Reliable Perfection of Security Interests in Crypto-Currency

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I. INTRODUCTION

As you all know, the organizers of this event chose a topic of burning interest when they selected crypto-currency as the focus of this year's panel. Fortunately, unlike most of the similar events at which the author has been asked to speak, we have not been asked to talk about Bitcoin as the currency of the future; my doubts about the ability of Bitcoin to succeed as a currency of routine use—as opposed to a speculative investment vehicle—dampen my interest in talking repeatedly about that subject. The task they have set for the speakers is one that involves a transactional development with much more potential for widespread deployment: transactions in which lenders extend loans in return for an interest in some form of crypto-currency as collateral.

That topic sidesteps the indeterminate speculation about the future development of Bitcoin in favor of something of commercial immediacy. Crypto-currencies, *in fact*, have present value on the balance sheets of commercial borrowers, and all signs suggest that, in the years to come, investments in one or another form of crypto-currency will become more routine and more substantial. To be sure, that value might be volatile, and it might or might not be useful to think of it as currency, but from the perspective of lenders, it represents value that would enhance the borrowing base of their customers if lenders could capture it reliably.

This article considers that topic. The author proceeds in three steps. First, the author considers the simple straightforward approach of perfecting a security interest under existing legal rules. Recognizing the obvious weaknesses of that approach in cabining transfers of collateral to pseudonymous purchasers, the author turns in the second part of the article to a more capacious use of institutional arrangements that should give the lender a more effective control of the asset—transactions using what the author calls "quasi-control." Finally, the third part of the article briefly considers technological advances that would use blockchain-based smart contracting tools to perfect the lender's interests more elegantly, namely the development of a "smart" lien that integrates the respective rights of the borrower and lender directly into the mechanism of the blockchain.

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II. CONVENTIONAL PERFECTION

The most straightforward approach would perfect a security interest in crypto-currency using the standard off-the-shelf rules of Article 9 of the Uniform Commercial Code (U.C.C.). The author's discussion of that topic can be brief because application of those rules in this context is straightforward, proceeding in two steps. First, the author considers where crypto-currency would fall in the various types of collateral defined in Article 9. Second, the author considers the potential methods of perfection available for that type of asset under Article 9.

A. What Is It?

The author is, of course, not the first to consider how crypto-currencies should be categorized for legal purposes. For Bitcoin in particular, the topic already has arisen, provoking considerable debate under a variety of legal regimes. For the most part, those debates have focused on the question whether Bitcoin is or is not "money," as opposed to some other asset. To the extent that question has practical import,[1] it is primarily because—at least if Bitcoin is not "money" in the relevant understanding—those that receive and dispense the currency are likely to owe taxes if the value of the currency rises during the period that they own it. In any event, practical consequences aside, regulators have mostly concluded that crypto-currencies are not money.[2]

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1. To some degree, the import of the question is considerably more emotional than it is practical, as proponents of crypto-currencies seem to take it as a personal slight when regulators or other legal decision makers conclude that a particular crypto-currency does not warrant recognition as "money" under any particular legal regime. The author's students, for example, seem to generally start from the premise that such determinations are more a demonstration of ignorance of the "true" attributes of crypto-currency than they are an application of longstanding legal categories to a newly arisen context. That is true even when, as is often the case, the outcome exempts those that traffic in the currency from burdensome obligations. *See, e.g.*, Florida v. Espinosa, No. F-14-2923 (Fla. Circuit Ct. July 22, 2016), https://www.morrisoncohen.com/siteFiles/files/2014_02_06%20-%20Florida%20v_%20Espinoza.pdf (dismissing criminal information arising out of Secret Service investigation on the ground that transactions involving bitcoin were not subject to a variety of statutes regarding the transmission of money) (discussed in detail in Brandon Peck, Comment, *The Value of Cryptocurrencies: How Bitcoin Fares in the Pockets of Federal and State Courts*, 26 U. MIAMI BUS. L. REV. 191 (2017)).

2. *E.g.*, IRS Notice 2014-21 (Apr. 14, 2014), https://www.irs.gov/irb/2014-16_IRB#NOT-2014-21 (concluding that bitcoin and similar "virtual" currencies should be treated as property rather than money for federal tax purposes); *IRS Virtual Currency Guidance: Virtual Currency is Treated as Prop. for U.S. Federal Tax Purposes; General Rules for Property Transactions Apply*, INTERNAL REV. SERV. (Mar. 25, 2014), https://www.irs.gov/newsroom/irs-virtual-currency-guidance; *see also infra* note 10 (discussing deliberations of the Securities

Whatever can be said for the clarity of those rules, it is much easier to categorize crypto-currency under the U.C.C., which includes specific definitions that leave little room for doubt as to the proper character of crypto-currencies. On the first point, mainstream crypto-currencies, like Bitcoin, are plainly not "money" under the U.C.C. because they are not "a medium of exchange currently authorized or adopted by a domestic or foreign government."[3]

That is not to say it is impossible for a crypto-currency to qualify as "money." For example, Venezuela began to issue a blockchain-based[4] currency earlier this year, responding to hyperinflation of the country's traditional currency.[5] Similarly, Sweden's central bank has given serious consideration to offering a blockchain-based currency (e-krona) as a supplement to, or even replacement of, its traditional currency.[6] For the most part,

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and Exchange Commission regarding treatment of initial coin offerings and crypto-currencies as securities).

3. U.C.C. § 1-201(b)(24). As far as uniform laws go, the U.C.C.'s limitation of the term to governmental currencies is not eccentric. *See, e.g.*, UNIF. MONEY SERV. ACT § 102(12) ("'Money' means a medium of exchange that is authorized or adopted by the United States or a foreign government. The term includes a monetary unit of account established by an intergovernmental organization or by agreement between two or more governments."). The recently promulgated Uniform Regulation of Virtual Currency Businesses Act is the first uniform law to address the subject explicitly, drawing a distinction between "legal tender" and "virtual currency." *Compare* UNIF. REGULATION OF VIRTUAL CURRENCY BUS. ACT § 102(8) ("'Legal tender' means a medium of exchange or unit of value, including coin or paper money issued by the United States or by another government."), *with* § 102(23) ("'Virtual currency' means (A) a digital representation of value that: (1) is used as a medium of exchange, unit of account, or store of value; and (2) is not legal tender, whether or not denominated in legal tender; and (B) does not include: (1) a transaction in which a merchant grants value as part of an affinity or rewards program, which value cannot be taken from or exchanged with the merchant for legal tender, bank credit, or virtual currency; or (2) a digital representation of value issued by or on behalf of the publisher and used within an online game, game platform, or family of games sold by the same publisher or offered on the same game platform.").

4. In this article, the author uses the term "blockchain-based currency" to include any currency issued on a blockchain, intending to include both currencies issued by governmental entities as well as the more generally pseudonymous private projects that I refer to as crypto-currencies.

