William & Mary Business Law Review

Volume 10 | Issue 2 Article 3

Evaluating the Costs and Benefits of a Smart Contract Blockchain Framework for Credit Default Swaps

Ryan Clements

EVALUATING THE COSTS AND BENEFITS OF A SMART CONTRACT BLOCKCHAIN FRAMEWORK FOR CREDIT DEFAULT SWAPS

Ryan Clements*

Abstract

Despite wide speculation about its use-value, there are very few large-scale Blockchain implementations, particularly in sophisticated financial applications and mature markets. The extent of Blockchain's disruptive potential in these domains is uncertain. This Article considers Blockchain's use-value for credit default swap contract execution, fulfillment, and post-trade processing by using, as an assessment base, a series of derivative industry whitepapers, academic and technological evaluative studies, and commentary relating to current market undertakings. In summary, when applied to credit default swaps, there are many barriers to implementation, as well as costs, fragmentation risks, technological deficiencies, and practical drawbacks. As a result, there is some doubt on the extent of Blockchain's short-term transformational value for complex financial structures and mature trading markets. This, at least in part, explains the fact that Blockchain projects are currently slow to materialize in derivatives and other financial market applications.

* Ryan Clements, BA (Honors, Alberta), LLB (First Class, Alberta), LLM (Magna Cum Laude, Duke) is an adjunct law professor at the University of Alberta and a current doctoral (SJD) candidate at Duke University School of Law.

TABLE OF CONTENTS

INTRODUCTION

Bitcoin ("BTC") took the world by storm in 2017.[1] First, there was an unprecedented price surge;[2] then, shortly thereafter, the U.S. Commodity Futures Trading Commission (CFTC) validated BTC derivatives[3]—sparking another price spike (and a round of criticism for facilitating systemic risk).[4] Although spot market sell-offs in early 2018 led some to suggest the BTC bubble was "bursting"[5] (and confirmed the skepticism of others, including industry leaders,[6] who questioned BTC's viability as a payment substitute)[7]

---

[1] Frances Coppola, *Bitcoin's Bubble Is Bursting. How Long Will Prices Fall?*, FORBES (Mar. 20, 2018, 2:02 PM), https://www.forbes.com/sites/francescoppola/2018/03/20/bitcoins-bubble-is-bursting-how-low-will-prices-fall/#20a0c2ac724e [http://perma.cc/A5AD-88LS].

[2] *See* Julie Verhage, *Bitcoin's Epic Rise Leaves Late-1990s Tech Bubble in the Dust*, BLOOMBERG (Aug. 29, 2017, 10:06 AM), https://www.bloomberg.com/news/articles/2017-08-29/bitcoin-s-epic-rise-leaves-late-1990s-tech-bubble-in-the-dust [https://perma.cc/XY9S-XB3M].

[3] LedgerX, LLC was first granted registration as a derivatives clearing organization for "fully-collateralized digital currency" swaps and options. *See* Press Release No. 7592-17, U.S. Commodity Futures Trading Comm., CFTC Grants DCO Registration to LedgerX LLC (July 24, 2017), http://www.cftc.gov/PressRoom/PressReleases/pr7592-17 [https://perma.cc/98LS-XYSY]. Then the CFTC allowed the self-certifications of the Chicago Mercantile Exchange Inc. and the CBOE Futures Exchange for BTC futures products as well as the Cantor Exchange for BTC "binary options." *See* Press Release No. 7654-17, U.S. Commodity Futures Trading Comm., CFTC Statement on Self-certification of Bitcoin Products by CME, CFE, and Cantor Exchange (Dec. 1, 2017), http://www.cftc.gov/PressRoom/PressReleases/pr7654-17 [https://perma.cc/94AZ-7P5U].

[4] In response to this criticism, the CFTC scheduled a series of meetings to investigate the self-certification process and the risks inherent in the digital currency derivatives market. *See* Pete Schroeder & Michelle Price, *U.S. Derivatives Regulator to Review Bitcoin Futures Risks*, REUTERS (Jan. 4, 2018, 12:22 PM), https://www.reuters.com/article/us-usa-cftc-bitcoin/u-s-derivatives-regulator-to-review-bitcoin-futures-risks-idUSKBN1ET20R [https://perma.cc/P66M-786H].

[5] *See* Coppola, *supra* note 1.

[6] *See* Matthew Frankel, *What 3 Billionaires Think About Bitcoin*, MOTLEY FOOL (June 15, 2017), https://www.fool.com/retirement/2017/06/15/what-3-billionaires-think-about-bitcoin.aspx [https://perma.cc/2MMK-HMPN].

[7] *See* David Henry & Anna Irrera, *JP Morgan's Dimon Says Bitcoin "is a fraud,"* REUTERS (Sept. 12, 2017, 9:35 PM), https://www.reuters.com/article/us-usa-banks-conference-jpmorgan/jpmorgans-dimon-says-bitcoin-is-a-fraud-idUSKCN1BN2KP [https://perma.cc/JB9L-UYHT].

many BTC skeptics also proclaimed Blockchain[8]—BTC's underlying technology[9]—as the real future.[10]

This sentiment seems almost ubiquitous at times.[11] Despite the absence of large-scale, Blockchain implementations and what technology writer, Irving Wladawsky-Berger, asserts in a recent *Wall Street Journal* article called a Blockchain "killer-app,"[12] no one knows the extent that Blockchain will ultimately impact commercial transactions and financial markets.[13] There is a lot of speculation about its use value across multiple applications including data management,[14] servicing assets,[15] identity protection,[16] and supply chain.[17] There is even talk about Blockchain being valuable for

---

[8] For simplicity, in this Article I refer to "Blockchain" as representative of the term "distributed ledger technology." There are, strictly speaking, other forms of distributed ledger technology in addition to Blockchain.

[9] *See* Sean Williams, *The Basics of Blockchain Technology, Explained in Plain English*, MOTLEY FOOL (Jan. 10, 2018, 8:09 AM), https://www.fool.com/investing/2018/01/10/the-basics-of-blockchain-technology-explained-in-p.aspx [https://perma.cc/9VV9-ZWRW].

[10] *See* Polina Marinova, *Jamie Dimon: Bitcoin Bad, Blockchain Good*, FORTUNE (Sept. 13, 2017), http://fortune.com/2017/09/13/jamie-dimon-bitcoin-blockchain/ [https://perma.cc/DW6P-3TYG].

[11] *See* Michael J. Casey & Paul Vigna, *In Blockchain We Trust*, MIT TECH. REV. (Apr. 9, 2018), https://www.technologyreview.com/s/610781/in-blockchain-we-trust/ [https://perma.cc/D6Z4-KF6Q].

[12] *See* Irving Wladawsky-Berger, *In Search of Blockchain's Killer-Apps*, WALL ST. J. (Mar. 9, 2018, 4:18 PM), https://blogs.wsj.com/cio/2018/03/09/is-search-of-blockchains-killer-apps/ [https://perma.cc/8VHL-MZHQ].

[13] *Id.*

[14] *See* EMBRACING DISRUPTION: TAPPING THE POTENTIAL OF DISTRIBUTED LEDGERS TO IMPROVE THE POST-TRADE LANDSCAPE 13 (Jan. 2016) [hereinafter DTCC WHITEPAPER] ("DTCC's viewpoint is that basic industry master data is an ideal candidate for improvement using decentralized consensus, rule standardization and auditable change history. This information is used by the entire industry by definition, and the lack of consistency and quality is a recurrent industry problem. Further, this could be constructed in such a manner that multiple firms can be authorized as data submitters, there can be many data validators and the majority of users will be data consumers.").

[15] *Id.* at 13–14.

[16] The amount of cybersecurity data protection that a Blockchain provides varies with each Blockchain. *See generally* Adam Waks, *Blockchain and Privacy*, LEXOLOGY (Nov. 29, 2017), https://www.lexology.com/library/detail.aspx?g=82c7ceb8-621f-4f6f-881f-8eabcf4507a6 [https://perma.cc/LV9M-4EB3].

[17] *See* Jacob Bunge, *Latest Use for a Bitcoin Technology: Tracing Turkeys From Farm To Table*, WALL ST. J. (Oct. 25, 2017, 5:30 AM), https://www.wsj.com/articles/latest-use-for-a-bitcoin-technology-tracing-turkeys-from-farm-to-table-1508923801 [https://perma.cc/26LW-G34N]; *see also* Robert Hackett,

election fraud prevention[18] and having important residual benefits for charities.[19] The question of Blockchain's application to complex financial transactions in mature economic markets is yet to be proven,[20] and it is in this forum where the Article seeks to contribute. Specifically, the Article will consider Blockchain's use value in over-the-counter ("OTC") and centrally cleared credit default swaps ("CDS")—the risk management tools popularly vilified for their part in the 2008 Global Financial Crisis ("GFC").[21]

The reason OTC CDSs have been chosen for this assessment is because they have been described by some, including technology writer, Noelle Acheson, as "ideal" for Blockchain implementation since they have a "programmable structure," they operate in a post-GFC regulatory "standardized" setting, and they trade largely "in a self-contained market."[22] What can be concluded, however, upon reviewing the mechanics of CDS contractual functionality, and the pros and cons of using Blockchain for CDS post-trade processing, is

---

Walmart and 9 Food Giants Team Up on IBM Blockchain Plans, FORTUNE (Aug. 22, 2017), http://fortune.com/2017/08/22/walmart-blockchain-ibm-food-nestle-unilever-tyson-dole/ [https://perma.cc/X5S6-KHB2].

[18] *See* Alyssa Satara, *What Is Blockchain Used for Besides Bitcoin?*, FORBES (Nov. 17, 2017, 12:34 PM), https://www.forbes.com/sites/quora/2017/11/17/what-is-blockchain-used-for-besides-bitcoin/#3b4cdc7d446e [https://perma.cc/D44R-22F6].

[19] *See* Rhodri Davies, *Knowing Me, Knowing You: Self-Sovereign Digital Identity and The Future For Charities*, CAF CHARITIES & FOUND. (July 21, 2017), https://www.cafonline.org/about-us/blog-home/giving-thought/the-future-of-doing-good/self-sovereign-digital-identity-and-the-future-of-charity [https://perma.cc/T4AR-VEZL].

[20] *See* Amy Nordrum, *Wall Street Firms to Move Trillions to Blockchains in 2018*, IEEE SPECTRUM (Sept. 29, 2017, 7:00 PM), https://spectrum.ieee.org/telecom/internet/wall-street-firms-to-move-trillions-to-blockchains-in-2018 [https://perma.cc/S22H-ZJ5B].

[21] The role that CDS played in the 2008 financial crisis has been widely cited, particularly in regards to American International Group, Inc.'s ("AIG") CDS overexposure and subsequent government bailout. *See* Gina-Gail S. Fletcher, *Hazardous Hedging: The (Unacknowledged) Risks of Hedging with Credit Derivatives*, 33 REV. BANKING & FIN. L. 813, 853–54 (2014)*; see also* Erik F. Gerding, *Credit Derivatives, Leverage, and Financial Regulation's Missing Macroeconomic Dimension*, 8 BERKELEY BUS. L.J. 29, 30, 44–45, 60 (2011); William Spencer Topham, *Re-regulating "Financial Weapons of Mass Destruction" Observations on Repealing the Commodity Futures Modernization Act and Future Derivative Regulation*, 47 WILLAMETTE L. REV. 133, 135 (2010).

[22] Noelle Acheson, *Blockchain and credit default swaps—Part 2, the application*, FINTECHBLUE (Sept. 13, 2017), http://www.fintechblue.com/2017/09/blockchain-credit-default-swaps-part-2-application/ [https://perma.cc/68TJ-TR27].

that at least in the short run, the costs largely outweigh the benefits.[23] Blockchain could be the future of financial transactions, but at the moment, when applied to CDS there are many barriers to integration.[24] Perhaps, this should give us pause with respect to the technology itself[25] and the deficiencies it may introduce when rendering contracts to code.[26] At the very least it should temper some of the "irrational exuberance"[27] about Blockchain and just how disruptive it will ultimately be for complex financial transactions and mature market structures.[28]

In arriving at this conclusion, the Article relies on and applies the findings of numerous industry technological assessment papers, academic studies, and market commentaries with a particular focus on a series of recent whitepapers[29] published by the International Swaps and Derivatives Association (ISDA)[30]

---

[23] *See generally* DTCC WHITEPAPER, *supra* note 14.

[24] *See* Acheson, *supra* note 22.

[25] *See* Kai Stinchcombe, *Blockchain is not only crappy technology but a bad vision for the future*, MEDIUM (Apr. 5, 2018), https://medium.com/@kaistinchcombe/decentralized-and-trustless-crypto-paradise-is-actually-a-medieval-hellhole-c1ca122efdec [https://perma.cc/LY9H-U2SP].

