ARTICLE VI

EVENTS WITHIN SMART DERIVATIVES CONTRACTS

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INTRODUCTION

When asked by a journalist what was most likely to blow governments off course, Harold McMillan is alleged to have responded "Events, dear boy, events."[1] The occurrence of unexpected events is similarly problematic for the operation of Smart Derivatives Contracts, specifically the automation of payment and delivery obligations. In this article, we explain how certain events contemplated within the ISDA Master Agreement (see below) may impact the automation of payments and deliveries under a Smart Derivatives Contract. We provide a framework for understanding how derivatives contracts are structured at different levels and we discuss the extent to which these are amenable to automation.[2]

ISDA DOCUMENTATION

High-value derivatives transactions establish a financial relationship between counterparties that may last for a very long period of time and may involve very substantial notional sums. This relationship requires extensive legal protection. In practice many derivatives transactions utilise standardised legal documentation provided by the International Swaps and Derivatives Association, Inc. (ISDA). Central to the ISDA documentation architecture is the ISDA Master Agreement. The ISDA Master Agreement is the standard contract used to govern all over-the-counter (OTC) derivatives transactions entered into between the parties. The ISDA Master Agreement sets out provisions which govern the parties' overall trading relationship, including how payments and deliveries are made and how certain events might impact upon the parties' obligations.[3]

WHAT ARE SMART DERIVATIVES CONTRACTS?

Smart Derivatives Contracts are smart contracts[4] for automating derivatives contracts.

"Automating the performance of derivatives contracts may allow for a

1. P. Kellner (Nov. 1 1985) Why Neil Kinnock has a new spring in his step. New Statesman, London, England, page 9.

2. A more detailed discussion can be found in our previous paper: C.D. Clack and C. McGonagle (2019) Smart Derivatives Contracts: the ISDA Master Agreement and the automation of payments and deliveries. arXiv:1904.01461. https://arxiv.org/pdf/1904.01461.pdf

3. A more detailed explanation of the ISDA documentation architecture can be found in ISDA (2019) ISDA Legal Guidelines for Smart Derivatives Contracts: Introduction. https://www.isda.org/a/MhgME/Legal-Guidelines-for-Smart-Derivatives-Contracts-Introduction.pdf

4. C.D. Clack, V.A. Bakshi, and L. Braine (2016, Revised March 15 2017) Smart Contract Templates: foundations, design landscape and research directions. arXiv:1608.00771. https://arxiv.org/pdf/1608.00771.pdf

substantial reduction in costs for large financial institutions through greater efficiencies and reduced human error.[5]"

Derivatives are generally considered to be fertile territory for the application of smart contracts because their main payment and delivery obligations are heavily dependent on conditional logic.[6][7] Much of the operational detail of payments and deliveries can be found in the economic terms and payment mechanics of the particular derivatives product i.e., within the transaction confirmation and associated product definitions. However, it is not sufficient only to automate these operational aspects of the contract. The broader contractual relationship must also be considered.

UNDERSTANDING EVENTS

The processing of payments and deliveries throughout the lifetime of a derivatives transaction can be affected by different kinds of events. ISDA documentation establishes rights, obligations and mechanisms reflecting the occurrence of these events that can affect both the timing and quantum of payments and deliveries for a potentially very large number of transactions. In the context of ISDA documentation, an "Event" is an event or circumstance that may (either immediately or with the passage of time) impact upon the parties' respective ability to perform their obligations, including payment and delivery obligations, under the transactions entered into between them. It is important that parties are able to react to events which may be indicative of either a deterioration in creditworthiness of their counterparty or some fundamental change in their counterparty's legal, regulatory, or operating framework such that their ability to continue making payments and/or deliveries could be impeded. The Master Agreement therefore contemplates the occurrence of a broad range of such events and provides each party with a mechanism to terminate derivatives transactions in order to eliminate or mitigate its financial exposure to its counterparty.[8]

The ISDA Master Agreement contemplates two distinct categories of Events. Events of Default generally relate to events where one of the parties is (in a general sense) considered to be at fault, whereas Termination Events relate to events where neither party is strictly at fault. The ISDA Master Agreement contains a number of standard Events, in both categories, all of which are capable of customisation.