5. *See* Kirk Semple & Nathaniel Popper, *Venezuela Launches Virtual Currency, Hoping to Resuscitate Economy*, N.Y. TIMES (Feb. 20, 2018), https://www.nytimes.com/2018/02/20/world/americas/venezuela-petro-currency.html.

6. *See* Sveriges Riksbank, *The Riksbank's E-Krona Project*, MONETARY L.F. SWITZ. (Sept. 2017), http://www.swissmlf.ch/wp-content/uploads/2017/10/Riksbank-ekrona-report-092017.pdf; *see also* Walter Engert & Ben S.C. Fung,

though, and certainly with regard to the most well-known applications like Bitcoin, crypto-currencies as they are used today are not "money" under the U.C.C.'s definition.[7]

Recognizing that the IRS's decision not to classify Bitcoin (and other crypto-currencies) as "money" leads to their treatment as an investment asset, I should explain that crypto-currencies also do not qualify as "investment property" under Article 9. Article 9 limits that term to assets that qualify as securities for purposes of U.C.C. Article 8.[8] Article 8, in turn, limits the term to assets that, among other things, represent "an obligation of an issuer or a share, participation, or other interest in an issuer or in property or an enterprise of an issuer,"[9] a limitation that excludes traditional crypto-currencies, like Bitcoin, that reflect no obligation of or interest in any particular entity.

Again, there is nothing inherent in a blockchain that would prevent issuers from using blockchain technology to maintain a registry of securities. Indeed, the Securities and Exchange Commission has issued a detailed report examining the circumstances under which an initial coin offering would become a security for purposes of federal securities law.[10] Still, notwithstanding

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Central Bank Digital Currency: Motivations and Implications, BANK OF CAN. (Nov. 2017), https://www.bankofcanada.ca/2017/11/staff-discussion-paper-2017-16/ (discussing the rationales for issuance of such a currency). *See generally* Morten Bech & Rodney Garratt, *Central Bank Cryptocurrencies*, BIS Q. REV. 55 (Sept. 2017) (academic typology of various initiatives in the area).

7. U.C.C. § 1-201(b)(24).

8. *Id.* § 9-102(a)(49).

9. *Id.* § 8-102(a)(15); *see id.* § 8-102 cmt. 15 (explaining that for an asset to qualify as a security "the interest or obligation [must] be fully transferable, in the sense that the issuer either maintains transfer books or the obligation or interest is represented by a certificate in bearer or registered form."); *id.* § 8-201 ("[A]n 'issuer' includes a person that: (1) places or authorizes the placing of its name on a security certificate . . . to evidence a share, participation, or other interest in its property or in an enterprise, or to evidence its duty to perform an obligation represented by the certificate; (2) creates a share, participation, or other interest in its property or in an enterprise, or undertakes an obligation; (3) directly or indirectly creates a fractional interest in its rights or property . . . ; or (4) becomes responsible for . . . another person described as an issuer in this section.").

10. Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO, Exchange Act Release No. 81,207, 117 SEC DOCKET 5 (July 25, 2017), https://www.sec.gov/litigation/investreport/34-81207.pdf. The issue is not likely to go away, as current developments raise the possibility that the currencies issued by Ethereum and Ripple might be securities. *See* Joon Ain Wong, *Is Ethereum a Security? The Answer Could Upend the Crypto World*, QUARTZ (May 3, 2018), https://qz.com/1262864/is-ethereum-is-a-security-the-answer-could-upend-the-cryptocurrency-world/amp/; *Ripple Hit with Class-Action Suit over 'Never Ending ICO'*, PAYMENTSSOURCE (May 4, 2018), https://www.paymentssource.com/articles/ripple-hit-with-class-action-suit-over-token-

the burgeoning possibilities for intertwining blockchain-based currencies with ongoing business investment opportunities, the fact remains that the traditional currencies, like Bitcoin, reflect neither an "obligation" of any particular entity nor an interest in any cognizable entity or property. Rather, the currency's sole monetary value derives from the empirical likelihood that others will value it.

In the end, then, it seems clear that traditional crypto-currencies would qualify under Article 9 as "general intangibles," the catch-all for assets that Article 9 does not place in a different category.[11]

B. How to Perfect?

It is equally straightforward to determine how best to perfect under Article 9. The first (and most traditional) possibility is possession.[12] Not surprisingly, given the impracticality of possessing assets that are intangible, Article 9 does not offer possession as a permissible method of perfection in general intangibles.[13] Nor does Article 9 offer the possibility of perfection by control, which the revised Article 9 offers as an analogy to perfection by possession for a variety of financial assets.[14] Rather, perfection by control is limited to a narrow and specifically enumerated group of assets: investment property, deposit accounts, letter-of-credit rights, and electronic chattel paper.[15] Because general intangibles (and thus crypto-currencies) fall beyond that enumeration, the only method of perfection available under Article 9 is the residual method: perfection by filing.[16] Ordinarily, when the borrower is a registered organization (such as a corporation, limited partnership, or limited liability

sales. For a skeptical perspective, see Jeff John Roberts, *Is the SEC Gunning for Ethereum and Ripple? Fat Chance*, FORTUNE (May 1, 2018), http://fortune.com/2018/05/01/sec-and-cryptocurrency-regulations.

11. U.C.C. § 9-102(a)(42). Having explained in the text why crypto-currencies ordinarily are not money or investment property, it seems superfluous to discuss all of the other possibilities other than the residual treatment as a general intangible. To the author's eye, at least, all of those other undiscussed possibilities seem plainly inapplicable. Just to be clear, though, the undiscussed possibilities (listed in U.C.C. § 9-102(a)(42) in alphabetical order) are accounts, chattel paper, commercial tort claims, deposit accounts, documents, goods, instruments, letter-of-credit rights, letters of credit, and oil, gas, or other minerals before extraction. *Id.*

12. *See generally* GRANT GILMORE, SECURITY INTERESTS IN PERSONAL PROPERTY 438–61 (1965).

13. U.C.C. § 9-313(a).

14. *See* RONALD J. MANN, COMMERCIAL FINANCE: A TRANSACTIONAL APPROACH 194–95 (2017).