[26] *See* Usha Rodrigues, *Law and the Blockchain* 5–6 (Univ. of Ga. Sch. of Law Research Paper No. 2018-07, 2018), https://ssrn.com/abstract=3127782 [https://perma.cc/7DBX-E4DA].

[27] The term "irrational exuberance" was first used by Alan Greenspan to describe the dot.com boom and then later adopted by Nobel Prize winner Robert Shiller in his book of the same name. Shiller has also labeled Bitcoin as "irrational exuberance" and compared it to the Tulip craze of the seventeenth century. *See* Brad Tuttle, *Bitcoin Is Likely To 'Totally Collapse and Be Forgotten,' Nobel Prize-Winning Economist Says,* MONEY (Jan. 19, 2018), http://time.com/money/5109474/bitcoin-predictions-collapse-economist-robert-shiller/ [https://perma.cc/DD8W-MDKF].

[28] *See* DTCC WHITEPAPER, *supra* note 14, at 18.

[29] *See generally* INT'L SWAPS & DERIVATIVES ASS'N, INFRASTRUCTURE, https://www.isda.org/category/infrastructure/market-infrastructure-technology [https://perma.cc/W3Q6-ALHT]; INT'L SWAPS & DERIVATIVES ASS'N, THE FUTURE OF DERIVATIVES PROCESSING & MARKET INFRASTRUCTURE (Sept. 15, 2016), https://www.isda.org/2016/09/15/the-future-of-derivatives-processing-and-market-infrastructure/ [https://perma.cc/SP8T-FWU7] [hereinafter ISDA FUTURE PROCESSING]; INT'L SWAPS & DERIVATIVES ASS'N LINKLATERS, WHITE PAPER: SMART CONTRACTS & DISTRIBUTED LEDGER—A LEGAL PERSPECTIVE (Aug. 2017), https://www.isda.org/a/6EKDE/smart-contracts-and-distributed-ledger-a-legal-perspective.pdf [https://perma.cc/FZ5G-B862] [hereinafter ISDA 2017 WHITEPAPER].

[30] ISDA has been described as the "de facto trade association of the global OTC derivatives industry." *See* Dan Awrey, *Limits of Private Ordering Within Modern Financial Markets*, 34 REV. FIN. & BANKING L. 184, 205 (2014); *see*

and by swap data repository Depository Trust & Clearing Corporation (DTCC).[31] Also, several financial market participants have considered migrating operational infrastructure to the Blockchain and their justifications, and related commentary, will also be assessed and applied.[32] In light of these resources, the Article will proceed as follows: in Part I, after providing an overview of Blockchain, smart contracts, and transactional foundations for CDS (and introducing the ISDA *Master Agreement* ("MA") structure), the Article will present a hypothetical smart contract CDS operational framework, using ISDA recommendations from a 2017 joint whitepaper on smart contracts with global law firm Linklaters.[33] The Section will further adapt the framework for operational technicalities based on current academic studies and industry assessments of Blockchain.[34] This Section will also discuss recommendations from both ISDA[35] and the DTCC[36] on how Blockchain could use hybrid models (combining current infrastructure with Blockchain)[37] and will conclude by highlighting the concerns that stand in the way of full integration.[38] Part II will consider the costs and benefits of using "permissioned"[39] Blockchain infrastructure for CDS operations, post-trade processing, and *Dodd Frank Act* (DFA)

also Gabriel V. Rauterberg & Andrew Verstein, *Assessing Transnational Private Regulation of the OTC Derivatives Market: ISDA, the BBA, and the Future of Financial Reform*, 54 VA. J. INT'L. L. 9, 13 (2013). ISDA was founded in 1985 and now operates in sixty-eight countries with over 875 members. *See* INT'L SWAPS & DERIVATIVES ASS'N, *About ISDA*, http://www2.isda.org/about-isda [https://perma.cc/7GS6-DPWX] (ISDA created "the ISDA Master Agreement and a wide range of related documentation materials, and in ensuring the enforceability of their netting and collateral provisions, has helped to significantly reduce credit and legal risk.").

[31] *See generally* DTCC WHITEPAPER, *supra* note 14.

[32] *See* Amy Nordrum, *Wall Street Firms to Move Trillions to Blockchains in 2018*, IEEE SPECTRUM (Sept. 29, 2017, 7:00 PM), https://spectrum.ieee.org/telecom/internet/wall-street-firms-to-move-trillions-to-blockchains-in-2018 [https://perma.cc/S22H-ZJ5B].

[33] *See generally* ISDA 2017 WHITEPAPER, *supra* note 29. References to this whitepaper, throughout the body of the Article, will for simplicity, combine ISDA and Linklaters collectively by the descriptive term "ISDA."

[34] *See generally id.*

[35] *See id.* at 13–15.

[36] *See generally* DTCC WHITEPAPER, *supra* note 14, at 13.

[37] *See generally id.*; ISDA 2017 WHITEPAPER, *supra* note 29.

[38] *See generally* DTCC WHITEPAPER, *supra* note 14; ISDA 2017 WHITEPAPER, *supra* note 29.

[39] *See* DTCC WHITEPAPER, *supra* note 14, at 6–7.

Title VII[40] regulatory compliance, and will show that despite potential cost savings and operational efficiencies, there are technological and practical barriers to widespread adoption, and the investment returns for near term implementation are uncertain.[41] The Article concludes by surveying recent derivatives (primarily focused on post-trade processing) and financial services market Blockchain implementations.[42]

I. WHAT DOES A SMART CONTRACT-CREDIT DEFAULT SWAP OPERATIONAL FRAMEWORK LOOK LIKE?

A. Blockchain Foundations: The Basics

Blockchain facilitates a "distributed, decentralized, immutable ledger for verifying and recording transactions" and a means to "securely send, receive, and record value or information through a peer-to-peer network of computers."[43] Because it is decentralized, and transactions are "cryptographically signed"[44] it purports to protect against cyber-attacks by "creating a public, cryptographically protected transaction list."[45] ISDA has also noted that Blockchain can be public (like Bitcoin) or "permissioned" (private) with the latter allowing for an "override" or "super-administrator" function.[46] Blockchain works to remove the role of "trust" in our financial transactions.[47] As Edward Baker in a recent *Southwestern Law Review* article describes, we trust banks to hold our money, governments to secure it, credit card companies and payment systems to "verify and authenticate transactions," and the legal system

---

[40] Title VII to the *Dodd Frank Act* instituted comprehensive regulation for OTC derivatives. *See generally* Dodd-Frank Wall Street Reform and Consumer Protection Act, 12 U.S.C. § 5301 (2010).

[41] *See* DTCC WHITEPAPER, *supra* note 14, at 18.

[42] *See generally id.*

[43] Nicolette Kost De Sevres, Bart Chilton & Bradley Cohen, *The Blockchain Revolution, Smart Contracts and Financial Transactions*, 21 No. 5 CYBERSPACE LAWYER NL 3, 1 (2016).

[44] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 7.

[45] Edward D. Baker, *Trustless Property Systems and Anarchy: How Trustless Property Technology Will Shape the Future of Property Exchange*, 45 SW. L. REV. 351, 355 (2015).

[46] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 8; *see also* Nordrum, *supra* note 32.

[47] *See* Baker, *supra* note 45, at 352.

to protect our interests.[48] Cryptography can add trust;[49] however, criminals can also use cryptography against us.[50] Since consumer distrust in financial institutions has increased post GFC, Blockchain could also remove power and control away from the banks.[51]

The "chain" in a Blockchain is simply a "chain of ownership of a given piece of property,"[52] each transaction being proved by cryptography[53] in a process called "mining"[54] (miners receive a small amount of some "virtual currency" for performing the cryptographic calculations).[55] Once proven, the "time-stamped" transaction block is published on the distributed ledger.[56] Each "node" (user) on the network gets a copy of the new information at the same time so there are not duplicative records.[57] Thus, Blockchain eliminates the need for "centralized storage" and reduces "single point of failure" risks (like hacking or technological failure).[58] For all of its benefits however, Blockchain poses several regulatory challenges including costs of enforcement and anonymity.[59]

---

[48] *Id.* at 353.

[49] *See* David J. Phillips, *Cryptography Secrets and the Structure of Trust*, *in* TECHNOLOGY AND PRIVACY: THE NEW LANDSCAPE 24 (Philip Agre & Marc Rotenberg eds., 2001).

[50] *See* Baker, *supra* note 45, at 354.

[51] *See id.* at 357; *see also* Adrian Blundell-Wignall, *The Bitcoin Question: Currency Versus Trustless Transfer Technology* 7 (OECD Working Papers on Finance, Insurance, and Private Pensions, Working Paper No. 37, 2014).

[52] *See* Baker, *supra* note 45, at 357.

[53] *See generally* Satoshi Nakamoto, *Bitcoin: Peer-to-Peer Electronic Cash System*, BITCOIN, https://bitcoin.org/bitcoin.pdf [https://perma.cc/RES6-GLQ6].

[54] *See* Nikolei M. Kaplanov, *Nerdy Money: Bitcoin, The Private Digital Currency, and the Case Against Its Regulation*, 25 LOY. CONSUMER L. REV. 111, 172 (2012).

[55] *See* Nakamoto, *supra* note 53, at 119.

[56] Paul Farmer, *Speculative Tech: The Bitcoin Legal Quagmire & the Need for Legal Innovation*, 9 J. BUS. & TECH. L. 85, 88–89 (2014).

[57] ISDA 2017 WHITEPAPER, *supra* note 29, at 7; *see also* Ryan Surujnath, *Off the Chain! A Guide to Blockchain Derivatives Markets and the Implications on Systemic Risk*, 22 FORDHAM J. CORP. & FIN. L. 257, 269–70 (2017).

[58] Surujnath, *supra* note 57, at 261.

[59] *See generally* Jerry Brito, Houman Shadab & Andrea Castillo, *Bitcoin Financial Regulation: Securities, Derivatives, Prediction Markets, and Gambling*, 16 COLUM. SCI. & TECH. L. REV. 144, 218, 221 (2014).

B. Distinguishing Blockchain From Smart Contracts

A widely cited use of Blockchain is to create "smart contracts"—a blockchain-hosted[60] and executed[61] agreement that relies on computer code to be "self-executing" (as opposed to relying on third parties, like lawyers or courts for condition settlement, execution, and remedies).[62] The process of "uploading" a smart contract to the Blockchain varies depending on the Blockchain, but one of the most popular cryptocurrency applications, Ethereum (ETH),[63] was designed to facilitate smart contracts.[64] ETH differs from BTC in that instead of tracking "ownership of digital currency" it simply provides a means of "running the programming code of any decentralized application."[65] Like BTC, ETH has a cryptocurrency (Ether), but the purpose of Ether is not to replace money but rather to monetize developers to "build and run distributed applications."[66]

---

[60] The benefit of hosting a smart contract on a Blockchain is the creation of a "golden" record and the ability for contractual automation. *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 9:

> DLT allows the code to be embedded in the distributed ledger. This means there is only one 'golden' version, which effectively binds both parties. More importantly, once the code is switched on, the parties can take comfort from the fact that it will self-execute automatically and neither party can tamper with that. This is what is meant when smart contracts are described as 'self-enforcing.' There should be no need to resort to the courts to enforce the legal contract for payment because, when the relevant event occurs, failure to pay is not something that can happen within the code.

[61] *See id.* at 8.

[62] *See* Jeremy M. Sklaroff, *Smart Contracts and the Cost of Inflexibility*, 166 U. PA. L. REV. 263, 266–67, 275 (2017) ("Smart contracts enable firms to transact without the need for law or courts. They can autonomously negotiate with other parties (or other parties' smart contracts), and then attach directly to the parties' information systems so that goods or payment promised by the contract are automatically delivered."); *see also* Jacob Rund, *ISDA to Increase Focus on 'Smart' Contracts, Trade Automation*, CONGRESSIONAL QUARTERLY ROLL CALL (Mar. 8, 2017).

[63] "Ethereum is an open software platform based on blockchain technology that enables developers to build and deploy decentralized applications." *See* Ameer Rosic, *What is Ethereum? A Step by Step Beginners Guide*, BLOCKGEEKS (Mar. 12, 2017), https://blockgeeks.com/guides/ethereum/ [https://perma.cc/Z3WV-B87E].

[64] *See* Surujnath, *supra* note 57, at 273; *see also* ETHEREUM, https://www.ethereum.org [http://perma.cc/4JYY-Q5AF].

[65] Rosic, *supra* note 63.

