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PROPERTY RIGHTS IN CRYPTOCURRENCIES: A LAW AND ECONOMICS PERSPECTIVE

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Can anyone really own virtual tokens such as Bitcoin and Ether? And if so, how should the law protect the rights of the owner? Legal rulings in federal courts have yielded inconsistent policies regarding the applicable remedy when rights in cryptocurrencies are infringed. Some adopt a property rule, granting injunctions and enforcement of property rights against third parties, whereas others restrict the remedy to damages. However, all rulings share one problematic feature: a lack of distinction between types of crypotokens, resulting in an implicit, one-size-fits-all policy. The economic analysis of law suggests that the choice between a property rule and a liability rule should depend on transaction costs, but such costs typically differ across cryptotokens because cryptotokens are diverse and customizable. Thus, this Article proposes to exploit the common taxonomy of cryptotokens, which distinguishes between security, utility, and currency tokens, as a proxy for transaction costs.

TABLE OF CONTENTS

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I. INTRODUCTION

The emergence of decentralized ledger technology (and, in particular, "blockchain")[1] has led to the introduction of a new category of digital assets: the cryptocurrencies, or more broadly "cryptotokens." These include, for example, Bitcoin,[2] Ether,[3] and Facebook's expected new token, the Libra.[4] Cryptotokens take many shapes and forms: some are used as a currency;[5] some provide a

[1] The terms "blockchain" and "decentralized ledger technology" ("DLT") are sometimes used as synonyms, but blockchain is only a subset of the broader category of DLT. *See generally* Sally M. Gainsbury & Alex Blaszczynski*, How Blockchain and Cryptocurrency Technology Could Revolutionize Online Gambling,* 21 GAMING L. REV. 482, 482–83 (2017) (explaining that "[b]lockchain is an open source distributed ledger").

[2] SATOSHI NAKAMOTO, BITCOIN: A PEER-TO-PEER ELECTRONIC CASH SYSTEM 1 (2008), https://bitcoin.org/bitcoin.pdf [https://perma.cc/7AUY-TMEW].

[3] *What is Ethereum?*, ETHEREUM.ORG (Dec. 18, 2020), https://ethereum.org/en/what-is-ethereum [https://perma.cc/ZM3V-Z4PR].

[4] DIEM, LIBRA ASS'N MEMBERS, AN INTRODUCTION TO LIBRA WHITE PAPER v2.0 2 (Apr. 2020), https://www.diem.com/en-us/white-paper [https://perma.cc/Q3YK-7XUX].

[5] For example, Bitcoin is a cryptocurrency that is now commonly accepted as means of payments for goods or services. Examples include purchases in the shopping area of some airports, or payments in real estate transactions. *See* Merrick Wang*,* Bitcoin and its Impact on the Economy 5 (Oct. 3, 2020) (unpublished manuscript), https://arxiv.org/abs/2010.01337 [https://perma.cc/N4WW-UPNC]. Bitcoin can even direct money withdrawals via ATMs. *See*, *e.g.*, Mitchell Hyman, *Bitcoin ATM: A Criminal's Laundromat for Cleaning Money*, 27. ST. THOMAS L. REV. 296, 304 (2015).

more specific utility (e.g., access to a product);[6] and some resemble financial instruments.[7]

As the cryptocurrency market is both nascent and ever-evolving, regulators have struggled to catch up.[8] Hence, existing regulation does not provide clear guidelines as to how courts should treat disputes involving entitlements in cryptotokens. As with any entitlement, protection of rights in cryptotokens can be implemented using one of two options: liability rules or property rules.[9]

Under a liability rule, whoever infringes upon the rights of a token holder is liable for damages and must compensate that holder for any harm caused.[10] Respectively, under a property rule, the remedy for infringement is not compensation, but rather a court order that enjoins the defendant to abstain from infringing, for

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[6] A commonly used example for utility tokens is the cryptocurrency Filecoin, which provides its owner with access to a decentralized cloud storage platform. *See* PROTOCOL LABS, FILECOIN: A DECENTRALIZED STORAGE NETWORK 1 (2017), https://filecoin.io/filecoin.pdf [https://perma.cc/M7CJ-H65G].

[7] For example, the token BCAP—launched by in 2017—provides its holder with a non-voting economic interest in the limited partnership "Blockchain Capital," which operates as a venture capital fund in the crypto market. Lin Lin & Dominika Nestarcova, *Venture Capital in the Rise of Crypto Economy: Problems and Prospects*, 16 BERKELEY BUS. L.J. 533, 550 n.68 (2019).

[8] *See generally* Lawrence J. Trautman, *Bitcoin, Virtual Currencies, and the Struggle of Law and Regulation to Keep Peace*, 102 MARQ. L. REV. 447, 450 (2018) (addressing the "constant struggle of law and regulation to keep pace with rapid technological developments").

[9] A third option is inalienability rules, which reflect non-enforcement. The operative result of such rules is that the defendant wins the dispute, but they are traditionally perceived not as property rules in favor of the defendant, but rather as ruling out the entitlement of the plaintiff. *See* Guido Calabresi & Douglas A. Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092–93 (1972).

[10] A liability rule permits a party to infringe on another party's rights, subject to monetary compensation. *See, e.g.,* Sony BMG Music Ent. v. Tenenbaum, 721 F. Supp. 2d 85, 113 (D. Mass. 2010), *aff'd in part, vacated in part, rev'd in part*, 660 F.3d 487 (1st Cir. 2011) ("The quintessential example of a liability rule is a rule that permits a factory to pollute only if it compensates surrounding homeowners by paying them an amount of damages determined by a court.").

example, through an injunction.[11] The key distinction between these two types of rules is whether one's right to a token can be involuntarily infringed or transferred: a property rule prevents involuntary transfers (as injunctions restore the right to its original owner), whereas liability rules facilitate transfers conditional on compensation.

Furthermore, the distinction is also closely related to the legal concepts of rights *in personam*, which are attached to a specific person, and rights *in rem,* which are attached to an object and are enforceable against anyone.[12] Liability rules are generally limited to *in personam* claims, so that a victim who suffers harm can only claim compensation against someone who directly interfered with his right.[13] Conversely, property rules typically suggest an *in rem*

[11] A property rule prohibits infringements in the absence of a voluntary transaction. *Id.* ("We generally require individuals who wish to reproduce or distribute a copyrighted work to purchase a license from the copyright owner in a voluntary transaction. In this sense, copyrights are protected by what academics in the field of law and economics call a 'property rule.' . . . Property rules are distinguished from liability rules, which permit one party to deprive another party of something to which the law says he is entitled by paying an objectively determined value for it.").

[12] The distinction between *in personam* ("rights to things") and *in rem* ("rights to objects") has long been a subject of debate among legal scholars. The debate dates to Blackstone's definition of a property right, which highlights the *in rem* right to exclude others. *See* Shyamkrishna Balganesh, *Demystifying the Right to Exclude: Of Property, Inviolability, and Automatic Injunctions*, 31 HARV. J.L. & PUB. POL'Y 593, 596 (2008); Thomas W Merrill & Henry E. Smith, *What Happened to Property in Law and Economics,* 111 YALE L.J. 357, 360–61 (2001). While some argue that all property rights are *in rem*, others note that all duty-violations claims (also those concerning an infringement of a property right) are made against a specific person and are therefore *in personam*. *See, e.g.,* Pavlos Eleftheriadis, *The Analysis of Property Rights,* 31 OXFORD J. LEGAL STUD. 31, 41 (1996); *see also* Jeremiah Smith*, Tort and Absolute Liability Suggested Changes in Classification*, 30 HARV. L. REV. 241, 251 (1916) (arguing that tort claims could be either for violation of *in rem* rights or *in personam* rights). For a general discussion of rights *in rem*, see George B. Fraser Jr, *Actions in Rem*, 34 CORNELL L.Q. 29, 29–30 (1948).

[13] Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719, 1794 (2004).

property right, thereby allowing victims to also pursue claims related to the object of property against third parties.[14]

As cryptocurrencies are virtual assets that are managed in a decentralized way—so that no central authority is responsible for registering who owns which crypotoken—treating them as property is not free of conceptual difficulties.[15] Nevertheless, legal policies around the world all seem to acknowledge that cryptocurrencies are eligible to be considered as property, so that a property rule could be implemented to protect entitlements in cryptocurrencies if one would wish to do so. Notably, the U.S. Internal Revenue Service determined that cryptocurrencies are a "general intangible" that should be taxed as property.[16] Court cases in Canada,[17] Singapore,[18] the United Kingdom,[19] and New Zealand[20] also demonstrate a general willingness to recognize cryptocurrencies as property.

However, courts drastically diverge on the type of remedy that is available for individuals whose rights in a cryptocurrency are infringed. In U.S. federal courts, some judicial decisions apply a

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[14] *Id*. at 1724.

[15] For further details on the literature's discussion surrounding the definition of cryptotokens as property, see *infra* Part III.B.

[16] I.R.S. Notice 2014-21, 2 (May 2014), http://www.irs.gov/pub/irs-drop/n-14-21.pdf [https://perma.cc/C28E-62YU]; I.R.S, *Frequently Asked Questions on Virtual Currency Transactions*, INTERNAL REVENUE SERV., https://www.irs.gov/individuals/international-taxpayers/frequently-asked-questions-on-virtual-currency-transactions [https://perma.cc/F9G3-M36] (last visited Feb. 11, 2021). *See also* Lorena Yashira Gely-Rojas, *Cryptocurrencies and the Uniform Commercial Code: The Curious Case of Bitcoin*, 8 UPR BUS. L.J. 129, 134 (2016) (explaining that the I.R.S. views cryptocurrency as "a digital representation of value that functions as a medium of exchange, a unit of account, and/or a store of value").

[17] Shair.Com Glob. Digit. Servs. Ltd. v. Arnold, [2018] CanLII 1512 (Can. B.C.S.C.); Copytrack Pte Ltd. v. Wall, [2018] BCSC 1709 (Can.).

[18] B2C2 Ltd. v. Quoine PTC Ltd., [2019] SGHC (I) 03 [142] (2019) (Sing.).

[19] AA v. Persons Unknown & Ors, Re Bitcoin, EWHC 3556 (Comm) (2019) (U.K.).

[20] *See* Paul T. Babie et al., *Cryptocurrencies as Property:* Ruscoe and Moore v Cryptopia Limited (In Liquidation) *[2020] NZHC 728* at 10 (Univ. of Adelaide Research Paper No. 2020-33, 2020), https://ssrn.com/abstract=3578264 [https://perma.cc/2RG9-SK28].

property rule[21] whereas others apply a liability rule,[22] mostly without any normative deliberation on why a specific rule was chosen.[23] Although there is a clear need to establish a consistent policy with respect to which legal remedy applies, these decisions largely neglect economic implications, such as which rule sets better incentives. In particular, courts do not seem to make any explicit distinctions between different types of tokens, resulting in a one-size-fits-all (either property or liability, depending on the case) rule for every token.[24]

Determining whether such a unified rule makes sense requires a framework for evaluating its effects. Luckily, such a framework is readily available in the economic analysis of law ("law and economics"). The economic analysis offers a criterion for determining which type of rule (property or liability) should generally be applied to protect an entitlement: policymakers should adopt the rule that is most efficient, meaning the rule that maximizes social welfare.[25] Such a rule should ensure that resources end up in

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[21] Sony BMG Music Ent. v. Tenenbaum*,* 721 F. Supp. 2d 85, 113 (D. Mass. 2010).