15. U.C.C. § 9-314(a).

16. *Id.* § 9-310(a).

company), perfection by filing would be accomplished by a filing in the state under the laws of which the borrower was organized.[17]

C. Reliability?

However simple and straightforward the above analysis might be, it only starts the transactional inquiry, because the lender advancing funds against crypto-currency as collateral would hardly be satisfied by knowing that its security interest will be perfected under applicable law. It will be much more interested to know how sure it can be that the collateral will be available as a source of repayment if the borrower fails to repay the loan as agreed. Thus, if the borrower can freely dispose of the collateral without the lender's consent, then the lender's security interest is of little practical value even if it is valid, binding, and enforceable as a legal matter.[18]

Article 9 recognizes and responds to that problem as well as it can, unconditionally providing that a security interest "continues in collateral notwithstanding sale, lease, license, exchange, or other disposition [of the collateral] unless the secured party authorized the disposition free of the security interest."[19] The principle that a security interest passes through a sale unaffected is important, of course, but it does not help the lender much for collateral that the borrower can readily transfer beyond the lender's reach. Unfortunately, the context of crypto-currencies raises just such problem because the inherently pseudonymous nature of blockchain transfers for ex-

17. The statute's delineation of that rule is remarkably circuitous. Under U.C.C. § 9-301(1), the effect of perfection or non-perfection in collateral is determined under the "local law" of the jurisdiction in which a borrower "is located." In context, that means that the question of whether a lender has perfected in a borrower's collateral depends upon the filing records of the jurisdiction of the borrower's location. *See id.* § 9-301 cmts. 3 & 4; *id.* § 9-307 cmt. 4. Under U.C.C. § 9-307(e), a "registered organization that is organized under the laws of a State is located in that State." Finally, U.C.C. § 9-102(a)(71) defines "registered organization" to include "an organization organized solely under the law of a single State . . . by the filing of a public organic record with . . . the State." *See id.* § 9-102 cmt. 11 (explaining that a general partnership is not a registered organization "because such a partnership is not formed or organized by the filing of a record with . . . the State," but that "[i]n contrast, corporations, limited liability companies, and limited partnerships ordinarily are 'registered organizations'").

18. As the author has explained, the lender will often have other reasons for wanting control of an asset as collateral, such as maintaining leverage over the borrower and limiting future borrowings that would dilute the interest of the lender. *See* Ronald J. Mann, *Explaining the Pattern of Secured Credit*, 110 HARV. L. REV. 625, 639–58 (1997). Those interests in collateral also would be vitiated were the borrower freely able to dispose of the collateral.

19. U.C.C. § 9-315(a)(1).

isting crypto-currencies, like Bitcoin,[20] make it trivially easy for a borrower to transfer assets to an entity that is difficult, if not practically impossible,[21] for the lender to identify or locate.[22] So, even if the borrower has granted a first-priority perfected security interest to a lender, a lender's superior right in the crypto-currency will be of no use if the lender cannot identify the entity or individual from the public key used to identify the purchaser in the blockchain ledger. Moreover, 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.

In a nutshell, Article 9 offers a straightforward and reliable method of legal protection that may well afford little in the way of reliable potential for enforcement. The author's task in the next section is to explore whether an alternate transactional design might afford lenders more reliable access to their collateral.

III. QUASI-CONTROL

The previous section treated the transactional form as a given—the borrower grants a security interest in a conventional security agreement, and the lender perfects that security interest in the ordinary course with a routine financing statement. The relative ineffectiveness of that approach will surprise no one with experience in arranging commercial finance transactions. It is commonplace for the off-the-shelf procedures that Article 9 has offered through the years to fall short of the protections that informed lenders would seek for their collateral. The question of interest, and the subject of this part of the article, is how best to design a transaction that affords the protections lacking in the simple transaction analyzed above.

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20. *See, e.g.*, Kevin V. Tu, *Crypto-Collateral*, 21 SMU SCI. & TECH. L. REV. (forthcoming 2019) (discussing pseudonymity of transfers on blockchain).

21. To be sure, transactions in cryptocurrencies are not nearly as anonymous as press reports suggest, and advances in "de-anonymization" techniques are enhancing the ability of investigators (principally law enforcement authorities) to identify those who have engaged in past transactions in crypto-currency. *See, e.g.*, Steven Goldfeder et al., *When the Cookie Meets the Blockchain: Privacy Risks of Web Payments via Cryptocurrencies* (Aug. 16, 2017) (unpublished manuscript), https://arxiv.org/abs/1708.04748. The author's point here is not that it is impossible for a lender to ascertain the identity of a pseudonymous transferee. Rather, as the text attempts to make clear, the author is suggesting only that the costs and limited reliability of de-anonymization will make it far more difficult (and less certain) to pursue a pseudonymous transferee than it would have been to pursue the original borrower.

22. Again, pseudonymity is not inherent in blockchain technology. It would be easy to establish a blockchain in which transfers were limited to a specified list of registered and thus identifiable entities.

In this particular case, a simple answer is apparent on the face of the revised Article 9 in the various transactional forms it offers as acceptable means of gaining "control" of the assets in which a lender can perfect by control.[23] As mentioned above, the 1999 revisions use control as an analogue for possession of certain intangible assets for which possession is categorically impracticable.[24] Specifically, for a set of widely used intangible financial assets, Article 9 offers control as an alternate method of perfection in addition to (or in the place of) filing.[25]

Importantly, the provisions for perfection by control build on the tradition that possession is the baseline method of perfection for financial assets,[26] and thus the notion that perfection by control is not only available, but also superior to, perfection by filing, generally carries forward into the realm of intangible financial assets. Thus, in this context at least, perfection by filing is relegated to a second-class method, primarily useful as a backstop for all-assets that lenders are unsuccessful in locating and for gaining control of after-arising financial assets. Specifically, a secured party with control of a deposit account has priority over a secured party that does not have control;[27] a secured party with control of investment property has priority over a se-

23. *See* U.C.C. § 9-314(a).

24. *See, e.g., id.* § 8-106 cmt. 7 (explaining that the delineation of control is "designed to supplant the concepts of 'constructive possession' and the like").

25. *See id.* § 9-314(a) (authorizing perfection by control of deposit accounts, investment property, letter-of-credit rights, and electronic chattel paper); *see supra* notes 14–15 and accompanying text (discussing provisions for perfection by control and explaining that they do not extend to general intangibles).

26. The relic of that tradition in the modern Article 9 is the provisions in U.C.C. §§ 9-330 & 9-331 under which a secured party perfected by filing in a promissory note or chattel paper can lose priority to a later-in-time secured party that perfects by possession of the chattel paper or promissory note. *See, e.g.*, STEVEN L. HARRIS & CHARLES W. MOONEY, JR., SECURITY INTERESTS IN PERSONAL PROPERTY: CASES, PROBLEMS, AND MATERIALS 420–24 (6th ed. 2016).

