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Kristin Johnson

Tulane University Law School, kjohnson9@tulane.edu

Sarah E. Hsu Wilbur

Morgan, Lewis, Bockius LLP, sewilbur1@gmail.com

Stanley Sater

Founders Legal, Bekiares Eliezer LLP, ssater2@tulane.edu

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(Im)Perfect Regulation: Virtual Currency and Other Digital Assets as Collateral

*Kristin N. Johnson**
*Sarah E. Hsu Wilbur***
*Stanley Sater****

I. INTRODUCTION

Over the last decade, virtual currencies have captured an increasingly significant role in financial markets, introducing a new class of assets and revolutionizing market notions of issuing, storing, and transferring value.¹ Even social media platforms have announced intentions to enter the market; Facebook anticipates launching Libra, a new digital currency that will be globally recognized as legal tender.² The underlying technology—blockchain³—has transformed capital and credit markets, creating a digital pathway that expands opportunities for raising capital⁴ and collateralizing debt obligations. This pathway has enabled financial arrangements in which market participants transfer significant volumes of funds, raise nearly \$17 billion in capital or borrow from lenders, and offer virtual currency as collateral to secure their promises to repay debt obligations.⁵

* Kristin N. Johnson is the McGlinchey Stafford Professor of Law, Associate Dean for Faculty Research, and the Gordon Gamm Faculty Scholar at Tulane University Law School.

** Sarah is a Litigation Associate at Morgan, Lewis, Bockius LLP.

*** Stanley Sater is an Associate at Founders Legal, Bekiares Eliezer LLP.

1. For a description of the varieties of virtual currencies that exist as of the writing of this article, and virtual currency exchanges and service platforms that currently exist worldwide, see *All Cryptocurrencies*, COINMARKETCAP (Dec. 21, 2018), <https://coinmarketcap.com/all/views/all/>; *Cryptocurrency Exchanges / Markets List*, CRYPTOCHAINCHARTS (Dec. 21, 2018), <https://cryptocoincharts.info/markets/info>.
2. AnnaMarie Andriotis et al., *Facebook Building Cryptocurrency-Based Payments System*, WALL ST. J. (May 2, 2019), <https://www.wsj.com/articles/facebook-building-cryptocurrency-based-payments-system-11556837547>.
3. See *infra* Part I.
4. *ICO Tracker*, COINDESK, <https://www.coindesk.com/ico-tracker>.
5. A growing literature explores questions at the intersection of innovative developments in blockchain technology and regulation. See, e.g., Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384 (2017); Kevin Werback & Nicolas Corness, *Contracts Ex Machina*, 67 DUKE L.J. 313 (2017); Robinson Randolph, *The New Digital Wild West: Regulating the Explosion of Initial Coin Offerings* 85 TENN. L. REV. 897 (2018), <https://tennesseelawreviewdotcom.files.wordpress.com/2019/03/5-robinson-macros-working-copy-v.3.pdf>; Jonathan Rohr & Aaron Wright, *Blockchain-Based Token Sales, Initial Coin Offerings, and the Democratization of Public Capital Markets* (Oct. 4, 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3048104.

Collateral is a foundational concept in secured lending arrangements. The application of innovative technology—blockchain and virtual currencies developed on this protocol—to collateralized debt transactions reveal the deep tensions that arise when new asset classes challenge static regulatory approaches.

A flurry of white papers published in the 1990s promised a design protocol for a trustless, peer-to-peer network for digital assets that would decentralize and democratize financial markets.⁶ Early reports were consistent with virtual currency enthusiasts' expectations: the trading price of Bitcoin—a preeminent virtual currency—rose from approximately \$13 in 2013⁷ to a staggering \$19,205 in December of 2017.⁸ Reports indicate that market participants engage in nearly 9,000 Bitcoin transactions every hour.⁹ Markets

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6. See, e.g., DAVID CHAUM, BLIND SIGNATURES FOR UNTRACEABLE PAYMENTS (1998), <http://sceweb.sce.uhcl.edu/yang/teaching/csci5234WebSecurityFall2011/Chaum-blind-signatures.pdf>; STEFAN BRANDS, UNTRACEABLE OFF-LINE CASH IN WALLET WITH OBSERVERS (1993), https://link.springer.com/content/pdf/10.1007%2F3-540-48329-2_26.pdf; TATSUAKI OKAMOTO & KAZUO OHTA, UNIVERSAL ELECTRONIC CASH (1992), https://link.springer.com/content/pdf/10.1007%2F3-540-46766-1_27.pdf; DAVID CHAUM, ET AL., UNTRACEABLE ELECTRONIC CASH (1990), https://link.springer.com/content/pdf/10.1007%2F0-387-34799-2_25.pdf.
 7. *Bitcoin Price*, COINBASE, <https://www.coinbase.com/charts?locale=en-US> (To display 2013 in URL, change date to “All”) (last visited Feb. 5, 2019).
 8. *Id.* (stating that in 2017 alone, the price of bitcoin climbed from below \$1,000 to over \$19,000); see Stan Higgins, *From \$900 to \$20,000: Bitcoin's Historic 2017 Price Run Revisited*, COINDESK (Dec. 30, 2017, 13:30 UTC), <https://www.coindesk.com/900-20000-bitcoins-historic-2017-price-run-revisited/>; see also *Bitcoin's Price Swings Wildly, Touching Above \$19,000*, L.A. TIMES (Dec. 7, 2017, 10:55 AM), <http://www.latimes.com/business/la-fi-bitcoin-20171207-story.html> (“Around 10:40 a.m. Pacific Time, one bitcoin was valued at \$15,872, according to Coinbase; it briefly surged above \$19,000 earlier in the day. Last week, the price of a bitcoin topped \$10,000 for the first time. At the start of the year, it was worth less than \$1,000.”); *Chaotic Trading Marks New Surge in Bitcoin Price*, FIN. TIMES (Dec. 7, 2017), <https://www.ft.com/content/3136ca5e-db78-11e7-a039-c64b1c09b482> (“Bitcoin prices on its biggest exchanges diverged wildly on Thursday in a session that sharply exposed the fragile trading infrastructure for the nascent cryptocurrency. In one wild 20-minute period, the price of bitcoin soared \$2,000 per coin to more than \$19,000.”).
 9. *Cryptocurrency Statistics*, BITINFOCHARTS, <https://bitinfocharts.com/> (last visited Feb. 5, 2019); see Kai Sedgwick, *Bitcoin by Numbers: 21 Statistics That Reveal Growing Demand for the Cryptocurrency*, BITCOIN.COM NEWS (Nov. 11, 2017), <https://news.bitcoin.com/bitcoin-numbers-21-statistics-reveal-growing-demand-cryptocurrency/>; see also Juliane Friedrich, *Blockchain—What is the Hype All About?*, VDMA (Aug. 25, 2017), <https://foerd.vdma.org/en/viewer/-/v2article/render/19962123> (quoting Dr. Johannes Hinckeldey, “Today Bitcoin allows for 7 transactions per second and 1,000 to 2,000 transactions per

have observed an undeniable increase in the use, demand, and price of virtual currency.¹⁰

As the diversity and number of virtual currencies expands exponentially, some coins, altcoins, stable coins, and various tokens have garnered greater popularity than others.¹¹ The number and diversity of investors in this asset class has quickly increased.¹²

block. Although this has changed since segmentation at the start of August [2017], it is still on a very low level. In other words, about 6 blocks are possible per hour or 9,000 transactions per hour—worldwide”); *How Does Bitcoin Work?*, BITCOIN, <https://bitcoin.org/en/how-it-works> (last visited Feb. 5, 2019) (“A transaction is a transfer of value between Bitcoin wallets that gets included in the block chain.”).

10. See Sedgwick, *supra* note 9; see also Evelyn Cheng, *Bitcoin Exchange Coinbase Has More Users Than Stock Brokerage Schwab*, CNBC (Nov. 27, 2017), <https://www.cnbc.com/2017/11/27/bitcoin-exchange-coinbase-has-more-users-than-stock-brokerage-schwab.html> (“The operator of the largest U.S.-based bitcoin exchange has more users than brokerage Charles Schwab. . . . Schwab reported in mid-November it had 10.6 million active brokerage accounts in October, up 5 percent from the same period last year. In contrast, Coinbase had 11.7 million users at the end of October . . . That’s up 148 percent from 4.7 million a year ago. Through Sunday, that number had grown to 13.3 million.”); Joseph Young, *Exponential Growth: Number of Bitcoin Users to Reach 200 Million by 2024*, CCN (Dec. 9, 2017, 20:44), <https://www.ccn.com/exponential-growth-number-bitcoin-users-reach-200-million-2024/> (“According to RT, analysts expect the number of bitcoin users to reach 200 million by 2024, within the next seven years, given the current exponential growth rate of bitcoin A Cambridge study conducted by Dr. Garrick Hileman and Michel Rauchs in March 2017 revealed that the number of active users of bitcoin wallets was in the range of 2.9 million and 5.8 million. However, since then, proportional to the market valuation and price of bitcoin, the cryptocurrency’s user base has grown at a rapid rate. Coinbase alone, the global market’s largest bitcoin brokerage and wallet platform, serves more than 13 million active users.”); *The Cryptocurrency Market is Growing Exponentially*, MIT TECH. REV. (May 29, 2017), <https://www.technologyreview.com/s/607947/the-cryptocurrency-market-is-growing-exponentially/>.
11. See Scott D. Hughes, *Cryptocurrency Regulations and Enforcement in the U.S.*, 45 W. ST. L. REV. 1, 4 (2017); Chloe Cornish, *Growing Number of Cryptocurrencies Spark Concerns*, FIN. TIMES (Jan. 9, 2018), <https://www.ft.com/content/a6b90a8c-f4b7-11e7-8715-e94187b3017e>. We recognize that a variety of virtual currencies exist. Some of these serve as an alternative form of cash (though they are not issued by a sovereign government). Throughout this Article, we will use the term “virtual currency” to refer to all the different types of virtual currencies including coins, altcoins, and tokens.
12. Jag Jassel, *Difference Between Bitcoin vs Ethereum vs Litecoin vs Ripple*, MEDIUM (May 7, 2018), <https://medium.com/@jag.jassel/difference-between-bitcoin-vs-ethereum-vs-litecoin-vs-ripple-a61d4f2ef7c4> (describing the differences between these virtual currencies).

Analysts estimate that millions of individuals and institutions around the world own virtual currencies.¹³ Predictions indicate that more than 200 million individuals and institutions will hold virtual currencies in their digital wallets by 2024.¹⁴

Conventional banking, securities, and commodities markets have already witnessed a deluge of origination and trading activity in virtual currency markets.¹⁵ Recently, commentators report a marked uptick in hedge

13. See Alex Lielacher, *How Many People Use Bitcoin? Updated for 2018*, BITCOIN MKT. J. (Jan. 18, 2018, 8:00 AM), <https://www.bitcoinmarketjournal.com/how-many-people-use-bitcoin/> (“Currently, there are almost 28.5 million bitcoin wallets that hold more than 0.001 BTC However, most bitcoin users have several bitcoin wallets and use multiple wallet addresses to increase their financial privacy when transacting in bitcoin. Hence, the number of bitcoin users is likely less than 28.5 million. The most popular bitcoin wallet and exchange provider internationally, Coinbase, reportedly has over 13 million users, which would suggest that the number of bitcoin users is somewhere between 13 million and 28.5 million. Given that Coinbase is available in 32 countries and that it has emerged as the go-to bitcoin wallet for newcomers, its user base number gives a better indication of how many users there are than purely analyzing wallet addresses. Having said that, among the countries that are not serviced by Coinbase are some of the largest bitcoin economies such as China, South Korea, and Japan. Additionally, no bitcoin users in South America or Africa can use the company’s service. Given the growing number of bitcoin users in Asia, Africa, and South America who are using other wallet providers, the number of bitcoin users has to be much higher than Coinbase’s 13 million.”); cf. Garrick Hileman & Michel Rauchs, *Global Cryptocurrency Benchmarking Study*, (2017), https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-04-20-global-cryptocurrency-benchmarking-study.pdf (“The estimated number of unique active users of cryptocurrency wallets has grown significantly since 2013 to between 2.9 million and 5.8 million today The total number of wallets can be estimated using data collected from study participants as well as including the number of software downloads of major wallet providers and Bitcoin’s reference implementation. It is estimated that the total number of wallets has increased more than 4x from 8.2 million in 2013 to nearly 35 million in 2016.”).
14. See Young, *supra* note 10. While there are many Bitcoin holders, commentators acknowledge that fewer than 1,000 people own 40% of the Bitcoin market. Olga Kharif, *The Bitcoin Whales: 1,000 People Who Own 40 Percent of the Market*, BLOOMBERG (Dec. 8, 2017), <https://www.bloomberg.com/news/articles/2017-12-08/the-bitcoin-whales-1-000-people-who-own-40-percent-of-the-market>. In addition, 96% of Bitcoin is owned by just 4% of Bitcoin addresses. Sedgwick, *supra* note 9.
15. See Young, *supra* note 10 (“The listing of bitcoin futures by CBOE and CME in [December 2017] will drive adoption of bitcoin in the traditional finance market, amongst large-scale institutional investors, retail traders, hedge funds, and investment firms.”).

fund investments in virtual currency markets.¹⁶ In the coming decade, analysts predict that institutional investors will acquire tens of billions of dollars of virtual currency; retail investors and individual consumers are already flooding the initial coin offering (ICO) market.¹⁷ Parallel trends appear to characterize credit markets.¹⁸ Virtual currencies are often closely-held by small groups that typically maintain a controlling interest in a specific currency, which is often accomplished by investing a significant portion of their individual wealth in a single currency.¹⁹

To invest or leverage the value of their digital assets, virtual currency holders face an inefficient two-step process.²⁰ To capture its benefits, virtual currency holders must often exchange their digital assets for government-issued currency or a more liquid asset class. This first step—exchanging or liquidating virtual currency—may create market price risks, conversion costs, and tax consequences.²¹ Virtual currency holders increasingly seek creative, more efficient, and less risky paths to leverage digital assets. Accord-