[22] *Id.*

[23] *See infra* Part III.AA (discussing the foreign cases mentioned in the text).

[24] Note that as most cases revolve around one specific set of tokens, the judgment simply does not raise the question of whether a token's type matters (thus making no distinction). In cases that do involve multiple tokens, the remedy usually pools together all tokens. For instance, in *Bureau of Consumer Fin. Protect. v. Consumer Advoc. Ctr. Inc*., No. 8: 19-CV-01998 2020 WL 7774930 (C.D. Cal. Aug. 28, 2020)*,* a receiver was appointed for Bitcoin, Ethereum, and Bitcoin Cash, without any discussion on whether these differ in any relevant way.

[25] In economic terms, maximizing "social welfare" means choosing the option that maximizes the sum of utilities of individuals in society. Often, this choice is analyzed in a market setting where profits of firms ("supplier surplus") and benefits to consumers ("consumer surplus") are added up to a "total surplus" representing social welfare. Alternatively, economists often instead use the term "efficiency," where the most efficient solution is the one where social welfare is maximized. *See, e.g.,* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 12–14 (6th ed. 2016). Note that this article generally follows the *traditional* analysis of law and economics, which adopts the assumptions of neoclassical economics. *Id.* This analysis entails, for instance, the assumption that the maximization of social welfare is best achieved by maximizing so-called Kaldor-Hicks efficiency and neglecting distributional considerations. *Id.* at 42.

the hands of the person who values them most.[26] The typical way in which goods change hands is through free trade between willing sellers and buyers, but agreements can only be formed when parties are able to effectively negotiate, which is hindered when there are so-called "transaction costs" (hereinafter "TC"). These costs can arise in different stages of the trade and include initial costs incurred when searching for a trading partner; costs of bargaining with a potential trading partner, once a partner is found; and costs incurred to ensure that all parties comply with the terms of the agreement.[27]

In particular, TC play a key role in one of the fundamental theorems in law and economics—the "Coase Theorem."[28] Concisely, the Coase Theorem suggests that when TC are sufficiently low, parties will negotiate and voluntarily prefer an efficient allocation to an inefficient one.[29] The rationale for this suggestion is that parties would prefer giving the good to the party who values it most (irrespective of who owned it initially) as that party will have the highest willingness to pay for the good—and the

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Alternative assumptions, such as the ones offered by behavioral law and economics, are not considered to focus on the main argument of interest.

[26] *See, e.g.,* Edwin C. Baker, *The Ideology of the Economic Analysis of Law*, 5 PHILOS. & PUB. AFF. 3, 4 (1975).

[27] *See also infra* Part III.B (discussing the exact definitions of TC).

[28] The foundations of the Coase theorem are usually attributed to two papers. *See generally* Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON 1 (1960) (discussing transaction costs with respect to actions which have negative effects on others); Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386, 388 (1937) (analyzing why firms operate as one entity instead of outsourcing tasks to separate organizations and explaining that a corporation structure saves on transaction costs). The name "Coase Theorem" was coined later by George Stigler. *See* Steven Medema, *A Case of Mistaken Identity: George Stigler, 'The Problem of Social Cost,' and the Coase Theorem*, 31 EUR. J.L. & ECON. 11, 12 (2011).

[29] The economic logic is that if the parties do not incur high transaction costs, then the party who assigns a higher value to a good would offer to pay the other party (who values the good less) enough money, so that a transaction would take place, leading to a more efficient allocation (where the party valuing the good more ends up owning it). For this logic to work, transaction costs must be sufficiently low. *See*, *e.g.*, COOTER & ULEN, *supra* note 25, at 85 (defining this aspect of the Coase Theorem as "[w]hen transaction costs are zero, an efficient use of resources results from private bargaining, regardless of the legal assignment of property rights").

extra surplus that this exchange creates can be split between the parties. Thus, allocative efficiency will not depend on the assignment of the initial property rights if TC are sufficiently low, so that the parties will in fact trade.[30] The seminal paper by Calabresi and Melamed extended this insight and proposed to adopt property rules whenever TC are low—as then parties will achieve efficiency by trading—and liability rules otherwise.[31]

Applying the logic of law and economics to the question of how to protect entitlements in cryptocurrencies reveals that a one-size-fits-all rule that applies for all tokens is unlikely to be efficient, as TC are likely to differ greatly from token to token. Namely, tokens are not homogenous,[32] and their values starkly depend on factors such as the details of the computer code that generated the token, the purposes for which the token can be used, the liquidity of the token, and so on.[33] Thus, it seems obvious that a one-size-fits-all rule makes little sense.

At the same time, establishing tailor-made rules for each token seems both tedious and costly, so some middle ground must be found. In the following pages, this Article seeks to exploit a common taxonomy of tokens, which divides tokens into three

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[30] COOTER & ULEN, *supra* note 25, at 81–88.

[31] Calabresi & Melamed, *supra* note 9, at 1118.

[32] For evidence that cryptocurrencies are, in fact, heterogeneous, see Frida Gustafsson & Elias Bengtsson, Are Cryptocurrencies Homogenous? (Dec. 2, 2019) (unpublished manuscript), https://ssrn.com/abstract=3496527 [https://perma.cc/XEH6-MVC3].

[33] The computer code behind a token determines what the token can and cannot do and hence determines what the exact value of holding the token is. For instance, if the code entails a mistake, it might reduce the value of the token. Similarly, the utility of using the token depends on what one can do with it, which is also determined by the code. Furthermore, as with any financial instrument, liquidity can play a role as well: if one buys a token but cannot sell it easily (due to low liquidity), this predicament entails a disadvantage. Note, however, that the empirical evidence regarding the effect of illiquidity is mixed. *See* Steven E. Kozlowski et al., *Cryptocurrency Return Reversals*, APPLIED ECON. LETT. (forthcoming) (finding evidence consistent with negative "reversal" effect for illiquid cryptocurrencies); Wang Chun Wei*, Liquidity and Market Efficiency in Cryptocurrencies,* 168 ECON. LETT. 21 (2018) (finding no evidence of illiquidity premiums).

categories: utility, currency, and security.[34] These categories are helpful in capturing some aspects of TC and can thus serve as a benchmark for developing appropriate rules.

This Article suggests that, from a pure TC perspective, security tokens are best protected by liability rules, whereas currency tokens are better protected through property rules. However, this Article's analysis also suggests that other efficiency considerations, such as preventing imperfect compensation when tokens are non-fungible, may support a different conclusion. Furthermore, given that the features of such tokens will always strongly depend on their connection to a specific underlying product or service, the choice of rule for utility tokens is generally still better off left to a case-by-case approach.

The rest of this Article is organized as follows: Part II provides an overview of cryptocurrencies and the debate surrounding their taxonomy. Part III reviews the existing case law and its inconsistencies, as well as the existing literature related to property rights in cryptocurrencies. Part IV then analyzes how insights from law and economics can help determine which rule should be adopted to best protect entitlements in cryptocurrencies. Part V concludes.

II. CRYPTOTOKENS: OVERVIEW AND TAXONOMY

A. Historical overview

In 2008, an author using the alias "Satoshi Nakamoto," posted a mysterious white paper online titled "Bitcoin: A Peer-to-Peer Electronic Cash System."[35] This white paper revealed a new and exciting technology: a digital token that can be freely transferred between owners without the need to rely on a central entity to register transactions.[36] Instead, the Bitcoin token transactions are recorded using a decentralized ledger technology, which combines advanced encryption, cryptography, and a chain of connected

[34] *See infra* Part II.B (discussing token taxonomy).

[35] *See* NAKAMOTO, *supra* note 2, at 8.

[36] *See, e.g.,* Dennis Chu, *Broker-Dealers for Virtual Currency: Regulating Cryptocurrency Wallets and Exchanges*, 118 COLUM. L. REV. 2323, 2326 (2018) ("Cryptocurrencies are digital assets recorded on decentralized, public ledgers.").

"blocks" (yielding the name "blockchain") that ensures the data is immutable.[37] Bitcoin is algorithmically designed to be a scarce resource that is released over time at a marginally decreasing speed, where new tokens enter the market only through the process of "mining."[38] As there is no central entity keeping track of the ownership in Bitcoin, the system offers Bitcoin holders technical control: each Bitcoin is protected by a pair of keys (each consisting of a unique serial number)—a private key and a public key.[39] The public key serves as the Bitcoin's address (somewhat similar to a bank account number), and the private key serves as the login details (somewhat similar to a user name and password) that grants access to the token and allows the transfer of the token to others.[40]

Although blockchain was developed to facilitate Bitcoin specifically, the general technological advantages spiked the interest of many.[41] Then, as the demand for Bitcoin began to soar (reaching

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[37] For the discussion in this Article, it is not necessary to delve too deeply into how blockchain technology exactly works. For overviews of the technology, see generally DYLAN YAGA ET AL., NAT'L INST. OF STANDARDS & TECH., U.S. DEP'T OF COM., BLOCKCHAIN TECHNOLOGY OVERVIEW (Oct. 2018), https://arxiv.org/ftp/arxiv/papers/1906/1906.11078.pdf [https://perma.cc/SM2W-VQQ8] (explaining the history, components, limitations, and misconceptions of blockchain technology); Lin William Cong & Zhiguo He, *Blockchain Disruption and Smart Contracts*, 32 REV. FIN. STUD. 1754 (2019) (discussing blockchain technology's categorization as a "decentralized consensus"). For an overview of Bitcoin in particular, see generally Christian Rueckert, *Cryptocurrencies and Fundamental Rights,* 5 J. CYBERSECURITY 1 (2019) (explaining how current regulatory frameworks interact with Bitcoin).

[38] Mining is the process in which users operate "nodes" by providing their computing power and disk-storage space for solving puzzles as part of the "Proof-of-work" consensus algorithm. For further details, see, for example, Vikrant Gandotra et al., *Cryptocurrency Mining*, *in* CRYPTOFINANCE AND MECHANISMS OF EXCHANGE 51 (Stéphane Goutte et al. eds., 2019).

[39] NAKAMOTO, *supra* note 2, at 2.

[40] For a review of the technology, see, for example, David Fox, Cryptocurrencies in the Common Law of Property (Aug. 16, 2018) (unpublished manuscript), https://ssrn.com/abstract=3232501 [https://perma.cc/PZU8-SR7D]; Michael Ng, *Choice of Law for Property Issues Regarding Bitcoin Under English Law*, 15 J. PRIV. INT'L L. 315, 315–16 (2019).