27. U.C.C. § 9-327(1); *see id.* at cmt. 4. Because a secured party cannot perfect in a deposit account by filing (U.C.C. § 9-312(b)(1)), the only competing secured party would be a secured party perfected in the deposit account as proceeds of other collateral in which the secured party had a perfected security interest. *See id.* § 9-315(a)(2), (c), (d)(2) (providing that a security interest attaches to and is perfected in any identifiable proceeds of collateral in which a lender was perfected at the relevant time, and that the perfection continues indefinitely if the collateral is cash proceeds a term that includes deposit accounts); *see also id.* § 9-312(b) (providing that perfection by control is the only method of perfection in a deposit account "[e]xcept as otherwise provided in Section 9-315(c) and (d) for proceeds"); *see id.* at cmt. 5. *See generally* HARRIS & MOONEY, *supra* note 26, at 446–48.

cured party that does not have control;[28] a secured party with control of letter-of-credit rights has priority over a secured party that does not have control;[29] and a secured party with control of electronic chattel paper has the same rights to priority over a secured party without control as the rights a secured party with possession of tangible chattel paper has over a secured party lacking possession of tangible chattel paper.[30]

In each case in which perfection by control is available, the notion of control rests on the premise that it is useful to conceive of the asset as a financial obligation owed from an identifiable party.[31] Thus, the deposit account is an obligation of the financial institution at which the account is located; investment property is an obligation of the financial intermediary at which the account is located (for security entitlements) or of the issuer of the security (for certificated securities); letter-of-credit rights are an obligation of the issuer of the letter of credit; and electronic chattel paper is an obligation of the issuer of the underlying promissory note.[32]

Although Article 9 offers a separate statutory delineation of the procedures for control of each of the four asset types for which control is available, the steps for gaining control for three of the four assets[33] are broadly similar.

28. U.C.C. § 9-328(1); *see id.* at cmt. 3 (detailed discussion); HARRIS & MOONEY, *supra* note 26, at 441–42.

29. U.C.C. § 9-329(1); *see id.* § 9-102 at cmt. f ("[A] secured party's failure to obtain control (§ 9-107) of a letter-of-credit right supporting collateral may leave its security interest exposed to a priming interest of a party who does take control."); *id.* at cmt. 2. Because a secured party cannot perfect in letter-of-credit rights by filing (U.C.C. § 9-312(b)(2)), the most obvious competing secured party would be a secured party automatically perfected in the letter-of-credit right as a supporting obligation of an account or instrument in which the secured party perfected by filing or possession. *See id.* § 9-102(a)(78) & cmt. f (defining "supporting obligation" to include "letter-of-credit right"); *id.* § 9-203(f) (providing that attachment of a security interest in an asset is attachment in the supporting obligation); *id.* § 9-308(d) (providing that perfection of a security interest in an asset perfects a security interest in any supporting obligation for that collateral); *see also id.* § 9-312(b)(2) (stating that perfection by control is the only method of perfection in letter-of-credit rights "except as otherwise provided in Section 9-308(d)"); *id.* § 9-312 cmt. 6 (discussing perfection in letter-of-credit rights as supporting obligations).

30. *Id.* § 9-330(a)–(b); *see id.* at cmts. 2 & 4 (discussing "non-temporal priority" to "promot[e] the negotiability" of chattel paper and discussing problems related to possession and control).

31. *See id.* § 9-104(a).

32. *See id.* § 9-314.

33. As discussed in more detail below, the rules for control of electronic chattel paper rest on a registry model rather than the asset-obligor model that dominates procedures for deposit accounts, investment property held as security entitlements, and letter-of-credit rights. *See id.* § 9-105.

Each generally requires a "control agreement" in which the party obligated on the asset agrees that it will respect instructions from the lender regarding disposition of the asset. So, in the most routinized case, the deposit account, the lender can gain control by use of a control agreement with the borrower and the bank at which the account is located.[34] That transaction is so common that experienced transactors can employ a Model Deposit Account Control Agreement promulgated by a Joint Task Force of the ABA Business Law Section.[35] The same result flows in the case of investment property (at least if it is held in the indirect holding system as a security entitlement) from an agreement between the lender and the securities intermediary.[36] In the case of the letter-of-credit right, a similar procedure gives a lender control "if the

34. *Id.* § 9-104(a)(2) (providing that a secured party gains control if it obtains an agreement "that the bank will comply with instructions originated by the secured party directing disposition of the funds in the deposit account without further consent by the debtor"); *see id.* at cmt. 3.

35. For detailed discussion, the text of the model agreement, and related forms, see R. Marshall Grodner et al, *Initial Report of the Joint Task Force on Deposit Account Control Agreements*, 61 BUS. L. 745 (2006). For additional details, see R. Marshall Groner et al, *Additional Report*, 64 BUS. L. 801 (2009). For a thoughtful analysis of the agreement from a creditor's perspective, see Joel F. Brown, *Deconstructing DACA: An Analysis of the Model Deposit Account Control Agreement*, COM. LENDING REV., Sept.–Oct. 2006, at 3.

36. Like much of the framework regarding investment property, the need to integrate Article 9 with the freestanding framework that Article 8 establishes for securities means that the relatively simple conclusion stated in the text is based on the interaction of several scattered sections of the U.C.C. First, § 9-106 defers to Article 8 for the delineation of the rules for control of investment property, providing that a person has control of investment property "as provided in Section 8-106." *See* U.C.C. § 9-106. Section 8-106(d)(2), in turn, provides that a "purchaser" has control of a securities entitlement if "the securities intermediary has agreed that it will comply with entitlement orders originated by the purchaser without further consent by the entitlement holder." *See id.* § 8-106 cmts. 4 & 7. In this context, the lender qualifies as a purchaser (defining purchaser as one "that takes by purchase"). *See id.* § 1-201(b)(29)–(30) (defining purchase to include "taking by . . . mortgage, pledge, lien, security interest . . . or any other voluntary transaction creating an interest in property"); *see id.* § 8-106 cmt. 1 (noting that Article 8's "concept of control plays a key role in various provisions dealing with the rights of purchasers, including secured parties" (emphasis added)); *see id.* § 8-102(a)(14)(ii) (the financial institution holding the account is the securities intermediary). Although it has considerably less practical significance, a parallel rule applies to uncertificated securities. *Id.* § 8-106(c)(2) (control of uncertificated security flowing from agreement of the issuer "that it will comply with instructions originated by the [lender] without further consent by the registered owner"); *see id.* at cmt. 3.

issuer . . . has consented to an assignment of proceeds of the letter of credit."[37]

Because many participants in the drafting of revised Article 9 doubted that lenders would regard the control provisions discussed above as sufficiently reliable, the statute includes, in several places, provisions authorizing a more intrusive method of control, under which the borrower would formally place the asset to be controlled in the name of the lender. Thus, a secured party can gain control of a borrower's deposit account if "the secured party becomes the bank's customer with respect to the deposit account";[38] of a security entitlement if it "becomes the entitlement holder";[39] and of electronic chattel paper "if a system employed for evidencing the transfer of interests in the chattel paper reliably establishes the secured party as the person to which the chattel paper was assigned."[40]

That same procedure provides an obvious model for a transaction in which the lender might use that method of "quasi-control" to prevent the borrower from evading the lender's security interest in cryptocurrency through a transfer to an untraceably pseudonymous purchaser. Indeed, that method of control seems tailor-made for Bitcoin and other modern blockchain-based cryptocurrencies. Early currencies based on "dual-key" asymmetric cryptography (DigiCash) used a "token" model that depended on a unique electronic file passed from "hand to hand," as it were.[41] But

37. *Id.* § 9-107 (incorporating by reference the procedures in U.C.C. § 5-114 that govern the issuer's consent to an assignment of proceeds of a letter of credit); *see id.* at cmt. 2. The lender's ability to gain control arguably is easier in this context than in the contexts discussed above, because the statute does not give the letter-of-credit issuer the untrammeled right to refuse consent that it gives the holder of a deposit account or the securities intermediary. Specifically, although an issuer "has no obligation to give . . . its consent to an assignment of proceeds of a letter of credit, . . . consent may not be unreasonably withheld if the assignee possesses and exhibits the letter of credit and presentation of the letter of credit is a condition to honor." *Id.* § 5-114(d); *see id.* at cmt. 3 (explaining that those rules "follow more closely recognized national and international letter of credit practices than did prior law").