16. See, e.g., Evelyn Cheng, *There Are Now More Than 120 Hedge Funds Focused Solely on Bitcoin*, *Digital Currencies*, CNBC (Oct. 27, 2017, 4:39 PM), <https://www.cnbc.com/2017/10/27/there-are-now-more-than-120-hedge-funds-focused-solely-on-bitcoin.html> (“More than 90 [hedge] funds focused on digital assets like bitcoin have launched [in 2017], bringing the total number of such ‘crypto-funds’ to 124, according to financial research firm Autonomous Next Total assets under management by crypto-funds now stands at \$2.3 billion.”).
17. Young, *supra* note 10.
18. See, e.g., Olga Kharif, *These Guys Want to Lend You Money Against Your Bitcoin*, *BLOOMBERG* (Dec. 14, 2017, 11:00 PM), <https://www.bloomberg.com/news/articles/2017-12-14/bitcoin-s-new-barons-no-longer-have-to-sell-to-live-in-luxury>; Josiah Wilmoth, *You Can Now Use Bitcoin as Collateral When Applying for a Personal Loan*, *STRATEGIC COIN* (Dec. 2, 2017), <https://strategic-coin.com/bitcoin-collateral-personal-loan/> (“The cryptocurrency markets have experienced unprecedented growth in 2017, and many bitcoin investors have accumulated significant wealth. However, many of these investors believe that the bitcoin price continues to have significant long-term potential, so they are reluctant to sell their holdings for cash when they need liquidity. Financial services firm Unchained Capital aims to fill this void. Earlier this week, the lending startup began offering bitcoin-secured loans to the U.S. public.”); Will Yakowicz, *Bitcoin Millionaires Have a New Way to Cash Out Without Ever Selling a Single Bitcoin*, *INC.* (Feb. 15, 2018), <https://www.inc.com/will-yakowicz/loan-startups-accept-cryptocurrency-collateral.html> (“Over the past year, a half a dozen new loan platforms including Salt Lending, Sweetbridge, MoneyToken, and EthLend have emerged with the sole purpose of giving crypto traders the ability to get a cash loan secured by cryptocurrencies as collateral.”).
19. See Kharif, *The Bitcoin Whales*, *supra* note 14.
20. See *infra* text accompanying note 60.
21. See *infra* text accompanying notes 60, 234.

ing to one commentator, the market for loans secured by virtual currency will reach tens of billions of dollars within the next decade.²² As financial markets increasingly embrace digital transactions, commentators query whether existing regulation effectively applies to lending arrangements secured by virtual currency.²³

Secured lending arrangements are generally understood to be a matter of state law. With only slight variations, all fifty states have adopted the Uniform Commercial Code (U.C.C.).²⁴ The U.C.C. is a set of regulations that creates a recording system enabling lenders to record a claim or interest in real property through a registry located in the county of the state where the property is located.²⁵ Article 9 of the U.C.C. establishes the requirements for perfecting a security interest in real property.²⁶ A perfected security interest enables lenders to establish priority with respect to their claims in real property and to ensure that subsequently established claims will be deemed subordinate.²⁷

Secured lending offers an attractive pathway to exploit the promised benefits of virtual currency while mitigating the inherent limitations and design-based risks of this asset class.²⁸ Financial technology (fintech) firms operating in digital asset markets have seized the opportunity to act as intermediaries by initiating business models that lend cash in exchange for virtual currency.²⁹ The loans facilitate purchasing tangible goods, such as

22. See Kharif, *These Guys Want to Lend You Money*, *supra* note 18.

23. See *infra* Part II.

24. Bob Lawless, *Is U.C.C. Article 9 the Achilles Heel of Bitcoin?*, CREDIT SLIPS BLOG (Mar. 10, 2014, 8:17 PM), <http://www.creditslips.org/creditslips/2014/03/is-ucc-article-9-the-achilles-heel-of-bitcoin.html>.

25. See *id.*; see also *infra* Part II.

26. See *infra* Part II.

27. See *infra* Part II.

28. See *Asset Backed Lending*, INVESTOPEDIA, <https://www.investopedia.com/terms/a/assetbasedlending.asp> (last visited Feb. 5, 2019). A variety of financial firms engage in secured lending activities. *Id.* Typically, borrowers who enter into secured lending arrangements seek to leverage illiquid assets, converting an asset that is difficult to sell or subject to high transaction costs into cash or credit. *Id.* In exchange for a distribution of cash, the borrower agrees to repay the principal (cash borrowed) at specified intervals for a stated price (the interest rate), which may be fixed or fluctuate. *Id.* The material payment terms, namely the interest, may vary based on the negotiations between the borrower and lender, the borrower's creditworthiness (history and reputation for timely satisfaction of previous debt obligations), and whether the borrower offers collateral to secure her debt. *Id.*

29. Kharif, *These Guys Want to Lend You Money*, *supra* note 18; see, e.g., Vanessa Salt, *What is SALT Lending?*, SALT LENDING (May 2018), <https://saltlending.zendesk.com/hc/en-us/articles/115009157387-What-is-SALT-Lending->; see

cars or houses, and portfolio diversification by investing across asset classes to diversify financial investments.³⁰

As the market for virtual currency-secured loans aggressively expands, commentators, regulators, and scholars have expressed concerns. In conventional lending arrangements, a borrower and lender enter into a security agreement that identifies the collateral that will be transferred to the lender if a borrower fails to repay a debt obligation. As noted above, Article 9 of the U.C.C. governs these lending arrangements.³¹ The U.C.C. establishes the process for perfecting security interests in the designated collateral.³² Under Article 9, the process for establishing perfection varies based on the type of real property that serves as collateral.³³ In some instances, such as loans secured by rights to intellectual property, a secured lender perfects a security interest in the collateral by filing a financing statement.³⁴ A scrivener's error in the recording of the description of the collateral or failure to precisely follow the perfection process may jeopardize the secured lender's right or priority in the event that a borrower defaults on payment obligations.³⁵ In order to perfect a security interest in other forms of collateral, such as money, a secured lender can possess the collateral.

Attempts to apply Article 9 to virtual currency engender myriad concerns that one might describe as the "perfection problem." First, the express language of Article 9 does not indicate that the regulatory framework applies to virtual currencies. Article 9 outlines a detailed list of assets that may serve as collateral. Some of the most commonly designated forms of collateral include investment property, money, securities, commodities, and deposit ac-

also Dan Caplinger, *Why Bitcoin Loans Are About to Explode*, MOTLEY FOOL (Dec. 17, 2017, 7:38 AM), <https://www.fool.com/investing/2017/12/17/why-bitcoin-loans-are-about-to-explode.aspx> ("Having seen more retailers willing to accept bitcoin, supporters of the virtual currency are now turning their attention to a key traditional banking function: lending using bitcoin as collateral. Major banks haven't yet stepped up to the plate pitching bitcoin loans as a growth driver, but smaller niche institutions have popped up to explore the cutting edge of crypto-financing. There are two reasons bitcoin loans are about to become the next big thing with investors in the digital currency . . . 1. Bitcoin owners need a tax-friendly exit strategy . . . [and] 2. Bitcoin lenders can now hedge their risk.").

30. See Yakowicz, *supra* note 18.

31. See Lawless, *supra* note 24.

32. Lawless, *supra* note 24.

33. U.C.C. § 9-312(b)(3).

34. Stephen Fishman, *How to Attach and Perfect a Security Interest Under the UCC*, NOLO.COM (May 2013), <https://www.nolo.com/legal-encyclopedia/how-attach-perfect-security-interest-under-the-ucc.html>.

35. *Id.*

counts. Collateral assets that do not fall into Article 9's enumerated asset categories are classified as "general intangibles."³⁶

In October 2017, the Uniform Law Commission (ULC) introduced the Uniform Regulation of Virtual-Currency Businesses Act (URVCBA), a statutory framework for the regulation of companies engaging in "virtual-currency business activity," such as (1) exchanging, transferring, or storing virtual currency; (2) holding electronic precious metals or certificates of electronic precious metals; or (3) exchanging digital representations of value within online games for virtual currency or legal tender.³⁷ The URVCBA's unique, three-tiered structure clarifies whether an individual or company engaging in virtual-currency business activity is exempt from the act, must register, or must obtain a license.³⁸ The URVCBA also contains numerous consumer protections.

In March 2019, the ULC requested that states considering enacting the URVCBA or competing legislation await a study committee report.³⁹ The ULC and American Law Institute commissioned the joint committee to write the study because emerging concerns suggested that the URVCBA did not adequately address competing regulators concerns and failed to establish that amendments to the UCC were needed to accommodate digital technology.⁴⁰ Curiously, several states, including California, Hawaii, Nevada, and Oklahoma had already begun moving legislation based on the URVCBA and a supplemental act.⁴¹ Adding to the confusion regarding the ULC's initial

36. *See infra* Part II.

37. Uniform Regulation of Virtual-Currency Businesses Act, UNIF. L. COMM'N (Oct. 9, 2017), <https://www.uniformlaws.org/committees/community-home?CommunityKey=e104aaa8-c10f-45a7-a34a-0423c2106778>.

38. *Id.*

39. Uniform Commercial Code and Emerging Technologies, UNIF. L. COMM'N, <https://www.uniformlaws.org/committees/community-home?CommunityKey=afffb337-d599-4456-9436-a52aa5d9dcc2> (last visited July 8, 2019).

40. Uniform Regulation of Virtual-Currency Businesses Act, UNIF. L. COMM'N 25–27, 39–40 (Oct. 9, 2017), <https://www.uniformlaws.org/committees/community-home?CommunityKey=e104aaa8-c10f-45a7-a34a-0423c2106778>.

41. *See* Edwin Smith, *The Uniform Commercial Code and Digital Assets: Legislative Initiatives*, UNIF. L. COMM'N (Mar. 13, 2019, 3:07 PM), <https://www.uniformlaws.org/blogs/edwin-smith/2019/03/13/ucc-and-digital-assets-legislative-initiatives>; Caitlin Long, *Seismic News About State Virtual Currency Laws: ULC Urges States to Withdraw Model Act*, FORBES (Mar. 25, 2019), <https://www.forbes.com/sites/caitlinlong/2019/03/25/seismic-news-about-state-virtual-currency-laws-ulc-urges-states-to-withdraw-model-act/#729689045fda> (Rhode Island's General Assembly has initiated legislation to adopt the URVCBA).

approach, two other states have rejected both approaches and elected to craft their own regulatory approach.⁴²

The debate regarding the application of Article 9 parallels similar discussions in the regulation of initial coin offerings in capital markets.⁴³ The absence of a reference to virtual currency in Article 9 may not, however, be determinative. Congress, courts, and regulators have interpreted the enumerated terms to enable dynamic application of federal securities laws.

It is hardly a surprise that virtual currencies do not appear in Article 9. Quite simply, the drafters of the most recent amendments of the U.C.C. did not envision lending arrangements secured by virtual currency. The absence of a reference to virtual currency in Article 9 may not, however, be critical. For many years, courts, regulators, and market participants have interpreted the language of the U.C.C. to encompass not only the enumerated assets but arrangements with economic realities that are similar to the enumerated asset classes.⁴⁴ Regulators and commentators posit that the U.C.C.'s scheme is elastic and its existing language may capture innovative digital assets.⁴⁵ Perhaps, some argue, digital assets are simply derivatives of existing asset classes.⁴⁶ As a result, one method of applying the U.C.C. to lending arrangements secured by virtual currency collateral may be to establish that virtual currency is merely derivative of an enumerated asset class—such as money or investment property—referenced in Article 9. This path however, shoehorns digital assets into the categories of collateral currently enumerated in Article 9—an outcome which may be less than ideal.

Second, even if one adds virtual currency to a defined term in order to capture this new asset class under the U.C.C., the operational mechanics of perfection and priority may be inconsistent with the nascent technology that creates digital assets.⁴⁷ Market participants who are willing to offer loans secured by digital assets and those seeking to leverage the value of digital assets have questioned whether lenders may effectively perfect a security interest in digital assets.⁴⁸ Finally, a number of questions regarding enforce-

42. See S.F. 0125, 65th Sess. (Wyo. 2019); Missouri House of Representatives, H.B. 1159, 100th Gen. Assemb., 1st Sess. (Mo. 2019).

43. See, e.g., Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO, Securities Exchange Act Release No. 81207, 2017 WL 7184670, at *1 (July 25, 2017).

44. U.C.C. § 9-102 (a)(61).

45. See *infra* Part II.

46. See, e.g., Timothy Bierer, Note, *Hashing It Out: Problems and Solutions Concerning Cryptocurrency Used as Article 9 Collateral*, 7 CASE W. RESERVE J.L. TECH. & INTERNET 79, 88–89 (2016).

47. See Ronald J. Mann, *Reliable Perfection of Security Interests in Crypto-Currency*, 21 SMU SCI. TECH. L. REV. (forthcoming 2019).

48. See Sarah Jane Hughes & Stephen T. Middlebrook, *Advancing A Framework for Regulating Cryptocurrency Payments Intermediaries*, 32 YALE J. ON REG.

ment, cryptography, and liquidity challenge the application of blunt secured lending regulation in virtual currency markets.

If digital assets are not explicitly included in an existing defined term in Article 9, secured lenders may find that financing arrangements that list virtual currency as collateral lack the U.C.C.'s well-established enforcement protections.⁴⁹ Uncertainty regarding collateral casts a shadow over digital asset transactions that increases transaction costs, reduces efficiencies, and leaves market participants vulnerable.

Scholars have offered several proposals to address the “perfection problem.” Some advocate for expanding the definitions of certain defined terms in Article 9 or understanding existing defined terms to include virtual currency.⁵⁰ According to Jeanne Schroder, classifying virtual currency as uncertificated securities effectively incorporates this new asset class under the U.C.C.⁵¹ Kevin Tu posits that resolving the “perfection problem” requires amending the U.C.C. to account for this new asset class.⁵²

Others encourage regulators to educate themselves on issues involving the evolving technology. By examining three examples of firms in the emerging secured lending market—Unchained Capital, Secured Automated Lending Technology (SALT) Lending, and Hive—Professor Xuan-Thao Nguyen introduces an important taxonomy and classifies early lending platforms based on their respective attributes.⁵³ Professor Nguyen cautions, however, that before considering any amendments to the U.C.C., regulators must understand virtual currency lenders’ innovative use of the technology.⁵⁴ In particular, open source multi-signature (multisig) smart contracts have the potential to overcome the limits created by virtual currencies’ central security and privacy design features in conventional secured lending arrangements collateralized by virtual currencies.