[41] *See, e.g.,* Jesse Yli-Huumo et al., *Where is Current Research on Blockchain Technology?—A Systematic Review,* 11 PLOS ONE, at 9 (2016) (finding empirical

a price of approximately $20,000 per token in 2017, and passing $60,000 in March 2021),[42] market players started creating their own cryptotokens. The creation of cryptotokens by market participants was made possible by the introduction of the Ethereum blockchain,[43] which enabled enterprises to create customized tokens and sell them publicly in an "initial coin offering" ("ICO").[44] ICOs were particularly attractive for entrepreneurs for different reasons, including the fact that issuing tokens enabled them to (1) raise funds without diluting the founder's rights[45] and at a relatively low cost;[46] (2) get access to investors that are typically inaccessible in traditional

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evidence of increasing scientific publications relating to blockchain). *See also* Dmitry Efanov & Pavel Roschin, *The All-pervasiveness of the Blockchain Technology,* 123 PROCEDIA COMP. SCI. 116, 116 (2018) (describing blockchain technology as "the most significant invention after the internet"); Ye Guo & Chen Liang, *Blockchain Application and Outlook in the Banking Industry,* 2 FIN. INNOVATION 24, 32 (2016) (referring to a blockchain product as currently being "the most promising model in the banking industry"); Andreas Kamilaris et al., *The Rise of Blockchain Technology in Agriculture and Food Supply Chains,* 91 TRENDS IN FOOD SCI. & TECH. 640, 641 (2019) (stating that "it has increasingly been realized that blockchain can be used for much more than cryptocurrency and financial transactions, so that several new applications are being explored").

[42] *Bitcoin*, COINDESK (last visited Dec. 29, 2020), https://www.coindesk.com/price/bitcoin [https://perma.cc/E7RV-KPLU]; Emma Newburger, *Bitcoin surpasses $60,000 in Record High as Rally Accelerates,* CNBC (Mar. 15, 2021), https://www.cnbc.com/2021/03/13/bitcoin-surpasses-60000-in-record-high-as-rally-accelerates-.html [https://perma.cc/LJ5Q-D9KP].

[43] *S*ee *generally* GAVIN WOOD ET AL., ETHEREUM: A SECURE DECENTRALISED GENERALISED TRANSACTION LEDGER (2014) (providing an overview of Ethereum's blockchain technology).

[44] *See* Jake Frankenfield, *What Is an Initial Coin Offering (ICO)?*, INVESTOPEDIA (Nov. 3, 2020), https://www.investopedia.com/terms/i/initial-coin-offering-ico.asp [https://perma.cc/277Z-SPMU] (explaining that "[an] initial coin offering (ICO) is the cryptocurrency industry's equivalent to an initial public offering (IPO)").

[45] Ralf Wandmacher, *Tokenomics*, *in* CRYPTOFINANCE AND MECHANISMS OF EXCHANGE 113, 113–23 (Stéphane Goutte et al. eds., 2019).

[46] Usman W. Chohan, *Initial Coin Offerings (ICOs): Risks, Regulation, and Accountability*, *in* CRYPTOFINANCE AND MECHANISMS OF EXCHANGE 165, 165–77 (Stéphane Goutte et al. eds., 2019).

funding;[47] and (3) avoid complex regulatory requirements that apply to traditional fundraising methods such as initial public offerings.[48] Cryptotokens soon proliferated and billions of dollars were raised from 2016 to 2019.[49] Over this period of time, so-called "crypto exchanges" began popping up. These exchanges operate similarly to a stock exchange and provide the market with liquidity by allowing sellers and buyers to trade between different tokens that are listed on the exchange.[50] Furthermore, exchanges often offer a "wallet" service, in which clients can open an online account at the exchange and store their private keys.[51]

At the same time, cryptotokens were bombarded with criticism. Tokens were accused of facilitating tax evasion,[52] scams,[53] Ponzi

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[47] Chen Liu & Haoquan Wang, *Crypto Tokens and Token Offerings: An Introduction*, *in* CRYPTOFINANCE AND MECHANISMS OF EXCHANGE 125, 125–44 (Stéphane Goutte et al. eds., 2019).

[48] *See generally* Hadar Y. Jabotinsky, *The Regulation of Cryptocurrencies-Between a Currency and a Financial Product*, 31 FORDHAM INTELL. PROP. MEDIA & ENT. L. J. 118, 123 (2020) (noting that "crowdfunding was not possible due to the heavy transaction costs associated with raising small amounts of money from many different investors").

[49] Estimates of the exact amounts raised in ICOs vary, but most sources claim that tens of billions of USD were raised between 2017 and 2019. *See, e.g.,* Shadi Samieifar & Dirk G. Baur*, Read Me if You Can! An Analysis of ICO White Papers,* 38 FIN. RES. LETTERS (Jan. 2021) (stating that more than 30 billion dollars were raised in ICOs between 2016 and 2019).

[50] MARIA DEMERTZIS & GUNTRAM B. WOLFF, THE ECONOMIC POTENTIAL AND RISKS OF CRYPTO ASSETS: IS A REGULATORY FRAMEWORK NEEDED? 8 (2018), https://www.econstor.eu/bitstream/10419/208022/1/1030937354.pdf [https://perma.cc/C24H-G73U].

[51] This sort of wallet is usually referred to as a "hot wallet." *See* Patrick McCorry et al., *Why Preventing a Cryptocurrency Exchange Heist isn't Good Enough*, *in* 11286 SECURITY PROTOCOLS XXVI 225 (Vashek Matyáš et al. eds, 2018) (explaining that a cold wallet is an "offline wallet" where cryptocurrencies are stored). Conversely, a wallet that stores the private keys offline is called a "cold wallet." *See id.*

[52] Thomas Slattery, *Taking a Bit out of Crime: Bitcoin and Cross-Border Tax Evasion*, 39 BROOK. J. INT'L L. 829, 844 (2014).

[53] Maria Vasek & Tyler Moore, *There's No Free Lunch, Even Ssing Bitcoin: Tracking the Popularity and Profits of Virtual Currency Scams, in* FINANCIAL CRYPTOGRAPHY & DATA SECURITY 44, 44 (Rainer Böhme & Tatsuaki Okamoto eds., 2015).

schemes,[54] money laundering,[55] and other forms of criminal activity.[56] Then, from 2018 to 2019, governments became increasingly concerned with the crypto market.[57] Some countries prohibited ICOs completely (e.g., China and Korea),[58] while others gradually adopted regulatory rules and guidelines that impose strict requirements on ICOs.[59] Eventually, the planned interventions, alongside other effects, yielded a highly bearish[60] market in 2019, so that ICOs ceased almost completely.[61] At the same time, two alternatives were born. First, many entrepreneurs turned to Security Token Offerings ("STOs") in which a token is issued, like any other security, with full regulatory compliance (i.e., with a prospectus,

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[54] *See generally* Maria Vasek & Tyler Moore, *Analyzing the Bitcoin Ponzi Scheme Ecosystem*, *in* FINANCIAL CRYPTOGRAPHY & DATA SECURITY 101, 104–106 (Aviv Zohar et al. eds., 2018) (discussing various Bitcoin-based Ponzi schemes).

[55] Rolf van Wegberg et al., *Bitcoin Money Laundering: Mixed Results? An Explorative Study on Money Laundering of Cybercrime Proceeds Using Bitcoin*, 25 J. FIN. CRIME 17, 20 (2018).

[56] Sean Foley et al., *Sex, Drugs, and Bitcoin: How Much Illegal Activity is Financed Through Cryptocurrencies?,* 32 REV. FIN. STUD. 179, 180 (2019).

[57] For instance, in late 2017, The U.S. Commodity Futures Trading Commission ("CFTC") published a primer on virtual currencies highlighting various risks. *See* CTFC, A CFTC PRIMER ON VIRTUAL CURRENCIES (Oct. 17, 2017), http://www.cftc.gov/idc/groups/public/documents/file/labcftc_primercurrencies100417.pdf [https://perma.cc/Q3NY-SBCQ]. For overviews of regulations around the world as of 2018, see generally GLOBAL LEGAL RESEARCH CENTER, REGULATION OF CRYPTOCURRENCY AROUND THE WORLD (June 2018), https://www.loc.gov/law/help/cryptocurrency/cryptocurrency-world-survey.pdf [https://perma.cc/F52U-CGU6] (discussing regulatory frameworks applied to cryptocurrencies internationally).

[58] Saman Adhami et al., *Why do Businesses Go Crypto? An Empirical Analysis of Initial Coin Offerings,* 100 J. ECON. BUS. 1, 10 (2018).

[59] Chohan*, supra* note 46, at 165–77.

[60] In finance, a market in which prices are on the rise is sometimes called a "bull market" or "bullish," whereas a market in which prices go *down* is called a "bear market" or "bearish."

[61] *See* Naeem Aslam, *Why A Crypto Bear Market Would Only Bring The Best ICOs,* FORBES (Mar. 29, 2018), https://www.forbes.com/sites/naeemaslam/2018/03/29/why-crypto-bear-market-would-only-bring-the-best-icos/?sh=a78e71131d2a [https://perma.cc/6SAU-TLBW] (discussing the effect 2018's bear market had on the frequency and quality of ICOs).

etc.).[62] Second, some entrepreneurs turned to Initial Exchange Offerings ("IEOs")[63] in which the initial offering is performed through the crypto exchanges, which sell the tokens to their existing client base. As of 2020, IEOs are still operable, but new regulations are constantly adopted which have limited their scope. For instance, the European Union ("EU") adopted the "Fifth Anti Money Laundering Directive" (2015/849) which requires member states to ensure that issuers of virtual tokens will conduct a thorough Know-Your-Client ("KYC") process and verify the identity of all buyers, which naturally imposes a burden on exchanges.[64]

The market for cryptocurrencies experienced turmoil in early 2020, following the eruption of the COVID-19 pandemic—a global event causing various economic shocks—leading to further interest in the crypto market.[65] In parallel, new regulation proposals were released in the EU in the form of a "digital finance package,"[66] entailing suggestions aimed to unify the regulation of trade in cryptocurrencies and of blockchain infrastructure.[67] Concurrently, the U.S. Conference of State Bank Supervisors ("CSBS") announced the launch of a program that similarly strives to achieve

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[62] Othalia Doe-Bruce, *Blockchain and Alternative Sources of Financing*, *in* CRYPTOFINANCE AND MECHANISMS OF EXCHANGE 91, 101 (Stéphane Goutte et al. eds., 2019).

[63] *Id.* at 108. *See also* Dmitri Boreiko et al., *Blockchain Startups and Prospectus Regulation*, 20 EUR. BUS. ORG. L. REV. 665, 672 (2019) (explaining that startups use ICOs "to finance project development by issuing coins or tokens in exchange for fiat money or Bitcoin or other cryptocurrencies").

[64] Another example is a new law adopted in South Korea, which requires exchanges to identify clients by name. *See* David Lee, *South Korea Passes Law to Introduce Permit System for Crypto Exchanges*, COINTELEGRAPH (Mar. 5, 2020), https://cointelegraph.com/news/south-korea-passes-law-to-introduce-permit-system-for-crypto-exchanges.https://cointelegraph.com/news/south-korea-passes-law-to-introduce-permit-system-for-crypto-exchanges [https://perma.cc/3MF7-BLN8].