38. *Id.* § 9-104(a)(3).

39. *Id.* § 8-106(d)(1); *see id.* at cmt. 4. Although it has considerably less practical significance, a parallel rule applies to uncertificated securities. *Id.* § 8-106(c)(1) (providing that lender control uncertificated security if "the uncertificated security is delivered to the [lender]"); *id.* § 8-301(b)(1) (providing that an uncertificated security is delivered if "the issuer registers the [lender] as the registered owner"); *see id.* at cmt. 3 (discussing delivery of uncertificated securities).

40. *Id.* § 9-105(a); *see id.* at cmts. 2 & 3.

41. *See generally* Andrew Lothian, *E-commerce: Debugging Legacy Legislation*, THE JOURNAL, http://www.journalonline.co.uk/Magazine/44-10/1001069.aspx (last visited Feb. 5, 2019).

blockchain-based currencies solve the problem of unauthorized duplication of the tokens by locating all evidence of ownership in a registry, or ledger, that provides authoritative evidence of any transaction creating or transferring an interest in the currency.[42]

Setting the lender's specific concern within that framework, the problem is that even if the lender has a security interest perfected by filing in a block of Ether (the currency maintained on the Ethereum platform) identified by the borrower's public key, application of the borrower's private key could authorize a transaction that would transfer that block of currency to the public key of a new (and possibly unidentifiable) owner. But with a quasi-control transaction, the borrower, as a formal matter, could transfer the block of Ether at the time it grants a security interest to the lender so that it is registered on the Ethereum blockchain under the lender's public key in the name of the lender. With that transaction, it would be impossible to transfer the Ether further without application of the lender's private key; if default by the borrower made liquidation of the collateral appropriate, the lender could proceed directly by application of its private key to sell the currency to any third party purchasing it.[43]

If the form of that transaction sounds startling, the author should mention that for centuries, real estate transactions in many jurisdictions have been documented with a document that, on its face, transfers full legal title to

42. *See generally What is Blockchain Technology?*, CBINSIGHTS, https://www.cbinsights.com/research/what-is-blockchain-technology/ (last visited Feb. 5, 2019).

43. It is difficult to deduce the details of transactional design from websites, but it appears that lenders currently working in this area may have failed to appreciate the lessons of pseudonymity that the text summarizes. Thus, the principal detailed example discussed in Xuan-Thao Nguyen's article in this issue involves an Austin-based startup named Unchained Capital. *See generally* Xuan-Thao Nguyen, *Lessons from Case Study of Secured Transactions with Bitcoin*, 20 SMU SCI. & TECH. L. REV. (forthcoming 2019). So far as her article discusses and the website suggests, the lenders seem to take a weak form of quasi-control in blockchain-based collateral by having the borrower transmit its private key into a receptacle from which the lender can retrieve it in the event of a default. *See How It Works*, UNCHAINED CAPITAL, https://www.unchained-capital.com/how_it_works/ (last visited Feb. 5, 2019) (stating only that the borrower must "send collateral to your new loan's vault address," not that the borrower will register any transfer of the collateral directly on the blockchain). But unless the lender can be sure that the borrower no longer is aware of its own private key—and it is not obvious how the lender could be sure of that—the lender would remain exposed to the risk that a disgruntled borrower would use that private key to transfer the collateral to a pseudonymous (and presumably irresponsible) purchaser.

the lender.[44] Similarly, in jurisdictions that permit nonjudicial foreclosure of real estate, it is common to record a document transferring title to the lender's attorney, to be held in trust for the lender. To be clear, in many contexts, the intention of the lender was to use the form of that transfer to evade applicable rules that specify procedures for foreclosure and otherwise bar inappropriate "clogs" on the borrower's ability by repaying the secured obligation to redeem its collateral free of the lender's interest.[45] It is now well settled, though, that whatever form the lender's interest might take—however absolute the lender's title might appear on the face of the applicable documents—the lender in such a transaction receives the rights accorded a secured lender under the applicable mortgage lending regime and can finally take ownership of the collateral free of the borrower's claims only by complying with that regime.[46]

Although those protective mortgage rules have no application to the blockchain-based transactions the author discusses here, those concerns should still pose no problem to the quasi-control transactional form the author discussed above. For one thing, consistent with practice in the existing lending transactions that formally place ownership of intangible collateral (such as deposit accounts and security entitlements) in the name of the lender, the author would expect the transfer of the blockchain-based currency to the name of the lender to accompany a conventional security agreement documenting the transaction as a secured transaction in which the lender would have not the rights of a full owner of the currency, but rather only the rights of a secured party under Article 9.

Moreover, even if the lender did not offer such a security agreement, Article 9 would limit the lender's interest—albeit full ownership on its face—to a security interest that the lender could exercise only in accordance with the procedures (and limitations) that Article 9 prescribes. To use the language of Article 9, the U.C.C. rules for security interests apply to any "transaction, regardless of its form, that creates a security interest in personal property . . . by contract."[47] The comment to that provision explains the point more expansively: "When a security interest is created, this Article applies regardless of the form of the transaction or the name that parties have given it. Likewise, the subjective intent of the parties with respect to the legal char-

44. *See, e.g.*, Restatement (Third) of Prop.: Mortgs. § 4.1 cmt. a(1) (AM. LAW INST. 1999) [hereinafter Restatement of Mortgages] (discussing jurisdictions that adhere to the "title theory" of mortgages).

45. *See, e.g., id.* § 3.2 at cmt. a (discussing prohibition on "clogging" the borrower's "equity of redemption").

46. *See, e.g., id.* § 4.1(a) & cmt. a ("A mortgage creates only a security interest in real estate . . . .", explaining that even title theory states "recognize that mortgagees hold title for security purposes only, and for both practical and theoretical purposes they usually view the mortgagor as the owner of the land").

