the calculation of the SIMM based on the historic value-at-risk (VaR) approach and publishes those in regular frequencies. Those input factors include:

   - Risk weights for scaling the delta sensitivities
   - Concentration risk factors
   - Correlation used for aggregating the sensitivities

In order to produce accurate IM results, the SIMM methodology needs to be set up in a flexible way to allow for dynamic data updates, including weights or correlations, as well as what-if scenarios.

IT impacts

The impact to a financial institution's IT function is considerable and includes the following:

- **Normalizing all front-office systems** at the group level to enable consistent computation of sensitivities following the SIMM methodology. This requires a detailed mapping of all curve buckets to create consistency across all systems. Otherwise, a centralized risk system should be dedicated to retrieving all portfolio data, market data and calculation rules, to ensure all analytics are generated in one centralized system.

- **Maintaining a complex eligibility dictionary** covering all legal entities within the bank, all local regulators and all trade types and decomposition rules (again, in the case of trade components, massive post-processing may occur in the portfolio). This is especially the case for index-based trades that must be treated as single-like trades for each underlying index. And because credit indices are evolving over time, complex mapping mechanism should be set up accordingly.

- **Managing IM orders** from the risk management to the collateral management team. Taking into account thresholds and exemption criteria, all relevant amounts should be posted through the applicable channels, such as collateral, margin call and other systems.

- **Reconciling IM positions at D+1** in order to validate all IM postings. Reconciliation capabilities are business-critical since dispute management should be constantly optimized.

- **Allowing for less explicit methodologies** for sensitivity computation. Although the finite differences are prescribed in the SIMM documents, other methodologies, such as Automatic Adjoint Differentiation or Malliavin Calculus, are not explicitly mentioned. Advanced banks apply these methods in risk and front-office departments for performance purposes. However, any restriction to finite differences could lead to a parallel sensitivity computation that would significantly impact performance, architecture and workflows.

CLEAR IMPACTS ON COSTS, LIQUIDITY AND RISK

Whether focusing only on ISDA's SIMM methodology or more generally on the alternative described by the Basel committee, new calculation of IM requirement is an extra step that will trigger new financial costs. Such costs will be directly related to posting, as well as indirectly related to the process itself including third-party custody, reporting, reconciliation and dispute management.

The liquidity effect of ISDA's SIMM compared to IM schedules

Whereas variation margin (VM) can be re-hypothecated, IM posted to a central counterparty (CCP) or a third-party custodian cannot. This significantly impacts banks in terms of liquidity management and funding costs, but analyzing SIMM against IM schedules or clearing costs is not a straight-forward exercise. A clear decision regarding trade profitability will require pre-deal simulation capabilities.

With the schedule-based methodology, there is an extremely limited netting effect between trades, represented in a gross-net ratio. Consider a scenario with typical buy-side positions. If trades are long-dated and always in the same direction, then the schedule-based methodology may be the simplest and most efficient solution.

However, when there is considerable netting (payer and receiver within the same counterparty set), the analysis becomes more complex and clear conclusions cannot be made. A complete portfolio impact analysis may become necessary. Current market expectations see a potential reduction of overall IM by five times when applying the ISDA's SIMM methodology given the typical portfolio of a global market maker. This, however, depends on portfolio structure and applicable netting effects.

Banks should also bear in mind that some end users might adhere to the standard IM schedules, while global organizations and market makers will prefer the ISDA's SIMM methodology—either by offering no opportunity, or including pricing cost and liquidity effects. That means banks may be forced to implement both IM schedules and the ISDA's SIMM.

The true cost of IM

Focusing only on IM and reconciliations of IM postings is ill advised. For one, it does not indicate the true costs of IM. Further, it induces direct collateral movements, capital charges, additional transaction and valuation reporting requirements, as well as new compliance costs and trade repositories. Without optimization, these processes can cost as much as one to two basis points of value of the global collateral balance sheet.

To achieve cost savings and process optimization, banks must invest in an IT framework. In addition, the true trade profitability will have to be calculated each time a new trade is captured, but also as portfolio changes occur.

Assessing the impact of IM is a key element for profitability and cost transparency, especially over the full lifecycle of each relevant trade. Figure 3 describes a simple case of a standard IM calculation based on lookup values obtained from notional amount and time-to-maturity. It becomes visually obvious that IM will generate extra funding costs.

Figure 3: Additional funding costs generated from a standard IM calculation.

EMTM (Expected Mark-to-Market Exposure)	Exposure computed upon Monte Carlo simulations over specific future grid points. This is a pure mark-to-future process.
EME (Expected Margin Exposure)	EME is the sum of EIME and EVME, covering all aspects of margining and associated costs, further used to compute corresponding MVA (Margin Value Adjustment)
EIME (Expected Initial Margin Exposure)	As opposed to the historical concept of IM for cleared trades, IM is now evolving over time and requires a proper future outlook that is segregated from VM (especially for the re-hypothecation process).
EVME (Expected Variation Margin Exposure)	Variation margin based on standardized rules (specific threshold, daily exchange, etc.) and computed forward.
ECE (Expected Collateral Exposure)	Exposure related to the forward exchange of collateral over the life of the portfolio. This collateral exposure takes into account standard collateral as well as collateral posted/received as margin.

CLEAR IMPACTS ON COSTS, LIQUIDITY AND RISK *CONTINUED*

IM's effect on simulations

The valuation of the adjustment that accounts for the present value of the future funding cost of IM is now called margin value adjustment (MVA). It can be seen as a dedicated new xVA or part of the global funding adjustment (FVA).

