



A Digital Transaction System Using Smart Derivatives Contracts & Distributed Ledger Technology To Manage Margining & Default Risk Algorithmically

Executive Summary

XVA Blockchain GmbH has implemented the world's first **Smart Derivatives Contract (SDC)** with an embedded algorithm to handle margining and default risk. This smart contract allows users to remove counterparty-related risks, such as inefficiencies in cash-flow netting, termination, and processing of the default event. "Smart" refers to a superior level of standardization and automation of derivatives clearing processes. Our SDCs automatically execute a transaction once the established conditions are met and fully control the process. Maintenance costs of the SDCs are provided by funding margin buffers and default penalties that can be bilaterally negotiated, and are lower and more transparent than conventional derivatives contracts with central or bilateral margining.

Legal Framework

For the first time in the world, in June 2021 DZ BANK and BayernLB successfully traded an OTC interest rate derivative as a smart derivatives contract on the XVA Blockchain platform, with the resulting payments settled daily via an account manager. We processed the entire life cycle of this OTC derivative over several days in a fully automated and legally binding manner.¹

The International Swaps and Derivatives Association's (ISDA's) Common Domain Model (ISDA CDM™) is a legal blueprint for how derivatives will be traded and managed across the trade lifecycle. A single, common digital representation of derivatives trade events and actions will enhance consistency and facilitate interoperability across firms and platforms, providing a bedrock upon which new technologies can be applied. ISDA predicts that SDCs will soon become the market standard for OTC derivatives, helping to revolutionize the derivatives market by creating much-needed efficiencies.

Remove Counterparty Credit Risk

Our SDCs simplify the termination procedure and transform counterparty credit risk into market risk.² To address gap risk, we introduce the concept of a penalty (P) and protection (P*) that correspond to the strike price of the embedded options.

The concept of a prefunded margin account and a fully deterministic termination (in the case of unfunded margins) allow for a complete automatic processing of the contract. It prevents willful

¹ The contracts were based on an individual framework under German law. We can offer contracts based under an ISDA framework now.

² Counterparty credit risk (CCR) can be defined as the risk that the counterparty to a transaction could default before the final settlement of the transaction cash flows. According to the Bank of International Settlements (BIS), "CCR is a complex risk to assess. It is a hybrid between credit and market risk and depends on both changes in the creditworthiness of the counterparty and movements in the underlying market risk factors."

termination because of the penalty premium. The contract specifies a margin buffer amount (M) that transparently determines the termination risk, and a penalty P that covers the gap risk in case of termination.

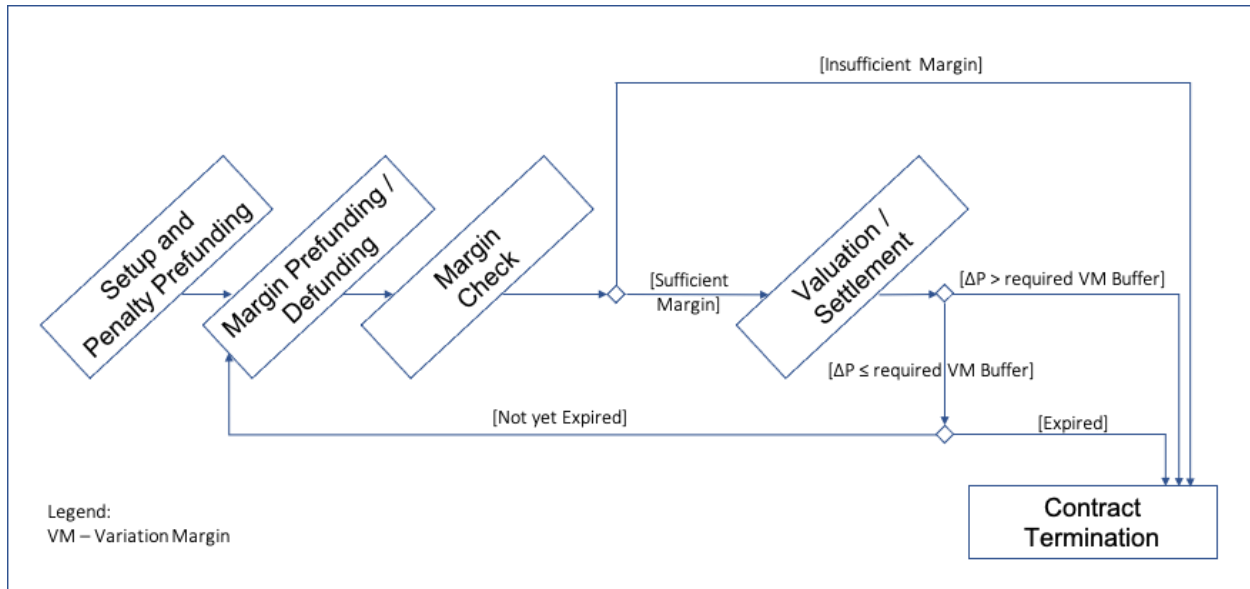


Figure 1

To mitigate counterparty credit risk in OTC derivative transactions, we have introduced a daily collateral exchange procedure in the SDC. Changes in market values can trigger an optional variation margin (VM) to adjust the amount of collateral posted in the Margin buffer (M), or alternatively, to terminate the trade. The SDC eliminates margin shortfalls typically found in traditional derivatives transactions.