47. U.C.C. § 9-109(a)(1).

acterization of their transaction is irrelevant to whether this Article applies."[48]

In sum, the ability of transactors to take advantage of, more or less, "off-the-shelf" institutions for protecting a lender's interest in collateral by putting title to the collateral in the name of the lender should allow lenders, with relatively manageable risks to borrowers, to protect themselves from the risks discussed in the first part of this article.

IV. PERFECTION DIRECTLY ON THE BLOCKCHAIN: THE PROMISE OF SMART LIENS

The "quasi-control" strategy discussed above has salient advantages over simple perfection by filing, specifically because 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—it obligates 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 on developing technology to break free of Restoration-Era transactional forms.

From that perspective, it seems only proper that an effort to design transactions for blockchain-registered assets like crypto-currencies should at least undertake to rely on some of the attributes of the blockchain that promise to give it significance far beyond the no-longer-novel Bitcoin application. Specifically, the transaction at hand seems a natural fit for a blockchain-based "smart" contract application. Two questions arise: how to design such an arrangement and whether it would be attractive enough to attract common use by transactors.

A. How Would You Build a "Smart" Lien?

In this context, a "smart" contract is a contract that relies on software to execute a transaction in response to prearranged conditions.[49] Although the technology dates to the last century,[50] several inherent limitations have

48. *Id.* at cmt. 2.

49. *See, e.g.*, Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. TECH. L. REV. 305, 320–21 (2017); Lin Cong & Zhiguo He, *Blockchain Disruption and Smart Contracts* (Sep. 10, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2985764; *"Smart Contracts" Legal Primer*, CHAMBER OF DIGITAL COM., https://digitalchamber.org/wp-content/uploads/2018/02/Smart-Contracts-Legal-Primer-02.01.2018.pdf (last visited Feb. 5, 2019).

50. The idea of the smart contract traditionally is attributed to Nick Szabo. *See* Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, FIRST MONDAY (Sept. 1, 1997), http://ojphi.org/ojs/index.php/fm/article/view/548/469 (last visited Feb. 5, 2019).

slowed its adoption.[51] Most obviously, because it depends on the execution of software code, it can work to execute a contract only if the actions to be completed on both sides of the contract can be reduced to objective attributes identifiable or executable by computer.[52] In modern contemplation, 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.[53] Thus, in the simplest model, an objective indicator of contract performance by a seller or service provider could produce an automated transfer of the appropriate funds from a purchaser.[54] The idea that the use of objective proxies for contract performance could automate the payment process is not a new one.[55] It is, for example, the foundation of the traditional letter-of-credit transaction, which unambiguously obligates a financial institution to make an immediate payment upon presentation of objectively specified documents, designed to serve as an adequate proxy of the counterparty's contractual performance.[56] For that reason, it should be no surprise that cross-border trade finance, where centuries of letter-of-credit practices have developed a staple of routinely accepted documentary proxies for contractual performance, should be one of the most promising frontiers for the development of smart contracts.[57]

51. *See generally* Stuart D. Levi & Alex B. Lipton, *An Introduction to Smart Contracts and Their Potential and Inherent Limitations*, HARV. L. SCH. FOR. ON CORP. GOVERNANCE & FIN. REG. (May 26, 2018), https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/.

52. *Id.*

53. *Id.*

54. *Id.*

55. *See generally* RONALD J. MANN, PAYMENT SYSTEMS AND OTHER FINANCIAL TRANSACTIONS 349–93 (6th ed. 2016).

56. *Id.*

57. *See, e.g.*, ICC BANKING COMM'N, RETHINKING TRADE & FINANCE 60–63, 230–32 (2017), https://cdn.iccwbo.org/content/uploads/sites/3/2017/06/2017-rethinking-trade-finance.pdf; LATA VARGHESE & RASHI GOYAL, HOW BLOCKCHAIN CAN REVITALIZE TRADE FINANCE (PART 1) (2017), https://www.cognizant.com/whitepapers/how-blockchain-can-revitalize-trade-finance-part1-codex2766.pdf; LATA VARGHESE & RASHI GOYAL, BLOCKCHAIN FOR TRADE FINANCE: PAYMENT METHOD AUTOMATION (PART 2) (2017), https://www.cognizant.com/whitepapers/how-blockchain-can-revitalize-trade-finance-part1-codex2766.pdf; LATA VARGHESE & RASHI GOYAL, BLOCKCHAIN FOR TRADE FINANCE: TRADE ASSET TOKENIZATION (PART 3) (2018), https://www.cognizant.com/whitepapers/blockchain-for-trade-finance-trade-asset-tokenization-part-3-codex3337.pdf; *see also* Sumeet Chatterjee, *HSBC Says Performs First Trade Finance Deal Using Single Blockchain System*, REUTERS (May 13, 2018), https://www.reuters.com/article/us-hsbc-blockchain/hsbc-says-per-

Having said that, the structure of the transaction at hand—collateralizing a blockchain-based cryptocurrency—is in several ways ideal for smart contracting. Most obviously, both sides of transaction performance are well-suited to blockchain-based verification. 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.

Interestingly, the use of smart contracts to execute secured transactions was one of the original examples offered in Nick Szabo's seminal 1997 paper.[58] Specifically, he suggested its use to replicate repossession in the automobile-lending context.[59] There, upon a failure of payment, the contract would "return control of the car keys to the bank."[60] Technology to accomplish that feat—remotely incapacitating the debtor's ability to start the vehicle—certainly did not exist in 1997[61] and even now remains a bit out of reach.[62] By contrast, the steps necessary to effectuate crypto-currency col-

forms-first-trade-finance-deal-using-single-blockchain-system-idUSKCN1IF01X (describing the first trade finance deal using a shared blockchain system).

58. Szabo, *supra* note 50.

59. Szabo, *supra* note 50.

60. Szabo, *supra* note 50.

61. Szabo, of course, recognized this. The prescience of his explanation of how we might "more fully embed in a property the contractual terms which deal with it" is notable:

> These protocols would give control of the cryptographic keys for operating the property to the person who rightfully owns that property, based on the terms of the contract. In the most straightforward implementation, the car can be rendered inoperable unless the proper challenge-response protocol is completed with its rightful owner, preventing theft. But if the car is being used to secure credit, strong security implemented in this traditional way would create a headache for the creditor—the repo man would no longer be able to confiscate a deadbeat's car. To redress this problem, we can create a smart lien protocol: if the owner fails to make payments, the smart contract invokes the lien protocol, which returns control of the car keys to the bank.

Szabo, *supra* note 50.

62. Only a bit. Recent developments in the "internet of things" realm suggest that cars, in the next few years, will include technology sufficient to make payments directly from the car. *See Connected Cars and Cards*, NILSON REP. 7, 7–8

lateralization both can be completed directly on the blockchain itself, without any need to develop electronic proxies for meatspace activity.