The hedging challenge becomes more complicated as it involves applying the SIMM methodology within the Monte Carlo framework and requires computing forward sensitivities at each node of the simulation grid.

Whether banks only use the SIMM methodology for regulatory reasons (it will be the only metric to reconcile with the counterparty) or over the lifetime of the portfolio (for usual risk management process), business owners have to clearly translate the board's objectives and long-term strategies into business requirements.

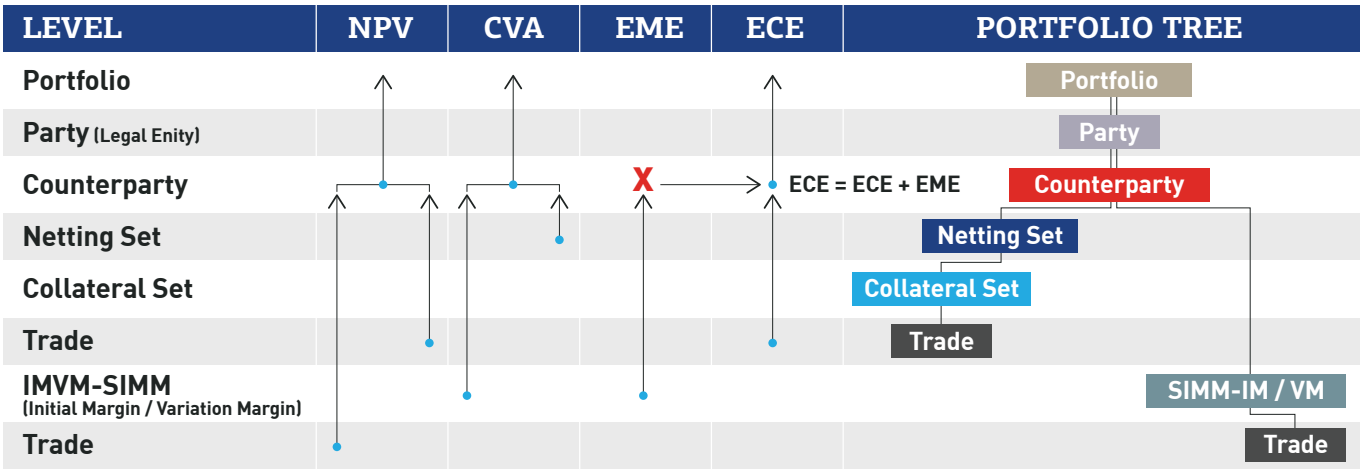
Why IM needs to be allocated back to the transaction level

Like each xVA component calculated at a netting set or collateral set level, collateral costs will need to be reallocated at the trade level to further assess the true profitability of each transaction.

Today's banks are using proprietary algorithms to reallocate the xVA component at the trade level. It is usually done on a deal-by-deal basis or invoiced at the desk level on a monthly basis for the flow trading. Computing these reallocated metrics on a pre-deal check level is essential and mandatory, but it is also challenging because it is algorithmically intensive to apply a redistribution in real time for a new deal. However, it is mandatory because it is the only way for traders to assess their trade profitability and ensure the right price is provided to the final client.

To ensure trade profitability is calculated over the lifetime of the trade, a full Expected Collateral Exposure (ECE) is required based on the classic collateral and margin exposures.

Figure 4: Collateral costs will need to be reallocated at the trade level to further assess the true profitability of each transaction.



CONCLUSION

From a pure mathematical perspective, the SIMM constitutes a fairly simple model that is based on sensitivities and a two-step calculation approach. The IM computation requires neither high calculating power nor a sophisticated algorithmic approach. The true challenge is in solving the data puzzle—ensuring required data is correct, complete and available to the calculation engine. However, apart from the methodology of the model itself and the implementation challenges, there are far more significant dimensions to the SIMM.

One dimension includes the cost and liquidity implications. If choosing the "BCBS standard approach," a financial institution has to post more collateral than it would using the SIMM for the same transaction. Since IM is fully segregated, received collateral cannot be reused, and posting more collateral than is necessary has a direct effect on liquidity and funding costs. Therefore, banks need to weigh the implications of model choice on profitability.

The other dimension is transparency and cost management. Considering the SIMM to be purely regulatory-driven is short-sighted. Implementing a solution that can calculate the SIMM as well as provide a detailed reallocation can be beneficial for the front office as well as the risk and treasury departments. Computing the true costs per transaction cannot be achieved on the basis of the spot price. For this purpose, forward prices must be utilized and SIMM needs to be implemented into xVA simulations. In order to manage costs and risks, true charges must be transparent to firms and the front office for accurate pricing.

Implementing a front-office and treasury-driven approach to enable full cost control and efficient pricing (with knowledge of P&L effects) is crucial, since only the correct collateral management approach can provide a competitive advantage.

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Matthieu Maurice joined Global Market Solutions GmbH in April 2013 as an Associate Director leading the new German unit, and is mostly involved in XVA projects. He built the CVA management desk of the Mittelstandsbank at Commerzbank AG in August 2010 with a focus on pricing, monitoring and hedging the counterparty risk inherent to OTC derivatives. Previously, his team developed cutting-edge portfolio solutions to mitigate the counterparty risk of illiquid names, particularly under the new regulatory framework. From 2002 to 2010, Matthieu held various positions at Dresdner Kleinwort in Frankfurt within the Credit Asset Management and CVA Trading units, including quantitative analyst and then CVA trader. He studied Financial Mathematics at the Ecole des Mines.

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