SDC As A Micro-Counterparty Versus Bilateral Margining or Clearing

SDCs enter the bilateral market with XVA Blockchain as an independent third party. The counterparties align on valuation with the transparency of our blockchain-based Calculation Agent. The blockchain reconciliation layer is used for a minimal set of data, including reference data in an FpML format plus market data, and the resulting price and margin requirement. Calculations are conducted on cloud off-blockchain, but on a clear pricing algorithm defined bilaterally between the counterparties. The blockchain layer eliminates reconciliation issues and dispute management, and offers an efficient alternative to bilateral margining and Central Counterparty (CCP) clearing.

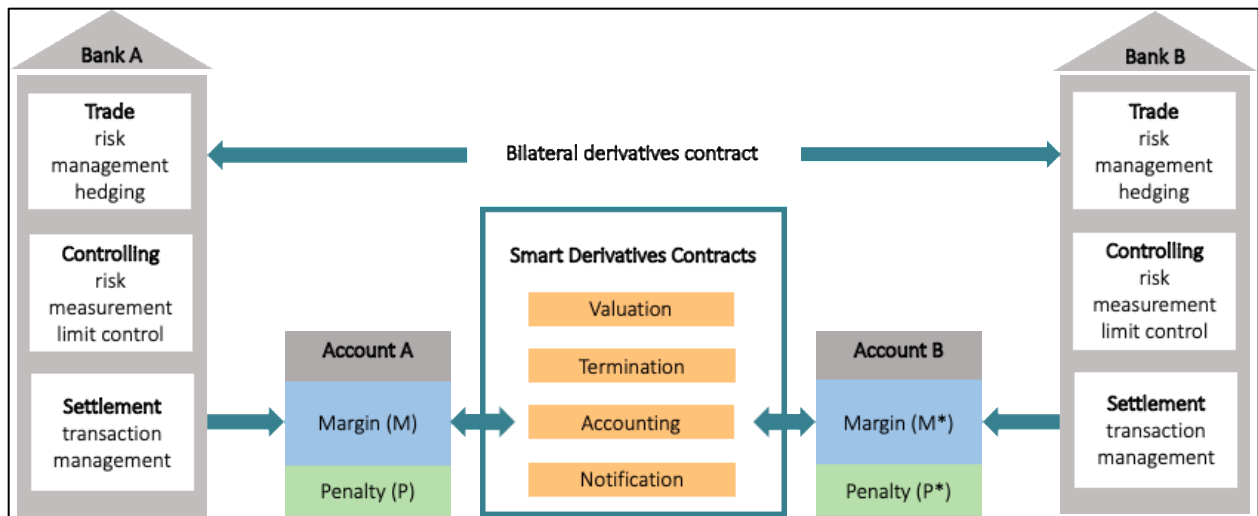


Figure 2 (Reference: DZ BANK AG)

The penalty amount (P and P*) can be recognized as a termination fee and should cover the replacement cost. These amounts create a natural hurdle to premature contract termination. The penalty amount of your counterparty (i.e. P*) is your protection amount.

Bilateral Margining

Currently, ISDA's Standard Initial Margin Model (SIMM) methodology for bilateral trades states that initial margin is designed to cover large market moves, but does not cover trade flow-based settlement risk⁶. A reduction of settlement risk can be performed by specialized agents (swap agent, continuous linked settlement), while leaving counterparty credit risk as an open issue.

Due to a lack of efficient transaction netting and determination of the correct market value, market participants are obliged to over-collateralize the transaction in order to protect against counterparty credit risk.

Central Counterparty Clearing

Under CCP rules, the netting of all derivative cash flows can be achieved across trades in a liquidation group, so settlement risk is reduced. All clearing members must participate in a resolution in case of an actual default by another member. Significant amounts of initial margin and default contributions have to be posted to a CCP to resolve a possible default event of a member and even to prevent CCP collapse.

For CCPs, due to several compression cycles, no one can determine its particular risk against other counterparties. In case of a default of a CCP member, a complex resolution mechanism - "the waterfall" is introduced. However, this creates systemic risk due to the CCP becoming a single point of failure. There has to be a better decentralized solution.

⁶ Settlement risk is the risk that one or more parties will fail to deliver on the terms of a contract at the agreed-upon time.

Smart Derivatives Contracts

Given the inefficiencies and complexities of the settlement processing of a standard derivative contract, we have identified and designed an SDC to resolve these issues. Ours is a derivative contract equipped with its own margining process and customized valuation, that can handle trade-based and margin cash flows efficiently, as well as manage a possible default of the counterparty.