[65] *See generally* Hadar Y. Jabotinsky & Roee Sarel, How Crisis Affects Crypto: Coronavirus as a Test Case (Mar. 23, 2020) (unpublished manuscript), https://www.ssrn.com/abstract_id=3557929 [https://perma.cc/YBJ2-FSZB] (producing empirical evidence on how the market for cryptocurrencies responded to the Covid-19 crisis).

[66] *Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937*, at 1, COM (2020) 593 final (Sept. 24, 2020).

[67] *Id.*

unified regulation of firms offering monetary services—including cryptocurrencies—across the states.[68]

B. Taxonomy of tokens

While regulators were working on new frameworks, a consensus began to form around the taxonomy of tokens, leading to the common use of three categories: (1) utility tokens, (2) security tokens, and (3) currency tokens.[69]

Utility tokens confer direct utility that is embedded in the token's specific characteristics.[70] The most common case is one

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[68] Press Release, Conference of State Bank Supervisors, State Regulators Roll Out One Company, One Exam for Nationwide Payments Firms (Sept. 15, 2020), https://www.csbs.org/regulators-announce-one-company-one-exam-for-payments-companies [https://perma.cc/VV5C-3AVS].

[69] Stéphane Blemus & Dominique Guegan, Initial Cryptoasset Offerings (ICOs), Tokenization and Corporate Governance 1 (Mar. 27, 2019) (unpublished manuscript), https://arxiv.org/ftp/arxiv/papers/1905/1905.03340.pdf [https://perma.cc/DTP7-GUQU]; Wandmacher, *supra* note 45, at 115. *See also* Josephine Nelson, *Cryptocommunity Currencies*, 105 CORNELL L. REV. 3, 4 (discussing the debate on how tokens should be classified). In the European Union, currency tokens are sometimes known as "payment tokens" and security tokens are known as "investment tokens." Valeria Ferrari, *The Regulation of Crypto-assets in the EU–investment and Payment Tokens under the Radar*, 27 MAASTRICHT J. EUR. & COMP. L. 325, 329 (2020). In a new regulation draft as part of the digital finance package, the EU explicitly recommends classifying tokens into categories that include "utility tokens," "asset-referenced" tokens and "electronic money" tokens. *See Proposal, supra* note 66, at § 9 of the Preamble. *See Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-Asset (MiCa)*, draft (2020) [hereinafter MiCA], https://www.politico.eu/wp-content/uploads/2020/09/CLEAN-COM-Draft-Regulation-Markets-in-Crypto-Assets.pdf [https://perma.cc/N4SF-52JD] (explaining that the proposal will "distinguish between three sub-categories of 'crypto-assets' that should be subject to specific requirements"). In contrast, security tokens are governed under the "Markets in Financial Instruments Directive II" ("MiFID II"). Article 2(2) of MiCA excludes financial instruments. For a review of the MiFID II directive, see generally Danny Busch, *MiFID II: Regulating High Frequency Trading, other Forms of Algorithmic Trading and Direct Electronic Market Access*, 10 L. & FIN. MKTS. 72 (2016) (discussing the CFTC's steps to regulate in market manipulation and associated forms of algorithmic trading).

[70] Utility tokens can confer direct utility by allowing the holder to use them as part of a specific digitized system. For example, a utility token that grants access

where the token grants access to some application, product, or service.[71] For instance, a club might choose to offer a membership card in the form of a token, so that the token's holder enjoys a utility from services offered by the club. As another example, consider theater tickets: the holder presents the ticket at the entrance and gains access to the show. If theater tickets are "tokenized" and digitally sold, the token grants direct utility to its buyer. As a third example, some children's playgrounds include devices that can only be operated with physical tokens. If these were replaced with a decentralized digital token, the token would grant utility to its holder.

Security tokens provide their holders with financial rights and are conceptually like instruments such as debt or equity.[72] Such tokens largely take two forms. First, some tokens are purposefully issued as a digital representation of a standard instrument, often in an STO.[73] For instance, a company may offer a share-like token that provides revenue sharing, dividends, or voting rights.[74] Second, some tokens provide financial benefits that implicitly fulfill the existing definition of a security, even if they are not marketed that way.[75]

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to computational services, such as Filecoin, grants its holder the direct benefit of using these services. PROTOCOL LABS, *supra* note 6.

[71] Doe-Bruce*, supra* note 62; Vladislav Burilov*,* Utility Token Offerings and Crypto Exchange Listings: How Regulation Can Help? at 10 (Aug. 7, 2019) (unpublished manuscript), https://ssrn.com/abstract=3284049 [https://perma.cc/DWG7-N3AY]. *See also* MiCA, *supra* note 69, at art. 3(1)(g).

[72] *Id.*

[73] Doe-Bruce, *supra* note 62.

[74] For instance, the token DAO grants holders with both a right to vote and a share of the profits. Jabotinsky, *supra* note 48, at 145.

[75] There are various ways in which a security token (which is not marketed that way) can provide financial benefits: the holder can decide to hold on to the token, expecting that the value increases over time due to actions of other people, and then sell it for profit. *See* JT Hamrick et al., *The Economics of Cryptocurrency Pump and Dump Schemes* 8 (Ctr. Econ. Pol'y Rsch. Discussion Paper No. DP13404, 2018), https://ssrn.com/abstract=3310307 [https://perma.cc/4HJ8-G6PD]. This strategy is sometimes referred to as "HODL," an acronym for "Hold on for Dear Life." *Id.* Another way in which investors can benefit is through "pump and dump" schemes by manipulating the market price through inflated demand followed by a quick sale once the price increases. *Id.* As another example,

Currency tokens serve as means of payment for purchasing services or goods.[76] These tokens differ from utility tokens, as they do not provide specific utility or access to a particular service.[77] They also differ from security tokens, as they do not grant financial rights. Instead, these tokens derive their value from the willingness of others to accept them as a form of payment.[78]

For some tokens, the classification is easy. For example, tokens such as Bitcoin ("BTC"),[79] Monero ("XMR"), Zcash ("ZEC"), Dash ("DASH"), Bitcoin Cash ("BCH"), and Litecoin ("LTC") were designed explicitly as a substitute for money: they are not attached to a specific platform and are accepted as a form of payment across many contexts.[80] An even more explicit example are the so-called "Stable coins"[81] such as Tether ("USDT"), Steem Dollars ("SBD"),

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early investors can sometimes purchase tokens at a discounted rate using early agreements, so that a profit can be made by selling after an ICO. *See* Doe-Bruce*, supra* note 62, at 98.

[76] *Id.*

[77] Although currency tokens might be used to *purchase* access to a good or service (similarly to fiat currencies), they do not—by themselves—grant specific access. Philipp Hacker & Chris Thomale*, Crypto-securities Regulation: ICOs, Token Sales and Cryptocurrencies Under EU Financial Law,* 15 EUR. COMP. & FIN. L. REV. 645, 676–80 (2018). This distinction can be thought of as the difference between a concert ticket (granting access to the concert) and the money paid to purchase the ticket.

[78] *See generally Frequently Asked Questions*, BITCOIN.ORG (last visited Dec. 19, 2019), https://bitcoin.org/en/faq#how-are-bitcoins-created [https://perma.cc/9VTS-3GXC] (explaining that Bitcoin's value stems from its users' "trust and adoption").

[79] Specifically, for Bitcoin, there has nonetheless been some debate considering empirical evidence, which suggest that Bitcoin "behaves" more like a technology product than a currency. *See* Reilly White et al., *Is Bitcoin a Currency, a Technology-Based Product, or Something Else?,* 151 TECH. FORECAST SOC. CHANGE 1, 7 (2020).

[80] *See HSB Survey Finds One-Third of Small Businesses Accept Cryptocurrency*, BUSINESSWIRE (Jan. 15, 2020), https://www.businesswire.com/news/home/20200115005482/en/HSB-Survey-Finds-One-Third-Small-Businesses-Accept [https://perma.cc/H2CC-34B7].

[81] *See* Doe-Bruce*, supra* note 62, at 102; Usman W. Chohan, *Are Stable Coins Stable?* (discussion paper), https://ssrn.com/abstract=3326823 [https://perma.cc/8YJJ-NXBC].

and Paxos ("PAX") that strive to imitate another currency and thus seem to neatly fit into the category of currency tokens.[82]

Similarly, tokens that are launched in an STO and explicitly confer revenue sharing or provide a debt-like instrument, such as Blockchain Capital ("BCAP"), Spice VC ("SPICE"), and Nexo ("NEXO"), are easily classifiable as security tokens.[83] Along similar lines, tokens that are exclusively limited to providing access to a product can usually be classified as utility tokens. For instance, tokens such as Golem ("GNT") and Filecoin ("FIL"), which grant access to additional computing power, are typically classified as utility tokens.[84]

However, once one moves away from simple token designs, it can become extremely difficult to determine the boundaries between the different categories. Ether ("ETH"), which provides access to the Ethereum blockchain, is an example.[85] As Ether is directly linked to a specific service and does not provide financial rights, it is unsurprising that some scholars have classified it as a utility token.[86] Others instead classify Ether as a security token,[87] and even still,

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[82] The question of whether Tether constitutes a security has been raised, but not yet decided, in the case of *In the matter of James v. iFINEX INC, NY* Slip Op. at 1 (N.Y. 2019).

[83] *See, e.g.*, Florie Mazzorana-Kremer, *Blockchain-Based Equity and STOs: Towards a Liquid Market for SME Financing?,* 9 THEORETICAL ECON. LETTS. 1534, 1545 (2019) (referring to Nexo as a security token); Liz Whelan, *SPiCE VC to List Security Token on Black Manta Capital Partners*, BUSINESSWIRE (Dec. 15, 2020), https://www.businesswire.com/news/home/20201215005822/en [https://perma.cc/KU63-ZMPK] (reporting the launch of the security token SPICE); Boreiko et al., *supra* note 63 (referring to BCAP as a de facto investment that is subject to securities regulation).

[84] Blemus & Guegan, *supra* note 69, at 9; Richard Holden & Anup Malani, *The ICO Paradox: Transactions Costs, Token Velocity, and Token Value* 11 (Nat'l Bureau Econ. Rsch. Working Paper No. 26265, 2019), http://research.economics.unsw.edu.au/richardholden/assets/w26265.pdf [https://perma.cc/6SQW-PNYG].

[85] ETHEREUM.ORG, *supra* note 3.

[86] Nate Crosser, *Initial Coin Offerings as Investment Contracts: Are Blockchain Utility Tokens Securities?*, 67 U. KAN. L. REV. 379, 393 (2018) (noting that Crosser uses the term "cryptocommodity" as a synonym for "utility token").

[87] Jabotinsky, *supra* note 48, at 150.

some scholars classify Ether as a currency token,[88] because one of its uses is to pay for so-called "gas charges" that are charged when using the Ethereum blockchain.[89] Such a conclusion may also arise due to the recent movements in the crypto-world, which has given rise to so-called Decentralized Finance ("DeFi") projects. These projects may require users to deposit Ether as collateral and in return grant the users another token.[90] Depositing Ether brings it closer to a currency—it is utilized as an acceptable form of payment, rather than used directly to get access to its originally linked service.