[66] Prableen Bajpai, *Bitcoin vs. Ethereum: Driven by Different Purposes*, INVESTOPEDIA (Aug. 12, 2018, 3:08 PM), https://www.investopedia.com/articles

C. Smart Contract Foundations and Operational Mechanics

In its most basic definition, ISDA defines a smart contract as "the automation and self-execution (and thereby enforcement) of a pre-set conditional action."[67] As such, a smart contract "operate[s] without the need for human legal interpretation"[68] and can be "nested" with other smart contracts to scale complexity.[69] Computer scientist Nick Szabo[70] first coined the term "smart contract" in the mid-1990s and described it as a contract "embedded in the hardware and software we deal with, in such a way as to make breach of contract expensive."[71] Szabo suggested that smart contracts would solve the "computational and transaction costs" of agreement design, execution, and default remedy through the use of "protocols, users interfaces, and promises expressed via those interfaces."[72] By way of interesting context, Szabo also created "bit gold"[73] (a predecessor to BTC), attended law school "for fun,"[74]

/investing/031416/bitcoin-vs-ethereum-driven-different-purposes.asp [http://perma.cc/2UMN-EPRS].

[67] ISDA 2017 WHITEPAPER, *supra* note 29, at 5.

[68] Gabrielle Orum Hernandez, *With Contract Automation, Ambition Doesn't Always Align with Reality*, LEGALTECH NEWS (Mar. 30, 2017, 9:46 AM), https://www.law.com/legaltechnews/almID/1202782521057/ [http://perma.cc/B5FG-B8J4].

[69] Sklaroff, *supra* note 62, at 273.

[70] *See* Richtopia, *The 100 Most Influential Blockchain People* (May 9, 2018, 6:33 PM), https://www.rise.global/top-fintech-people/p/5824542/r/2520358 [http://perma.cc/3UHR-Q4VJ]; *see also* Antonio Madeira, *30 Most Influential People In The Blockchain Space*, CRYPTOCOMPARE (Sept. 10, 2018), https://www.cryptocompare.com/coins/guides/30-most-influential-people-in-the-blockchain-space/ [http://perma.cc/24PT-L8KG].

[71] Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets*, EXTROPY #16 (1996), http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html [http://perma.cc/F9Q7-LDQH].

[72] Nick Szabo, *Smart Contracts: Formalization and Securing Relationship on Public Networks*, FIRST MONDAY (Sept. 1997), http://firstmonday.org/ojs/index.php/fm/article/view/548/469%23Building [http://perma.cc/PFG7-FU7G].

[73] *See generally* Nick Szabo, *Bit Gold*, UNENUMERATED (Dec. 27, 2008, 4:16 PM), http://unenumerated.blogspot.com/2005/12/bit-gold.html [http://perma.cc/7GFL-QQQ8].

[74] Shane Ferro, *The alleged Bitcoin founder went to law school for fun—and that says a lot about what Bitcoin is really for*, BUS. INSIDER (May 15, 2015, 3:01 PM), http://www.businessinsider.com/bitcoin-is-about-property-law-2015-5 [http://perma.cc/9W6K-QX7A].

and is alleged by some to be the mysterious BTC creator Satoshi Nakamoto[75] (a claim Szabo has denied).[76]

Like BTC, smart contracts are "immutable" (in that they cannot be breached) because of what Jeremy Sklaroff describes as "decentralized consensus, instantaneous exchange, and complex computational states."[77] In other words, there is an automatic consequence and remedy if a party defaults (so enforcement is eliminated).[78] In a well-cited example by Szabo, a lessee defaulting on a car payment would trigger automatic responses (like the termination of digitized keys, or the transfer of funds from a collateral account).[79] ISDA points out that smart contracts should be

---

[75] *See* Nathaniel Popper, *Decoding the Enigma of Satoshi Nakamoto and the Birth of Bitcoin*, N.Y. TIMES (May 15, 2015), https://www.nytimes.com/2015/05/17/business/decoding-the-enigma-of-satoshi-nakamoto-and-the-birth-of-bitcoin.html?mcubz=0 [http://perma.cc/FY7R-9FEF].

[76] *See* Rob Price, *The man everyone thinks is the creator of bitcoin gave a speech discussing the history of the technology*, BUS. INSIDER (Nov. 13, 2015, 7:49 AM), http://www.businessinsider.com/nick-szabo-ethereum-bitcoin-blockchain-history-satoshi-nakamoto-2015-11?r=UK&IR=T [http://perma.cc/PUS4-TPT9].

[77] Sklaroff, *supra* note 62, at 273:

> It is written and executed without the need for expensive intermediating institutions; by interacting with devices that monitor states of the world and with firms' internal information systems, it can check whether conditions are satisfied and then instantaneously provide the bargained-for goods or money. And it can exist either in isolation or be nested within multiple sets of other smart contracts, so that its complexity can scale up to meet whatever transaction logic the parties desire.

[78] *See id.* at 267. *See generally* Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 331–32 (2017).

[79] *See* Szabo, *supra* note 72:

> As another example, consider a hypothetical digital security system for automobiles. The smart contract design strategy suggests that we successively refine security protocols to more fully embed in a property the contractual terms which deal with it. These protocols would give control of the cryptographic keys for operating the property to the person who rightfully owns that property, based on the terms of the contract. In the most straightforward implementation, the car can be rendered inoperable unless the proper challenge-response protocol is completed with its rightful owner, preventing theft. But if the car is being used to secure credit, strong security implemented in this traditional way would create a headache for the creditor—the repo man would no longer be able to confiscate a deadbeat's car.

distinguished from coded software "automated" contracts (which are not new), as true smart contracts use a singular code "embedded in the distributed ledger."[80] ISDA also notes that "smart contract code" (computer code automating certain tasks) is different from "smart legal contracts" (automated "legal" agreements satisfying the doctrinal conditions of offer, acceptance, consideration, intention to contract, and certainty of terms).[81] In ISDA's view, "every smart legal contract can be said to contain one or more pieces of smart contract code, but not every piece of smart contract code comprises a smart legal contract."[82] Also, smart contracts may require some element of human oversight and intervention.[83]

The benefits of smart contracts include transactional efficiency and minimization of monitoring and enforcement costs,[84] as well as "the integrity of data."[85] However, as identified by Jeremy Sklaroff in a recent *University of Pennsylvania Law Review* article, smart contracts also introduce significant costs since they must contemplate "all future states," and there is uncertainty whether contemplation of all contingencies is possible.[86] As such, Sklaroff notes that smart contract formation creates an externality "by removing

---

> To redress this problem, we can create a smart lien protocol: if the owner fails to make payments, the smart contract invokes the lien protocol, which returns control of the car keys to the bank. This protocol might be much cheaper and more effective than a repo man. A further reification would probably remove the lien when the loan has been paid.

80 ISDA 2017 WHITEPAPER, *supra* note 29, at 9.

81 *See id.* at 6 ("For a smart legal contract, there would need to be a legal contract satisfying the requirements of the relevant governing law, but with some element of that legal contract being electronically automated. With smart contract code, in contrast, there might exist no legal contract at all.").

82 *Id.* at 5.

83 *Id.*

84 *See* Werbach & Cornell, *supra* note 78, at 317–18. *See generally* Harry Surden, *Computable Contracts*, 46 U.C. DAVIS L. REV. 629, 689–90 (2012).

85 *See* Sklaroff, *supra* note 62, at 275.

86 *See id.* at 277:

> The transactional relationship created by a smart contract between two firms must be completely formed and precisely defined, eliminating forms of flexibility that are crucial to the contracting process. In this sense, the transaction costs of entering into smart contracts may actually be higher than those associated with traditional semantic contracts.

enforcement flexibility."[87] As a result, Professors Kevin Werbach and Nicolas Cornell argue that smart contracts have a "fundamentally different purpose" from conventional contracts[88] and given formation costs and application drawbacks, there is a measure of uncertainty as to whether they will ever fully supplant traditional forms.[89]

---

[87] *Id.*:

> Parties that cannot build bespoke contracts prefer to avoid litigation and resolve contract disputes informally. Litigation over generic contracts is unpredictable and extremely costly, incentivizing parties to bootstrap their relationship—their history of business and the promise of more business in the future—as a cheap way to constrain opportunistic behavior. Smart contracts remove these informal strategies from parties' range of responses to breach. Once initialized, a smart contract creates a permanent and unalterable link between the terms of the contract and the information systems it manipulates, lasting until the transaction is complete. Without the ability to flexibly enforce their agreement, parties who determined that custom legal agreements were too expensive will instead be forced to rely on customized and equally expensive blocks of code.

See also id. at 277–78.

[88] *See* Werbach & Cornell, *supra* note 78, at 318:

> While smart contracts can meet the doctrinal requirements of contract law, they serve a fundamentally different purpose. Contract law is a remedial institution. Its aim is not to ensure performance ex ante, but to adjudicate the grievances that may arise ex post. Smart contracts bring this core function of contract law into sharper relief, as they eliminate the act of remediation by admitting no possibility of breach. But, the needs that gave rise to contract law do not disappear. If the parties do not or cannot represent all possible outcomes of the smart contract arrangement ex ante, the results may diverge from their mutual intent. The parties' expression may also not produce legally sanctioned outcomes, as in the case of duress, unconscionability, or illegality. Promise-oriented disputes and grievances will not disappear, but their complexions will shift. In such scenarios, either the parties or the state will seek to reintroduce the machinery of contractual adjudication. Once one properly appreciates what is—and what is not—the function of contract law, it becomes evident that the reports of its death are "greatly exaggerated."

[89] Sklaroff, *supra* note 62, at 300–02.

D. Introducing Credit Default Swaps

CDSs were invented in 1991 by Bankers Trust and later refined by the investment banking arm of J.P. Morgan in the mid-1990s.[90] A CDS is fundamentally a hedge[91] against credit risk,[92] where a purchaser buys protection against a "credit event" on an underlying asset.[93] If the credit event occurs during a prescribed time frame the protection seller indemnifies the purchaser (and if the event doesn't occur then the seller keeps the premium).[94] In practice, CDSs are often much more complicated.[95] Pre-GFC,

---

[90] *See* JENNIFER TAUB, OTHER PEOPLE'S HOUSES: HOW DECADES OF BAILOUTS, CAPTIVE REGULATORS, AND TOXIC BANKERS MADE HOME MORTGAGES A THRILLING BUSINESS 192 (1st ed. 2014).

[91] The use of CDSs to hedge risk has been criticized, however, see Fletcher, *supra* note 21, at 897:

> The use of credit derivatives to neutralize risk exposure is, itself, fraught with risks. Firms that choose to offset risks with these complex instruments may be exposed to different risks, including counterparty risk, convergence risk, basis risk, or codependent risk. To decide whether a transaction is a true hedge, therefore, the inquiry should not focus on the intent of the parties or on the source of the risk; rather, a true hedge should be determined by looking at whether the benefits of the transaction outweigh the costs. While balancing the costs against the expected benefits of the transaction seems straightforward, firms and the markets are limited in their ability to accurately gauge the costs of using credit derivatives to hedge. Asymmetrical information and negative externalities affect the ability of firms to account for the costs of hedging with credit derivatives. Regulation is needed to force parties to account for costs that they would otherwise fail to incorporate when deciding how to value the costs of credit derivatives used to manage risk exposure.

See also Patrick A. Jackman & John R. Wilson, *Using Derivatives to Have Your Cake and Eat It, Too*, 24 COLO. L. 2213 (1995). *See generally* Bernard J. Karol, *An Overview of Derivatives as Risk Management Tools*, 1 STAN. J.L. BUS. & FIN. 195, 197 (1995).

[92] Jongho Kim, *Can Risks be Reduced in the Derivatives Market? Lessons from the Deal Structure Analysis of Modern Financial Engineering Debacles*, 6 DEPAUL BUS. & COM. L.J. 29, 31 (2008). *See generally* Kimberly D. Krawiec, *More than Just "New Financial Bingo": A Risk-Based Approach to Understanding Derivatives*, 23 J. CORP. L. 1, 34 (1997).

[93] *See generally* Fletcher, *supra* note 21, at 828.

[94] *Id.* at 828–29.

[95] Consider for example during the GFS, CDS were sold by AIG on opaque structures like mortgage backed securities (MBS) or collateralized debt obligations (CDOs). *See* TAUB, *supra* note 90, at 192–93:

CDSs traded "over the counter"[96] and operated without central clearing[97] (post-GFC reforms introduced mandatory clearing for many standardized CDSs and also exchanged trading through organized swap execution facilities).[98] In 2016, the Intercontinental Exchange ("ICE") debuted a trading platform[99] for clearing "single-name credit default swaps,"[100] signaling a departure from bank oversight of CDS trading and allowing for wider market participation.[101] The Securities and Exchange Commission (SEC) has

---

> Early on, the loans and bonds on which AIG sold credit protection were fairly transparent. But when they began to sell CDSs for residential MBSs and CDOs based on them, the clarity vanished. The names and credit histories of the underlying homeowners were not shared with investors in these mortgage-linked securities.

Also, the opacity of CDS was increased through the use of "synthetic" structures. *See Synthetic CDO*, INVESTOPEDIA, https://www.investopedia.com/terms/s/syntheticcdo.asp [http://perma.cc/53SK-4WR2].