Additional Events can also be defined by the parties. While the ultimate consequence of the occurrence of either type of Event is the same i.e., the potential termination of derivatives transactions entered into between the parties, they are necessarily distinct. For example, while the occurrence of either type of

5. See ISDA (2016) The Future of Derivatives Processing and Market Infrastructure. https://www.isda.org/a/UEKDE/infrastructure-white-paper.pdf

6. See ISDA and Linklaters (2017) Smart Contracts and Distributed Ledger – A Legal Perspective. https://www.isda.org/a/6EKDE/smart-contracts-and-distributed-ledger-a-legal-perspective.pdf

7. Certain aspects of derivatives contract have implemented on blockchain using smart contracts. For example, see: https://www.deutsche-boerse.com/dbg-en/media/press-releases/DZ-BANK-BayernLB-and-Deutsche-B-rse-prove-functionality-of-digital-smart-derivative-contracts-2637128

8. A more detailed discussion of different types of events under the ISDA Master Agreement can be found in ISDA (2019) ISDA Legal Guidelines for Smart Derivatives Contracts: The ISDA Master Agreement. https://www.isda.org/a/23iME/Legal-Guidelines-for-Smart-Derivatives-Contracts-ISDA-Master-Agreement.pdf

Event gives a party the potential right to terminate derivatives transactions entered into under the Master Agreement, the manner in which these derivatives transactions terminate may differ depending on whether an Event of Default or Termination Event has occurred. The different outcomes and potential for customisation makes it important for smart contract developers to understand and correctly categorise the relevant Event in order to reflect accurately the contractual consequences that flow from the occurrence of an Event and the precise manner in which the Event may impact upon the parties' respective payment and delivery obligations.[9] Any technology solution that intends to automate payments and deliveries within a derivatives transaction will need to take account of the various events that might occur and be capable of i) observing the occurrence of a circumstance that might give rise to an event; ii) determining that an event has occurred; and iii) taking action to manage the consequences that might arise from the occurrence of the event (which may entail notifying the parties where further assessment is required).

LEVELS OF EVENTS

The "contract" relating to derivatives transactions between two parties is often represented by a combination of documents. These documents are highly interdependent. It is not possible to fully understand a single derivatives transaction or the overarching contractual relationship between the parties simply by looking at the terms of an individual transaction or even by reference to the Master Agreement. To fully understand the terms of a particular transaction and how external events may impact upon it, it is important to look at each of the various levels of obligation that exist within the ISDA documentation architecture, the key documents involved, and how they interrelate.[10] Within this contractual architecture, it is possible to distinguish four different levels (described below) at which circumstances or events might be observed and which may ultimately give rise to the occurrence of an Event. A single event might be observed at more than one level, and there will typically be a hierarchy of events within the contract, allowing one to determine how best to treat an event which may be observed within two or more levels.

Events may occur at the Transaction Level. Events occurring at the Transaction Level are typically related to the specific product lifecycle, with expected behaviour being set out in the Confirmation and product definitions. Observing the occurrence of an event at this level would seem to present the fewest challenges for smart contract code. For example, it should be relatively straightforward for the code to determine whether a party has failed to make a required payment of the required amount at the required time as the parties will have immediate access to the relevant transaction data.

Events may occur at the Relationship Level. Events occurring at this level are related to the agreement negotiated between the counterparties and may involve more than one transaction. Events of Default and Termination Events are examples of Events that might be triggered through the observation of information relating to the parties themselves. For example, the smart contract code might be able to observe the bankruptcy of

9. The unnecessary customisation of clauses within the Master Agreement is being addressed through initiatives such as the ISDA Clause Library. https://www.isda.org/2020/04/20/what-is-the-isda-clause-library/

10. A more detailed overview of the ISDA documentation architecture can be found in ISDA (2019) ISDA Legal Guidelines for Smart Derivatives Contracts – Introduction. https://www.isda.org/a/MhgME/Legal-Guidelines-for-Smart-Derivatives-Contracts-Introduction.pdf

a party by monitoring information sources that might publish information relating to the insolvency of that party (e.g., a regulatory authority or similar administrative, regulatory, or judicial body).

Events may occur at the Third-Party Level. Observing the occurrence of potential Events at the Third-Party Level is likely to be more challenging. Here, the smart contract code may be unable to establish the potential occurrence of an Event by reference to either the derivatives transaction data or to information relating solely to the counterparties. Instead, the code will need to observe information relating to a third party i.e., a party who is not a contracting party to the Master Agreement . Without continuing access to information or data relating to third party arrangements, deciding whether the relevant circumstances have arisen may prove very challenging to automate.