A second, more difficult, example involves the distinction between utility tokens and security tokens. Consider any token that would give both access to some service and revenue sharing (e.g., a token that provides membership to a club, but also a right to residual earnings at the end of the year). Such a token would have both utility and security features, making the classification challenging. In other words, many different hybrid varieties of a token can exist.[91]

Given the challenge of classifying tokens, a long list of questions arises: Should "hybrid tokens"[92] be treated as utility tokens or

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[88] *See, e.g.,* Christian Masiak et al., *Initial Coin Offerings (ICOs): Market Cycles and Relationship with Bitcoin and Ether*, 55 SMALL BUS. ECON. 1113, 1115 (2019).

[89] *See* Boreiko et al., *supra* note 63, at 671 ("The biggest protocol platform is Ethereum, and many proprietary tokens are just dapps of the Ethereum ecosystem (the 'Ethereum Virtual Machine'), where Ether is used as a currency (but it is actually called 'gas') to pay for the computing power required to obtain consensus and to execute transactions."); Shaanan Cohney et al., *Coin-operated Capitalism,* 119 COLUM. L. REV. 591, 603 (2019) ("To perform computations on this decentralized 'world computer,' users must pay a per-function fee of 'ether'—a 'gas' charge—which functions as Ethereum's currency.").

[90] *See, e.g.*, Leon Perlman, *Regulation of the Financial Components of the Crypto-Economy* 212, n.335 (SIPAs Entrepreneurship & Pol'y Initiative Working Paper Series, 2019) https://ssrn.com/abstract=3493342_[https://perma.cc/53L6-2J7U] (discussing the Dai token). *See also* Xuan-Thao Nguyen, *Lessons from Case Study of Secured Transactions with Bitcoin*, 21 SMU SCI. & TECH. L. REV. 181, 193 (2018); Richard Hagerty & Amir Shachmurove, *The Lay of a Virtual Land: Cryptocurrencies as Collateral*, 2019 BUS. CREDIT MAG. 10, 10 (May 2019) (providing an example of credit based on tokens as collateral).

[91] Bart Custers & Lara J. Overwater, *Regulating Initial Coin Offerings and Cryptocurrencies: A Comparison of Different Approaches in Nine Jurisdictions Worldwide*, 10 EUR. J.L. & TECH 1, 5 (2019).

[92] Doe-Bruce, *supra* note 62, at 103.

security tokens? Does the answer depend on which feature is dominant? And should one create sub-categories? For now, these questions remain unanswered and have already led to some confusion and several legal disputes. The most well-known example is perhaps the U.S. Securities and Exchange Commission ("SEC") proceedings against the popular messaging application, Telegram.[93] In early 2018, Telegram issued their TON and GRAM tokens and promised to construct a new and faster blockchain infrastructure, raising a staggering amount of $1.7 billion.[94] The SEC argued that the issued tokens are, in fact, a security, and thus accused Telegram of breaching U.S. securities law.[95] The proceedings ended in a settlement in which Telegram acknowledged its liability and agreed to pay back $1.2 billion to the investors.[96] Several other proceedings by the SEC against other issuers have resulted in similar decisions that treat tokens as securities.[97]

The difficulty in classifying tokens is not limited to their features, but also to the divergence in definitions across the globe. In the United States, instruments are securities if they fulfill the definitions set in *SEC v. WJ Howey Co.*[98] The *Howey* test asks whether: (1) a person has invested money; (2) in a common enterprise;

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[93] S.E.C. v. Telegram Grp. Inc., No. 19 Civ. 9439 (PKC) at *1 (S.D.N.Y 2019); *see also* Blemus & Guegan, *supra* note 69, at 9, n.19 (explaining the SEC's use of securities law precedent to pursue initial coin offerings).

[94] Ilya Khrennikov. *Telegram Raises $1.7 Billion in Coin Offering, May Seek More,* BLOOMBERG (Mar. 30, 2018, 4:20 A.M.), https://www.bloomberg.com/news/articles/2018-03-30/telegram-raises-1-7-billion-in-coin-offering-may-seek-more [https://perma.cc/TU3X-M8XG].

[95] *S.E.C.,* No. 19 Civ. 9439 (PKC) at *11.

[96] Press Release, U.S. Sec. & Exch. Comm'n, Telegram to Return $1.2 Billion to Investors and Pay $18.5 Million Penalty to Settle SEC Charges (June 26, 2020), https://www.sec.gov/news/press-release/2020-146 [https://perma.cc/Q32M-AD7W].

[97] For a review of the SEC's enforcement policy, see generally James J. Park & Howard H. Park, *Regulation by Selective Enforcement: The SEC and Initial Coin Offerings,* 61 WASH. J.L. & POL'Y 99, 110–18 (2020) (discussing the S.E.C.'s regulatory response to various ICOs).

[98] 328 U.S. 93 (1946).

and (3) was led to expect profits (4) solely from the effort of the promoter or of someone other than themselves.[99]

For clear-cut cases of security tokens, the *Howey* test seems straightforward. For instance, in the case of the "Monkey Capital Coin," a decentralized hedge fund issued a token that pooled investments of individuals and distributed profit.[100] This token was classified as a security without much deliberation.[101] In *Rensel v. Centra Tech., Inc.*,[102] the security status of a token granting access to a debit card was not even disputed by the parties.[103]

However, in many other instances, the *Howey* test easily yields ambiguous results. An investment of money is made in an ICO but not in so-called "Airdrops,"[104] although both events distribute the same token. A common enterprise requires that the fortune of holders be somehow tied to the efforts of other holders or of the promoter,[105] but designating cryptotokens as such may depend on (1) how others use the tokens, and (2) which uses the token has, which may change over time. In a recent case, a U.S. federal court adopted a very broad interpretation of the "common enterprise" requirement with respect to cryptotokens. In *Balestra v. ATBCOIN*

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[99] The last criterion appears in the original decision as specified in the text, but has subsequently been rephrased in several different ways, sometimes neglecting "solely" and other times neglecting "the promoter." *See, e.g.*, Jabotinsky, *supra* note 48, at 137; Benjamin Van Adrichem, *Howey Should be Distributing New Cryptocurrencies: Applying the Howey Test to Mining, Airdropping, Forking, and Initial Coin Offerings*, 20 COLUM. SCI. & TECH. L. REV. 388, 399 (2019).

[100] Hodges v. Harrison, 372 F. Supp. 3d 1342, 1345 (S.D. Fla. 2019).

[101] *Id*. at 1349.

[102] *See generally* Rensel v. Centra Tech., Inc., No. 17-24500-Civ (S.D. Fla., May 13, 2019) (finding the cryptotokens in question a security, without dispute of that issue).

[103] *See generally id.* (ruling on a motion to dismiss, stating that "[t]he parties do not dispute that the CTR Tokens are unregistered securities and that the Defendant used the facilities of interstate commerce").

[104] Airdrops are distributions of cryptotokens for free, usually for the purpose gaining attention, followers, and a larger user base. *See* Van Adrichem, *supra* note 99. *See also* Solis v. Latium Network, Inc., No. 18-10255, 2018 WL 6445543 at *4 (D.N.J. Dec. 10, 2018) (finding that buyers' participation in ICOs satisfies the "investment" definition as it pertains to the *Howey* test's analysis of "investment contracts").

[105] S.E.C. v. Edwards, 540 U.S. 389, 393 (2004).

LLC,[106] the court held that if money collected in an ICO is intended for a specific purpose, then all of the buyers' money pooled together constitutes a "common enterprise."[107]

Expectation of profits seems subjective: some people buy the token in speculation that its value will increase, while others buy it for its utility value. Effort of others seems equally vague: does the mere fact that people exert effort to mine the token fulfill this requirement? And how should one treat a token that yields profits only if the holder and others jointly exert effort? Here, federal courts have also taken a broad interpretation, noting that the term "solely" should not be construed as a literal limitation, so that courts are free to consider all the circumstances.[108] For instance, in *Balestra*, the court held that because the defendants marketed the token as an asset whose value is expected to increase when the company will launch its product, the "effort of others" requirement was directly fulfilled.[109]

Given the very wide interpretation of the *Howey* test, some have cautioned that even currency tokens, such as Bitcoin, might be classified as securities by courts.[110] To make things worse, even if a token fails the *Howey* test and is viewed as a security at first, it is unclear whether the token will continue to constitute a security post-ICO. For instance, Michael J. O'Connor argues that a token may constitute a security when issued in an ICO, but ceases to be a

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[106] 380 F. Supp. 3d 340, 354 (S.D.N.Y. 2019)

[107] *See id.* at 354. This case, however, seems to have ended in an eventual settlement with opaque details. *See generally* Balestra v. ATBCoin, LLC, No. 17-CV-10001 (S.D.N.Y. Mar. 3, 2020) (order discontinuing action) (noting that it "has been reported to the Court that this case has been settled").

[108] Balestra, 380 F. Supp. 3d at 355.

[109] *Compare* Solis, 2018 WL 6445543 at *4, *with* S.E.C., 540 U.S at 394 (explaining that there is "no reason to distinguish between promises of fixed returns and promises of variable returns" in investment contract analysis).

[110] Gely-Rojas, *supra* note 16, at 33. In one case in Florida, a court classified Bitcoin as a "payment instrument" (neglecting the *Howey* test altogether), so that regulation concerning exchanges of currencies applied to the defendant. *See* Florida v. Espinoza, 264 So. 3d 1055, 1062 (Fla. Dist. Ct. App. 2019). Conversely, in another case, the court rejected the claim that crypto-currencies are "cash-like" without explicitly applying the *Howey* test. *See* Tucker v. Chase Bank, 399 F. Supp. 3d 105, 114 (S.D.N.Y. 2019).

security when traded on exchanges, as then the promise of future profit is absent.[111] Kristin Johnson proposes to exempt crypto exchanges from SEC registration, given that trade is not identical to an initial offering.[112] Patricia H. Lee notes that agreements which promise that early investors will receive tokens in a future ICO (so-called "SAFT" agreements)[113] may transform utility tokens into securities.[114] Dmitri Boreiko et al. argue more strongly that, under the current European regulation, all tokens should be classified as securities.[115]

The SEC published guidelines on how to apply the *Howey* test, addressing the difficulties in doing so with thirty-eight separate considerations.[116] M. Todd Henderson and Max Raskin proposed to

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[111] Michael J. O'Connor, *Overreaching its Mandate: Considering the SEC's Authority to Regulate Cryptocurrency Exchanges*, 11 DREXEL L. REV. 539, 566 (2018).

[112] Kristin N. Johnson, *Cryptocurrency Secondary Market Trading Platforms* 2020 U. CHI. L. REV. ONLINE 26, 30 (2020)

[113] A Simple Agreement for Future Tokens ("SAFT") provides investors with the right to purchase tokens at a discount once they are issued or sold under pre-defined conditions. They are similar to Simple Agreements for Future Equity (or "SAFE" agreements), which provide a similar right but with respect to equity instead of tokens. *See* Sabrina T. Howell et al., *Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales,* REV. FIN. STUD. 2015 at 8.