96 Saul S. Cohen, *The Challenge of Derivatives (Continued)*, 66 FORDHAM L. REV. 747, 747 (1997). *See generally* Lynn A. Stout, *Betting the Bank: How Derivatives Trading Under Conditions of Uncertainty Can Increase Risks and Erode Returns in Financial Markets*, 21 J. CORP. L. 53 (1995); William F. Stutts, *The Derivative as Fiend: Killer Bunny or Trojan Rabbit?*, 36 TEX. INT'L L.J. 827 (2001).

97 Colleen M. Baker, *Regulating the Invisible: The Case of Over-the-Counter Derivatives*, 85 NOTRE DAME L. REV. 1287, 1303–05 (2010); *see also* Jared M. Burden, *Blowing Bubbles: Participations, Derivatives, and How Sharing Risk Creates Banking Crisis*, 45 TULSA L. REV. 551, 572 (2010). The non-cleared OTC derivatives market has been widely cited as a significant contributor to the GFC. *See* Lynn A. Stout, *Derivatives and the Legal Origin of the 2008 Credit Crisis*, 1 HARV. BUS. L. REV. 1, 34 (2011).

98 *See generally* Donal Gallagher et al., *Daisy Chains and Non-Cleared OTC Derivatives*, QUATERNION RISK MGMT. (Jan. 3, 2017), https://www.quaternion.com/wp-content/uploads/2017/02/Optimisation_White_Paper_0_1.pdf [http://perma.cc/39ST-ZACB].

99 *See Credit Default Swaps: Growth in Clearing and Futures*, INTERCONTINENTAL EXCHANGE INC., https://www.theice.com/article/cds-growth [http://perma.cc/XSZ3-79RF].

100 *See* Christopher L. Culp, Andria van der Merwe & Bettina J. Stärkle, *Single-Name Credit Default Swaps: A Review of Empirical Academic Literature*, INT'L SWAPS & DERIVATIVE ASS'N, at v (Sept. 2016), https://www.isda.org/a/KSiDE/single-name-cds-literature-review-culp-van-der-merwe-staerkle-isda.pdf [http://perma.cc/2AWG-U3F5]; *see also* Vincent Basulto & Richard J. Lee, *Single-Name Credit Default Swaps: A Primer*, LEXOLOGY (May 2, 2016), https://www.rkollp.com/assets/htmldocuments/Single-Name%20Credit%20Default%20Swaps%20A%20Primer.pdf [http://perma.cc/VQX3-RZS2].

101 *See* Sridhar Natarajan & Matthew Leising, *ICE Said to Let Investors Bypass Banks in Credit-Swap Trades*, BLOOMBERG (July 19, 2016, 10:36 AM),

regulatory jurisdiction over "security-based swaps"[102] (which includes most "single name credit default swaps")[103] and the Commodity Futures Trading Commission (CFTC) has jurisdiction over "swaps" (including CDS index classes[104]—which are standardized, centrally cleared, traded (through a swap execution facility), and benefit from higher liquidity).[105]

The primary contracting vehicle for non-cleared OTC CDSs is the ISDA *Master Agreement* ("MA").[106] The MA contains standardized terms for efficiency but can also be uniquely customized[107] (which customization takes place in the schedules to the MA, the credit support annex, the confirmations, and the product specific definitions—all of which together form, along with the MA, a "single contract," which format allows for multiple trades, established in confirmations under one MA).[108] The MA also provides for continuing regulatory compliance through a "multilateral contractual amendment mechanism" called a "*Protocol*."[109] Post-GFC legislative

---

https://www.bloomberg.com/news/articles/2016-07-19/ice-said-to-let-investors-bypass-banks-in-credit-swaps-trading.

[102] *See* U.S. SECURITIES & EXCHANGE COMM., FACT SHEET, DEFINING SWAPS-RELATED TERMS, https://www.sec.gov/opa/Article/press-release-2012-67---related-materials.html [http://perma.cc/6ZQZ-XLC8].

[103] *Id.* A "single name credit default swap" is only one type of credit default swap. Credit default swaps also encompass a range of other credit derivative products including credit default index swaps and credit default swaps on a "basket of entities." *See* EDUPRISTINE, *Credit Derivatives Explained in Detail* (Oct. 8, 2015), https://www.edupristine.com/blog/credit-derivatives-in-detail [http://perma.cc/QSX6-RZ86].

[104] *See* U.S. COMMODITY FUTURES TRADING COMM., CFTC ISSUES CLEARING DETERMINATION FOR CERTAIN CREDIT DEFAULT SWAPS AND INTEREST RATE SWAPS (Nov. 28, 2012), http://www.cftc.gov/PressRoom/PressReleases/pr6429-12 [http://perma.cc/TT62-6SN4].

[105] *See generally* Acheson, *supra* note 22.

[106] It has been estimated that ISDA *Master Agreements* are used in over 90 percent of OTC CDSs. *See* Ian Acker, *Strength in Transparency: Mitigating Systemic Risk Through Harmonization of Reporting Requirements for OTC Derivatives*, 49 GEO. WASH. INT'L L. REV. 947, 970 (2017).

[107] *See id.* at 953, 970–71.

[108] *See* LEXIS BANKING & FINANCE PSL, *Scope of the ISDA Master Agreement and Schedule—Overview*, https://www.lexisnexis.com/uk/lexispsl/bankingandfinance/document/391289/57X4-8841-F185-X2H3-00000-00/ [https://perma.cc/7BQ9-GRMY].

[109] *Protocol Overview*, INT'L SWAPS & DERIVATIVES ASS'N, http://www2.isda.org/functional-areas/protocol-management/about-isda-protocols, [https://perma.cc/5WGY-CHFR] ("The fundamental benefit to an adhering party to a

provisions contained in the DFA[110] introduced "swap data repositories" ("SDR") as a mechanism for containing systemic risk by maintaining what Ian Acker calls a "centralized electronic database for OTC derivatives transactions";[111] however, because of certain SDR indemnification provisions in the DFA,[112] it has been estimated that only "sixty to eighty percent" of the U.S. OTC credit derivatives market is reported to regulators.[113]

E. ISDA's Vision for a Smart Contract Master Agreement Framework

ISDA (together with *Linklaters*) has identified that, in a CDS, the "main payments and deliveries are heavily dependent on conditional logic."[114] As such, they have outlined a potential CDS OTC Blockchain framework that could be used to record transactions (the "golden record"), warehouse data, give access to

---

protocol is that it eliminates the necessity for costly and time-consuming bilateral negotiations."); *see also* Acker, *supra* note 106, at 972 explaining:

> Examples of protocols that promote compliance with local U.S. and European regulatory requirements include the Dodd-Frank Protocol, which facilitates implementation of various CFTC rulemakings, and the EMIR Protocol, which, inter alia, does the same for new portfolio reconciliation, dispute resolution, and disclosure protocols. Additionally, ISDA's Working Group on Margin Requirements (WGMR) issued a final protocol creating a policy framework for margin requirements for non-cleared OTC derivatives that official regulators in individual jurisdictions use as a model for their own markets—a prime example of ISDA promoting its own policies successfully. Protocols issued by ISDA are optional and only go into effect when both parties to the Master Agreement "adhere" to it. More than just a buzzword, adherence to ISDA protocols by members is a specific process that must be performed via the association's website and involves the transmittance of firm-specific information.

See also MICHAEL S. BARR, HOWELL E. JACKSON & MARGARET E. TAHYAR, FIN. REG.: LAW & POL'Y, 1115 (2016) ("As of December 31, 2015, ISDA has developed two primary Dodd-Frank Act business conduct protocols, which addresses the CFTC's rules on (1) swap trading documentation, (2) the end-user exception to the clearing requirement, and (3) portfolio reconciliation. Each of these protocols had close to 17,000 adhering parties.").

[110] *See* 12 U.S.C. § 5301 (2012).

[111] Acker, *supra* note 106, at 964.

[112] *See* 12 U.S.C. §§ 728, 763 (2012).

[113] Acker, *supra* note 106, at 965.

[114] ISDA 2017 WHITEPAPER, *supra* note 29, at 19.

regulators, host the smart contracts (or smart contract code), and also be programmed to execute automatically when conditional commands are satisfied.[115] In order to establish this framework, they suggest that ledger participants (financial institutions) could be given a "unique private key" which would also act as an "electronic signature" and when integrated with smart contract code could validate signing authority.[116] They also note that the MA could be written in formal language "tractable by computers" or written in "natural language" with references to code stored elsewhere.[117] As suggested by technology consultant Breana Patel, the smart contract CDS could also be written to adhere with "collateral, swap and margin" regulatory requirements, and also execute automatically through conditional logic programmed in the Blockchain code.[118]

A CDS must have a "credit event" determination.[119] This would need to be contemplated in the smart contract and ISDA, pursuant to its 2014 ISDA *Credit Derivatives Definitions,* has suggested that credit event determinations by a "Determination Committee" (DC) could lead to an automatic triggering of a payment without notification.[120] A smart contract CDS would also need to integrate code-making references to the DC as a "third party oracle."[121]

ISDA also suggests that "*Definitions Booklets*" would need to be amended so that they "lend themselves to the application

---

[115] *See id.* at 19–21.

[116] *Id.* at 21.

[117] *Id.* at 19.

[118] Breana Patel, *Blockchain in Capital Markets*, FINEXTRA (Mar. 1, 2018), https://www.finextra.com/blogposting/15096/blockchain-in-capital-markets [https://perma.cc/3ZGU-8L2C].

[119] *See The ISDA Credit Derivatives Determinations Comms.*, ISDA (MAY 2012), https://www.isda.org/a/CHDDE/agm-2012-dc-anniversary-appendix-043012.pdf [https://perma.cc/Q2DD-ZKBW].

[120] ISDA 2017 WHITEPAPER, *supra* note 29, at 18.

[121] *Id.*; *see also* Surujnath, *supra* note 57, at 274:

> Oracles use multi-sig to incorporate outside information into the blockchain. An oracle serves as an additional signatory that attests to information that is not tracked by the blockchain. It can reference an agreed upon data source and serve as an additional signature to a transaction that is contingent on a real-world event. Once the required condition is met, the oracle signs the transaction with its private key to effectuate the transaction. In a trading system that relies on numerous ledgers to keep track of different assets, the oracle can facilitate a payment that is contingent on a factor tracked by another blockchain.

of conditional logic."[122] Also, a smart contract MA would need to be appropriately coded so that they are linked to bank accounts to meet initial and variation margin.[123]

Given the significant impediments to full operational implementation (as will be presented shortly), ISDA has articulated two potential models of smart contract integration.[124] The first is an "external model" which would preserve the current MA structure but use Blockchain embedded smart contract code to automate some aspects of the contract so that they happen automatically upon condition satisfaction.[125] In this model, the actual contract would "take precedence" (in the event of contradictions) over the code, which would effectively just serve as a mechanism for more efficient performance and the parties would need to sign off on the code pre-execution to ensure suitability.[126] ISDA has noted that this is really only a partial adaptation from what's already used (for example "daily collateral flows" are currently automated in the context of maintaining margin requirements.)[127]

A second model identified by ISDA is an "internal model" resembling a hybrid contract with either a written contract using "natural human language" for some clauses while describing others in computer code, or a written contract making reference to code in another place.[128] In this model, the code is actually "part" of the written contract.[129] To this end, ISDA has suggested a number of possibilities: either create a new programming language (which lawyers would need to learn) or use an existing language that's for smart contracts[130] (like Ethereum's Solidity).[131] The thought of lawyers being responsible for code that is legally binding could trigger

---

[122] ISDA 2017 WHITEPAPER, *supra* note 29, at 20.

[123] *See* Kari S. Larsen, Brett Hillis & Michael Selig, *Suitability Of Swaps Documentation To The Blockchain Considered By ISDA*, MONDAQ (Aug. 16, 2017), http://www.mondaq.com/unitedstates/x/620418/Commodities+Derivatives+Stock+Exchanges/Suitability+of+Swaps+Documentation+to+the+Blockchain+Considered+by+ISDA#_ftn5 [https://perma.cc/Z7JG-6SJZ].

[124] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 14–17.

[125] *Id.* at 14.

[126] *Id.*

[127] *Id.*

[128] *Id.*

[129] *Id.* at 16.

[130] *See id.* at 15.

[131] Solidity is a "contract-oriented" programming language used for creating smart contracts. *See The Greeter*, ETHEREUM, https://www.ethereum.org/greeter [https://perma.cc/8JGX-TLHR].

a collective shudder throughout the derivatives transactional bar, thus ISDA suggests an "industry standard" code would likely need to be produced.[132] ISDA notes however that a singular coding language may not be "interoperable" across a variety of Blockchains.[133]

F. Legal Recognition, Electronic Execution, and Jurisdictional Enforceability Issues

In the next two subsections, the Article will outline some of the problems with fully implementing an ISDA MA with a smart contract. First, there is some uncertainty on the legal enforceability of smart contracts altogether;[134] although several states including Arizona,[135] Delaware,[136] Vermont,[137] Nevada,[138] New Hampshire,[139] Hawaii,[140] and Illinois[141] have initiated smart contract

---

[132] ISDA 2017 WHITEPAPER, *supra* note 29, at 17.