Finally, a growing set of proposals suggest that regulation should utilize the very technology at issue to solve the “perfection problem.” Ronald Mann and Carla Reyes propose solutions that involve using blockchain technology to build a decentralized network of records.⁵⁵ The perfection process may be enhanced, these scholars contend, by utilizing blockchain technology.⁵⁶

495 (2015); *see also* Reyes, *supra* note 5; Jeanne L. Schroeder, *Bitcoin and the Uniform Commercial Code*, 24 U. MIAMI BUS. L. REV. 1 (2016); *infra* Part III.

49. *See infra* Part II.

50. *See infra* text accompanying note 48.

51. *See infra* Part II.

52. *See infra* Part II.

53. *See, e.g.*, Xuan-Thao Nguyen, *Lessons from Case Study of Secured Transactions with Bitcoin*, 21 SMU SCI. & TECH. L. REV. (forthcoming 2019).

54. *Id.*

55. *See infra* Part II.

56. *See infra* Part II.

Blockchain further offers a more efficient method of creating and storing records for loans secured by virtual currency and other assets.

While each of these solutions illuminate the challenges underlying the “perfection problem,” each proposal has noteworthy limitations. Rather than embrace the attributes of a static regulatory approach, this article argues that the current structure of the U.C.C. may not adequately address the concerns raised by this emerging asset class. The innovative use of blockchain to serve as the recording platform for security interests also faces several difficulties. The accelerated development of blockchain, and the seismic shifts in the evolution and application of this technology leave private market participants struggling to keep pace.

This article contends that regulators and market participants must engage in a collaborative, transparent dialogue and carefully consider the distinguishing features of this nascent class of assets. Part I of this article briefly explores the ecosystem of virtual currencies. Part II examines the challenges of defining and using virtual currency as collateral for secured transactions under the existing contours of Article 9 of the U.C.C. Part III surveys proposed solutions situated within the existing regulatory framework and beyond.

Part IV compares the approaches adopted by early voices in the market for digital asset regulation. This Part introduces critical questions regarding the successes and limitations of various considered and adopted regulatory paths. Part V offers brief concluding remarks, encouraging regulators to embrace a flexible regulatory approach.

II. A VIRTUAL CURRENCY PRIMER

Virtual currency⁵⁷ is a medium of exchange.⁵⁸ Virtual currencies function in a manner similar to long-recognized forms of money, such as government-issued fiat or specie. These forms of money enable market participants to purchase and sell valuables or engage in a variety of other financial transactions.⁵⁹ Unlike conventional forms of legal tender or fiat, such as the dollar, euro, or yen, virtual currency is not issued or backed by a sovereign government.⁶⁰ Virtual currencies allow transactions on a decentralized, peer-

57. Note that this analysis of virtual currencies is limited to virtual currencies designed to function as a financial medium of exchange and does not include other types of utility tokens, altcoins, and other coins that are not intended to serve as a form of money.

58. Kevin V. Tu & Michael W. Meredith, *Rethinking Virtual Currency Regulation in the Bitcoin Age*, 90 WASH. L. REV. 271, 279 (2015).

59. Jay Clayton, Chairman, SEC, *Statement on Cryptocurrencies and Initial Coin Offerings* (Dec. 11, 2017), <https://www.sec.gov/news/public-statement/statement-clayton-2017-12-11>.

60. *Id.*; see Hughes & Middlebrook, *supra* note 48, at 503–06 (for a further description of a virtual currency).

to-peer platform, thus creating a pathway to transfer value to anyone capable of receiving the value anywhere in the world.⁶¹

By design, virtual currencies and the blockchain, or distributed ledger, technology underlying these assets enable market participants to create, store, and transfer the value of the currencies. This in turn reduces the role of conventional payment systems or financial intermediaries, such as banks.⁶² Like the sophisticated international banking and payment system ledgers, virtual currencies solve the double-spend problem—a concern that one might attempt to spend the same asset more than once.⁶³ Blockchain technology records virtual currency transactions on a decentralized public ledger. While virtual currencies have not eliminated the need for conventional intermediaries, digital ledger technology enhances market participants' independence from traditional banking and exchange ledgers and increases transactional efficiency, thereby lowering transaction costs.

Several design details underscore the nature of virtual currencies and distinguish this new class of assets from conventional money and payment systems. Market participants store virtual currency in digital wallets; digital encryption or cryptography protects the virtual assets and wallets from cyber criminals or conventional thieves.⁶⁴ Blockchain is decentralized. This attribute distributes the information recorded in each block on the chain to the

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61. Clayton, *supra* note 59; *cf.* Hughes, *supra* note 11, at 7–8 (“Prior to cryptocurrencies, there were three main types of money: commodity money, credit money, and fiat money. The term commodity money refers to a physical commodity, which was originally valued for its commercial uses. Examples of commodity money include gold and silver The second type of money, credit money, differs fundamentally from commodity money. It consists of non-interest-bearing receivables that cannot be redeemed on demand. As a rule, credit money is often issued as a redeemable rate with commodity money or fiat money The last type of money is fiat money. Today, all government issued currencies are fiat. This means that the money itself has no intrinsic value but obtains value from government decree. The value of the currency is not based on a link to the value of a commodity but on trust in the government or central bank that issues the fiat money. Theoretically, the amount of fiat money can be expanded indefinitely, which has led to hyperinflation in the several countries throughout history that have experimented with fiat money. In contrast, cryptocurrencies, such as bitcoin, usually have a mathematically limited amount of supply, and thus also a limited and precisely determinable supply inflation. Due to the decentralized and digital nature of bitcoin, it does not easily fit into any of the three traditional types of money.”).
62. Schroeder, *supra* note 48, at 11.
63. See generally Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, BITCOIN.ORG (2008), <https://bitcoin.org/bitcoin.pdf>.
64. Tu & Meredith, *supra* note 58, at 279; JERRY BRITO & ANDREA CASTILLO, BITCOIN: A PRIMER FOR POLICYMAKERS 7 (2016).

entire network of blockchain participants.⁶⁵ Virtual currency “miners” verify transactions executed on the blockchain.⁶⁶

Market participants create virtual currencies through a handful of processes, the most common of which involve coin offerings or mining.⁶⁷ Creating virtual currency through a coin offering simply entails issuing coins and distributing ownership rights in exchange for value, cash, or conventional fiat.⁶⁸ The mining process is more intricate and resource intensive.⁶⁹ For each virtual currency transaction that involves mining, information regarding the transaction is broadcast to the network of virtual currency holders, miners, and others who have installed the blockchain protocol on their computers.⁷⁰ Miners monitor the blockchain and, through their execution of mathematical problems, verify the identities of parties engaged in transactions on the blockchain and confirm the authenticity of the transaction.⁷¹

65. See Schroeder, *supra* note 48, at 11; see generally Nakamoto, *supra* note 63.

66. See Michael Nielson, *How the Bitcoin Protocol Actually Works*, DATA DRIVEN INTELLIGENCE BLOG (Dec. 6, 2013), <http://www.michaelnielsen.org/ddi/how-the-bitcoin-protocol-actually-works/>.

67. This article notes that there are a range of relevant protocols that may be implicated, but for simplicity focuses on proof of work. See Andrew Tar, *Proof of Work Explained*, COINTELEGRAPH (Jan. 17, 2018), <https://cointelegraph.com/explained/proof-of-work-explained>.

68. See Clayton, *supra* note 59.

69. Discussion of the mining process is beyond the scope of this article. Like the gold mining process, cryptocurrency mining uses immense computer power to find solutions to complex problems. See KEVIN DOWD, *NEW PRIVATE MONIES: A BIT-PART PLAYER?* 41 (2014).

70. Nakamoto, *supra* note 63.

71. Tu & Meredith, *supra* note 58, at 283. In the Bitcoin context, “the network adjusts the difficulty of ‘finding’ Bitcoin to the number of active ‘miners’ and the computer power used in a way that was initially set to generate a production rate of 50 Bitcoin every ten minutes.” Dowd, *supra* note 69, at 41; see also Tu & Meredith, *supra* note 58, at 284 (footnotes omitted) (“Before a block can be added to the ‘block chain,’ a miner’s computer is required to correctly solve ‘a difficult mathematical problem, called a ‘proof-of-work.’” The difficulty of the algorithm adjusts itself such that, on average, one ‘block’ is created every ten minutes. This mining process limits the total amount of currency that enters into the Bitcoin market and renders non-market fluctuations impossible. New bitcoins only enter the market after the addition of a ‘block’ to the ‘block chain.’ A block is merely a record of a recent Bitcoin transaction. However, the creation of ‘blocks’ occurs at a predictable rate. This is ensured by the increasing difficulty of the ‘proof of work’ required before a ‘block’ can be added. As such, it is known as a mathematical certainty the rate at which new blocks, will be created.”); Schroeder, *supra* note 48, at 12 n.35 (“The system depends on the equilibrium caused by the factors that (i) on the one hand, these algorithms take a lot of computer power to solve so that only a limited number of miners

Solving the mathematical problems is not simple and requires increasingly significant volumes of computing energy. Miners “offer their computing power in exchange for the chance of winning newly ‘minted’ Bitcoin” and then record those transactions on the public blockchain.⁷² Upon discovering the solution to an outstanding mathematical problem and confirming the authenticity of a transaction, miners receive virtual currency as a reward for their efforts.⁷³

Verified transactions become links connecting blocks in a chain of transactions creating a blockchain. The earliest protocols that designed blockchains presumed these ledgers would be publicly accessible, permissionless databases that stored verified records or transactions on the blockchain.⁷⁴ The blockchain protocol is built on a decentralized, distributed ledger of transactions, meaning the protocol operates across a network of computers. Consequently, virtual currency exists in a series of records embedded in blocks and stored on every computer within the applicable network.⁷⁵ This intentionally decentralized design aims to reduce the likelihood that a single point of vulnerability in the network would render the virtual currency susceptible to cyber-theft.⁷⁶

have any chance to claim a bitcoin, and (ii) on the other, solving the algorithms takes shear computer power rather than skill.”). The cryptocurrency mining process will not continue indefinitely; the total amount mined cannot exceed 21 million. DOWD, *supra* note 69, at 41; BRITO & CASTILLO, *supra* note 64, at 9 (“This process of mining bitcoins will not continue forever. Bitcoin was designed to mimic the extraction of gold or other precious metals from the earth—only a limited, known number of bitcoins can ever be mined. The arbitrary number chosen to be the cap is 21 million bitcoins. Miners are projected to painstakingly harvest the last ‘satoshi’ (named for the unidentified Satoshi Nakamoto), or 0.00000001 of a Bitcoin, in the year 2140.”).

72. Schroeder, *supra* note 48, at 11; *see generally* Nakamoto, *supra* note 63.

73. DOWD, *supra* note 69; *see also* BRITO & CASTILLO, *supra* note 64, at 7–9.

74. *See* DOWD, *supra* note 69, at 41. Permissioned blockchains are blockchain ledgers that “need special permissions to read, access, and write information on them” and whose intrinsic configuration “controls the participants’ transactions and defines their roles in which each participant can access and contribute to the blockchain.”; *see also* *Permissioned Blockchains*, INVESTOPEDIA, <https://www.investopedia.com/terms/p/permissioned-blockchains.asp> (last visited Mar. 8, 2019). Permissioned ledgers differ from both public ledgers and private ledgers. Unlike permissioned blockchains that require accessers and users to have special permission, anyone can read, copy, or make changes to public ledgers, and unlike permissioned ledgers, only known nodes are permitted to participate in private ledgers. *Id.*

75. Kristin Johnson, *Banking on Blockchain* (forthcoming 2019).

76. *Id.*

III. VIRTUAL CURRENCY UNDER THE U.C.C.

Security arrangements enable market participants to avoid the expense and difficulty of accessing the value of illiquid assets such as real estate, unregistered securities, or artwork. Consider, for example, a coin collector with a portfolio of rare coins. The coin collector seeks to enjoy the value of the coin collection but laments the thought of selling her precious coins, especially because it is unlikely she will be able to repurchase the same coins in the future.

Rather than sell her collection, the coin collector may solicit a lender and ask to borrow cash in exchange for entering into an agreement to repay the borrowed cash at agreed upon intervals. Because the lender's motives are not altogether altruistic, the lender may demand that the borrower repay the principal on the loan and pay interest at either a fixed or variable rate. The lender may also request that the coin collector agree to forfeit certain specific coins or all of the coins if the borrower should fail to repay the principal debt obligation (cash borrowed) or interest on the loan.⁷⁷ The borrower and the lender will typically enter into a security agreement that identifies rare coins as collateral and indicates that ownership of the coins will pass to the lender or creditor if the coin collector defaults on the loan obligations.⁷⁸

For debtors and creditors, secured lending arrangements that designate digital assets as collateral⁷⁹ engender both opportunities and challenges. This Part examines the existing regulatory framework applied when a creditor seeks to perfect a security interest in collateral and the benefits and limitations of this approach in the context of virtual currency collateral.

A. Conventional Forms of Collateral

The U.C.C. governs transactions in which a lender claims a security interest in a borrower's collateral.⁸⁰ Once adopted by state legislatures, the

77. See, e.g., *What in the World is a General Intangible?*, DAVENPORT EVANS LAW (Sept. 10, 2013), <https://dehs.com/what-in-the-world-is-a-general-intangible/>.

78. *Id.*

79. See, e.g., Shawn Gordon, *Options for Borrowing and Lending with Cryptocurrency Are on the Rise*, BITCOIN MAG. (Dec. 4, 2017, 10:02 AM), <https://bitcoinmagazine.com/articles/options-borrowing-and-lending-cryptocurrency-are-rise/>; see also Kharif, *These Guys Want to Lend You Money*, *supra* note 18; Frederick Reese, *Top 7 Borrowing and Lending Platforms for Bitcoin*, BITCOIN MKT. J. (Dec. 20, 2017, 1:13 PM), <https://www.bitcoinmarketjournal.com/bitcoin-borrowing/>.

80. U.C.C. § 9-102(a)(12) (“‘Collateral’ means the property subject to a security interest or agricultural lien. The term includes: (A) proceeds to which a security interest attaches; (B) accounts, chattel paper, payment intangibles, and promissory notes that have been sold; and (C) goods that are the subject of a consignment.”); see, e.g., Lawless, *supra* note 24 (“The bank that gave you a car loan has an Article 9 security interest in the automobile serving as collateral for the

language of the U.C.C. becomes state law, and is applicable to any financing arrangements within the ambit of the relevant state statute. The U.C.C. operational provisions apply in a rigid and formal manner.