[114] *See* Particia H. Lee, *Crowdfunding Capital in the Age of Blockchain-Based Tokens*, 92 ST. JOHN'S L. REV. 833, 887–88 (2018). Note that this format does not to apply to private sales. *See* Park Yield LLC v. Brown, No. 18 Civ. 1947 at *11 (S.D.N.Y. Dec. 6, 2019). SAFT agreements are often made with private investors rather than in a public sale. *Cf.* Scott W Maughan, *Utility Token Offerings: Can a Security Transform into a Non-Security?*, 2019 BYU L. REV. 1113, 1135 (2019); James J. Park, *When Are Tokens Securities? Some Questions from the Perplexed* 5 (UCLA Law-Econ Research Paper 18-13) (2018).

[115] Boreiko et al., *supra* note 63, at 680. *See also* Lars Klöhn et al., Initial Coin Offerings (ICOs): Economics and Regulation 41 (Nov. 26, 2018) (unpublished manuscript), https://ssrn.com/abstract=3290882 [https://perma.cc/EL7D-LSLQ] (arguing that tokens are securities under European regulation if they are standardized and negotiable on capital markets, where utility tokens are considered securities depending on the extent of decentralization, the purpose of the token sale, and their network functions).

[116] U.S. SEC. & EXCH. COMM'N, FRAMEWORK FOR "INVESTMENT CONTRACT" ANALYSIS OF DIGITAL ASSETS (2019), https://www.sec.gov/corpfin/framework-investment-contract-analysis-digital-assets [https://perma.cc/XS72-69QR]. *See*

implement the *Howey* test in a two-step process.[117] First, apply a so-called "Bahamas Test,"[118] which asks whether the token is sufficiently decentralized, so that the "effort of others" condition is not fulfilled.[119] Second, apply the so-called "Substantial Steps Test," which focuses on expectation of profit.[120] Along similar lines, Thijs Maas argues that most tokens constitute securities, but a test looking at the degree of decentralization can be useful for identifying exceptions.[121] A recent proposal by the SEC, titled "Rule 195," suggests a three-year grace period followed by applying the usual *Howey* test, subject to some guarantees of good faith by the token issuer.[122]

As the United States remains conflicted regarding the right policy, legislators have started taking an active interest in adopting definitions and establishing an official token taxonomy. In 2019, a flood of state bills called for recognition and promotion of blockchain technology and virtual tokens, with over thirty states (as

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also Jonathan L. Marcus et al., *Recent Cryptocurrency Regulatory Developments*, 38 BANKING & FIN. SERV. POL'Y REP. 1, 1–2 (Sept. 2019) (noting that the SEC's guidance "identifies 38 separate considerations, listing sub-points under many of them").

[117] M. Todd Henderson & Max Raskin, *A Regulatory Classification of Digital Assets: Toward an Operational Howey Test for Cryptocurrencies, ICOs, and Other Digital Assets,* 2019 COLUM. BUS. L. REV. 443, 450 (2019).

[118] The name "Bahamas test" refers to a thought exercise asking whether the project would continue to exist if its creator would run away to the Bahamas. *Id.* Then, if the project is self-sustaining and does not depend on the creator, the test concludes that the risk of fraud is reduced so that the token should not be classified as a security. *Id.* at 461.

[119] The connection between decentralization and a security status lies in whether there is an explicit or implicit contract that is created when one purchases the token. *See id.*

[120] *Id.* at 483.

[121] Thijs Maas, Initial Coin Offerings: When Are Tokens Securities in the EU and US? 47 (Feb. 13, 2019) (unpublished manuscript), https://ssrn.com/abstract=3337514 [https://perma.cc/95BE-HEYR].

[122] Hester M. Pierce, *Running on Empty: A Proposal to Fill the Gap Between Regulation and Decentralization*, SEC. & EXCH. COMM'N (Feb. 6, 2020), https://www.sec.gov/news/speech/peirce-remarks-blockress-2020-02-06 [https://perma.cc/8NFQ-Z878].

of March 2020) adopting related decisions.[123] In December 2019, the U.S. Senate Committee of Commerce, Science, and Transportation established a working group tasked with developing blockchain-related definitions.[124] FinCEN (the financial crimes enforcement agency network at the Department of the Treasury) released guidelines that aim to help businesses decide whether a token is a currency for the purpose of money transmissions.[125]

At the peak of the policy initiatives relating to taxonomy lies a new bill titled the "Crypto-Currency Act of 2020," which was submitted to Congress in early March 2020.[126] The bill proposes to explicitly adopt the taxonomy discussed above, by differentiating between three categories: utility ("crypto-commodity"), security ("crypto-security"), and currency ("crypto-currency").[127] Interestingly, the bill's definition of "crypto-commodity" does not seem to include

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[123] *See* Shelagh Dolan, *How the Laws & Regulations Affecting Blockchain Technology and Cryptocurrencies, like Bitcoin, Can Impact its Adoption*, BUS. INSIDER (Mar. 3, 2020), https://www.businessinsider.com/blockchain-cryptocurrency-regulations-us-global?r=DE&IR=T [https://perma.cc/F9F2-DQQZ]. South Carolina adopted a resolution on 10 Mar. 2020 (SC S1158); Rhode Island adopted a resolution on 11 Mar. 2020. *See* Jason Brett, *Legislation In Rhode Island Bets On Blockchain Growth To Drive Economic Policy*, FORBES (Mar. 15, 2020), https://www.forbes.com/sites/jasonbrett/2020/03/15/legislation-in-rhode-island-bets-on-blockchain-growth-to-drive-economic-policy/#636c2cca4e2f [https://perma.cc/KJM6-ZEQ7].

[124] Blockchain Promotion Act of 2019, H.R. 1361, 116th Cong. (2019) (establishing "a working group to recommend to Congress a definition of blockchain technology").

[125] *See generally* U.S. DEP'T OF THE TREAS., FINANCIAL CRIMES ENF'T NETWORK, FIN-2019-G001, APPLICATION OF FINCEN'S REGULATIONS TO CERTAIN BUSINESS MODELS INVOLVING CONVERTIBLE VIRTUAL CURRENCIES (2019), https://www.fincen.gov/sites/default/files/2019-05/FinCEN%20Guidance%20CVC%20FINAL%20508.pdf [https://perma.cc/9E83-SB28] (providing regulatory guidelines that explain when cryptotokens are currency). For an overview, see Osato Avan-Nomayo, *FinCEN Unveils New Bitcoin Guidelines: Here's What You Need to Know,* BITCOINIST (May 11, 2019), https://bitcoinist.com/bitcoin-crypto-fincen-guidlines-new [https://perma.cc/L9AH-B43D].

[126] Crypto-Currency Act of 2020, H.R. 5889, 116th Cong. (2020).

[127] For discussions of the new bill, see Tony Spilotro, *New Cryptocurrency Act in Congress Classifies Assets into Three Distinct Groups,* NEWSBTC (Mar. 11, 2020), https://www.newsbtc.com/2020/03/11/new-cryptocurrency-act-congress [https://perma.cc/H2K6-37JN].

all utility tokens, as only tokens whose value is independent of the identity of the issuer are considered a commodity.[128] Still, the direction of the proposal is clear: a trio of categories will be used to differentiate between tokens. The bill, which was presented to Congress on March 9, 2020, has received mixed reactions—where some argue that the bill is unlikely to pass, while others identified a wave of support from entrepreneurs and regulators.[129]

Other countries have adopted different approaches, taking various stances on how tokens should be classified.[130] For instance, Bermuda views tokens as a security only if there is promise of future profit;[131] Colombia views all tokens as non-securities;[132] Anguilla does not consider utility tokens to be securities, but has set a specific regulation for such tokens;[133] Germany has issued elaborate rules which classify most tokens as financial instruments;[134] and France has classified Bitcoin as a "fungible intangible asset," i.e., as a regular currency.[135] The new EU digital finance package entails a proposal that largely adopts the three categories of utility, security,

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[128] H.R. 5889, 110th Cong. § 2(1)(b) (2008).

[129] *See* Jason Brett, *U.S. Blockchain Entrepreneurs Support Crypto-Currency Act of 2020 Despite Pressure From D.C. Lobbyists,* FORBES (Mar. 14, 2020), https://www.forbes.com/sites/jasonbrett/2020/03/14/us-blockchain-entrepreneurs-support-crypto-currency-act-of-2020-despite-pressure-from-dc-lobbyists/#7065a0df5945 [https://perma.cc/L45A-K9RX]; Daniel Kuhn, *The Cryptocurrency Act of 2020 Is 'Dead on Arrival,' Washington Tells Sponsors,* COINDESK (Mar. 10, 2020), https://www.coindesk.com/the-cryptocurrency-act-of-2020-is-dead-on-arrival-washington-dc-tells-sponsors?amp=1&__twitter_impression=true [https://perma.cc/73YF-KXW9].

[130] GLOBAL LEGAL RESEARCH CENTER, *supra* note 57.

[131] *Id.* at 8.

[132] *Id.* at 12–13.

[133] *Id.* at 20.

[134] Virtual Currencies (VC), BAFIN, https://www.bafin.de/EN/Aufsicht/FinTech/VirtualCurrency/virtual_currency_node_en.html [https://perma.cc/R8EF-DZXB] (last visited Mar. 11, 2020).

[135] In a recent case, a court in Nanterre rejected a lender's claim in tokens that a borrower received during a so-called "hard fork" of Bitcoin (where new tokens were handed out to the holder of existing tokens), based on the notion that Bitcoins are currencies, so that their proceeds do not belong to the lender. *See* Lujan Odera, *Bitcoin (BTC) Is a Legal Form of Currency, French Courts Rules,* COINGAPE (Mar. 6, 2020), https://coingape.com/france-courts-rules-bitcoin-btc-is-a-fungible-asset-similar-to-fiat-currencies/ [https://perma.cc/DJ2U-UFBS].

and currency.[136] Thus, the classification of tokens remains subject to some legal uncertainty.[137]

With that said, the new initiatives described above indicate that regulators believe that preceeding with no taxonomy for tokens is probably far worse than taxonomies implimented elsewhere. This belief is especially true for the question of whether rights should be protected by property or liability rules. A lack of taxonomy does, however, emerge in the case law, as discussed in the following section.

III. ENTITLEMENTS IN CRYPTOCURRENCIES: CASE LAW AND LITERATURE

A. Case law

Considering the rising popularity of cryptocurrencies, legal disputes surrounding various entitlements began to emerge in U.S. courts. However, rulings have been somewhat inconsistent. In the case of *Currier v. PDL Recovery Group, LLC*,[138] a creditor filed a request to liquidate Bitcoin and Ether tokens held by the defendant via an online wallet at a crypto exchange.[139] The district court determined that the tokens are the defendant's intangible personal property and refused to grant a liquidation order, among else, because the tokens were held by a crypto exchange, which is a third party.[140] In another case, a court-appointed receiver recovered tokens from the hands of a third party, where these tokens were first

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[136] *See* the text in *supra* note 69.