[133] *Id.* at 15.

[134] *See generally* Craig A. de Ridder, Mercedes K. Tunstall & Nathalie Prescott, *Recognition of Smart Contracts in the United States*, 29 No. 11 INTELL. PROP. & TECH. L.J. 17, 17 (2017).

[135] *See* H.R. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017); *see also* de Ridder, Tunstall & Prescott, *supra* note 134, at 17:

> More recently, Arizona introduced the so-called "Smart Contract Bill" in early February, and it quickly landed on the governor's desk for signature on March 29. Arizona's new statute does more than recognize the legality of smart contracts—it also brings any signature, record, or contract that is "secured through blockchain technology" within the ambit of the state's Electronic Transactions Act. Other jurisdictions could recognize smart contracts under existing state laws modeled on the Uniform Electronic Transaction Act or the federal Electronic Signatures in Global and National Commerce Act, without having to pass smart contract, or blockchain technology, specific legislation.

[136] *See* Joshua Ashley Klayman, Geoffrey R. Peck & Mark S. Wojciechowski, *Why The Delaware Blockchain Initiative Matters To All Dealmakers*, FORBES (Sept. 20, 2017, 9:55 AM), https://www.forbes.com/sites/groupthink/2017/09/20/why-the-delaware-blockchain-initiative-matters-to-all-dealmakers/#45d6529c7550 [https://perma.cc/K9VG-CKUD]; *see also* Michael del Castillo, *Delaware House Passes Historic Blockchain Regulation*, COINDESK, https://www.coindesk.com/Delaware-house-passes-historic-blockchain-regulation/ [https://perma.cc/FV2G-3NXY].

[137] *See* Stan Higgins, *Vermont Could Collect Taxes in Crypto Under Proposed Law*, COINDESK (Jan. 8, 2018), https://www.coindesk.com/vermont-collect-taxes-crypto-proposed-law/ [https://perma.cc/LJ6E-X7YY].

[138] *See* H.R. 398, 79th Leg. (Nev. 2017).

[139] *See* H.R. 436, Reg. Sess. (N.H. 2017).

[140] *See* H.R. 1481, 29th Leg. (Haw. 2017).

[141] *See* H.R. 120, 100th General Assem. (Ill. 2017–2018).

recognition legislation, or state-driven Blockchain initiatives to provide greater support for their legal validity.[142] Further, significant business projects are currently underway using smart contracts including the Brooklyn Microgrid solar energy project, the California "Share & Charge" electronic vehicle platform, a multibank "syndicated loan servicing program," and Nasdaq's New York Interactive Advertising Exchange.[143] Next, there is some jurisdictional uncertainty for electronic execution and on this point ISDA has commissioned "e-contract opinions" from a number of locations to determine viability.[144]

Also, ISDA has noted that there is some uncertainty, when using Blockchain across international borders with respect to the "situs" or location of assets.[145]

G. Partial or Full Integration: Transaction Costs and Strategic Considerations

Smart contracts may, as technology writer Robin Moody describes, reduce the cost of "managing mass repapering and renegotiations," and also provide "data extraction" efficiencies;[146] however, there are many aspects of smart contracts that make full OTC CDS integration questionable.[147] The previous section introduced several legal uncertainties in relation to enforceability and jurisdiction.[148] This Section will build on those concerns and focus on specific practical and strategic challenges related to the contract operation itself. First, as noted by lawyer Gernot Fritz,

---

[142] *See* de Ridder, Tunstall & Prescott, *supra* note 134, at 17 ("Other jurisdictions could recognize smart contracts under existing state laws modeled on the Uniform Electronic Transaction Act or the federal Electronic Signatures in Global and National Commerce Act, without having to pass smart contract, or blockchain technology, specific legislation.").

[143] *Id.* at 18–19.

[144] ISDA 2017 WHITEPAPER, *supra* note 29, at 21.

[145] *Id.* at 9.

[146] Robin Moody, *Derivatives Document Management—How Do Smart Contracts Fit In?*, DERIVSOURCE (Sept. 20, 2016), https://derivsource.com/2016/09/20/derivatives-document-management-how-do-smart-contracts-fit-in-2/ [https://perma.cc/W77E-9ZBG].

[147] *See* Gernot Fritz, *What's in a smart contract*, FRESHFIELDS BRUCKHAUS DERINGER BLOG, https://www.freshfields.com/en-us/our-thinking/campaigns/digital/fintech/whats-in/whats-in-a-smart-contract/ [https://perma.cc/G3DY-C347].

[148] *See* de Ridder, Tunstall & Prescott, *supra* note 134, at 17–18; *see also* ISDA 2017 WHITEPAPER, *supra* note 29, at 20.

smart contracts are final and cannot be undone, modified or revised (the Blockchain prevents this), so void, or mistaken contracts require additional programming, and remain on the Blockchain—this creates an additional risk, and potential transaction cost.[149] Next, as pointed out by Ryan Surujnath in a recent *Fordham Journal of Corporate and Financial Law* article, a single party, even with the consent of the other counterparty, cannot "edit" a Blockchain to "reverse a transaction" or to satisfy a judicial order.[150] To avoid such a situation, ISDA suggests that CDS counterparties consider all contingencies up front,[151] but they also acknowledge this may be unrealistic and the cost of such activity could easily outweigh the potential benefits.[152]

Next, even if one could identify all potential contingencies, ISDA points out that some contractual provisions are "subjective or require interpretation"[153] and that provisions requiring "good faith" or "commercially reasonable" interpretations can have different meanings in different jurisdictions.[154] ISDA further notes that a self-executing smart contract could lead to automatic performance that is unauthorized by law,[155] and automation may not be wanted at all—for example in the 2002 ISDA MA, on an "Event of Default,"[156] the non-defaulting party has a right of termination[157] but they may not want to automatically terminate the agreement if it is in their economic best interest to keep it open (or some other factor warrants keeping the contract alive),[158] and the determination of

---

[149] Fritz, *supra* note 147.

[150] Surujnath, *supra* note 57, at 284, 295.

[151] *See generally* ISDA 2017 WHITEPAPER, *supra* note 29, at 13.

[152] *Id.*

[153] *Id.* at 3.

[154] *Id.* at 11.

[155] *Id.*

[156] *See* § 5(a) of the ISDA 2002 Master Agreement.

[157] *See id.* § 6(a).

[158] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 17–18:

> The reasons for that decision tend to be subjective, depending on the commercial and relationship context at the time of the event, the nature of the default, and other external factors (e.g., proceedings that may occur under applicable law because of the default). This would not seem to be susceptible to preprogramming. That does not mean a legal contract cannot have elements of it 'made smart'. It simply means these events would not be automatically triggered (although they could lead to automatic alerts, which would be useful).

which course to take is best made at the time of default, after careful consideration of the context.[159]

An example of strategic self-selection against automation can be found in Section 2(a)(iii)(1) of the 2002 ISDA MA, which provides that payments or delivery obligations of parties are subject to a "condition precedent" that there are no "Events of Default" or "Potential Events of Default."[160] In an MA negotiating strategy industry article, lawyer GuyLaine Charles suggests that in an "Event of Default" a non-defaulting party may want to keep trades open (for instance if a party is "net out of the money on all trades") but stop making payments or deliveries to the defaulting party (in reliance on Section 2(a)(iii)(1)) and at the same time force the defaulting party to continue making payments to them.[161] She adds this strategy can have a significantly negative impact on a defaulting party, and the non-defaulting party's choice of pursuing this route is contextual on economic factors of the trade at the time, and there might be multiple avenues of pursuit for a non-defaulting party in relation to the valuation of an early termination

---

[159] *See id.*

[160] *See* § 2(a)(iii)(1) of the ISDA 2002 Master Agreement; *see also* GuyLaine Charles, *The ISDA Master Agreement—Part II: Negotiated Provisions*, PRACTICAL COMPLIANCE & RISK MANAGEMENT FOR THE SECURITIES INDUSTRY (May–June 2012) at 40:

> The non-defaulting party may choose not to terminate its trades under the ISDA, perhaps because it is net out of the money on all trades, and yet may cease performing in reliance on these provisions. In the meantime, the defaulting party is still required to make timely payments, deliveries and margin transfers to the non-defaulting party. Section 2(a)(iii)(1) allows the non-defaulting party to game the market by refusing to terminate its transactions under the Agreement until it is beneficial to do so, or when the market swings in its favour.

[161] Charles, *supra* note 160, at 40:

> The non-defaulting party may choose not to terminate its trades under the ISDA, perhaps because it is net out of the money on all trades, and yet may cease performing in reliance on these provisions. In the meantime, the defaulting party is still required to make timely payments, deliveries and margin transfers to the non-defaulting party. Section 2(a)(iii)(1) allows the non-defaulting party to game the market by refusing to terminate its transactions under the Agreement until it is beneficial to do so, or when the market swings in its favour.

payment.[162] For example, in the 2002 ISDA MA when there is an "Event of Default"[163] or a "Termination Event,"[164] the non-defaulting party (called a "Determining Party") has the flexibility to determine a "Close-Out Amount"[165] and in determining this amount may consider third party quotations, market data, and internally derived sources.[166] ISDA has opined that the "Close Out Amount" choice was provided to Determining Parties to give them flexibility[167] to use contextual factors to determine the best means of calculating the Close Out Amount.[168] Preprogramming arguably removes this benefit.[169]

Another argument against full smart contract integration identified by ISDA is that "operational clauses" in the MA (like contingent payments, "options exercise" clauses, settlement set-offs, and asset transfer clauses)[170] are more easily drafted as "conditional logic" expressible through machine-automation[171]—while "non-operational" clauses (like governing law,[172] jurisdiction,[173] integration,[174] enforceability, or other representations)[175] are not as easily translated into computer expression.[176] Also, ISDA points out that what the parties agree on must align with what the code

---

[162] *See id.*:

> Excess collateral and settlement payments owed to the defaulting party may be withheld by the non-defaulting party, thereby creating or further deepening the defaulting party's credit problems. This lack of liquidity may cause the defaulting party to default on its obligations with other trading counterparties, triggering a wave of defaults that leads to the defaulting party's demise.

[163] *See* § 5(a) of the ISDA 2002 Master Agreement.

[164] *See id.* § 5(b).

[165] *See id.* § 2(c).

[166] *See* Charles, *supra* note 160, at 33–35.

[167] *See ISDA Close-Out Amount Protocol*, LEXOLOGY (Feb. 27, 2009), https://www.lexology.com/library/detail.aspx?g=bfb7f4c4-ab5b-4b30-933f-730cfee24b91 [https://perma.cc/3RWT-LWCX].

[168] *See id.*

[169] *See* Charles, *supra* note 160, at 33–34.

[170] *See* § 6.1 ISDA 2006 Definitions; *see also* §§ 8.1, 8.2, 8.4, 8.5 ISDA 2002 Equity Derivative Definitions.

[171] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 11.

[172] *See* § 13(a) ISDA 2002 Master Agreement.

[173] *See id.* § 13(b).

[174] *See id.* § 9(a).

[175] *See id.* § 3(a)(v).

[176] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 11–12.

actually says and what happens when it is automated.[177] As a result, lawyers would need to either develop computer-programming acumen, or involve technologists (thus increasing costs and opening up lawyer-client confidentiality concerns).[178] ISDA also questions whether one "coding language" is sufficient for smart contracts (or whether multiple are required).[179] Given these criticisms, some commentators question whether permissioned Blockchain may provide little "beyond a traditional database or a basic messaging service" and may be just another "walled off network."[180] Also, it is possible that a status quo bias could motivate a slow integration process.[181] As a result, at least in the short run, ISDA and *Linklaters* recommends "automating" certain tasks in the MA (via smart contract code) rather than replacing the MA all together.[182]

II. How Would Permissioned Blockchain Impact CDS Post-Trade Functionality, Processing, and Regulatory Compliance?

A. Inefficiencies in the Current CDS Post-Trade Processing Framework & Potential Efficiency Gains From Blockchain

In a press release for a 2016 whitepaper[183] on "*Embracing Disruption*," DTCC stated that Blockchain could "modernize, streamline and simplify the siloed design of the financial industry infrastructure and address certain limitations of the current post trade process"[184] and that Blockchain is the "virtual opposite" of the traditional processing structure.[185] DTCC has identified

---

[177] *See id.* at 17 ("The second potential area of difference is illustrated by the question: 'how do I know the effect of the code, when executed by a machine, will be what I intend?'").

[178] *See generally* Fritz, *supra* note 147.

[179] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 15.

[180] *See* Nordrum, *supra* note 32.

[181] *See* Moody, *supra* note 146.

[182] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 3.

[183] *See generally* DTCC WHITEPAPER, *supra* note 14.