To create an enforceable security interest, a secured lending agreement must include a description of the collateral that serves as a guarantee that the debtor will repay outstanding obligations.⁸¹ Collateral designated in the financing arrangement may be classified as either tangible or intangible personal property.⁸² Notwithstanding the broad scope of these two categories of collateral, neither expressly includes a reference to virtual currency. To apply the U.C.C. to lending arrangements secured by virtual currency, lenders must establish that virtual currency fits into a U.C.C. Article 9 category of collateral.⁸³

Article 9 of the U.C.C. describes tangible property in broad language and emphasizes the physical attributes of tangible property.⁸⁴ A lender or her agent may take physical possession of tangible assets.⁸⁵ Commonly cited examples of tangible assets include money, agricultural commodities (such as coffee, wheat, or corn), equipment, inventory, fixtures, and negotiable instruments.⁸⁶ Examples of intangible assets, on the other hand, include accounts, software, investment property, letters of credit, letter-of-credit rights, and “general intangibles.”⁸⁷ Article 9 describes “general intangibles” as: “any personal property, including things in action, other than accounts, chattel paper, commercial tort claims, deposit accounts, documents, goods, instruments, investment property, letter-of-credit rights, letters of credit, money, and oil, gas, or other minerals before extraction. The term includes payment intangibles and software.”⁸⁸ “General intangibles” is thus a catch-all term

loan, and the bank providing operating capital for your corner bakery similarly may have an Article 9 security interest in the inventory, equipment, and accounts at the store.”).

81. See U.C.C. § 9-203; Louis Del Duca & Patrick Del Duca, *Judicial Highlights: Article 9—Secured Transactions*, 40 U.C.C. L.J. 1 Art. 5, §§ 9-108, 9-203 (2007).
82. See U.C.C. § 9-102(a)(12); see also Schroeder, *supra* note 48, at 10 (describing the various different categories of personal property that can be used as collateral in secured lending transactions under Article 9).
83. See U.C.C. § 9-109(a) (stating that among other things, Article 9 of the U.C.C. applies to secured transactions that create “a security interest in personal property or fixtures by contract,” regardless of the transaction’s form, and to “sale[s] of accounts, chattel paper, payment intangibles, or promissory notes”).
84. *Id.* § 9-102(a)(44).
85. *Id.* § 9-313(a).
86. See *id.* § 9-102(a)(44).
87. See *id.*
88. U.C.C. § 9-102(a)(42).

that captures various forms of personal property except for those types of personal assets specifically exempted by the language of the definition—excluded assets.⁸⁹ Based on this construction, market participants, drafters, and courts often presume that an asset is a general intangible unless the asset appears on the enumerated list of excluded assets.⁹⁰

B. Applying the Existing U.C.C. Regulatory Framework to Virtual Currency

The U.C.C. segregates collateral into two general categories: tangible assets and intangible assets. Tangible assets typically include physical resources, such as goods, money, inventory, and equipment. Whereas intangible assets include assets such as accounts, investment property, letter-of-credit rights, and general intangibles. Attempts to fit virtual currency into the express definitions of tangible and intangible assets under Article 9 reveal the uniqueness of this new asset class.⁹¹

Consider, for example, attempts to classify virtual currency as tangible “goods.” Article 9 defines “goods” as assets that are “movable when a security interest attaches.”⁹² Virtual currency is among the most liquid assets in contemporary financial markets. Virtual assets are stored in digital wallets and traded on digital platforms.⁹³ Developers design the blockchain protocol that facilitates virtual currency creation and trading to enable virtual currency to function in a wholly digital or virtual manner.⁹⁴

Virtual assets are antithetical to tangible assets or physical resources. Notwithstanding market participants’ ability to execute transactions moving virtual currency at exceptional speeds across global markets,⁹⁵ it would be inaccurate to suggest that virtual currency is “moveable” in a manner like the

89. *Id.*

90. See Kevin V. Tu, *Perfecting Bitcoin*, 52 GA. L. REV. 505, 547–50 (2018).

91. See *id.* at 547.

92. U.C.C. § 9-102(a)(44).

93. Adam J. Levitin, *Pandora’s Digital Box: The Promise and Perils of Digital Wallets*, 166 U. PA. L. REV. 305, 315 (2018).

94. Schroeder, *supra* note 48, at 11.

95. Tu, *supra* note 90, at 511–12.

transfer of physical resources.⁹⁶ Virtual currency is an intangible, digital record.⁹⁷

Even if it is not a tangible asset, virtual currency may be considered a “general intangible.” Some suggest that virtual currency is analogous to software, an asset class that is defined in Article 9 as “a computer program and any supporting information provided in connection with a transaction relating to the program.”⁹⁸ This argument, however, misunderstands the structure and design of digital assets.

Although blockchain—the underlying protocol for virtual currency—is transferred, reconciled, and indeed *created* by computer code, it is not traditional software.⁹⁹ Early developers designed the blockchain protocol as permissionless, open-source code available to anyone who downloads the protocol. Accessibility is a critical feature of the protocol’s design.¹⁰⁰ While blockchain developers and commentators note a lack of uniform definitions for basic terminology, all agree that the blockchain protocol and the code that creates virtual currency are clearly distinguishable from general references to software.¹⁰¹

Demonstrating that virtual currencies are not “general intangibles” may simply involve confirming that this new asset class is among the list of excluded assets in the term’s definition. Virtual currencies share notable similarities with several excluded assets, namely “accounts,” “money,” and

96. See Schroeder, *supra* note 48, at 11, 22 (noting virtual currency “has no physical form” and “is a digital rather than physical form of money”); Tu, *supra* note 90, at 548 (“Virtual currency is outside the scope of the definition [of goods in U.C.C. Article 9] because it is not moveable. Unlike tangible personal property, virtual currency is created and stored electronically. It is digital and has no physical manifestation.”); see also *infra* text accompanying note 130 (describing physical possession as a method for perfecting a security interest in tangible collateral).

97. See Daniel Krawisz, *Bitcoin as a Store of Value, Unit of Account, and Medium of Exchange*, SATOSHI NAKAMOTO INST. (Jan. 12, 2015), <https://nakamotoinstitute.org/mempool/bitcoin-as-a-store-of-value-unit-of-account-and-medium-of-exchange/>.

98. U.C.C. § 9-102(a)(76) (stating that this definition excludes a computer program that is included in Article 9’s definition of “goods.”).

99. See, e.g., Ian A. Holcomb, *Bitcoin’s Standing Within the Global Regulatory and Economic Marketplace*, 23 CURRENTS: J. INT’L ECON. L. 56, 61 (2016) (Virtual currencies “are intangible pieces of coding, similar to software . . . [In Article 9,] ‘software’ is defined as a specific type of ‘general intangible.’ While this definition appears to be suitable on its face, it ignores the economic realities of [virtual currencies]. [Virtual currencies are] more than just software. In fact, [they tend] to act more like a deposit account and investment property.”).

100. See Schroeder, *supra* note 48, at 10–11.

101. See *supra* text accompanying note 99.

“investment property.”¹⁰² Notwithstanding these similarities, careful consideration reveals that virtual currencies are functionally distinct from the relevant excluded assets.¹⁰³

Due to its functional role as a “store of value,” one may suggest that virtual currency is a type of “account” or perhaps even a “deposit account.” Article 9 describes “accounts” as rights to payment for services rendered or goods delivered.¹⁰⁴ The U.C.C. defines “deposit accounts” as arrangements involving a bank acting as custodian.¹⁰⁵ Each virtual currency wallet is functionally a type of account,¹⁰⁶ as each stores value. The “accounts” referenced in Article 9, however, are distinguishable from virtual currency wallets.¹⁰⁷ In contrast to “deposit accounts” or “accounts,” digital wallets that contain virtual currency do not necessarily involve financial obligations owed to third parties.¹⁰⁸ A growing number of banks and many other financial intermediaries offer virtual currency wallets or facilitate trading of virtual currency, participating in the virtual currency wallets and trading platform market.¹⁰⁹ But the creation, underwriting, and distribution and trading of virtual currencies do not necessarily require banks’ participation.

“Money” is likely the excluded asset which most closely resembles virtual currency. In 1962, U.C.C. drafters introduced the term “money,” acknowledging the use of cash, specie, notes, and other forms of currency as collateral.¹¹⁰ U.C.C. § 1-201(b)(24) defines “money” as “a medium of ex-

102. Holcomb, *supra* note 99, at 61 (Virtual currency “users will want to [know] how [virtual currencies] could be used commercially, specifically as collateral for obtaining loans. Articles 8 and 9 of the Uniform Commercial Code will be the best resource in resolving this issue. This is a tricky situation, for [virtual currencies] share similar aspects with several different types of collateral. [Virtual currencies] can be used to purchase property and services, like money; they are intangible pieces of coding, similar to software; they are stored in a wallet, like how money is stored in a deposit account, and bitcoins can also be held for investment, exactly like investment property.”).

103. *See* Holcomb, *supra* note 99, at 61–62; *see also* Tu, *supra* note 90, at 548–50.

104. *See* U.C.C. § 9-102(a)(29).

105. *Id.*

106. *See* Holcomb, *supra* note 99, at 61.

107. Tu, *supra* note 90, at 549.

108. Tu, *supra* note 90, at 549.

109. *See* Holcomb, *supra* note 99, at 62 (citation omitted) (“‘[D]eposit account,’ cannot be the definition [for virtual currencies] for one small reason—the definition of ‘deposit account’ has limiting language to the effect that deposit accounts are ‘maintained with a bank.’ From what we have learned about [virtual currency] thus far, that is simply not the case. Many [virtual currency] wallets are either held by the individuals themselves or they are maintained by a third party exchange, neither of which constitute a bank.”).

110. Schroeder, *supra* note 48, at 17.

change currently authorized or adopted by a domestic or foreign government.”¹¹¹ While “money” is not limited to legal tender,¹¹² it does not encompass every instrument that has value or stores value.

Several of the most well-known and frequently traded virtual currencies function as a medium of exchange. Like government-issued fiat or specie, virtual currencies can be exchanged for services, property, or investments.¹¹³ In support of claims that virtual currency constitutes a form of “money,” one may contend that market participants commonly refer to virtual currency as “coins,” “tokens,” and “currency”; each a commonly adopted moniker for money.¹¹⁴ Indeed, several state and federal financial market regulators have adopted policies that subject virtual currency transactions to the regulation and taxation schemes applied to cash transactions.¹¹⁵ Although a few governments around the world have signaled a desire to issue a form of virtual currency,¹¹⁶ to date, only a handful of countries have formally issued a type

111. U.C.C. § 1-201(b)(24).

112. *Id.* cmt. 24 (“The narrow view that money is limited to legal tender is repeated.”).

113. Holcomb, *supra* note 99, at 61.

114. *See* Schroeder, *supra* note 48, at 14.

115. Schroeder, *supra* note 48, at 14 (“Because its proponents refer to bitcoin as a form of digital currency, and because it is correctly treated as equivalent to money under the reporting requirements of the Bank Secrecy Act, it is tempting to try to argue that one should be able to find a way to fit it into the U.C.C.’s defined word ‘money.’”). The detailed requirements of the Bank Secrecy Act are outside the scope of this Article.

116. *See, e.g.*, Ralph Atkins & Laura Noonan, *Central Banks Should Embrace Digital Currencies*, Axel Weber Says, FIN. TIMES (Nov. 13, 2017), <https://www.ft.com/content/5019fc52-c845-11e7-ab18-7a9fb7d6163e> (“In China, the central bank has said it will develop a digital currency using the blockchain technology behind bitcoin. In Europe, Sweden’s Riksbank published a report in September suggesting there were few obstacles to issuing e-krona. But other central banks have been much more cautious . . . [For example,] the Swiss National Bank is not convinced of the need for central bank e-currencies.”); *see also* Gertrude Chavez-Dreyfuss, *Marshall Islands to Issue Own Sovereign Cryptocurrency*, REUTERS (Feb. 28, 2018, 12:38 PM), <https://www.reuters.com/article/us-crypto-currencies-marshall-islands/marshall-islands-to-issue-own-sovereign-cryptocurrency-idUSKCN1GC2UD> (“The Marshall Islands will issue its own cryptocurrency that will be circulated as legal tender along with the U.S. dollar, according to one of the remote Pacific republic’s top officials. The new currency will be called SOV and its legal tender status has been approved by the country’s parliament[.] . . . Plans for possible sovereign cryptocurrencies have gained momentum in recent months, as digital tokens launched by private companies have jumped in value. Several governments, including China, Estonia, and Iran, have discussed plans for their own digital currency. Venezuela, meanwhile, has gone ahead with a new digital token called the petro, backed by oil.”); *see also* Hilary Hosia & Nick Perry, *This is the First Country to Adopt a*

of virtual currency and these offerings raise as many questions as they resolve.¹¹⁷ Virtual currencies are not generally issued, authorized, or adopted by governments.¹¹⁸

The design attributes of virtual currencies further undermine arguments that these assets fit within the U.C.C.'s definition of money. Early digital asset architects embraced the blockchain protocol that facilitates the creation of virtual currency as a response to the financial crisis, which began in 2007 with the introduction of the alternative financial market system.¹¹⁹ Self-described “cryptoenthusiasts” announced their goals to displace government-issued fiat with an alternative form of money.¹²⁰

Cryptocurrency as Its Official Currency, TIME (Mar. 5, 2018), <http://time.com/money/5186316/this-is-the-first-country-to-adopt-a-cryptocurrency-as-its-official-currency/> (“The tiny Marshall Islands is creating its own digital currency in order to raise some hard cash to pay bills and boost the economy. The Pacific island nation said it became the first country in the world to recognize a cryptocurrency as its legal tender when it passed a law this past week to create the digital ‘Sovereign,’ or SOV. In the nation of 60,000, the cryptocurrency will have equal status with the U.S. dollar as a form of payment. Venezuela last month became the first country to launch its own cryptocurrency when it launched the virtual Petro, backed by crude oil reserves. The Marshall Islands said the SOV will be different because it will be recognized in law as legal tender, effectively backed by the government.”).

117. See, e.g., Eric Lam, *What the World’s Central Banks Are Saying About Bitcoin*, BLOOMBERG TECH. (Dec. 14, 2017, 8:53 PM), <https://www.bloomberg.com/news/articles/2017-12-15/what-the-world-s-central-banks-are-saying-about-cryptocurrencies> (last updated Apr. 4, 2018) (describing briefly the world’s largest central banks’ views on cryptocurrencies).