Finally, Events may occur at the Exterior Level (i.e. not related to either party, nor to a specific third party). Much of the complexity at this level arises due to the large number of external events that may arise and the difficulty of assessing whether those external events could be relevant in determining when an Event has occurred under the Master Agreement.[11] Some Events (e.g., a Force Majeure) are necessarily broad in scope. This is necessary due to the existence of a very wide range of circumstances that may, for example, make it impossible for parties to fulfil their obligations. Ongoing observation and interpretation of information relating to each of the legal and regulatory frameworks applicable to all parties is likely to prove both challenging and inefficient to automate.. Despite the inherent difficulties, we believe it may be possible to automate some aspects of the monitoring of events at this level, perhaps with the smart contract code monitoring some readily available external information and providing alerts that will then be followed by human interpretation. In other situations, human observation of an external event may require the ability to pause or stop the smart contract code (e.g., in the case of an Illegality).[12]

MANAGING EVENTS

Effective processing of Events within a smart derivatives contract will require the following steps:

Observation: The first step in processing events is the ability to observe. Observation breaks down into two aspects: what to observe, and how to observe. These are linked: for example, some events may arise within the technology platform and are relatively straightforward for smart contract code to observe, whereas events arising externally may be more difficult to observe. For example, with a distributed ledger platform, an “oracle” must be established in advance to make the external observation and route it through to multiple instantiations of the smart contract code so that they all receive identical information.

Determination: Once an event or circumstance has been observed, the smart contract code must be

11. For example, certain events of default and termination events may be extended in scope to capture certain designated ‘specified entities.’ A specified entity would typically be an affiliate or entity within the same corporate group, the circumstances of which are likely to have some impact upon a party’s creditworthiness or its ability to continue meeting its obligations under the Master Agreement. Such an entity would typically not be a party to the Master Agreement.

12. If the smart contract code were to run on a distributed ledger, both incoming and outgoing interaction with the parties might occur via the use of “oracle” services as for example described in M. Hearn and R.G. Brown (2016) Corda: A distributed ledger. Corda Technical White Paper.

able to determine whether or not the criteria for triggering an Event of Default or a Termination Event might be fulfilled. This requires the smart contract code to obtain and monitor information and understand the implication of that information as it relates to the precise circumstances that may ultimately constitute or give rise to the occurrence of a particular Event. Of course, for computer code "understanding the implication" of a set of observed events means that the mechanism and thresholds for such determination must be analysed in advance and incorporated into the smart contract code.

"While in most cases objective criteria are used in determining whether or not a relevant Event has occurred, the determination of some Events may include subjective elements. In these instances, a party seeking to trigger the Event must therefore rely upon their own subjective interpretation of the relevant criteria and convey this information to the smart contract code. An appropriate dispute resolution mechanism (which may or may not be automated) should be triggered where the parties disagree on the subjective interpretation."

Action: When the circumstances giving rise to a potential Event have occurred and are continuing, the parties may be entitled to exercise certain contractual rights under the Master Agreement. A party may wish to terminate their contractual relationship with their counterparty. Alternatively, they may decide that the Event is relatively immaterial or inconsequential and that they do not wish to take any action. Therefore, there will often be uncertainty as to what the exact consequences of an Event will be due to the levels of human intervention and discretion required. It is unlikely that all counterparties will have identical appetites for risk, and therefore unlikely that they will all wish the consequences of an Event to be managed in the same way. Thus, it would seem that the default action for smart contract code to take once an Event has been determined should be to inform the relevant parties and await further authorisation (though for greater efficiency this should be structured, so that for each Event a human can authorise one of a selection of pre-programmed further actions).

Looking ahead, it might be possible for smart contract code to have pre-programmed actions that are different for each party. For example, one party may have a lower tolerance for risk and may wish to terminate the contract upon the occurrence of minor, technical breaches, whereas their counterparty may have a higher risk tolerance and may be prepared to waive certain breaches that are not indicative of serious deterioration in the creditworthiness of the other party. Since the smart contract code must be authorised by all parties, these pre-programmed responses will of course be known to all parties in advance, so some care will be required to ensure that these known responses cannot be exploited to the advantage of defaulting party. More subtle schemes might be imagined — for example, the smart contract code

could be instructed to observe a rising level of smaller events and thereby infer a rising level of risk, so that as the risk grows the automated response to each subsequent Event becomes less lenient (or perhaps triggers an alert to the party at growing risk).

HOW MUCH TO AUTOMATE?