Since a netting of product and collateral flows effectively removes any product cash flows, the only flows remaining are the margin amounts that are induced by market movement. Thus, the SDC resembles a derivative with daily settlement. In addition, our smart contract has an automatic termination feature: if a payment cannot be executed due to insufficient funds, the contract will terminate itself.

Smart Derivatives Contracts Advantage

SDCs offer significant advantages for OTC transactions. Most importantly, the penalty amount allows for minimal initial margin requirements, and this has tremendous impact on potential future exposure (PFE) of a portfolio, on capital efficiencies in the balance sheet (e.g. IFRS 13), and on regulatory CVA and XVA.

Category	Smart Derivative Contract (SDC)	Bilateral Swap Agent	Bilateral Today	Central Counterparty (CCP)
Customized Collateral Documentation	✓	✗	✓	✗
Independent Valuation Agent	✓	✓	✗	✓
Dispute Elimination	✓	✓	✗	✓
VM/Coupon/Interest Netting	✓	✓	✗	✓
Standardized Risk Factor Calculation	✓	✓	✗	✓
Standardized Payment Processing	✓	✓	✗	✓
Cross-Currency and Swaptions	✓	✓	✓	✗
Non-Central Counterparty	✓	✓	✓	✗
No Default Fund	✓	✓	✓	✗
No Initial Margin	✓	✗	✓	✗
	Clearing options: EUR, USD	GBP	<i>internal credit lines</i>	EUR, CHF

Figure 3

The margining process for SDCs is accompanied by a margin account manager. This can be your own custody bank or one of our partners'. Since the accounts are fully segregated, the solution has a better or at least the same level of settlement efficiencies known from clearing. We are discussing CBDC (central bank digital currencies) with Bundesbank, ECB, and relevant regulators for the next evolution.



Trade Example: Funding costs of a smart derivatives contract vs. ISDA-SIMM™

	A	B	C	D	E	F	G	H	I	J
21		swap delta	delta	10		(we consider a 10Y swap)				
22		required margin buffer	M	-3,0%		(required margining buffer in % of notional)				
23		<i>Calculation of penalty:</i>								
24		swap rate penalty quantile	q_P	0,0597%		(here the penalty is calculated as an option price)				
25		required margin buffer+penalty	M+P	-3,6%						
26		<i>Summary of funding costs:</i>								
27		funding rate	r_f	3%				<i>Bachelier option value</i>		
28		funding cost of smart contract	r_sc	-10,81 bp		(p.a. of notional)		sigma	0,04%	(per day)
29		<i>Note: actual funding costs are smaller due to aging or product.</i>								
30								T	14	(days)
31		<i>Comparison: Current funding cost under SIMM (rough estimate):</i>								
32		SIMM risk weight for 10Y swap rate		51,00 bp				integrated vol	0,001496663	
33		SIMM margin quantile for 10Y swap rate		-0,510%				strike	0,00%	
34		SIMM initial margin (for 10Y swap)		-5,1%		(this has to be compared to M+P)		d1	0	
35		funding cost of SIMM IM	r_simm	-15,30 bp		(p.a. of notional)		value	0,0597%	
36										
37		<i>Reverse engineering of volatility assumed by SIMM:</i>								
38		SIMM probability for margin mismatch	p	1,0%						

In 2022, XVA Blockchain became an ISDA member, and we discussed our approach with leading industry experts at the general annual meeting in May, disclosing our methods for the first time to a public audience. We are active in various working groups and we manage financial transformation with responses to the Bank for International Settlements (BIS), to ESMA, or the European Banking Authority.

XVA Blockchain Ready To Deploy - What To Do Next

The deployment of Smart Derivatives Contracts combines product and process innovation. The contract offers protection against credit risk with automatic termination enacted if a counterparty cannot meet settlement obligations. The use of blockchain technology provides an efficient mechanism for verifying transaction data and minimizing reconciliation challenges. The blockchain layer enhances transparency for our clients and regulators alike. There is a clear settlement process where the smart contract takes over the entire settlement procedure known in traditional finance. (Please note that our protocol can be implemented without blockchain for those clients who prefer this alternative.)

XVA Blockchain takes a multidisciplinary approach to address requirements from trading, risk, IT, legal, settlement and payment operations. We provide the components for successful SDC implementation as well as trade capture, valuation services that include market data and risk analytics, and transaction reporting. In addition, we support our clients with advisory services to identify and implement SDC opportunities. We help our customers realize the benefits of digital solutions for derivatives.

References

Smart Derivative Contracts - Detaching Transactions from Counterparty Credit Risk

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ISDA Common Domain Model (ISDA CDM™)

<https://www.isda.org/2019/03/20/isda-publishes-cdm-2-0-for-deployment-and-opens-access-to-entire-market/>

ISDA Demystifying Collateral Optimization

<https://www.isda.org/a/G1UgE/Demystifying-Collateral-Optimization.pdf>