118. See *id.*

119. See, e.g., Hughes, *supra* note 11, at 3–4 (citation omitted) (“After 20 years of failed attempts at making a private virtual currency, Bitcoin emerged somewhat inexplicably out of the 2007/08 global banking crisis. The creator(s) of Bitcoin, who is still unknown, was determined to provide a decentralized, private, and secure means of transferring value online without interference by sovereign entities, central banks, or financial intermediaries or any other ‘trusted third party.’”); Jordan Eliseo, *Bitcoin, Dollars, Gold: What Is the Future of Money?*, ABC BULLION (Nov. 2017), at 4, <https://www.abcbullion.com.au/media/pdf/Bitcoin-Dollars-and-Gold-ABC-Bullion.pdf> (stating one “motivation behind the creation of [bitcoin (BTC)] was a likely frustration with the monetary (as well as economic and political) status quo, with the world still in the grip of the Global Financial Crisis (GFC) back in early 2009 when BTC was first released.”).

120. See Stephanie Lo & J. Christina Wang, *Currency Policy Perspectives: Bitcoin as Money?*, 14-4 FED. RES. BANK BOS. 1, 2 (Sept. 4, 2014), <https://www.bostonfed.org/-/media/Documents/Workingpapers/PDF/cpp1404.pdf> (“The ultimate goal of Bitcoin, according to its advocates, is to serve as an alternative to the existing payments system and to enable transactions across national borders

As a result, commentators generally assume that virtual currency is not an asset that satisfies the elements described in the U.C.C.'s definition of "money."¹²¹ Jeanne Schroeder notes that in context, this definition is clearly "intended to cover only hand-to-hand money" (i.e., physical cash) because it explicitly excludes intangible deposit accounts.¹²² "Even though virtual currency is stored in a physical form of sorts, because access is facilitated by tangible goods such as a computer or a smartphone,"¹²³ virtual currency is not a tangible good and not money as defined by the U.C.C.¹²⁴ Thus, virtual currencies do not fit into the U.C.C. definition of "money."

One can imagine that virtual currency may constitute "investment property." Article 9 defines "investment property" as certificated and uncertificated securities, security entitlements, securities accounts, commodity contracts, and commodity accounts.¹²⁵ Further below, we discuss a recent report by the SEC exploring the application of the Securities Act of 1933 and the Securities Act of 1934 to virtual currencies. Assuming that at least some virtual currencies do not qualify as "securities," adopting this blanket approach seems over-inclusive.¹²⁶ While virtual currency may share attributes with commonly referenced classes of securities, such as shares of stocks and bonds, there are coins and tokens that lack important features of financial arrangements that constitute investment property.¹²⁷

Absent new case law or amendments or additions to the U.C.C., virtual currencies would likely be classified as general intangibles, as they do not fit

and currency denominations without the interference of sovereign entities or central banks, and without the alleged exploitation by traditional financial intermediaries such as banks. From the viewpoint of supporters of virtual currencies, national governments often impose undesirable controls, such as restrictions on convertibility, while central banks may facilitate an oversupply of currency, leading to hyperinflation. At the same time, many groups bemoan the exorbitant fees, among other alleged abuses imposed by banks.").

121. See U.C.C. § 1-201(b)(24); Michael R. Gordon et al., *Bitcoin116 to Blockchain: How Laws and Regulations Are Conforming to and Impacting the Use of Virtual Currency*, 20160428P N.Y. CTY. BAR 1, 40 (2016) (citations omitted) ("[W]hether or not a Bitcoin [or other cryptocurrency] is 'money' for other purposes, a Bitcoin does not appear to be 'money' under the U.C.C. Bitcoins are not authorized or adopted by governments. Perhaps a secured creditor could authorize Bitcoin dispositions for ordinary course operations, but it is unclear how a transferee would confirm that all liens that previously attached to the relevant Bitcoins have been released.").

122. Schroeder, *supra* note 48, at 17–18.

123. Tu, *supra* note 90, at 548.

124. See Tu, *supra* note 90, at 547–48.

125. U.C.C. § 9-102(a)(49).

126. See Tu, *supra* note 90, at 549–50.

127. See Tu, *supra* note 90, at 550.

within any of Article 9's enumerated asset categories. As such, these virtual currencies would be subject to the rules applicable to general intangibles with regard to attachment, perfection, priority, and enforcement of security interests in virtual currency assets.

C. The Perfection Problem

Enforceability is a central concern for counterparties that enter into secured lending arrangements, particularly arrangements that lend against virtual currency as collateral. Attachment is required to create an enforceable security interest. To attach an enforceable security interest: (1) a secured creditor must give value; (2) a debtor must have rights to the collateral or the power to give those rights to a creditor; and (3) one of several enumerated conditions in U.C.C. § 9-203(b)(3) must be satisfied.¹²⁸ The conditions in the final element of this standard may be satisfied if a debtor authenticates a security agreement, which must contain a sufficient description of the collateral.¹²⁹ The creditor may also satisfy the third element of attachment by: (1) taking possession of collateral that constitutes goods, instruments, money, negotiable documents, or tangible chattel paper;¹³⁰ (2) taking control over collateral that constitutes deposit accounts, electronic chattel paper, investment property, or letter-of-credit rights;¹³¹ or (3) taking delivery of collateral that constitutes certificated securities.¹³²

Attachment creates an enforceable security interest, but creditors must perfect their security interest in collateral to establish the priority of their claim on the collateral in the event of a debtor's default.¹³³ Perfection—a U.C.C. term of art—refers to the process that puts the world on notice of the individual's security interest in specific collateral.¹³⁴ Perfection is important; the first creditor to properly attach and perfect a security interest has priority over everyone else.¹³⁵

The process of perfecting a security interest in collateral under Article 9 differs based on the kind of collateral guaranteeing repayment in the security agreement.¹³⁶ For tangible collateral such as negotiable documents, goods, instruments, money, and tangible chattel paper, physical possession of the

128. U.C.C. § 9-203(b).

129. *Id.* § 9-203(b)(3)(A).

130. *Id.* § 9-203(b)(3)(B).

131. *Id.* § 9-203(b)(3)(D).

132. *Id.* § 9-203(b)(3)(C).

133. Schroeder, *supra* note 48, at 10.

134. *See* Schroeder, *supra* note 48, at 35.

135. *See* U.C.C. § 9-322(a).

136. Schroeder, *supra* note 48, at 10.

collateral is an effective method of perfecting a security interest.¹³⁷ For deposit accounts, electronic chattel paper, investment property, and letter-of-credit rights, obtaining control of the collateral is an effective method of perfecting a security interest.¹³⁸ For certificated securities, perfection can be achieved by taking delivery of the certificated security, meaning the purchaser or person acting on behalf of the purchaser acquires possession of the security certificate.¹³⁹ Thus, for these specific types of collateral, possession, control, and delivery can serve as to both attach and perfect a security interest in those types of collateral.

The default and most common method of perfecting a security interest under Article 9 for other types of collateral is by filing a UCC-1 financing statement with the appropriate state office.¹⁴⁰ The financing statement need only contain the creditor's name, the debtor's name, and a brief description of the collateral.¹⁴¹ Thus, one must file a UCC-1 financing statement with a sufficient description of the collateral (e.g., debtor's virtual currency assets) to perfect a security interest in general intangibles.¹⁴² The collateral should be adequately described in the financing statement, though the description can be as vague as "all assets."¹⁴³

Upon perfection, a security interest remains attached to and perfected in the identified collateral. If a secured creditor successfully attaches and perfects a security interest in collateral, the attachment and perfection apply to any disposition of the collateral, including proceeds from the sale of the collateral.¹⁴⁴ Under U.C.C. § 9-315(a)(1), a security interest in collateral continues notwithstanding sale, lease, license, exchange, or other disposition unless the secured party authorizes the disposition free of the security interest.¹⁴⁵ Apart from selling, licensing, or otherwise disposing of the collateral, a security interest in general intangibles continues unless the secured party con-

137. U.C.C. § 9-313(a).

138. *Id.*; George K. Fogg, *The U.C.C. and Bitcoins—Solution to Existing Fatal Flaw*, 104 BBR 741, 742 (Apr. 14, 2015).

139. U.C.C. §§ 9-313(e), 8-301(a).

140. *Id.* § 9-310(a) ("Except as otherwise provided . . . a financing statement must be filed to perfect all security interests and agricultural liens"); *see id.* § 9-501(a).

141. *Id.* § 9-502(a).

142. *See id.* § 9-310(a)–(b); *see also* Tu, *supra* note 90, at 552 ("As applied to virtual currency, there is only one viable method of perfection: the filing of a financing statement that appropriately describes the collateral. Because virtual currency constitutes a general intangible, the special rules allowing for perfection by possession or control are inapplicable.").

143. U.C.C. § 9-504.

144. *Id.* §§ 9-308(c), 9-315(a)–(c).

145. *Id.* § 9-315(a).

sents to the transfer free of its security interest, the obligations secured by the security interest have been satisfied, or the security interest has otherwise terminated.¹⁴⁶

Several challenges arise in the context of perfecting an attached, enforceable security interest in virtual currency. As discussed, virtual currencies are intangible digital assets with no physical attributes.¹⁴⁷ Consequently, perfecting a security interest in virtual currency collateral by possession or control may not be possible. One could argue that it is possible to take possession or control of the digital wallet that contains the virtual currency. But this argument is tenuous; custody of virtual currencies rests in control of the private/public cryptographic key.¹⁴⁸ The security measures developed to protect digital wallets require one party to control access to the assets. A virtual currency holder accesses her digital wallet by employing a private key and a public key.¹⁴⁹ These keys limit access to the virtual currency holder.

The economic realities of virtual currencies and the operational limits of the U.C.C. have prompted many scholars and commentators to conclude that virtual currencies are general intangibles.¹⁵⁰ If we assume that virtual currencies are general intangibles, perfection of virtual currency collateral could only be accomplished by filing an effective UCC-1 financing statement. Even if one concludes that virtual currency is a general intangible, the mechanics of digital wallets and the public/private encryption keys that protect virtual currencies challenge secured lenders' ability to employ conventional attachment and perfection processes to maintain a security interest in this asset class.

In the context of virtual currencies, the operational provisions governing the ongoing security interest challenge the limits of the formalism of the U.C.C. If virtual currency is a general intangible and perfection is accomplished by filing a UCC-1 financing statement, a continuing security interest should exist. If a debtor transfers the virtual currency from one wallet to another, however, what remedy exists for the secured creditor who has a valid, perfected security interest in the virtual currency in the wallet? Due to the operational mechanics of the blockchain on which the transaction occurred, the transfer would be irreversible and facilitated by the anonymous body of participants on the blockchain.¹⁵¹

146. *See id.*; Schroeder, *supra* note 48, at 10.

147. *See supra* text accompanying notes 95–97.

148. Tu, *supra* note 90, at 565–66.

149. Schroeder, *supra* note 48, at 13.

150. *See supra* text accompanying notes 121–24.

151. Gordon et al., *supra* note 121, 40–41 (“First, even if a secured creditor has a valid, perfected security interest in Bitcoins, a separate concern is whether the secured creditor would have an effective remedy to realize upon its collateral after a default. Users typically hold Bitcoins in a digital ‘wallet’ and while Bitcoin transactions are recorded on a decentralized public ledger (the

As a critical commentator notes the operational mechanics of storing and transferring virtual currency facilitate asset transfers that make it difficult, if not impossible, for the lender to identify or locate the assets.¹⁵² Thus, even when a borrower grants a lender a first-priority perfected security interest in the virtual currency, the lender may face several difficulties in using the public key that is an immutable design factor of blockchain technology to identify purchasers or transferees. Even if a lender can identify the purchasers or transferees of assets, the global nature of the virtual currency market may make it difficult for lenders to enforce a first-priority perfected security interest.¹⁵³

Does a person or entity who accepts virtual currency that has been pledged as collateral in a secured lending arrangement take that currency free of the lender's security interest in that currency?¹⁵⁴ These are some of the many issues and challenges raised with attempting to use the current regulatory framework under U.C.C. Article 9 to the ever-evolving new asset class of virtual currency collateral.

IV. THE PATH TO MORE PERFECT REGULATION

Commentators have outlined several potential alternative approaches for integrating virtual currencies into the existing secured transaction framework.¹⁵⁵ Some scholars propose amending the existing defined terms or operating provisions of the U.C.C. to expand the scope of the framework and

'blockchain'), the users are anonymous and Bitcoin transactions are irreversible. Thus, a secured creditor would have difficulty learning that Bitcoin collateral had been transferred or identifying the transferee. Consequently, upon a default, the secured creditor would have no rapid mechanism to prevent the debtor from transferring Bitcoins (unlike when a secured creditor has a control agreement with a bank and can sweep an account). Second, there is a question as to whether Bitcoins can be described with sufficient specificity to create and perfect a security interest. For example, although each Bitcoin is unique, Bitcoin exchanges might place all Bitcoins into a single pot and Bitcoin wallets present an anonymity issue Due to challenges in obtaining a perfected security interest and price volatility, a lender may prefer covenants and representations and warranties precluding Bitcoin ownership or utilization by the applicable borrower.”).

152. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 11).

153. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 11–12) (“even if the lender can identify the purchaser, location in a remote jurisdiction might make enforcement impractical—either because the jurisdiction declines to recognize the priority of the lender’s interest or because of the increased costs of litigation in a forum remote from the lender’s expectations.”).

154. *See* Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 11–12) (citations omitted).

155. Schroeder, *supra* note 48, at 10.

encompass these innovative technologies.¹⁵⁶ Others posit that re-envisioning the regulatory system or more substantive changes are required to accommodate this nascent class of assets.¹⁵⁷

A. Expanding Existing Definitions

Part II examined whether virtual currency might be understood as an existing category of collateral: an enumerated tangible or intangible asset or a general intangible that does not fall within one of the enumerated excluded assets. The discussion revealed many similarities between virtual currencies and existing asset classes.¹⁵⁸ According to several commentators, expanding the definition of certain excluded assets in the definition of general intangibles creates a pathway to bring this virtual currency within the existing regulatory framework.