[137] For a criticism of the lack of consistency in the U.S. regulation, see Lukas Hofer, *Legal Limbo: U.S. Blockchain Regulations Fragmented and Undeveloped,* BLOCKCHAIN LAND (Mar. 2, 2020), https://theblockchainland.com/2020/03/02/legal-limbo-us-blockchain-regulations-fragmented-undeveloped [https://perma.cc/3YDK-YTP6]. For a discussion of the approach adopted in the European Union, see Ferrari, *supra* note 69, at 329.

[138] Currier v. PDL Recovery Grp. LLC*,* No. 14-12179, 2018 WL 4057394, at *1 (E.D. Mich. Aug. 27, 2018).

[139] *Id*. at *1.

[140] *Id.* at *2 (stating that "the Court's ability to order satisfaction of a judgment with a defendant's personal property that is in possession of a third party is limited" and that "Plaintiff seeks the liquidation of intangible personal property—Defendant's cryptocurrency accounts with Coinbase").

fraudulently extracted from the original owner.[141] These rulings seem to adopt a clear property rule.

Conversely, in *Temurian v. Piccolo*,[142] a Florida district court refused to acknowledge Bitcoin and Ether as property, based on the notion that the tokens are equivalent to money and are not specifically identifiable.[143] In two other cases, requests for temporary injunctions regarding tokens were rejected because the plaintiffs failed to meet the necessary evidentiary standard.[144] While these cases did not formally review the question of property rights, their outcomes are consistent with a reversed property rule, where the alleged infringer is the one who retains ownership.[145]

Yet, a liability rule is imposed in a different set of cases. In *Smoak v. Bitcoin Market, LLC*,[146] a plaintiff was temporarily denied access to Bitcoins that were held in a wallet at a crypto exchange. As the defendant failed to respond, the court granted a default verdict awarding the plaintiff damages at the amount equal to the Bitcoin's price at the time.[147] Similarly, in *Day v. Boyer*,[148] a plaintiff

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[141] Rasmussen v. Smith, No. 3:18-CV-01034-M, 2020 WL 109863, at *4 (N.D. Tex. Jan. 8, 2020).

[142] Temurian v. Piccolo, No. 18-CV-62737, 2019 WL 1763022, at *5 (S.D. Fla. Apr. 22, 2019).

[143] The plaintiff's claim relied on a "conversion" argument under Florida law, which requires, among else, that money is identifiable. *Id.* The court ruled that the diversion of thousands of dollars in value are not enough to establish that the funds are identifiable. *Id.*

[144] In *MacDonald v. Dynamic Ledger Sols., Inc.*, No. 17-CV-07095-RS, 2017 WL 6513439 (N.D. Cal. Dec. 20, 2017), the plaintiff transferred Bitcoin and Ether to the defendant in exchange for other tokens in an ICO. Based on various claims, the plaintiff demanded to freeze the tokens that were transferred. *Id.* at *3. In *ZG TOP Tech. Co. v. Doe*, No. C19-92-RAJ, 2019 WL 917418 (W.D. Wash. Feb. 25, 2019), an anonymous hacker managed to take control of Tether and Ether tokens owned by the plaintiff and transfer them to a wallet managed at a crypto-exchange. *Id.* at *1. The court rejected the plaintiff's request to freeze the account. *Id.* at *3.

[145] Both a rule granting the plaintiff an injunction and a rule of no remedy reflect a property rule: a party is allowed to hold on to the token without the consent of the opposite party. For simplicity, this Author refers to the (property) rule favoring the defendant as a "reversed property rule."

[146] No. CIV-18-1096-PRW, at *2 (W.D. Okla. 2018).

[147] *Id.* at *9.

[148] Day v. Boyer, No. 19-CV-01669, 2020 U.S. Dist. LEXIS 9959, at *12 (C.D. Cal. Jan. 21, 2020).

who purchased tokens but did not receive them was awarded with damages.[149] In the case of *Rensel v. Centra Tech., Inc.*,[150] investors in an ICO demanded to receive damages in the amount equal to the worth of Bitcoin and Ether transferred to the defendant.[151] The Court did not seem to consider the possibility of returning the specific tokens transferred (which would be required under a property rule) and instead awarded the plaintiffs damages.[152]

Interestingly, none of these cases—neither those that implement a property rule nor those that implement a liability rule—dedicate any attention for the possible need to distinguish between different types of tokens. A lack of distinction between different types of tokens arises not only in the United States but also in some other jurisdictions. In the United Kingdom, a high court classified Bitcoins as property and granted an injunction against a crypto exchange regarding tokens that were extracted through illegal extortion.[153] Thereby, a property rule was implemented.[154] A property rule also emerges in two Canadian cases.[155] In the first case, a court ordered a defendant to return a misappropriated computer in which private keys were stored, based on a propriety argument.[156] In the second case, a court determined that Ether that was transferred by mistake should be returned to its original owner.[157] In the first case, the court explicitly acknowledged the plaintiff's proprietary interest in the laptop which contained the private key as well as in

[149] As the court entered a default judgement, the proprietary issues were not fully deliberated. Still, the court did determine that damages are the appropriate remedy, even for a claim of theft regarding the tokens. *Id.* at *3–4.

[150] No. 17-24500-CIV, 2018 WL 4410126, at *6 (S.D. Fla. June 25, 2018).

[151] *Id*. at *5 ("Because investors invested using BTC or ETH, the Securities Act requires that Plaintiffs' Section 12 damages be calculated in terms of BTC or ETH.").

[152] *Id.*

[153] AA v. Persons Unknown & Ors, Re Bitcoin [2019] EWHC (Comm) 3556 [50–63] (U.K.).

[154] *Id.*

[155] For a review of the two cases, see Janis Sarra & Louise Gullifer QC (Hon), *Crypto-claimants and Bitcoin Bankruptcy: Challenges for Recognition and Realization*, 28 INT'L INSOLVENCY REV. 233, 246–48 (2019).

[156] Shair.Com Glob. Digit. Servs. Ltd. v. Arnold, [2018] CanLII 1512, para. 13–17 (Can. B.C.S.C.).

[157] Copytrack Pte Ltd. v. Wall, [2018] CanLII 1709 (Can. B.C.S.C.).

the tokens themselves.[158] In the second case, a property right was not explicitly acknowledged, but the outcome was nonetheless consistent with a property rule.[159]

Contrarily, in a case in Singapore, a defendant converted Bitcoins to Ether using an incorrect exchange rate and then reversed the trade unilaterally to avoid a loss.[160] There, the court similarly classified the cryptocurrencies as property,[161] but then rejected the plaintiff's demand of specific performance (i.e., of receiving the tokens) and awarded damages instead.[162] Thus, a liability rule was adopted.[163]

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[158] Shair.Com Glob. Digit. Servs. Ltd., CanLII 1512 at para. 15 ("The plaintiff has established that it has a claim to a proprietary interest in the laptop computer and in any digital currencies purchased by the defendant flowing from the plaintiff's initial $18,500 investment in Bitcoin."). Note that because the defendant did not dispute the plaintiff's rights, the decision did not conduct a full analysis of this point. *Id.*

[159] Copytrack Pte Ltd. v. Wall, CanLII 1709 at para. 37 ("In my view, the appropriate remedy is therefore [….] as follows: An order that Copytrack be entitled to trace and recover the 529.8273791 Ether Tokens received by Wall from Copytrack on 15 February 2018 in whatsoever hands those Ether Tokens may currently be held.").

[160] B2C2 Limited v. Quoine PTC Ltd., [2019] SGHC (I) 03 [142] (2019) (Sing.).

[161] *Id.* For a discussion of whether Bitcoin can be stolen according to Singapore's law, published prior to said case, see generally Koh Thiam Kwee, *Can You Steal Bitcoin?: Lessons for Singapore from the UK and New Zealand*, 36 SING. L. REV. 186, 192 (2018–2019) (explaining that cryptotokens' status as property under Singapore's criminal law means that stealing bitcoin is not punishable). For reviews of the case itself, see generally Jeremiah Lau, *Computerised Mistake and Proprietised Bitcoin: B2C2 v. Quoine Pte Ltd.*, 35 BANKING & FIN. L. REV. 205 (2019) (discussing the central issues addressed by the court in the case); Hans Tjio, *Securities and Financial Services Regulation*, 19 SING. ACAD. L. ANN. REV. 738, 752 n.50 (2018).

[162] B2C2 Limited v. Quoine PTC Limited, at § 255–57.

[163] *Id.* In civil law countries, litigation seems to have not picked up yet, so that there is little indication on which directions courts will proceed in. One exception is a 2015 case in Japan, which rejected a creditor's claim that Bitcoin held by a bankrupt exchange was the creditor's property. *See* Tang Hang Wu, *Trustees' Investment Duties and Cryptoassets*, 26 TRUSTS & TRUSTEES 183, 189 (2020).

B. Existing literature

Several academic scholars have addressed the difficulty of recognizing cryptocurrencies as property, but they have also alluded to a general intuition that a property rule should apply. For instance, Michael Ng stipulates that in the case of theft, "there is every reason to characterize the issue between them as proprietary,"[164] as otherwise, the victim has no other direct link to a third party who purchases the tokens from the thief.[165] David Fox has asserted similarly that even if a transaction is irreversible in the technical sense (because the distributed ledger is immutable), the registration stored on the blockchain does not provide information about whether the transaction was lawful.[166] Thus, he argues that property law should allow recovery of tokens that are "stolen or transferred by fraud."[167]

Generally, Fox's argument is that existing property law can (and sometimes should) also apply to tokens, either directly—by treating tokens as a special case of intangible assets—or by analogy.[168] For the case of transfers to third parties, this application of property law to tokens means that one can apply the usual "rules of derivative transfer":[169] a person who does not have a legal right cannot confer it to another (as captured by the maxim *nemo dat quod non habet*), so that the original lawful owner will keep a legal property right that is enforceable against third parties.[170]

Several scholars point out other conceptual and practical difficulties of treating Bitcoin as property, for instance, due to "blanket liens";[171] if banks gain an interest in all the property of a

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[164] Ng*, supra* note 40, at 322.
[165] *Id.*
[166] Fox, *supra* note 40, at 19–21.
[167] *Id.* at 27.
[168] *Id*. at 19.
[169] *Id.*
[170] *Id.* at 19–20.
[171] A blanket lien is a typical arrangement between banks and borrowers, which allows the bank to seize any type of assets owned by a debtor in case of non-payment. *See Blanket Lien,* FREE DICTIONARY, https://financial-dictionary.thefreedictionary.com/Blanket+Lien [https://perma.cc/UQ36-RFY3] (last visited Feb. 14, 2021).

business, then once the business receives Bitcoin as payment, the lien applies automatically and hinders liquidity.[172] Janis Sarra and Louise Gullifer investigate whether Bitcoin is considered property for the purpose of insolvency law.[173] They propose to view Bitcoin as property notwithstanding the conceptual difficulties, given that Bitcoin is an asset that has value.[174] Earlier discussions in the literature also reach a similar conclusion, i.e., that Bitcoin can be perceived as property.[175]

While the legal discussion seems to be extensive, neither the courts nor the academic literature reviewed above dedicated particular attention to aspects of efficiency. Some scholarly work does consider the role of TC in the trade of Bitcoin, but its analysis is done mostly in comparison to fiat money[176] and not with respect to other tokens.[177] Jonathan Turpin highlights that cryptocurrencies

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[172] *See* Evan Hewitt, *Bringing Continuity to Cryptocurrency: Commercial Law as a Guide to the Asset Categorization of Bitcoin*, 39 SEATTLE UNIV. L. REV. 619, 629–30 (2016); Gely-Rojas, *supra* note 16, at 138–40.