[184] *See New DTCC White Paper Calls for Leveraging Distributed Ledger Technology to Solve Certain Long-Standing Operational Challenges*, DEPOSITORY TRUST & CLEARING CORP. (Jan. 25, 2016), http://www.dtcc.com/news/2016/January/25/new-dtcc-white-paper-calls-for-leveraging-distributed-ledger-technology [https://perma.cc/NSY2-L3WJ].

[185] *See* DTCC WHITEPAPER, *supra* note 14, at 1.

Blockchain as potentially useful for issuing and servicing assets and securities, managing data, validating trades and contracts, netting, clearing, and settlement,[186] and that Blockchain could also potentially remedy four financial processing weaknesses: "siloed" systems with human error discrepancies; unneeded complexity; susceptibility to hacks; and no "24/7/365 processing" abilities.[187] DTCC also notes that Blockchain may reduce "manual interactions, data exchanges, data format conversions and reconciliations with other systems."[188] DTCC identifies however several areas where Blockchain frameworks fall short, including database functionality (like in high-speed searching, retrieval, and reporting functions)[189] as well as requiring costly computing and storage capacity.[190]

Under the current processing framework for CDS, there is potential for human error when, as technology reporter Laura Shin notes, information gets "entered into multiple databases in different ways."[191] For example, a trade may be recorded initially then altered when processed by operations (and further edited by risk management and again by the credit department).[192] ISDA in a September 2017 whitepaper on *Data and Process Standards*,[193] has identified several "stakeholders" who might benefit by adopting a Blockchain processing framework including "market participants," regulators, "market infrastructure providers," and "fintech and solution providers."[194] In a separate whitepaper on "*The Future of Derivative Processing and Market Infrastructure*," ISDA also suggests that for market participants, operating expenses and inefficiencies could be decreased through a "Golden Record" processing model with a "single representation of a transaction."[195] This singular

---

[186] *See id.* at 2.

[187] *See id.* at 5.

[188] *See id.* at 12.

[189] *See id.* at 8.

[190] *See id.* at 9.

[191] *See* Laura Shin, *DTCC Partners With IBM, Startups For Blockchain-Based Credit Default Swaps Solution*, FORBES (Jan. 9, 2017, 8:00 AM), https://www.forbes.com/sites/laurashin/2017/01/09/dtcc-selects-partners-for-blockchain-solution-for-credit-default-swaps/#c56f49750619.

[192] *See id.*

[193] *See* WHITE PAPER: DATA & PROCESS STANDARDS, INT'L SWAPS & DERIVATIVES ASS'N CDM (Sept. 2017) [hereinafter ISDA DATA PROCESS].

[194] *See id.* at 10.

[195] *See* ISDA FUTURE PROCESSING, *supra* note 29, at 23:

> If structured correctly, this Golden Record may remove the need for many of the duplicative reconciliation processes that exist

record may also lead to "optimized" collateral and netting procedures and regulatory compliance efficiencies,[196] and provide regulators with better technological tools to monitor and manage systemic risk.[197] Additionally, ISDA, in two other whitepapers, suggests that "market infrastructure providers" and "fintech and solution providers" could add greater benefits through coordinated action,[198] and the digital "modularisation" of documentation terms in a "universal repository" could also be used to enhance individual transactions.[199] This would allow the ISDA library to be continually updated instead of the "periodic updates of definitional booklets" that currently happens.[200]

B. Regulatory Standards: Business Conduct, Reporting, and Record-Keeping

Blockchain integration potentially impacts *Swap Dealer's* and *Security-Based Swap Dealers* (collectively "SDs")[201] and *Major Swap Participant's* and *Major Security-Based Swap Participants* (collectively "MSPs")[202] business conduct, reporting, and record-keeping obligations pursuant to Title VII of the DFA.[203] Pursuant to business conduct standards, SDs and MSPs must comply with "fair dealing and trade disclosures, written trading documentation and swap confirmations that contain all applicable terms of a swap transaction, and portfolio reconciliation to confirm that the terms of their swaps match the terms in the records of their

---

> today, such as reconciliation for settlement, compression and margining purposes. More importantly, it will assist market participants and regulators to access an accurate and up-to-date instance of a transaction at any time, potentially removing or reducing some of the current burdens of regulatory reporting.

[196] *See id.* at 23, 25.

[197] *See id.* at 25.

[198] *See* ISDA DATA PROCESS, *supra* note 193, at 10.

[199] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 22.

[200] *See id.* at 22.

[201] *See* 7 U.S.C. § 1a(49)(A) (2012), Commodity Exchange Act § 1a(49)(A); *see also* Further Definition of "Swap Dealer," "Security Based Swap Dealer," "Major Swap Participant," "Major Security Based-Swap Participant," and "Eligible Contract Participant," 77 Fed. Reg. 30, 751–53 (May 23, 2012).

[202] *See* Further Definition of "Swap Dealer," "Security Based Swap Dealer," "Major Swap Participant," "Major Security Based-Swap Participant," and "Eligible Contract Participant," 77 Fed. Reg. 30, 751–53 (May 23, 2012).

[203] *See* 12 U.S.C. §§ 729, 766 (2012).

counter parties."[204] The use of a permissioned Blockchain may ease these counterparty verification and disclosure burdens and potentially reduce the costs of "portfolio reconciliation,"[205] thus minimizing potential disputes. Forbes technology reporter Laura Shin suggests that in this regard, Blockchain may facilitate a more efficient ledger, ensuring information consistency and avoiding "fragmented processing" that facilitates errors and risk.[206]

Post GFC reform ushered in a host of reporting obligations for both cleared and non-cleared swap trades.[207] In particular, Section 731 of the DFA[208] includes heightened reporting, record-keeping and daily trading records requirements and registration.[209]

Specifically SDs and MSPs must "make such reports as are required by the Commission by rule or regulation regarding the transactions and positions and financial condition of the registered swap dealer or major swap participant,"[210] adhere to prescribed bookkeeping requirements,[211] and allow open access to the regulators.[212] SDs and MSPs are also required to keep daily

---

[204] *See* BARR, JACKSON & TAHYAR, *supra* note 109, at 1112.

[205] *See id.* at 1113:

> Portfolio reconciliation is a post-trade execution process and a risk management tool that is designed to (1) identify and resolve any discrepancies between the records of the counterparties regarding the terms of a swap and the valuation of the swap; and (2) ensure effective confirmation of all terms of the swap. The frequency with which parties must engage in portfolio reconciliation ranges from daily to annually and depends on the number of swaps in the counter parties' portfolio and the parties involved (whether one party is an end user).

[206] *See* Shin, *supra* note 191.

[207] *See generally* 7 U.S.C. §§ 2(a)(13)(G), 6r (2012); 15 U.S.C. §§ 78m(m)(1)(G), 78m-1 (2012).

[208] *See* 7 U.S.C. § 6s.

[209] *See id.* at §§ 6s(f), 6s(g).

[210] *See id.* at § 6s.

[211] *See generally* M. Holland West & Matthew K. Kerfoot, *The Impact of Dodd-Frank on Derivatives*, 18 FORDHAM J. CORP. & FIN. L. 269, 289–300 (2013).

[212] *See* 7 U.S.C. § 6s(f)(1)(B)–(D):

> (B)(i) for which there is a prudential regulator, shall keep books and records of all activities related to the business as a swap dealer or major swap participant in such form and manner and for such period as may be prescribed by the Commission by rule or regulation; and (ii) for which there is no prudential regulator, shall keep books and records in such form and manner and for

trading records,[213] counterparty records,[214] and an audit trail.[215] Colleen Baker, of the Volcker Alliance, notes that, as a result of the reforms, "all swaps and security-based swaps—whether cleared or not—must be reported to swap data repositories."[216] Having all trading and counterparty information readily available on a Blockchain, and providing the regulators access to the ledger can reduce the cost of compliance with these reporting provisions and provide reporting on an "intraday" basis describes technology writer Breana Patel.[217] Time delays, however, would need to be programmed into the Blockchain code for large "block trades" to adhere to market regulations and the permissioned Blockchain would need to be adjusted to maintain confidentiality in relation to market positions and counterparty identity.[218]

> such period as may be prescribed by the Commission by rule or regulation; (C) shall keep books and records described in subparagraph (B) open to inspection and examination by any representative of the Commission; and (D) shall keep any such books and records relating to swaps defined in section 1a(47)(A)(v) of this title open to inspection and examination by the Securities and Exchange Commission.

See id. at § 6s(f)(1)(A).

[213] *See* 7 U.S.C. § 6s(f)(1)(B)–(D):

> (B)(i) for which there is a prudential regulator, shall keep books and records of all activities related to the business as a swap dealer or major swap participant in such form and manner and for such period as may be prescribed by the Commission by rule or regulation; and (ii) for which there is no prudential regulator, shall keep books and records in such form and manner and for such period as may be prescribed by the Commission by rule or regulation; (C) shall keep books and records described in subparagraph (B) open to inspection and examination by any representative of the Commission; and (D) shall keep any such books and records relating to swaps defined in section 1a(47)(A)(v) of this title open to inspection and examination by the Securities and Exchange Commission.

[214] *See* § 6s.

[215] *See id.* at §§ 6s(f), 6s(g).

[216] *See* Colleen Baker, *Clearinghouses for Over-the-Counter Derivatives* 15 (Volcker Alliance, Working Paper, 2016).

[217] Patel, *supra* note 118.

[218] *See* West et al., *CFTC Issues Guidance on Block Trade and Large Notional Off-Facility Swap Rules; Advisors Must Obtain Consent*, DECHERT LLP (Sept. 2013).

C. Central Clearing, Netting, Collateral Management and Settlement

A major tenant of post-GFC derivatives reform was adopting clearing by central counterparties ("CCPs") for a variety of previously OTC CDS.[219] Colleen Baker describes this process as a CCP stepping "into the middle of an OTC derivative trade and creat[ing] two new transactions through a legal process known as novation."[220] This results in original counterparties being only subject to the credit risk of the CCP (rather than to each other)[221] and this market mechanism is believed to be better than dealer banks in managing and absorbing counterparty credit risk,[222] and also an effective means of reducing the transaction costs involved in netting.[223] CCPs have been criticized heavily across a variety of academic studies as centralizing the "locus of systemic risk" in swap transactions;[224] increasing systemic risk in the context of bankruptcy;[225] facilitating "fragmented netting;"[226] causing "destructive coordination" by segmenting assets;[227] underpricing risk because

---

[219] Central clearing is mandatory for "index-based" credit default swaps. *See* Hester Peirce, *Derivatives Clearinghouses: Clearing The Way To Failure*, 64 CLEV. ST. L. REV. 589, 590 (2016).

[220] Baker, *supra* note 216, at 17.

[221] *Id.* at 18.

[222] *See* Adam J. Levitin, *Response: The Tenuous Case For Derivatives Clearinghouses*, 101 GEO. L.J. 445, 461 (2013). *See generally* Baker, *supra* note 216.

[223] *See* Baker, *supra* note 216, at 25.

[224] Sean J. Griffith, *Governing Systemic Risk: Towards a Governance Structure For Derivatives Clearinghouses*, 61 EMORY L.J. 1153, 1153 (2012).

[225] *See* Julia Lees Allen, *Derivatives Clearinghouses and Systemic Risk: A Bankruptcy and Dodd-Frank Analysis*, 64 STAN. L. REV. 1079, 1093 (2016).

[226] Sean J. Griffith, *The Derivatives Clearinghouse: Designing A Governance Structure To Manage Systemic Risk*, 32 No. 4 BANKING & FIN. SERV. POL'Y REP. 1, 15–16 (Apr. 2013):

> The rise of multiple clearinghouses means fragmented netting. In a world of fragmented netting, the only trades available to a clearinghouse to offset losses from a dealer's default are positions cleared by that particular clearinghouse, a subset of all open positions with the defaulting dealer. Fewer open positions, of course, means greater residual loss for the clearinghouse to absorb, a problem that will be repeated for each clearinghouse in which the defaulting member participates.

See also Baker, *supra* note 216, at 35.

[227] Griffith, *supra* note 226, at 16 ("Because ... clearinghouses specialize in specific asset classes—for example, foreign exchange, interest rate swaps, or credit default swaps (CDS)—they are likely to be susceptible to asset bubbles

of "adverse selection"[228] (and thereby increasing moral hazard);[229] and perpetuating "too-big-to-fail" financial institutions.[230] As a result, CCPs may not eliminate risk, but as Colleen Baker states merely "transform" it.[231] Netting and collateralization (including margin requirements) are important ways that CCPs manage default risk.[232] DTCC has identified Blockchain as potentially allowing an "optimized settlement" when considering the netting,[233] clearing,[234] and processing[235] of CDS transactions to create "value transfer, in near real time, independent of a trusted third party."[236] However DTCC also notes that this comes with significant costs and a potential for "bifurcated markets with proprietary settlement and asset management mechanisms."[237] As such, DTCC suggests the opportunity may be more suitable for emerging markets[238] which leads to some commentators doubting whether Blockchain will actually supplant CCPs.[239] Given that there is still a large portion of the CDS market that is not cleared,[240] Ryan Surujnath, in

---

in the underlying asset. This is a case of 'destructive coordination' brought on by regulation.").