Some commentators argue excluded assets offer a useful point of departure for incorporating virtual currencies into the existing regulatory framework.¹⁵⁹ Many financial products and platforms commonly associated with investing appear among the list of excluded assets.¹⁶⁰ For example, some scholars have suggested that by expanding the definitions of “deposit accounts,” “money,” and “investment property,” virtual currencies may be brought into the regulatory fold.

Article 9 defines deposit accounts as custodial arrangements maintained by a bank.¹⁶¹ Expanding the definition of deposit accounts to expressly include virtual currency wallets superficially addresses the challenge of incorporating this new class of assets into the regulatory framework. This approach, however, prompts significant questions.

Financial intermediaries may offer virtual currency wallets, serve as virtual currency custodians, or manage platforms for virtual currency exchange. These intermediaries may create, issue, or facilitate the trading of virtual currencies. To date, however, not all virtual currency intermediaries are regulated financial institutions. Banking entities that provide custodial services are heavily regulated and highly transparent. To limit these obligations and to provide an obscuring shroud for virtual currency transactions, many non-banking financial intermediaries offer digital wallets or operate virtual currency platforms.

156. *Id.* at 43–46.

157. *See* Tu & Meredith, *supra* note 58, at 276–77; Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 4–7). *Compare* Schroeder, *supra* note 48, at 276–77, with Hughes & Middlebrook, *supra* note 48, at 499.

158. Tu, *supra* note 90, at 517.

159. *Id.* at 514.

160. *See supra* Part II.

161. U.C.C. § 9-102(a)(29).

Expanding the existing definition of “deposit accounts” to include virtual wallets and platforms presumably subjects this new asset class to the existing regulatory design applied to the intermediaries who operate in these more highly-regulated areas of financial markets. Adopting a framework that is slightly less rigorous, such as the regulatory approach applied to securities, commodities, or derivative exchanges, has similarly significant consequences. Some market participants argue that such a regulatory approach will stymie the development of emerging virtual currency markets.¹⁶²

Article 1 defines “money” as a “medium of exchange currently authorized or adopted by a domestic or foreign government.”¹⁶³ According to Bob Lawless and Lynn LoPucki, a domestic or foreign government’s decision to adopt virtual currency would integrate this new asset class into the definition of “money,” bringing virtual currency within the ambit of Article 9.¹⁶⁴ This approach has several limitations.

First, the conclusion that virtual currency is “money” may offer a forward-looking solution, but a significant number of existing wallets are impacted by liens.¹⁶⁵ Second, even if a government authorized or adopted virtual currency, other challenges may persist. As one scholar explained, the U.C.C. definition of money does not encompass all forms of currency.¹⁶⁶ Instead, it is limited to tangible fiat used in hand-to-hand transactions.¹⁶⁷ Finally, as noted in Part III, the established operational approach for perfecting a security interest in money—possession—is not achievable with virtual currency.¹⁶⁸ Based on its intentional digital design, physical possession of the code that represents virtual currency ranges from difficult (if the virtual currency is stored in cold wallets) to nearly impossible (if the virtual currency is stored in hot wallets).¹⁶⁹

162. Hughes & Middlebrook, *supra* note 48, at 499–500.

163. U.C.C. § 1-201(b)(24).

164. Lawless, *supra* note 24.

165. *Id.*

166. Schroeder, *supra* note 48, at 20–22 (“The U.C.C.’s idiosyncratic limitation of money to hand-to-hand currency can be seen by the fact that it does not include in the definition the most common form in which money is held within this country—that is, deposit accounts Probably the most obvious (albeit, once again, indirect) indication that the defined term ‘money’ as used in the U.C.C. is intended to cover only hand-to-hand money is the fact that Article 9 distinguishes ‘money’ from ‘deposit accounts.’”).

167. *Id.* at 20.

168. *Id.*

169. *See id.* at 23–24 (“The U.C.C. uses the word ‘possession’ over 100 times. In only two or three places is this modified by the word ‘physical.’ Reading the U.C.C. as a whole, and understanding the customs and practices it enshrines, the term ‘possession’ is meant as physical custody of a tangible thing.”).

Given the similarities between virtual currencies and investment properties, some suggested the definition of “investment property” could be expanded to include virtual currencies as collateral.¹⁷⁰ Article 9 defines investment property as “a security, whether certificated or uncertificated, security entitlement, securities account, commodity contract, or commodity account.”¹⁷¹

Jeanne Schroeder argues that understanding virtual currencies as “uncertificated securities” (a type of investment property) governed by Article 8 may overcome a number of the challenges with making virtual currencies “deposit accounts” or “money” under Article 9.¹⁷² According to Professor Schroeder, digital wallets and exchange platforms facilitate investment securities transactions which makes the virtual currency stored in wallets and traded on platforms “financial assets.”¹⁷³ Article 8 of the U.C.C. regulates transactions involving such financial assets or “uncertificated securities.”¹⁷⁴

170. *See, e.g.*, Fogg, *supra* note 138, at 4 (arguing that “changing the Article 9 collateral type of bitcoins from general intangibles to investment property” will eliminate the flaws in Article 9 as it relates to virtual currency).

171. U.C.C. § 9-102(a)(49).

172. Schroeder, *supra* note 48, at 69 (stating that U.C.C. § 8-102(a)(18) “defines an uncertificated security as ‘a security that is not represented by a certificate’” and U.C.C. § 8-102(a)(15) defines a “security” as “an obligation of an issuer or a share, participation, or other interest in an issuer, or a share, participation, or other interest in an issue or in property or an enterprise of an issuer: (i) which is represented by a security in bearer or registered form, or the transfer of which may be registered upon books maintained for that purpose by or on behalf of the issuer; (ii) which is one of a class or series or by its terms is divisible into a class or series of shares, participations, interests, or obligations; and (iii) which: (A) is, or is of a type, dealt in or traded on securities exchanges or securities markets: or (B) is a medium for investment and by its terms expressly provides that it is a security governed by this Article.”); Schroeder, *supra* note 48, at 69 (A classic example of a security is “common stock—the residual equity interest in a corporation.”); Schroeder, *supra* note 48, at 69–70 (Thus, if common stock were issued on a blockchain, it would be an uncertificated security.); Schroeder, *supra* note 48, at 2 (maintaining that Article 8 could also “provide a legal regime for another contemplated use for the blockchain—namely as a readily searchable means of recording the ownership and transfer of property generally.”); *see generally* Reyes, *supra* note 5 (discussing the advantages and potential uses for blockchain or distributed ledger technology); Schroeder, *supra* note 48, at 72. Additionally, Schroeder notes that unlike the U.C.C.’s use of the term “possession” with regards to money, the U.C.C. uses the term “delivery” with regard to securities, which means that transfer of uncertificated securities “is not implicitly limited to a transfer of physical custody, but is a term of art for the act(s) that is necessary to complete the transfer of the security.” *Id.*

173. Schroeder, *supra* note 48, at 46, 59–60.

174. Schroeder, *supra* note 48, at 59.

Re-envisioning Article 8 overcomes many concerns regarding the application of the U.C.C. to virtual currency. Under to this approach, virtual currencies may be understood as “financial assets” because this new asset class represents “interest . . . in property . . . which is, or is of a type, dealt in or traded on financial markets, or which is recognized in any area in which it is issued or dealt in as a medium for investment.”¹⁷⁵ While this approach may eliminate difficulties that arise when satisfying the demanding and detailed path toward perfection, recognizing virtual currency as uncertificated securities engenders a new set of problems.

Article 8 defines “financial assets” as “assets held by a ‘securities intermediary’ that maintains ‘securities accounts’ for others (‘accountholders’) in the ordinary course of business, *provided* the intermediary agrees to treat the assets as financial assets under Article 8.”¹⁷⁶ Adopting this approach, virtual currencies would be “financial assets” and a virtual currency wallet would be comparable to a “securities account,” which the U.C.C. defines as “an account to which a financial asset is or may be credited in accordance with an agreement under which the person maintaining the account undertakes to treat the person for whom the account is maintained as entitled to exercise the rights that comprise the financial asset.”¹⁷⁷

Some might also attempt to argue that the financial intermediaries that facilitate the transactions should be regulated as “brokers.”¹⁷⁸ If securities market regulators concluded that all virtual currencies are securities, then navigating the quagmire of securities regulations may offer a logical approach. Without such a conclusion, this approach introduces significant hurdles and it may create more questions than it resolves. As discussed above, virtual currencies are diverse, and each coin, alt-coin, or token varies significantly from others.

Some virtual currencies offer the promise of appreciation or an investment return.¹⁷⁹ Others function quite differently.¹⁸⁰ There is no single, uni-

175. See U.C.C. § 8-102(a)(9)(ii); see also Fogg, *supra* note 138, at 3–4 (describing the various benefits of having a U.C.C. Article 8 structure for cryptocurrencies).

176. U.C.C. §§ 8-102(a)(14), 8-501(a).

177. *Id.* § 8-501(a); Holcomb, *supra* note 99, at 62.

178. See Clayton, *supra* note 59.

179. See Alex Lielacher, *Top 5 Biggest ICOs (by Return on Investment)*, BITCOIN MKT. J. (Aug. 6, 2018, 8:00 AM), <https://www.bitcoinmarketjournal.com/biggest-icos-roi/> (providing that Bitcoin and Ethereum are two virtual currencies that have shown promise of appreciation and return on investment, and describing Ethereum as one of the top five best-performing initial coin offering tokens in terms of return on investment); Jemima Kelly, *\$10,000 in Sight For Bitcoin As It Rockets to New Record High*, REUTERS (Nov. 27, 2017, 2:51 AM), <https://www.reuters.com/article/us-global-markets-bitcoin/10000-in-sight-for-bitcoin-as-it-rockets-to-new-record-high-idUSKBN1DR0VP> (noting that both Bitcoin and Ethereum have seen “stratospheric gains” in the last few years); Rituparna

form class of virtual currency. Each virtual currency has unique properties. Each currency must be evaluated on its merits and based on its function and utility. Consequently, there is no single classification for all virtual currencies and no basis for concluding that the entire universe of virtual currencies might be described as “investment property.”¹⁸¹ More importantly, treating virtual currency as uncertificated securities threatens one of the most prized attributes of virtual currency: market participants’ ability to transfer funds directly between persons without any third-party intermediary.¹⁸²

Ghosh et al., *Bitcoin or Ethereum? The Million Dollar Question*, THE ECONOMIST (2016), https://www.economist.com/sites/default/files/carey_business_school_submission.pdf (using a risk assessment model to conclude that a portfolio consisting of equal parts Ether and Bitcoin would result in “an expected return of 115.5 percent over the next 5 years” when “[t]aking into consideration cryptocurrency environment and potential of both cryptocurrencies”).

180. See, e.g., Arics Technology, *Introduction to Cryptocurrency — Different Types of Cryptocurrency*, MEDIUM (Jan. 1, 2018), <https://medium.com/@aricstechnology7/introduction-to-cryptocurrency-different-types-of-cryptocurrency-629733514de6> (describing several types of virtual currencies and their primary uses including Ripple, which “allows organizations such as banks and companies to securely and instantly send money at almost no cost”; Litecoin, which “focuses on using the latest in technology to improve performance and user experience”; and NEO, which allows “developers to build their own cryptocurrency”); *Different Types of Cryptocurrency*, EMPIRICA, <http://empirica.io/blog/different-types-cryptocurrency/> (last visited Feb. 5, 2019); see also *supra* text accompanying note 108.
181. See U.C.C. § 9-102(a)(49) (defining “investment property” as “a security, whether certificated or uncertificated, security entitlement, securities account, commodity contract, or commodity account.”); see also William Hinman, *Digital Asset Transactions: When Howey Met Gary (Plastic)*, (June 14, 2018), <https://www.sec.gov/news/speech/speech-hinman-061418> (discussing the difficulties in determining whether virtual currencies can be classified as securities, and stating that while ICOs are considered securities, “the Ethereum network and its decentralized structure, current offers and sales of Ether are not securities transactions.”).
182. See Schroeder, *supra* note 48, at 18 (suggesting that for cryptocurrencies to “really to take off as a payment system, let alone a currency, it may be necessary to amend the U.C.C. to add a super-negotiability rule for cryptocurrency.”); see also Bierer, *supra* note 46, at 88–89 (proposing how U.C.C. “Article 9 could be amended or clarified in order to provide a clearer legal basis for [using cryptocurrency as collateral],” including proposals to treat cryptocurrency as traditional currency under Article 9, classify cryptocurrency as an investment property under Article 9, or classify cryptocurrency as a security under Article 8 or the Securities Act of 1933).

Another popular proposal suggests recognizing virtual currency as a payment system.¹⁸³ “Over the past few years, Bitcoin, Litecoin, and Dash have begun to compete with PayPal, Western Union, and bank wires as a global payment system.”¹⁸⁴ For instance, the Bitcoin network permits users to send virtual currency anywhere in the world for approximately forty cents per transaction.¹⁸⁵ Virtual currency users conduct approximately 360,000 transactions per day on the Bitcoin network.¹⁸⁶ U.C.C. Article 4A describes a regulatory framework for payment systems that facilitate transactions between intermediaries (banks) and their customers.¹⁸⁷ According to recent proposals, the U.C.C. drafters should expand Article 4A to provide a similar regulatory framework for transactions involving virtual currencies.¹⁸⁸

Article 4A provides the basis for state laws that regulate fund transfers “in which commercial banks act for the originator and beneficiary and also serve as intermediaries in the series of transfers needed to push funds into the beneficiary’s account.”¹⁸⁹ Article 4A sets forth specific requirements for issuing and accepting payment orders, including: when and how acceptance can occur; how one can reject, cancel, or amend a payment order; how to handle erroneous or unauthorized payment orders; when certain payment orders are unenforceable; and what information can be relied on in processing payment orders.¹⁹⁰

Scholars Sarah Hughes and Stephen Middlebrook propose that a comprehensive framework for regulating virtual currency as a payment system could be modeled off of, or added as a subpart to, U.C.C. Article 4A.¹⁹¹ This is because Article 4A “offers the closest analogy to rules for multi-party

183. See U.C.C. § 4A-104(a); Hughes & Middlebrook, *supra* note 48, at 549–59; Stephen M. McJohn & Ian McJohn, *The Commercial Law of Bitcoin and Blockchain Transactions*, U.C.C. L.J. (forthcoming Nov. 2016); see RONALD J. MANN, *PAYMENT SYSTEMS: THE ESSENTIALS* (2013) (providing a general background on payment systems); see also Ronald J. Mann, *Regulating Internet Payment Intermediaries*, 82 TEX. L. REV. 681 (2004).