To be sure, a few additional tweaks are necessary to replicate the traditional lien transaction. Most obviously, the contract also needs to include code to vitiate the lender's interest if the borrower in fact makes the required payments.[63] Thus, just as the lien would ripen into full title if the borrower fails to make the required stream of payments, the lien would evaporate, returning full and unencumbered title to the borrower if the borrower did in fact make the required stream of payments.

More generally, for the transaction to attract mainstream lenders, it should be adapted to function with payments made in conventional currency as opposed to blockchain-based currency. That is particularly true if, as seems likely, the principal context in which blockchain-based currency is useful as collateral is in "all-assets" transactions, in which lenders seek an interest in the blockchain-based currency simply because it represents a cognizable portion of the borrower's balance sheet.[64] The volatile prices of blockchain-based currency suggest that they would be much less valuable as collateral in asset-specific lending contexts, especially given the substantial likelihood that its value would decline markedly during the term of a loan.[65] Once the transaction involves payments in conventional currency, the problem arises that the payment (or lack of payment) is not an act directly apparent on the blockchain.[66] Thus, some blockchain-verifiable event needs to be devised as a proxy for the actual payment.

One simple approach would insert a trusted third party into the transaction, obligating the third party to record a notice on the relevant blockchain to indicate the presence—or absence—of each payment. Using arrangements

(Nov. 2016) (discussing developing procedures for provisioning payment tokens into applications embedded in automobiles); *Jaguar Test-Drives Embedded Payments*, PYMNTS.COM (Feb. 15, 2017), http://www.pymnts.com/news/mobile-payments/2017/jaguar-test-drives-embedded-payments/ (adjustment of that technology to use the connectivity to disable the vehicle seems a trivial extension).

63. Szabo recognized that little detail even in his summary sketch. *See* Szabo, *supra* note 50 ("A further reification would provably [sic] remove the lien when the loan has been paid off.").

64. *See, e.g.*, AnnaMaria Andriotis & Paul Vigna, *Credit Card Companies Don't Want You to Buy Bitcoin With Plastic*, WALL ST. J. (Jan. 25, 2018), https://www.wsj.com/articles/should-you-buy-bitcoin-with-your-credit-card-1516897097.

65. Indeed, Bitcoin has been so volatile that major credit card issuers have stopped allowing cardholders to purchase bitcoin with a credit card, even though the lenders in those transactions get no interest at all in the collateral. *See id.*

66. Michael Crosby et al., *BlockChain Technology*, SUTARDJA CTR. FOR ENTREPRENEURSHIP & TECH. 3 (2015), https://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf.

akin to those for an escrow agent, the parties could arrange for each payment to pass through the third party, with the third party then providing notice on the blockchain regarding the propriety of each required payment. If the notice were "signed" with the agent's indicated private key, it would be accepted as a new block on the chain; under the terms of the smart contract, the notice either would or would not trigger the responses indicated (such as a transfer of the collateral to defray any outstanding balance of the obligation) in the event of default.

In sum, it easily should be within the technological reach of existing techniques to integrate the traditional attributes of a lien into a smart contract.

B. If We Build It, Will They Come?

The natural question, then, is whether any substantial group of commercial transactors would use a smart lien if the basic building blocks described above were designed and implemented on one of the major blockchains. The author's strong impression is that the answer is yes, but only (at least at first) within the niche for all-assets lending to large businesses. The author can start with explaining why he thinks the smart lien is ill-suited to other contexts before explaining why he thinks it would be not only effective but also attractive within that particular niche.

On the first point, the author noted above why a lien on cryptocurrency is more likely to make sense in the context of all-assets lending as opposed to purchase-money or other lending founded on advances made against the value of specific assets.[67] Those transactions typically cap their funding at a specified percentage of the purchase price of the asset at the time of the loan (often in the range of 75–80%).[68] For asset classes that have relatively stable values, the likelihood of a price decline that exceeds twenty percent might be relatively small; in that case, the lender's credit losses would be relatively slight, without regard to the personal creditworthiness of the borrower.[69]

The inflexibility of the enforcement structure also makes the smart lien ill-suited to loans in which relational or other considerations might make a pre-arranged and automated execution on collateral precipitous. It is one thing for a publicly traded company to suffer a catastrophic loss from its balance sheet the day after it fails to make a quarterly payment on one of its bond issues. For smaller and middle-market borrowers, though, there is a

67. *See* Andriotis & Vigna, *supra* note 64.

68. *Cf.* Eric B. Garfield & Matthew T. VanEck, *Cap Rate Calculation*, CERTIFIED COM. INV. MEMBER INST., https://www.ccim.com/cire-magazine/articles/cap-rate-calculations/?gmSsoPc=1 (discussing how cap rates are calculated in the real estate market).

69. To be sure, home-mortgage lenders in the first decade of this century commonly lent up to 90% or even 100% (or more) of the purchase price of the home. Even at the time, though, few experienced lenders regarded those transactions as prudent.

much greater likelihood that transactors will negotiate for notice or grace periods, or perhaps for an opportunity to cure defaults before the exercise of remedies by the lender. More broadly, even in transactions in which the parties have not negotiated for such things, there might be a sense that the lender's duty of good faith and fair dealing obligates it to provide such things, at least in some circumstances. To put it another way, the inflexible enforcement structure makes sense only in contexts in which it is sensible to believe that the borrower should be understood, in a practical and effective way, as agreeing without qualification or reservation to an immediate and irrevocable disposition of the collateral instantaneously upon a single payment default.[70]

The last question, then, is to consider whether the transaction would be attractive within the milieu identified above: all-assets lending for relatively large business borrowers. Although any discussion is speculative, several overlapping reasons persuade that the transaction would be attractive. The first is the most speculative, but also probably the most important: the likelihood that blockchain-based currencies of one form or another will become a bigger share of the balance sheet of businesses in the years to come.

The history of secured credit in the United States over the last century has been a history of shifts in the balance sheets of businesses followed by innovations in the practice and law of secured credit to ensure that lenders can obtain a reliable security interest. To offer just the most obvious examples, compare the ease of perfecting blanket liens in accounts receivable under Article 9 with the mélange of imperfect remedies available in earlier years under the scattered state-law regimes;[71] the ease of third-party perfection in deposit and securities accounts under the revised Article 9 with practice under the original Article 9;[72] and the development over the last two decades of institutions to perfect securities interests in intellectual property, responding to the increased importance of intellectual property on business

70. That is not to say that the smart lien could not be crafted to accommodate some or all of the features of more flexible arrangements. For example, it would not be difficult, using the mechanisms summarized above, to grant a grace period or a right of notice and opportunity to cure. In common practice, though, those mechanisms tend to occur in environments in which transactors are more likely to conceive of a correlative flexibility in the ultimate enforcement of the remedy than the idea of the smart lien contemplates; it is not nearly so easy to design a software-coded instantiation of the kind of flexibility or forgiveness that would be contemplated by challenges arising under a duty of good faith and fair dealing.