[228] Baker, *supra* note 216, at 26.

[229] *See* Levitin, *supra* note 222, at 463–64; *see also id.* at 27.

[230] Levitin, *supra* note 222, at 447.

[231] *See* Baker, *supra* note 216, at 5.

[232] *See* Surujnath, *supra* note 57, at 279.

[233] *See* DTCC WHITEPAPER, *supra* note 14, at 15 ("Netting is defined as an optimized settlement requirement between all parties involved in trading an asset."); *see also* Baker, *supra* note 216, at 24 ("With multilateral netting, a clearinghouse can offset the payment obligations of multiple counterparties (its clearing members) so that only counterparties' net payment obligations—typically a much smaller amount than their gross obligations—need to be exchanged with the clearinghouse.").

[234] *See* DTCC WHITEPAPER, *supra* note 14, at 15 ("Clearing is using a central counter party for each trade to simplify multiparty netting and reduce risk of settlement failure.").

[235] *Id.*

[236] *Id.*

[237] *Id.* at 16.

[238] *Id.*

[239] *See* Surujnath, *supra* note 57, at 281–82.

[240] *See* Baker, *supra* note 216, at 33:

> At the end of 2014, about half of all interest rate swaps and a fifth of credit default swaps were cleared. The percentages are much higher for new transactions: about 80 [percent] of new interest rate swaps are cleared and 70 [percent] of new credit default swaps based on credit indices are cleared.

a recent *Fordham Journal of Corporate and Financial Law* article suggests that Blockchain may impact the non-cleared OTC market since it "can assume functions typically undertaken" by CCPs and allow users to organize into "distributed autonomous organizations" (a function also facilitated by Ethereum).[241]

In a Blockchain CDS, collateral calls could be written through smart contract code to directly debit bank accounts as the market changes[242] and in this case technology writer Breana Patel frames Blockchain as an "enterprise-wide management" of client and firm credit risk.[243] ISDA has established the *ISDA Collateral Infrastructure Committee* ("CIC")[244] to develop a blueprint for an "optimal future state" of collateral processing that takes into consideration scalability, central storage, "interoperability," and automation.[245] To this end, certain "observed pain points" identified by ISDA in the current OTC trading system include costs of repetition, a lack of standardization and scalability, delays, and problems in resolving disputes.[246] Another challenge noted by ISDA, which may benefit from Blockchain is "mismatched trades" and margin disputes.[247] On this point the smart contracts could

---

See also Arshadur Rahman, *Over-the-counter (OTC) derivatives, central clearing and financial stability*, BANK OF ENG. Q. BULL. Q3 (2015).

[241] Surujnath, *supra* note 57, at 283:

> Firms trading these derivatives could use a blockchain like Ethereum, which allows users to organize into distributed autonomous organizations ("DAO") governed by smart contracts. Once the criteria for admission into the DCN are met, the blockchain manages the functions usually conducted by the CCP: valuing contracts, calculating initial and variation margins, facilitating custody of collateral, handling novation and netting, and managing closeout. Derivatives are contracts that have calculable terms with an "algorithm" expressed through legal terms. Valuations typically present a problem in bilateral markets because the two parties compute the algorithms themselves and may reach different conclusions on pricing. Blockchains crowdsource the calculations and allow the network to reach a consensus on their accuracy. Proponents hope that the communal process can result in more transparent OTC markets.

[242] *See* Patel, *supra* note 118.

[243] *Id.*

[244] *See A Blueprint for the Optimal Future State of Collateral Processing*, INT'L SWAPS & DERIVATIVES ASS'N (Oct. 2017).

[245] *Id.* at 4.

[246] *Id.* at 5–6.

[247] *Id.* at 8.

make reference to an agreed upon benchmarks to adjust margin requirements as asset values change.[248]

With respect to settlement,[249] DTCC has stated that many complex swaps can take many weeks (or months) to settle.[250] Blockchain might decrease this time frame; however, as DTCC points out, "real time settlement" can actually be achieved right now[251] and changes to settlement conventions require, "revising laws, changing market practices and structures" and as such imply a level of coordination difficulty.[252] DTCC also argues that the logic of settlement applies to collateral management since "[t]he provenance of assets, the ability to track transaction movements and, with proper design, true ownership vs. temporary/borrowing is fundamental to the promise of distributed ledger technology."[253]

D. Trade Validation, Recording, Matching, and Position Limit Management

Breana Patel suggests that Blockchain may facilitate "matching of trades during the settlement process" to avoid errors during settlement.[254] In a CDS, participating parties use a "matching service" to ensure aligning terms which translate into a final agreement and Blockchain might be able to reduce "costly trade and payment reconciliations" associated with this process.[255] DTCC has expressed concern however with using Blockchain for trade validation, recording and matching because of the issues relating to

---

248 *See generally* Surujnath, *supra* note 57, at 280–81.

249 *See generally* Norman Menachem Feder, *Market in the Remaking: Over the Counter Derivative in a New Age*, 11 VA. L. & BUS. REV. 309, 326 (2017).

250 *See* DTCC WHITEPAPER, *supra* note 14, at 16.

251 *Id.* at 16–17.

252 *Id.*

253 *Id.*

254 Patel, *supra* note 118:

> Confirm matching of trades during the settlement process can be done via smart contracts. If a European bank has transacted a swap contract with a U.S. bank, the settlement details would only be provided if the financial details of the trade match between the two banks. The smart contract allows automatic payment processing, only if certain parameters within the agreed upon contract are satisfied. As a result of smart contracts, costly errors from the manual processing of settlement instructions can be reduced dramatically.

255 *See* Nordrum, *supra* note 32.

finality and singular ledger data entry since it does not contemplate "real world mismatches and exception processing."[256] Further, DTCC suggests that a Blockchain based framework might lead to a system based on "regional rules" leading to a "partitioned scheme."[257] A Blockchain framework could however help to prevent a large unknown trading loss, like JP Morgan Chase's 2012 "London Whale"[258] through the programming of position limits.[259] In addition, "suspicious trading activity" could be identified early on a Blockchain to prevent regulatory penalties or financial losses.[260]

E. Regulatory Considerations and Developments Relating to Blockchain Derivatives

ISDA has identified regulatory benefits using Blockchain since "[t]ransaction data could be held on a permissioned, private distributed ledger that would be available to regulators. This would ensure there is a single, shared representation of each trade."[261]

Regulators would however need to adopt consistent standards for the industry.[262] On November 30, 2017, at ISDA's *Technology and Standards: Unlocking Value in Derivatives Markets* conference, CFTC Commissioner, Brian Quintenz articulated both the promise and the challenges (such as market participant adoption and overcoming implementation costs) in integrating Blockchain in derivatives markets.[263] To support innovation, the CFTC recently launched *Lab CFTC*—designed to provide timely regulatory feedback to innovators, study, test and recommend new products and technologies, and coordinate oversight efforts with other domestic and international regulatory bodies.[264] The CFTC

---

[256] DTCC WHITEPAPER, *supra* note 14, at 14.

[257] *Id.*

[258] The "London Whale" scandal relates to a 2012 CDS trading losses of at least $6.2 billion by JPMorgan Chase & Co. that caught senior management unaware. *See* Patricia Hurtado, *The London Whale*, BLOOMBERG (Feb. 23, 2016), https://www.bloomberg.com/quicktake/the-london-whale.

[259] Patel, *supra* note 118.

[260] *Id.*

[261] ISDA 2017 WHITEPAPER, *supra* note 29, at 3.

[262] *Id.*

[263] *See* Brian D. Quintenz, Keynote Speech at the ISDA TECH CONFERENCE (Nov. 30, 2017), https://www.pscp.tv/ISDA1/1mnxerjNgvnKX?t=58s/.

[264] *See id.*; *see also Lab CFTC Overview*, U.S. COMMODITY FUTURES TRADING COMM'N, https://www.cftc.gov/LabCFTC/Overview/index.htm [https://perma.cc/4DLN-XEYW].

also recently signed a collaboration agreement with the UK's *Financial Conduct Authority* to study financial technology.[265]

There are lingering uncertainties including the effect of deregulation,[266] the reporting and execution framework for cross border trades,[267] regulatory arbitrage,[268] and whether industry should own the Blockchain technology.[269] Also the data made available to the regulators pursuant to the DFA requires technology to interpret and proactively monitor.[270]

ISDA notes that an industry-wide Blockchain framework could remedy this problem, but regulators would need to improve assessment technologies.[271] Also, regulators need "modified permissions or an identification system to de-anonymize" the transaction parties.[272] Another regulatory uncertainty noted by Ryan Surujnath is the effect of Blockchain on systemic risk,[273] which could reduce the "risk of over-centralization."[274]

However, as Surujnath has argued, Blockchain derivatives could actually increase systemic risk relating to uncertainties in "settlement finality and recourse, especially in the context of

---

[265] See *US CFTC and UK FCA Sign Agreement to Collaborate on FinTech Innovation*, U.S. COMMODITY FUTURES TRADING COMM'N (Feb. 20, 2018), http://www.cftc.gov/PressRoom/PressReleases/pr7698-18 [https://perma.cc/757W-W7BS].

[266] *See Protecting Financial Stability and Enhancing Competitiveness in the Derivatives Market*: *Hearing on "Legislative Proposals Regarding Derivatives" Before the H. Comm. on Fin. Servs. Subcomm. on Capital Mkts.*, *Sec. & Inv.*, 116th Cong. 9, 16 (Feb. 14, 2018) [hereinafter *Protecting Financial Stability and Enhancing Competitiveness in the Derivatives Market*] (testimony of Andy Green, Managing Director, Economic Policy, Center for American Progress).

[267] *See* Acker, *supra* note 106, at 950.

[268] *See* Benjamin M. Weadon, *International Regulatory Arbitrage Resulting From Dodd-Frank Derivatives Regulation*, 16 N.C. BANKING INST. 249, 251 (2012).

[269] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 9.

[270] *See Protecting Financial Stability and Enhancing Competitiveness in the Derivatives Market*, *supra* note 266.

[271] *See generally* ISDA 2017 WHITEPAPER, *supra* note 29, at 3, 9*; Hearing on Implementation and Cybersecurity Protocols of the Consolidated Audit Trail Before the H. Fin. Servs. Comm., Subcomm. on Capital Mkts., Sec., & Inv.*, 115th Cong. (Nov. 30, 2017) (testimony of Tyler Gellasch, Executive Director of the Healthy Markets Association), https://financialservices.house.gov/uploadedfiles/hhrg-115-ba16-wstate-tgellasch-20171130.pdf [https://perma.cc/T3PY-QPT3].

[272] Surujnath, *supra* note 57, at 282.

[273] *See id.* at 294–95.

[274] *Id.* at 291.

potential cyberattacks."[275] However, he notes that this concern may be alleviated through a private ledger.[276]

F. Technological Barriers, Market Participant Adoption, Integration Failure Costs, and Data Privacy Concerns

Despite the potential appeal of Blockchain, there are many technological barriers to be overcome before widespread integration can take place. ISDA has identified the need for a "consistent, non-ambiguous" coding language[277] that is interoperable across industry lines and diverse use cases.[278] Also, as noted by DTCC, there are "limits on the size of individual transactions and the number of transactions that can be written simultaneously," as well as "latency between writes to the ledger and final confirmation."[279] Further, DTCC posits that existing infrastructure might be improved without such high costs[280] and the reality of hacks on a distributed leger (like in the case of the DAO) drives lingering privacy and data protection concerns.[281]

Also, as suggested by CFTC Commissioner Quintenz, participants in the market must be willing to undertake the costs of digitization of their entire processing infrastructure.[282]

This is a point that ISDA has identified and stressed in a September 2017 whitepaper entitled *Data and Process Standards*, "there is no commercial advantage to organi[z]ations developing and maintaining standards separately. Current mechanisms for information exchange and storage are not scalable and will potentially (i) inhibit innovation and (ii) increase operational risks and

---

[275] *See also id.* at 295, 299 ("There is always the possibility that an actor or several actors working in concert could assume most of the blockchain's mining power, giving them the ability to rewrite blocks and undo previously settled transactions.").

[276] *Id.* at 299–300.

[277] ISDA 2017 WHITEPAPER, *supra* note 29, at 19.

[278] *Id.* at 20.

[279] DTCC WHITEPAPER, *supra* note 14, at 12.

[280] *See id.*

[281] *See* David Siegel, *Understanding the DAO Attack*, COINDESK, https://www.coindesk.com/understanding-dao-hack-journalists [https://perma.cc/GE6D-TUAV].