184. See Hughes, *supra* note 11, at 5; see also Gur Huberman et al., *The Economics of the Bitcoin Payment System*, VOXEU (Dec. 16, 2017), <https://voxeu.org/article/economics-bitcoin-payment-system> (“The blockchain design enables Bitcoin and other cryptocurrencies to function similarly to conventional electronic payment systems such as PayPal, Venmo, FedWire, Swift, and Visa The innovation in Bitcoin’s blockchain design is its ability to operate an electronic payment system without a governing organization.”).

185. Hughes, *supra* note 11, at 5.

186. Hughes, *supra* note 11, at 5.

187. McJohn & McJohn, *supra* note 183, at 16–18.

188. McJohn & McJohn, *supra* note 183, at 16–18.

189. Hughes & Middlebrook, *supra* note 48, at 550.

190. See, e.g., U.C.C. §§ 4A-201–4A-212.

191. Hughes & Middlebrook, *supra* note 48, at 558–59.

transfers of credits in the United States.”¹⁹² They state that such a framework should address the diversity of issues that arise in virtual currency transactions.¹⁹³ Specifically, Hughes and Middlebrook contend that such regulations should require transparency with: security procedures; subrogation rights requirements for how virtual currency intermediaries execute payment instructions and how to treat cancellations or amendments to those instructions; duties of virtual currency intermediaries; provisions for how to handle lost virtual currencies, erroneous, counterfeit, or unauthorized information or instructions; and how to deduct any applicable fees.¹⁹⁴ Hughes and Middlebrook argue that although much of Article 4A’s current terminology could be applied to virtual currency payments laws, there is a risk of confusion for using the same terms for cash and credit payment systems as for virtual currency payment systems.¹⁹⁵ Thus, U.C.C. drafters should use new language for terms related to virtual currency payment systems.¹⁹⁶ For purposes of their article, Hughes and Middlebrook suggest using the term “initiator” for the person issuing instructions for payment of goods or services to a virtual currency wallet, exchange, or other intermediary or converting virtual currency to fiat; the term “recipient” for the person receiving payment for goods or services; and the terms “wallet operator” and “exchange operator” for people or entities who operate public virtual currency wallets or virtual currency exchanges.¹⁹⁷

Hughes and Middlebrook also posit that regulation of virtual payment systems based on Article 4A should address virtual currency payments (transaction-execution rules) as well as key behavioral norms.¹⁹⁸ It should also address definitions for market participants (e.g., exchange operator and wallet operator) and their responsibilities, including instructions for market participants as well as virtual currency payment instructions, apportioning risks, any potential fees and fee disclosure requirements, and risk calculation, and limitations on liability.¹⁹⁹ They further suggest that “[l]ike section 4A-

192. Hughes & Middlebrook, *supra* note 48, at 558–59.

193. Hughes & Middlebrook, *supra* note 48, at 550 (providing that such issues include: “defining the framework’s subject matter and covered participants, giving cryptocurrency payment instructions to their respective intermediaries, executing senders’ cryptocurrency payments instructions, fixing the Timing and Effect of Payments; Obligations to the Initiator of the Payment Instruction; Obligations of Intermediaries to Complete Transaction; Discharge of Underlying Obligations, and, addressing miscellaneous Issues that include provisions related to creditor service of process.”).

194. Hughes & Middlebrook, *supra* note 48, at 552–54.

195. Hughes & Middlebrook, *supra* note 48, at 551.

196. Hughes & Middlebrook, *supra* note 48, at 551.

197. Hughes & Middlebrook, *supra* note 48, at 551.

198. Hughes & Middlebrook, *supra* note 48, at 554–55.

199. Hughes & Middlebrook, *supra* note 48, at 551–54.

406(d), the rules for [virtual currency] intermediaries should provide that no agreement except one made by the initiator and recipient of the crypto-payment should affect the rights and obligations to the [virtual currency] payment instruction.”²⁰⁰ Hughes and Middlebrook state that such rules could address other issues such as how to handle when “creditor process is served on the recipient’s agent” and notices of receipt to initiators and recipients of virtual currency payments.²⁰¹

Simply amending defined terms may be insufficient, however, to address the comprehensive challenges raised by transactions secured by virtual currency.²⁰² Moreover, amendments to the U.C.C. require review, debate, recommendation, and a formal resolution by the U.C.C. drafters. Consequently, such an approach would be subject to anticipatable delays and the influence of interested parties.²⁰³ Amending certain operating provisions of the U.C.C. may offer a more effective approach to integrating virtual currency into the secured transactions regulatory framework.

B. Integrating A New Class of Collateral

Rather than adding “virtual currency” to the definition of existing defined terms in U.C.C. Article 9, Kevin Tu proposes that drafters make virtual currency its own distinct type of collateral and revise the U.C.C. to supplement the framework for this new class.²⁰⁴ Tu contends that “Article 9 can only develop and implement rules specific to virtual currency collateral if it exists separately from other types of general intangibles.”²⁰⁵ The best way to

200. Hughes & Middlebrook, *supra* note 48, at 554 (citing U.C.C. § 4A-406(d)).

201. Hughes & Middlebrook, *supra* note 48, at 556.

202. U.C.C. § 9-322(a); Schroeder, *supra* note 48, at 15–16 (stating that U.C.C. § 9-332(a) provides, with respect to money, that: “A transferee of money takes the money free of a security interest unless the transferee acts in collusion with the debtor in violating the rights of the secured party.” § 9-322(a). Virtual currencies could only truly function as money under the U.C.C. if they are governed by a rule like § 9-332(a) because one of the trademarks of money is that if you take cash dollars as payment, “you can always be sure that no previous claimant could try to replevy it from you.”).

203. See Pamela J. Martinson & Christopher P. Masterson, *Bitcoin and the Secured Lender*, 33 BANKING & FIN. SERVS. POL’Y REP. 13, 19 (2014).

204. See Tu, *supra* note 90, at 561 (stating “it may not be appropriate to relegate virtual currency to the residual category of general intangibles. Article 9 plainly rejects a one-size-fits-all approach to secured transactions. Indeed, it recognizes a long list of distinct collateral types that exist separately from the ‘general intangibles’ catchall, allowing for the operative provisions of Article 9 to be tailored in ways that make sense for each type of collateral. This is evidenced by the provisions of Article 9 that only apply to certain types of collateral.”); see also Martinson & Masterson, *supra* note 204.

205. Tu, *supra* note 90, at 561.

accomplish this goal, according to Tu, would be to create a newly defined type of collateral for virtual currency.²⁰⁶

Creating a new category of collateral solves the problem of perfecting a security interest in an asset without relying on possession or physical custody to establish attachment, perfection, and priority. As discussed in Part II, possession and control are two well-established methods of perfection under Article 9 to gain priority over subsequent creditors in the same collateral.²⁰⁷ Depending on the type of collateral involved, a secured creditor can establish control under Article 9 in several ways: (1) a creditor who is a bank has control of debtor deposit accounts maintained there; (2) a creditor can enter a Deposit Account Control Agreement that requires a bank to comply with the creditor's instructions regarding disposing funds in the deposit account without the debtor's further consent; and (3) the creditor has or obtains the "rights to access or dispose of funds in a deposit account to the exclusion of the debtor."²⁰⁸ "By obtaining control in one of these ways, the secured party effectively obtains the rights of the debtor as the owner of the collateral."²⁰⁹

As virtual currency is a digital asset, physical possession of the individual coins is not possible.²¹⁰ Tu argues that a creditor may attach a security interest in virtual currency with a security agreement.²¹¹ A secured party could establish control of a debtor's virtual currency collateral by "taking delivery or physical possession of the debtor's [virtual currency] wallet"; "having the debtor transfer the virtual currency to the secured party's wallet so that only someone with the secured party's digital key could access the collateral"; or "us[ing] an online or mobile wallet operated by a third-party service provider [such as Coinbase or other virtual currency exchange] to manage their virtual currency" where the creditor obtains "an authenticated agreement obligating the third party to comply with the secured party's instructions regarding the virtual currency without further consent from the debtor."²¹² Thus, Tu maintains that "[v]irtual currency resembles the types of collateral that can be controlled and appears capable of control in much the same way" and that "extending control to virtual currency makes sense as it maintains consistency of treatment across similar collateral types."²¹³

Tu further posits that adapting the existing Article 9 framework to virtual currency "minimizes potential uncertainty" because "creditors are familiar with the concept of control, so adapting to control over a different type of

206. Tu, *supra* note 90, at 561.

207. See U.C.C. § 9-203(b).

208. Tu, *supra* note 90, at 563.

209. Tu, *supra* note 90, 564.

210. Tu, *supra* note 90, at 565.

211. Tu, *supra* note 90, at 568.

212. Tu, *supra* note 90, at 565–67.

213. Tu, *supra* note 90, at 568.

collateral should cause minimal disruption.”²¹⁴ Tu argues that control could be a sufficient method for perfecting a security interest in virtual currency collateral and could also be added to Article 9 as an alternate method of attachment for virtual currency collateral.²¹⁵ Tu contends that “extending the concept of control to virtual currency results in a more effective and efficient process for obtaining enforceable rights in virtual currency collateral.”²¹⁶ This is because “[c]ontrol gives secured creditors a clear and unambiguous way to bypass the uncertainties of determining priority.”²¹⁷ “Those who wish to establish priority over virtual collateral must simply: (1) request that the virtual currency be transferred to them, and (2) determine whether the third party that maintains the debtor’s virtual currency has executed a control agreement with the debtor and any other person.”²¹⁸

Moreover, secured creditors who attached and perfected their interest in virtual currency collateral would have priority over subsequent creditors who obtain a security interest in the same collateral.²¹⁹ Specifically, Tu proposes a new section addressing priority among conflicting security interests in virtual currency could be added to Article 9 Section 9-327 to state the following:

(1) a secured creditor with control of virtual currency collateral has priority over any conflicting security interest by a person without control; (2) priority between conflicting security interests perfected by control rank in order of when the secured party obtained control; and (3) a method for determining the relative priority between different methods of controlling virtual currency (for example, a secured creditor that obtains control by transfer of the virtual currency trumps a secured creditor who obtains control via a tri-party agreement).²²⁰

214. Tu, *supra* note 90, at 568.

215. Tu, *supra* note 90, at 568–71 (“To achieve consistency as to attachment, virtual currency should be added to the list of collateral types in [U.C.C. Article 9] § 9-203(b)(3)(D), and a new section should be added to demonstrate how a secured party establishes control of virtual currency. These modifications would allow for the attachment of a security interest in virtual currency to be achieved in the same way as similarly situated intangible collateral: either by an authenticated security agreement that describes the collateral or by control pursuant to the debtor’s security agreement.”).

216. Tu, *supra* note 90, at 578.

217. Tu, *supra* note 90, at 578.

218. Tu, *supra* note 90, at 578.

219. Tu, *supra* note 90, at 569, 571–72.

220. Tu, *supra* note 90, at 571–72 (“By adopting this proposed new section, the priority rules governing virtual currency would effectively mirror Article 9’s treatment of similar categories of intangible collateral, and the default priority rule in Section 9-322 would be supplemented by new priority rules specific to virtual currency.”).

Tu contends that defining virtual currency as its own distinct collateral type is preferable to the alternative of expanding the definitions of existing defined terms.²²¹ This is because adding a new category of collateral “provides the same substantive benefits that would exist by rolling virtual currency into the definition of investment property” or “money.”²²² Tu also argues this provides for “a broader framework that clearly encompasses different uses of virtual currency (not just investment related) and new types of virtual currency that may arise in the future.”²²³

As noted above, the lack of universally employed terminology creates significant confusion in digital markets because critical terms may be erroneously used interchangeably.²²⁴ Current efforts to draft regulation must account for the rapid evolution of innovative technologies. In fairness, virtual currencies share a variety of attributes with existing financial products. Virtual currencies are, however, a distinct asset class and distinguishable from conventional and even exotic financial products in many important respects. In part, early regulatory intervention aimed at applying existing regulation to virtual currencies stems from a failure to understand the technological and operational complexities of virtual currencies.

C. Perfecting Virtual Currency Collateral Through Blockchain

Ronald Mann proposes two possible solutions for secured creditors who want to perfect security interests in virtual currency collateral.²²⁵ As indicated in Part III, the perfection problem may render collateral worthless if the lender is unable to enforce her claims that she has a perfected security interest.²²⁶ Specifically, Mann argues that secured lenders may be unable to identify the entity or individual who holds the public key used to identify the purchaser of that collateral currency.²²⁷ But “even if the lender can identify the purchaser, location in a remote jurisdiction might make enforcement impractical.”²²⁸ Mann contends that one feasible, though imperfect, solution to this problem is the “quasi-control” method for perfecting security interests in virtual currency.²²⁹

221. Tu, *supra* note 90, at 562.

222. Tu, *supra* note 90, at 562.

223. Tu, *supra* note 90, at 561–62. As an alternate to the above solution, Tu states the definitions of “investment property” and “money” could be amended and expanded to explicitly include virtual currency, though this solution would not be as effective as having virtual currency be its own distinct type of collateral.

224. Johnson, *supra* note 75.

225. See, e.g., Mann, *Reliable Perfection*, *supra* note 47.

226. Tu, *supra* note 90, at 565–66.

227. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 11).

228. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 7).

229. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 19).

Under this method, at the time a debtor grants a security interest to a lender, the debtor transfers the virtual currency as the collateral in the transaction to the appropriate blockchain under the lender's public key and in the name of the lender.²³⁰ This makes it impossible for the debtor to transfer the virtual currency without the lender's private key.²³¹ In this arrangement, the lender has exclusive control over the debtor's virtual currency and can choose when and how to access and dispose of the collateral in the event of default.²³² Further, this "prevent[s] the borrower from evading the lender's security interest in [virtual currency] through a transfer to an untraceably pseudonymous purchaser."²³³ Such a transfer into the lender's name would likely be accompanied by a security agreement that would give the lender *only* the rights of an Article 9 secured creditor, "not the rights of a full owner of the currency."²³⁴ In the absence of such a security agreement, "Article 9 would limit the lender's interest . . . to a security interest that the lender could exercise only in accordance with the procedures (and limitations) that Article 9 prescribes."²³⁵

Mann proposes another solution to the perfection problem that he claims is better than the quasi-control method: the "smart" contract.²³⁶ This is "a contract that relies on software to execute a transaction in response to prearranged conditions."²³⁷ Specifically, in the crypto-lending context, the smart contract would "stipulate that the collateral would be transferred to the lender automatically on the appropriate date if the borrower had not by that date submitted the requisite evidence of payment."²³⁸ Because such a contract depends on executing software code, it can only work if actions on both sides can be objectively identified or executed by a computer.²³⁹ "In modern con-

230. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 10–12).

231. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 19–20).

232. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 29).

233. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 19).

234. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 21–22).

235. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 14–15) ("The 'quasi-control' strategy discussed above has salient advantages over simple perfection by filing in that it gives the lender a more practically efficacious interest in the promised collateral while at the same time relying on conventional transactional forms. Having said that, it must be acknowledged that it is far from an elegant solution—obligating borrowers to execute documents designed to have legal effects remote from their stated terms. It seems ironic that we should struggle in transactions involving new asset forms based directly in developing technology to break free of Restoration-Era transactional forms.").

236. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 23–33).

237. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 23).

238. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 26).

239. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 24).

templation, which situates smart contracts on the blockchain, the actions of the contracting parties must be demonstrable to (or executable by) the distributed consensus of the blockchain.”²⁴⁰ Mann contends that collateralizing virtual currency is ideal for smart contracts because transactions on both sides of the collateralization are suitable for blockchain-based verifications.²⁴¹

A trusted third party could act as a type of escrow agent to the transaction between the borrower and the lender by assuming responsibility for recording on the appropriate blockchain each payment made or not made.²⁴² If no payment was made, this could trigger the actions to be taken in the event of default.²⁴³ Mann argues that “implementation of the transactions at the blockchain level would be less ‘clunky’—more elegant—than the circuitous use of quasi-control.”²⁴⁴ Mann further argues the smart contract would be more advantageous than the quasi-control method because it would limit borrower concerns about lender opportunism, meaning the lender being in a position “to dispose of the collateral without the borrower’s consent, or even over the borrower’s objection.”²⁴⁵ A debtor’s willingness to enter into a smart contract with a creditor shows the creditor that the debtor is “willing to accept the draconian consequences that would flow from default on a smart-lien secured transaction—automated disposition of the collateral at the then-current market value.”²⁴⁶

Carla Reyes proposes a “crypto-legal structure” that follows Article 9’s filing system, wherein a state filing office would implement a type of distributed ledger technology (DLT) protocol for perfecting securities interests in virtual currency collateral.²⁴⁷ Reyes states that one of the primary functions of DLT is to provide “a tamper-resistant, distributed, self-executing ledger of value transfers,” which includes both monetary transfers and “recording

240. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 25).

241. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 25–26) (“Consider first the borrower’s future obligation: payment of a sum of money. That is easily settled by having the required payment made in a blockchain-based currency; by submitting the relevant transaction details the borrower could demonstrate to the relevant distributed ledger community that the payment had been made. Conversely, consider the lender’s side of the transaction: foreclosure on the collateral in the event of nonpayment. The smart contract need only stipulate that the collateral would be transferred to the lender automatically on the appropriate date if the borrower had not by that date submitted the requisite evidence of payment.”).

242. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 29).

243. Mann, *Reliable Perfection*, *supra* note 47.

244. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 32).

245. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 33).

246. Mann, *Reliable Perfection*, *supra* note 47 (manuscript at 36).

247. Reyes, *supra* note 5, at 419.

events other than monetary transfers.”²⁴⁸ She contends that to create a crypto-legal structure to function as the existing Article 9 filing system, state filing offices “could create a Factom chain (or other similar DLT protocol) for use in recording financing statements.”²⁴⁹ Each financing statement for a creditor’s collateral in a debtor’s virtual currency would be recorded by being added to the appropriate currency’s blockchain.²⁵⁰ The state filing office could still index the recordings by the debtor’s name so a search would fetch all blockchain recordings related to each particular debtor.²⁵¹ Such a system would reject any financing statements that do not contain the required information, like the debtor’s name, the creditor’s name, and a description of the collateral.²⁵² Reyes argues this would be an improvement from the current filing system because “the enforced sequence would not, as is common at filing offices, incorrectly accept a filing that should be rejected for failure to comply.”²⁵³ Thus, “the rules regarding the partial effectiveness of wrongfully accepted filings could be eliminated.”²⁵⁴ She further asserts that such a system’s programming could be designed to remind the secured party when a continuance for a financing statement needs to be filed.²⁵⁵ This would “simplify priority analysis and reduce litigation relating to unintentionally lapsed filings.”²⁵⁶

Reyes suggests that using DLT for such a crypto-legal filing system would be beneficial because the blockchain would be updated every time a creditor filed a termination statement or an amendment to an accepted financing statement, and no one could alter or delete the history of the statement.²⁵⁷ This type of DLT-backed audit system could be linked to other online databases (e.g., the state Division of Motor Vehicle’s electronic database) to cross-reference or verify debtor name and location information.²⁵⁸ Another benefit of such a system, Reyes notes, would be that it could eradicate or at least streamline the Article 9 rules permitting “grace periods to account for the difficulty in tracing name changes.”²⁵⁹ Reyes acknowledges that such a proposal would need to be much more detailed to be a fully functional

248. Reyes, *supra* note 5, at 419.

249. Reyes, *supra* note 5, at 419.

250. Reyes, *supra* note 5, at 419.

251. Reyes, *supra* note 5, at 419.

252. Reyes, *supra* note 5, at 419.

253. *See* Reyes, *supra* note 5, at 420.

254. Reyes, *supra* note 5, at 420.

255. Reyes, *supra* note 5, at 420.

256. Reyes, *supra* note 5, at 420.

257. Reyes, *supra* note 5, at 420.

258. Reyes, *supra* note 5, at 420.

259. Reyes, *supra* note 5, at 420 (citing U.C.C. § 9-507).

crypto-legal filing system.²⁶⁰ But she proposes the system as a solution to make secured transactions involving virtual currency as collateral more practical. But this proposal does not solve the problem of volatility and virtual currency's ever-fluctuating value that poses a large risk for creditors.

V. EARLY LESSONS IN REGULATING DIGITAL ASSET MARKETS

Many challenges plague the blockchain protocol and the virtual currency markets built on this technology. Some concerns emerge from the anonymity of transactions; market participants may capitalize on the obscurity of the market and may utilize virtual currency for deeply disconcerting illicit and often illegal transactions.²⁶¹ Other concerns arise when regulators find themselves unable to effectively monitor and regulate the market.²⁶² The explosive growth of startup companies seeking to lend borrowers cash in exchange for a pledge of virtual currency has engendered significant risk management concerns.²⁶³

Recall that virtual currency is not a tangible, physical asset like government fiat issued in notes or specie. It is also not software or captured in a single electronic file on a bank custodian's balance sheet or ledger. Virtual currency exists on the blockchain. Storage choices for virtual currency are therefore limited to cold storage systems, cold wallets, or hot wallets.²⁶⁴

Access to storage is controlled by private keys.²⁶⁵ Consider, for example, startups such as Xapo, which physically stores hard drives and computer servers on which virtual currency information and virtual currency wallets are stored.²⁶⁶ Xapo permits potential creditors to physically take the drives and servers.²⁶⁷ As long as the physical equipment is connected to a network, however, one can quickly transfer the virtual currency funds before the equipment is physically removed.²⁶⁸

As noted above, the debate regarding the application of Article 9 to digital assets parallels a debate in capital markets regarding which coins or

260. Reyes, *supra* note 5, at 420.

261. Clayton, *supra* note 59; *cf.* Hughes, *supra* note 11, at 11–13.

262. Clayton, *supra* note 59.

263. Gerald Nash, *Why Startups are Raising Money with Tokens*, MEDIUM (Sept. 5, 2017), <https://medium.com/crypto-currently/why-startups-are-raising-money-with-tokens-ea47ce1c89bb>.

264. *How to Store Your Bitcoin*, COINDESK, <https://www.coindesk.com/information/how-to-store-your-bitcoins/> (last updated Jan. 20, 2018).

265. *See* Schroeder, *supra* note 48, at 45.

266. Martinson & Masterson, *supra* note 203, at 18.

267. Martinson & Masterson, *supra* note 204, at 18.

268. Martinson & Masterson, *supra* note 203, at 18.

tokens have the attributes of “securities” as the term is understood by courts and regulators.²⁶⁹ A recent SEC report on the application of the Securities Act of 1933 to initial coin offerings strongly discourages financial market participants from engineering assets that share attributes with financial arrangements that may be deemed “securities.”²⁷⁰

The DAO Report examines a capital raising venture launched by an automated investment fund or decentralized autonomous organization (DAO).²⁷¹ The DAO entered into a “funding phase” where investors sent Ether to the DAO’s account using the Ethereum platform. Based on the DAO structure, early investors received different benefits than later investors.²⁷² The DAO raised approximately \$150 million in an initial coin offering (ICO) of Ethereum tokens which it then converted into DAO tokens.²⁷³ Developers often hold ICOs after releasing a white paper detailing their idea for a future product to garner investors.²⁷⁴ However, not long after launching its ICO and prior to funding any projects, in June 2016, the DAO was subject to a cyber-attack wherein a hacker stole approximately one-third of its assets.²⁷⁵

269. Carol Goforth, *The Lawyer’s Cryptionary: A Resource for Talking to Clients about Crypto-Transactions*, 41 CAMPBELL L. REV. 47, 86 (2019); see also Nate Crosser, *Initial Coin Offerings as Investment Contracts: Are Blockchain Utility Tokens Securities?*, 67 KAN. L. REV. 379, 390 (2018) (“ICOs are the online sale of blockchain tokens. Tokens are given in exchange for relatively liquid cryptocurrency (like Bitcoin) or fiat currency in an ICO to fund the development of a distributed ledger project. . . . Tokens come with various rights and features and may or may not purport to confer any actual ownership interest or voting power in an organization.”).
270. Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO, Release No. 81207, SEC. EXCH. COMM’N (July 25, 2017), <https://www.sec.gov/litigation/investreport/34-81207.pdf> (“An investment contract is an investment of money in a common enterprise with a reasonable expectation of profits to be derived from the entrepreneurial or managerial efforts of others.”); see also SEC v. Edwards, 540 U.S. 389, 393 (2004).
271. Andrew Tar, *SEC Ruling on the DAO and ICO, Explained*, COINTELEGRAPH (July 27, 2017), <https://cointelegraph.com/explained/sec-ruling-on-the-dao-and-ico-explained>.
272. Usha Rodrigues, *Law and the Blockchain*, IOWA L. REV. (forthcoming).
273. Michael Mendelson, *From Initial Coin Offerings to Security Tokens: A U.S. Federal Securities Law Analysis*, 22 STAN. TECH. L. REV. 52, 69 (2019); Rodrigues, *supra* note 272 (“The DAO’s token creation code was open source code, where anyone could copy or modify the original code, and it was written by the Slock.it team”).
274. See Nareg Essaghoolian, *Initial Coin Offerings: Emerging Technology’s Fundraising Innovation*, 66 UCLA L. REV. (2019).
275. Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO, Release No. 81207, SEC. EXCH. COMM’N (July 25, 2017), <https://www.sec.gov/litigation/investreport/34-81207.pdf>.

Parallel to the construction of the U.C.C., Section 2 of the Securities Act of 1933, the defined terms, does not include digital assets or cryptocurrency among the enumerated classes of assets to which the statute applies. However, Congress included among the enumerated terms a catchall phrase “investment contract” to enable regulators to apply federal securities laws to financial arrangements even if the arrangements were not listed as types of securities. Thus, a financial arrangement might be considered a “security” if the economic realities of the transaction reflect the common attributes of any of the classes of “securities” expressly enumerated in Section 2. As the Court explained in *SEC v. W.J. Howey Co.* and subsequent precedent, “[t]he ‘touchstone’ of an investment contract ‘is the presence of an investment in a common venture premised on a reasonable expectation of profits to be derived from the entrepreneurial or managerial efforts of others.’”²⁷⁶ The analysis values substance over form.

Applying this analysis in the context of the DAO, the SEC concluded that DAO investors purchased securities and that the promoters of the offering failed to register the securities with the SEC in advance of sales as required by Section 5 of the Securities Act of 1933 and they violated federal securities laws. While the SEC’s analysis in the DAO Report illustrates a path for regulating coin offerings under federal securities laws, critics immediately raised questions regarding how the rule might apply with such a great diversity of tokens. Similar to the debate regarding the application of the U.C.C., many still argue that amending the definition of “security” may offer a more useful approach.

The current secured transactions regime under Article 9 leaves many operational questions unanswered. A secured lender’s uncertainty as to the perfection and continuation of a security interest increases transaction costs and inefficiencies.²⁷⁷ This likely increases lending rates for secured transactions involving virtual currency as collateral.²⁷⁸ As Bob Lawless suggests, virtual currency threatens to unravel the entire enterprise of secured transactions.²⁷⁹

VI. CONCLUSION

The arrival of virtual currencies has deeply impacted financial markets and will influence the shape of market activities for many years to come. The introduction of this new technology in financial markets, however, has challenged existing institutional and regulatory structures. As discussed in Parts I

276. *SEC v. W.J. Howey Co.*, 328 U.S. 293, 301 (1946); *see also* *United Housing Found., Inc. v. Forman*, 421 U.S. 837, 852 (1975).

277. *McJohn & McJohn*, *supra* note 183, at 19.

278. *McJohn & McJohn*, *supra* note 183, at 15–19.

279. Lawless, *supra* note 24.

and II, virtual currencies raise a significant number of regulatory issues.²⁸⁰ While the existing regulatory framework—U.C.C. Article 9 in the context of secured lending—offers a pathway for attempting to regulate virtual currencies, relying on antiquated notions of financial products and regulations that lack the flexibility to address innovations in the markets will fail to offer a sustainable solution. Surely, subsequent contributions comparing early entrants in the regulatory market will illuminate the approaches adopted by FinCEN, the bureau of the U.S. Department of the Treasury responsible for oversight of money services businesses, or the Internal Revenue Service. Each of these regulators has taken important steps toward expanding existing regulation in the virtual currency markets. While we may not yet have answers to many questions regarding how to structure regulation, a valuable literature encouraging an important discussion has emerged, enabling scholars, market participants, and regulators to begin to weigh the costs and benefits of various approaches.

280. McJohn & McJohn, *supra* note 183.