71. *See* GILMORE, *supra* note 12, at 128–45, 196–249, 250–86.

72. *Compare, e.g.*, U.C.C. § 9-314 (discussing perfection by control), *with* GILMORE, *supra* note 12, § 10.7 (discussing transactions excluded under U.C.C. § 9-104).

balance sheets.[73] If blockchain-based currencies continue to increase in commercial significance, the pressure for effective mechanisms of perfection will be compelling.

That pressure would motivate the development of smart contracts to facilitate lending against blockchain-based currencies only if there is something markedly advantageous about those transactions, and the author thinks there is. The most obvious reason is the one summarized above, that implementation of the transactions at the blockchain level would be less "clunky"—more elegant—than the circuitous use of quasi-control discussed in the preceding section. But the author does not think that the point of elegance standing alone would go far—after all, elegance of transactional design is certainly of more interest to theorists and academics than it is to borrowers and lenders, who are primarily interested in documenting, as cheaply as possible, a transaction that comes as close as possible to enforcing their shared agreement.

The discussion above, though, shows one obvious advantage that the smart contract approach would have over the quasi-control approach: limiting borrower concerns about lender opportunism (clogging). Specifically, because the quasi-control arrangement puts formal ownership of the blockchain-based currency in the name of the lender, the lender is in a position, at least as a matter of raw power, to dispose of the collateral without the borrower's consent or even over the borrower's objection.[74] That is particularly problematic in all-assets transactions in which the borrower typically will be free to buy and sell assets of particular types, subject only to conventional limitations designed to prevent transactions outside the ordinary course of the borrower's routine business. Thus, for a borrower that happens to own some blockchain-based currency, which is not the central focus of the borrower's balance sheet, a transfer of title to the lender might seem particularly objectionable, insofar as it would require the borrower to obtain a release (and reconveyance) from the lender to affect any transaction involving the currency in question.

To be sure, the simplistic smart contract arrangement discussed above would not leave the borrower the same freedom to convey blockchain-based currency that it might have under a conventional all-assets security agreement, but replicating the convenience of that freedom in the blockchain-based smart contract should be trivially easy. To discuss just a few of the most common arrangements without working through all the bells and whistles, the smart lien could provide, for example, that the borrower, without any constraint, could transfer a specified amount of the currency during

73. *See, e.g.*, Ronald J. Mann, *Secured Credit and Software Financing*, 85 CORNELL L. REV. 134, 187 (1999); MANN, *supra* note 14, at 158–92 (discussing perfection of security interests in copyright and patents); Xuan-Thao Nguyen, *Financing Innovation: Legal Development of Intellectual Property as Security in Financing: 1845–2014*, 48 IND. L. REV. 509 (2015).

74. *See How It Works*, *supra* note 43.

any single time period. Conversely, it could provide that the lender could record a notice of default on the blockchain that would terminate any right of the borrower to transfer any of the currency until resolution of the alleged default.

You might ask yourself why an aspect of the transaction that makes it more attractive to the borrower should make adoption of the transaction more likely. After all, if we conceive of a transaction design as a zero-sum game, then any shift to make the transaction more palatable to one party necessarily makes it less palatable to the other. But transaction design is not a zero-sum game. The author works from the perspective that the inefficiencies of doctrinal rules and judicial enforcement generally make it impossible for the parties to document a transaction that perfectly replicates whatever their shared agreement might be. That is particularly true in the context of secured lending, because the law in that context has such a pervasive overlay of borrower-protective concerns that place a wide variety of arrangements to which well-informed parties might agree completely off the table.[75] From that perspective, arrangements that reassure the parties about the consonance of the practical effect of the agreement and the shared agreement of the parties can improve the attractiveness of the arrangements for both sides of the transaction.

For the reasons discussed above, this arrangement should provide considerable reassurance to borrowers about the potential for malfeasance by lenders related to the borrower's collateral, lessening the amount of trust that is necessary for borrowers to find the transactions acceptable. In the same vein, if effectively implemented, the smart lien should lessen the transactional burden, as compared to a quasi-control transaction, for the borrower's dealings with blockchain-based assets that it would be free to convey under the terms of the security agreement. The author's sense, based on interactions with borrowers, is that those effects would be regarded as substantial, if not affirmatively important.

At the same time, the author doubts that most lenders—at least the institutional lenders likely to be involved in transactions of this size and character—would enter into the transaction with an expectation that they would engage in those activities profitably in any event.[76] If so, they would not regard it as a significant cost to enter into a transaction, the design of which

75. MANN, *supra* note 14, at 77–101 (discussing rules that recharacterize transactions to treat them as secured transactions); MANN, *supra* note 14, 237–87 (discussing rules limiting the arrangements to which the parties can agree for disposition of collateral after default).

76. That might be true because of a perception that it would harm the lender's reputation to act opportunistically, because of concerns that the costs of litigation (including possibly supra-compensatory legal remedies available to borrowers) ultimately would undermine the profitability of opportunistic action against the collateral, or even because of a sense that the activity is "wrong" or "unfair."

foreclosed those routes for opportunism. To put it another way, the well-designed smart contract could, at least potentially, increase transactional surplus by providing a mechanism for the lender willing to enter it to provide a credible signal that the lender has no interest in undue trammeling of the borrower's ability to deal with its assets during the term of the loan.

Conversely, the automation of the remedial process that comes with the smart lien could make the transaction more attractive to lenders in important ways. As discussed above, the smart lien would be problematic in relational lending transactions that involved a substantial amount of give and take between the parties, or in smaller transactions in which the parties (or courts) would expect flexibility or deliberation in the remedial process. But the borrower's willingness to enter into a transaction with a smart lien provides a signal to the lender that the borrower is willing to accept the draconian consequence that would flow from default on a smart-lien secured transaction: automated disposition of the collateral at the then-current market value. To be sure, the benefits from that signal might be slight. Because the consequences of default ordinarily are catastrophic and immediate in the large-dollar lending contexts for which the author thinks the transaction is suited, the willingness of a borrower to extend that treatment to whatever blockchain-based currency it might own is probably expected. Still, the availability, and acceptability, of an effective remedy should play some role in making the transaction more attractive.

V. CONCLUSION

As the author neared the end of this article, he became increasingly concerned about the high dose of speculation, much of which is far removed from the kind of solid empirical backing to which the author aspires in his work. But on reflection, the author came to appreciate the value of the speculative tone. Speculation is inherent in the design of this project—assessing the prospects for transactions that do not yet commonly occur. The author applauds the foresight of the editors for putting together a panel on the subject of collateralizing crypto-currencies, because it has induced this speculation. There is something special, almost exciting, about this effort to analyze potential structures for transactions that are likely to be routine in a few short decades, a sense of being in "on the ground floor." The author looks forward to seeing those developments as they unfold in the years to come, even as he recognizes how unlikely it is that they will track closely with the introductory thoughts the author offers in the preceding pages.