[282] *See* U.S. COMMODITY FUTURES TRADING COMMISSION, REMARKS OF COMMISSIONER BRIAN QUINTENZ AT THE TECHNOLOGY AND STANDARDS: UNLOCKING VALUE IN DERIVATIVES MARKETS CONFERENCE (Nov. 30, 2017), http://www.cftc.gov/PressRoom/SpeechesTestimony/opaquintenz4#P16_4000 [https://perma.cc/UN73-8V98].

costs."[283] To this end, ISDA has recommended a "standardized data and process definition hierarchy"[284] and has noted that, despite the costs (and challenges), a Blockchain solution to derivatives does present "long-term scalable foundations."[285]

DTCC has also identified several challenges to widespread industry integration of Blockchain including cost justifications, "inherent scale and performance challenges," and industry and regulatory coordination and consensus.[286] Further, the costs of error are high since the current system works.[287] Additionally, ISDA notes there is a possibility that multiple ledgers could arise across markets and connecting these ledgers may prove difficult and costly.[288] DTCC also notes uncertainty on Blockchain's immunity from cyber-attacks[289] and on the size and number of individual transactions that can be written simultaneously.[290]

Another concern is data privacy, especially in light of different global regulatory standards.[291] One could contemplate a "partitioned ledger" solution, but this would need to be tested as viable.[292]

CONCLUSION: CURRENT CDS AND OTHER FINANCIAL SERVICES BLOCKCHAIN INITIATIVES

In the spring of 2017, the first publicly announced Blockchain derivatives initiative launched between DTCC, Blockchain developer Axoni, financial services software provider R3, and technology giant IBM.[293] DTCC's mission is to provide "post-trade

---

[283] ISDA DATA PROCESS, *supra* note 193, at 4.

[284] *Id.*

[285] *Id.* at 6.

[286] DTCC WHITEPAPER, *supra* note 14, at 2.

[287] *See id.* ("[T]he industry is at risk of repeating the past and creating countless new siloed solutions based on different standards and with significant reconciliation challenges.")

[288] *See* ISDA FUTURE PROCESSING, *supra* note 29, at 23.

[289] *See* DTCC WHITEPAPER, *supra* note 14, at 12.

[290] *Id.*

[291] *Id.* at 9.

[292] *Id.*

[293] *See* Alex Lielacher, *DTCC to Launch Blockchain Credit Default Swaps Reporting in Early 2018*, NASDAQ (May 25, 2017, 2:31 PM), http://www.nasdaq.com/article/dtcc-to-launch-blockchain-credit-default-swaps-reporting-in-early-2018-cm794771 [https://perma.cc/469A-3AR6].

market infrastructure" to the U.S. financial industry[294] and the joint venture project aims at creating a CDS clearing platform to enhance its operations.[295] The joint venture's first phase is to use Blockchain to improve DTCC's *Trade Information Warehouse,*[296] which is used in over 70 countries by more than 2500 firms to manage records for "$11 trillion of credit derivatives."[297] An additional, more ambitious, subsequent phase would contemplate providing ledger connection points to participating firms, thereby "enabling them to validate reported data and directly access information."[298] Project partners estimate that the joint venture will save between "20 to 30 percent" of the costs of running swaps conventionally,[299] and preliminary trials show positive results.[300] Also, the initial assessments protected party confidentiality and showed regulatory promise as "regulators could view in 'real time' a wide range of financial events including trade details, counterparty risk metrics, and exposure to reference entities."[301] Critics, however, say that it is "still a proprietary system through which centralized players control trading behind walled-off networks."[302]

In additional to swaps, there are other Blockchain derivatives projects currently contemplated. In February 2017, DTCC, along with Blockchain developer Digital Assets, announced the

---

[294] *See* DEPOSITORY TRUST AND CLEARING CORPORATION, http://www.dtcc.com/~/media/Files/Downloads/About/DTCC_Capabilities.pdf [https://perma.cc/F826-P54J].

[295] *See* Lielacher, *supra* note 293.

[296] See *Trade Information Warehouse*, DEPOSITORY TRUST CLEARING CORP., http://www.dtcc.com/derivatives-services/trade-information-warehouse, [https://perma.cc/QG4T-X2UW].

[297] Shin, *supra* note 191.

[298] Helen Bartholomew, *Derivatives—DTCC on track for Q1 2018 blockchain CDS reporting*, REUTERS (May 19, 2017, 7:37 AM), https://www.reuters.com/article/derivatives-dtcc-on-track-for-q1-2018-bl/derivatives-dtcc-on-track-for-q1-2018-blockchain-cds-reporting-idUSL8N1IJ5BF [https://perma.cc/UU9L-5PX9].

[299] Nordrum, *supra* note 32.

[300] *See* Anna Irrera, *DTCC to rebuild credit default swaps processing platform with blockchain*, REUTERS (Jan. 9, 2017, 8:04 AM), https://www.reuters.com/article/us-blockchain-dtcc-cds/dtcc-to-rebuild-credit-default-swaps-processing-platform-with-blockchain-idUSKBN14T1EA [https://perma.cc/C26B-GBXT].

[301] Michael del Castillo, *7 Wall Street Firms Test Blockchain For Credit Default Swaps,* COINDESK (Apr. 7, 2016), https://www.coindesk.com/blockchain-credit-default-swaps-wall-street [https://perma.cc/X9CQ-SYJ9].

[302] Nordrum, *supra* note 32.

desire to form a "Stakeholder Working Group" to study a Blockchain application for the repo-netting process.[303] Unfortunately this initiative was shelved in 2018 because "banks and other potential users believed the same results could be achieved more cheaply using current technology."[304] The repo-netting initiative would have allowed DTCC to "calculate a new net settlement amount at a point in time and record it in an immutable, secure and transparent distributed ledger."[305] DTCC is however working with Digital Asset Holdings on a Blockchain framework for syndicated loans,[306] and also recently released a new study noting that distributed ledger technology "is capable of supporting the average daily trading volumes in the U.S. equity market."[307] In the United Kingdom, interdealer broker ICAP has also completed Blockchain trials for securities "post-trade processes,"[308] and private equity firm, Unigestion, recently adapted a "shadow mode" Blockchain private investment fund.[309] Also, the Bank of Canada (Canada's central bank) has partnered with TMX Group and Payments Canada to investigate the application of Blockchain to settlement and securities clearing,[310] and recently announced

---

[303] *DTCC & Digital Asset Move to Next Phase After Successful Proof-Of-Concept for Repo Transactions Using Distributed Ledger Technology*, DEPOSITORY TRUST & CLEARING CORP. (Feb. 27, 2017), http://www.dtcc.com/news/2017/february/27/dtcc-and-digital-asset-move-to-next-phase [https://perma.cc/27CB-WRJ2].

[304] Anna Irrera & John McCrank, *Wall Street Rethinks Blockchain Projects as Euphoria Meets Reality*, REUTERS (Mar. 27, 2018), https://www.reuters.com/article/us-banks-fintech-blockchain/wall-street-rethinks-blockchain-projects-as-euphoria-meets-reality-idUSKBN1H32GO.

[305] *Id.*

[306] *See* Irrera, *supra* note 300.

[307] Sarah Hansen, *DTCC Study: Tech Inspired By Bitcoin Could Work For U.S. Equity Markets*, FORBES (Oct. 16, 2018), https://www.forbes.com/sites/sarahhansen/2018/10/16/dtcc-study-tech-inspired-by-bitcoin-could-work-for-us-equity-markets/#323aea2036d0.

[308] Stan Higgins, *Interdealer Broker ICAP Completes Post-Trade Blockchain Trial*, COINDESK (Mar. 16, 2016), https://www.coindesk.com/icap-completes-post-trade-blockchain-trial [https://perma.cc/4XJZ-2Z2X].

[309] Nordrum, *supra* note 32.

[310] *See* Alexandra Posadzki, *Bank of Canada Exploring Blockchain Technology for Securities*, GLOBE & MAIL (Oct. 17, 2017), https://www.theglobeandmail.com/report-on-business/bank-of-canada-exploring-blockchain-technology-for-securities/article36628558 [https://perma.cc/5JW4-NF6Q].

proof of concept for this project.[311] Further, ING is working with ABN Amro and Societe Generale on a Blockchain project for agricultural commodities;[312] and Northern Trust has rolled out a Blockchain-based framework for private equity deals based out of Guernsey, Channel Islands.[313]

It would be disingenuous to state that Blockchain will not impact financial transactions in some way—even in mature markets—and this will likely include derivatives contracting and processing.[314] The extent of its impact at this point is uncertain. As with other nascent technologies, the "promise" (or hope) of an innovation's potential impact can bring with it an unrealistic optimism about how fast change will come about, the costs associated with creating this change, and the extent that we will end up in a better situation (all things considered) than we currently have.[315] As the Article has shown, applying Blockchain to CDS, for both smart contract execution and post-trade processing infrastructure, has problems and drawbacks.[316] At a minimum—given our current level of technology—the implementation costs and questionable benefits should perhaps give us pause and cast a little doubt on just how quickly (and to what extent) Blockchain will actually change complex financial structures like derivatives transactions.[317] As such, it would seem that the rush to herald Blockchain as inevitable for all commercial transactions is premature,[318] and there is an emerging concern, identified recently by Penny Crosman of the *American Banker*, that enthusiasm for

---

[311] *See The Bank of Canada, TMX Group, Accenture and R3 Demonstrate Feasibility of Instantaneous Equity Settlement Through Distributed Ledger Technology*, PAYMENTS CANADA (May 11, 2018), https://www.payments.ca/about-us/news/payments-canada-bank-canada-tmx-group-accenture-and-r3-demonstrate-feasibility.

[312] *See* Penny Crosman, *The Reasons U.S. Blockchain Adoption Has Stalled,* AM. BANKER (Mar. 23, 2018, 2:12 PM), https://www.americanbanker.com/news/the-reasons-us-blockchain-adoption-has-stalled [https://perma.cc/BTL8-XE3Q].

[313] *Id.*

[314] *See* Shin, *supra* note 191.

[315] *See* Crosman, *supra* note 312.

[316] *See* Nordrum, *supra* note 32.

[317] *See* Crosman, *supra* note 312.

[318] *See* Kai Stinchcombe, *Ten years in, nobody has come up with a use for blockchain*, HACKERNOON (Dec. 22, 2017), https://hackernoon.com/ten-years-in-nobody-has-come-up-with-a-use-case-for-blockchain-ee98c180100 [https://perma.cc/8KYY-3QQN].

new Blockchain projects across financial applications in America is "ebbing" by major institutions because of legal, regulatory and security concerns, high implementation costs, "interoperability issues", and a lack of a clear "return on investment."[319]

This Article has analyzed a derivatives product (CDS) that seems, at the outset, to be ideal for Blockchain application, and then assessed, using the studies produced by ISDA, the DTCC, and other industry, technology, and legal commentaries and academic papers, whether there is a case to be made for using Blockchain to improve CDS execution and processing, while also facilitating enhanced regulatory supervision, and reducing transactional, operational and regulatory compliance costs.[320] As noted, the results are largely mixed and also point to many drawbacks.[321] There are benefits worth exploring (which would explain the current projects discussed in this Part);[322] however, there are also significant costs and barriers to implementation, with drawbacks for smart contracts (which suggests a partial implementation is the only feasible application),[323] and also concerns when Blockchain is used for CDS post-trade processing.[324]

These drawbacks and concerns may explain why Blockchain has not yet transformed the derivatives world, despite the technology being known for over a decade.[325] Is it possible that, as technology writer Kai Stinchcombe has argued, "[t]he entire worldview underlying blockchain is wrong?"[326] Time will ultimately judge this question, although a more reasonable short-term explanation is simply that—like every other business decision—there are costs and benefits to be explored, and right now the costs seem to outweigh the benefits when using Blockchain for CDS. So what we are left with is a "wait and see" proposition, as to whether, and to what extent, technological improvements relating to Blockchain

---

[319] Crosman, *supra* note 312.

[320] *See generally* DTCC WHITEPAPER, *supra* note 14; ISDA 2017 WHITEPAPER, *supra* note 29.

[321] *See*, *e.g.*, Stinchcombe, *supra* note 318.

[322] *See* del Castillo, *supra* note 301; Higgins, *supra* note 308; Nordrum, *supra* note 32; Posadzki, *supra* note 310.

[323] *See* ISDA 2017 WHITEPAPER, *supra* note 29, at 14–17.

[324] *See* Nordrum, *supra* note 32.

[325] *See* Nakamoto, *supra* note 53.

[326] Stinchcombe, *supra* note 25.

will reduce or overcome altogether these costs, and also whether industry adoption will be homogenized enough to transcend the fragmentation concerns previously identified. If this occurs then we could see a larger CDS and derivatives market adoption of Blockchain technology; however, if technological progress is static, and adoption remains fragmented, then Blockchain implementation will be slow to materialize.