Assessing the impact of events on contractual provisions is a complex exercise. In many cases, it will require a user to observe data that is not immediately available or accessible and/or exercise subjective judgement as to the impact of the relevant event. Given these challenges, it is unlikely that the entirety of a legal contract will ever be converted into smart contract code.[13] It is important therefore to choose which provisions should be automated. In making this assessment, it is important to consider both (i) what can be automated, and (ii) what should be automated. This of course is not a static consideration: the former will increase for example as we gain a better understanding of contract semantics and as technology improves, and the latter will vary for example according to jurisdiction and legal certainty and the risk appetites of the parties.

WHAT CAN BE AUTOMATED?

As noted above, derivatives contracts are considered good candidates for automation as many of their obligations are highly operational in nature. However, it is not always possible to identify whether a part of a contract is operational or non-operational in nature simply by inspecting the text to determine whether it uses conditional logic. Some operational phrases do not use conditional logic, and some phrases that use conditional logic are non-operational. Furthermore, it is not always the case that an "operational" aspect of contractual language is easier to automate than a "non-operational" aspect. Many operational clauses could require very complex code to automate, particularly where multiple conditional statements are used in combination.

In the context of derivatives contracts specifically, the documentation framework provides many different sources of both operational and non-operational aspects, many of which interact with others. Studies of the semantics of the Master Agreement have revealed not only a large operational aspect, but also an unexpected entangling of deontic, temporal, and operational aspects.[14] This is referred to as the "separability problem."[15]

WHAT SHOULD BE AUTOMATED?

If automation were limited to the basic economic conditions outlined in the Confirmation and product definitions, the accruing benefit would be modest in comparison to what could be achieved by also automating the provisions of the Master Agreement. A truly autonomous Smart Derivatives Contract should for example be capable of observing a range of events. This does not mean that the entirety of the Master Agreement must necessarily be automated, and it is important to reason about which parts should be automated — e.g., because they are

13. See C. McGonagle (2021) Translations: creating legally effected smart derivatives contracts. Journal of International Banking and Financial Law 8(540).

14. C.D. Clack (2018) Smart Contract Templates: legal semantics and code validation. Journal of Digital Banking 2(4),338–352. Author's preprint: http://www0.cs.ucl.ac.uk/staff/C.Clack/research/JDigitalBanking-Clack-AuthorPreprint.pdf

15. C.D. Clack and G. Vanca (2018) Temporal aspects of smart contracts for financial derivatives. Lecture Notes in Computer Science 11247:339–355. http://arxiv.org/abs/1805.11677/

easy to automate, or because their automation although difficult would bring great benefit.

ISDA has proposed some guidelines to support the selection of parts of the contract which are likely to be amenable to automation:[16]

- Focus on automating common, standardised, aspects of derivatives contracts, so that the automation is widely applicable across a large number of different contracts.
- Avoid automating complex legal provisions, since these might be more difficult to establish, operate and maintain. We have observed that complex legal text can sometimes be captured with quite simple logic (and therefore simple code). The reverse is also true, that seemingly simple legal text may require quite complex logic (and therefore complex code).
- Consider how external factors such as observable events or discretion (including by a third party) will be efficiently incorporated into the smart contract code.
- When designing functions aimed at automating derivatives contracts, these should be common across multiple products.[17]
- Only automate those aspects of a derivatives contract where a lawyer can confirm that their legal effect will not be changed when automated.

CONCLUSION

Smart Derivatives Contracts aim to automate high-value derivatives contracts, including automation of aspects of the Master Agreement as well as automation of lifecycle events stated in the economic terms of the specific derivatives product. This vision raises many issues to be solved, such as (i) how the smart contract code can be faithful to the legal agreement, and (ii) to what extent the provisions of the legal agreement can be automated. This requires an inter-disciplinary approach that brings together computer scientists, lawyers, and banking practitioners to consider how much of a derivatives contract can be automated so that the greatest possible efficiency gains are realised. Central to this assessment will be the consideration of how events might impact the expected operation of a smart derivatives contract. We hope this article will prove useful in providing a framework to understand how the occurrence of different types of Events might impact upon derivatives contracts and how these Events might be considered within the operation of autonomous, self-executing Smart Derivatives Contracts.

16. See ISDA and King & Wood Mallesons (2018) Smart Derivatives Contracts: From Concept to Construction. https://www.isda.org/a/cHvEE/Smart-Derivatives-Contracts-From-Concept-to-Construction-Oct-2018.pdf

17. The ISDA Common Domain Model, for example, creates a single, common digital representation of derivatives trade events and actions to enhance consistency and facilitate interoperability across firms and platforms: https://www.isda.org/a/z8AEE/ISDA-CDM-Factsheet.pdf