[173] Sarra & Gullifer QC (Hon)*, supra* note 155, at 242.

[174] *Id*. at 251.

[175] *See* Paul N. McCullum*, Bitcoin: Property or Currency?*, 148 TAX NOTES 867, 867 (2015); Petter Hurich, *The Virtual is Real: An Argument for Characterizing Bitcoins as Private Property*, 31 BANKING. & FIN. L. REV. 573, 574–75 (2016); Scott A. Wiseman*, Property or Currency: The Tax Dilemma Behind Bitcoin*, 2016 UTAH L. REV. 417, 418 (2016); Kelvin FK Low & Ernie GS Teo, *Bitcoins and Other Cryptocurrencies as Property?,* 9 L. INNOV. TECH. 235, 242 (2017); Jeanne L Schroeder, *Bitcoin and the Uniform Commercial Code*, 24 U. MIAMI BUS. L. REV. 1, 78 (2015).

[176] "Fiat money" is the common term used by many to refer to traditional, non-cryptographic, currencies. *See Fiat Money*, INVESTOPEDIA (Feb. 18, 2021) https://www.investopedia.com/terms/f/fiatmoney.asp [https://perma.cc/2WA9-GXJ3].

[177] *See*, *e.g.*, Saurabh Ahluwalia et al., *Blockchain Technology and Startup Financing: A Transaction Cost Economics Perspective,* 151 TECH. FORECASTING & SOC. CHANGE 1, 4 (2020) (comparing the transactions costs in crypto transactions to those in traditional financing methods). For empirical evidence, see generally Thomas Kim, *On the Transaction Cost of Bitcoin*, 23 FIN. RES. LETTERS 300 (2017) (examining the transactional costs associated with Bitcoin); Anne H. Dyhrberg et al., *How Investible is Bitcoin? Analyzing the Liquidity and Transaction Costs of Bitcoin Markets*. 171 ECON. LETTERS 140 (2018) (finding empirical evidence of lower explicit transaction costs in the form of bid-ask spreads). *See also* Sebastien Meunier & Danni Zhao-Meunier, Bitcoin, Distributed Ledgers and the Theory of the Firm (Jan. 20, 2019) (unpublished

are typically related to lower TC compared to fiat money (e.g., due to the possibility of making micro-payments for a reduced fee), but also emphasizes the risk that uninformed individuals will fall victim to fraud and theft (which implies higher TC).[178] Eric Engle similarly alludes to the lower TC, but argues that these also facilitate transactions by criminals, leading to negative externalities.[179] Sinclair Davidson et al. review how one of blockchain technology's main benefits is reducing TC, in particular through the transparency of the ledger, which enables decentralized monitoring and reduces opportunism.[180] Lesïaw Pietrewicz reviews how blockchain relates to TC, but restricts attention to utility tokens and does not consider property rights.[181]

Thus, although the literature seems to identify that TC are important for the trade of cryptotokens, the next step—examining how property rights should be assigned—has not yet been taken. In the following section, this Article connects the (thus far disparate) discussions of property rights in cryptotokens, TC, and token taxonomy. Doing so will then allow this Article to discuss the lessons that a law and economics approach can provide for the issue at hand.

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manuscript), https://ssrn.com/abstract=3327971 [https://perma.cc/9Z53-XMMA].

[178] Jonathan B. Turpin, *Bitcoin: The Economic Case for a Global, Virtual Currency Operating in an Unexplored Legal Framework*, 21 IND. J. GLOB. LEGAL STUD. 335, 350 (2014).

[179] Eric Engle, *Is Bitcoin Rat Poison: Cryptocurrency, Crime, and Counterfeiting (CCC)*, 16 J. HIGH TECH. L. 340, 345 (2016).

[180] Sinclair Davidson et al., *Blockchains and the Economic Institutions of Capitalism*. 14 J. INST. ECON. 639, 651 (2018).

[181] Lesïaw Pietrewicz, *Token-Based Blockchain Financing and Governance: A Transaction Cost Economics Approach,* 2/2018 STUDIA I MATERIAŁY 126, 134–36 (2018).

IV. WHAT LAW AND ECONOMICS HAS TO SAY: A DISCUSSION

A. Coase theorem and transaction costs

From a law and economics perspective, there seems to be no conceptual difficulty in treating tokens as property.[182] Namely, economic theory stipulates that "private goods" can (and should) be privately owned.[183] A "private good" is a good which fulfills two conditions: it must be rivalrous, so that using the good detracts from the ability of others to use it, and it must be excludible, so that the owner can prevent others from simultaneously using the good at a sufficiently low cost.[184] In the case of tokens, both conditions seem easily satisfied: holding a token precludes others from using it at the same time (so that it is rivalrous), and allows the holder to exclude others, as the holder has exclusive access to his private key.[185]

As there is no conceptual problem, a law and economics analysis would instead shift the focus from the definition of what property is to the question of how to assign and protect the rights of token holders. Generally, when scholars of law and economics approach the topic of property rights, the starting point is the theorem developed by one of the discipline's fathers—Nobel Prize winner, Ronald Coase.[186] The Coase Theorem[187] builds on the foundations of

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[182] Recall that tokens are generally designed as a scarce resource, e.g., by using algorithmic methods that reduce the speed in which new tokens are created. For a discussion on the scarcity of Bitcoin, see, e.g., Samuel Elliott, *Bitcoin: The First Self-Regulating Currency,* 3 LSE L. REV. 57, 64 (2018).

[183] *See* COOTER & ULEN, *supra* note 25, at 103 (stating that "[e]fficiency requires that private goods should be privately owned and that public goods should be publicly owned").

[184] *See id.* at 102–05. The ability to exclude others and detract from others' usage ensures that trade may be desirable. If the sellers do not have the ability to exclude others, or if others can simply use the good simultaneously, then potential buyers will not be willing to pay to purchase the good.

[185] Rueckert, *supra* note 37, at 7.

[186] Sarah Galer & Jeremy Manier, *Ronald H. Coase, Founding Scholar in Law and Economics, 1910-2013,* UNIV. CHI. L. SCH. (Sept. 2, 2013), https://www.law.uchicago.edu/news/ronald-h-coase-founding-scholar-law-and-economics-1910-2013 [https://perma.cc/7DUA-2V9E] (explaining that "Ronald H. Coase helped create the field of law and economics . . .").

[187] *See supra* Part I (providing an explanation about the Coase Theorem).

cooperative game theory[188] and provides a prediction for when an efficient allocation of property rights is achieved.[189] The traditional example used is one in which a farmer's fields might be damaged by his neighbor rancher's cattle, where both parties can prevent the damage but one of them can accomplish it at a lower cost.[190] The theorem argues that, if the parties successfully negotiate, they will realize that it is mutually beneficial for the person who can prevent the harm in a cheaper way to do so, as this negotiation creates a surplus that the parties can divide between them.[191] As a result, it will not matter whether the rancher or the farmer has a legal obligation to prevent the harm, meaning, it does not matter to whom the state allocates a property right, as the outcome ex-post will always be efficient.[192] However, the theorem acknowledges that this efficiency only holds when negotiations are feasible, which requires zero (or very low) TC.[193]

A first insight for the context of cryptotokens may be that if one believes that there are zero TC, it does not matter who owns the token initially and whether a liability rule or property rule is applied. Then, the case law mentioned above would set a precedent that is neither beneficial nor harmful.

However, as the cryptocurrency market may well entail various TC, a more detailed analysis that allows for adjusting the rule to the

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[188] Cooperative game theory focuses on joint outcomes that are achieved through coalitions of individuals. It differs from non-cooperative game theory, which instead focuses on strategic interactions in which each individual maximizes his own payoff. *See* Senka Hadzic et al., *Cooperative Game Theory and its Application in Localization Algorithms*, *in* GAME THEORY RELAUNCHED 173, 175–77 (Hardy Hanappi ed., 2013).

[189] Some of the literature highlights an additional aspect related to the Coase Theorem: Parties are more likely to successfully bargain when property rights are clear and unambiguous. COOTER & ULEN, *supra* note 25, at 89. As the ambiguity of property rights in cryptocurrencies is largely the same across all tokens (given the legal uncertainty that governs disputes), it is less relevant for the discussion of varying transaction costs, which is at the heart of this article.

[190] *See* COOTER & ULEN, *supra* note 25, at 88.

[191] *Id.*

[192] *Id.*

[193] *Id*. at 85.

circumstances is in order.[194] In this context, it is important to define exactly what TC include. Several definitions for transaction costs can be found in the literature,[195] but for the purpose of this analysis, this discussion will restrict attention to the most common categorization by Carl Dahlman,[196] which divides such costs into three categories: (1) search and information costs; (2) bargaining and decision costs; and (3) policing and enforcement costs.[197]

"Search and information costs" arise due to imperfect information about the availability of trading opportunities or characteristics of tradeable items.[198] For instance, if the token holder is not fully informed about the demand for his token or does not know where potential buyers reside, tracking down a suitable buyer may involve some costs. Furthermore, a token holder must fully understand which benefits the token brings—otherwise, he will not be able to properly evaluate who might be interested in trading.

"Bargaining and decision costs" arise when there is imperfect information about the counterpart's willingness to trade at given prices and conditions, or when resources must be spent to determine whether the terms of the trade are mutually agreeable.[199] For instance, if the token holder has already located a potential buyer, he may still need to incur costs to determine the exact willingness to

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[194] Transaction costs in cryptocurrencies may take many forms. *See infra,* Part IV.C. For instance, explicit transaction costs arise when trading in ERC-20 tokens on the Ethereum blockchain in the form of a "gas charge." *See* Cohney et al., *supra* note 89. For each action, one (predefined) party must pay a certain amount of Ether tokens. *Id.*

[195] *See* Oliver E. Williamson, *Transaction Cost Economics*, 1 HANDBOOK OF INDUS. ORG. 135, 137–38 (1989); David A. Lesmond et al., *A New Estimate of Transaction Costs*, 12 REV. FIN. STUD. 1113, 1114 (1999); David M. Driesen & Shubha Ghosh, *The Functions of Transaction Costs: Rethinking Transaction Cost Minimization in a World of Friction*, 47 ARIZ. L. REV. 61, 62 (2005). *See also* Douglas W. Allen, *Transaction costs*, 1999 ENCYC. L. & ECON. 893, 893–94 (1999) (arguing that some interpret "transaction costs" widely, as "all laws, rules, social customs and organizations that generate incentives for behavior," whereas others use a narrow definition).

[196] Carl J. Dahlman, *The Problem of Externality*, 22 J.L. & ECON. 141, 148 (1979).

[197] *Id.*

[198] *Id.* at 147–48.

[199] *Id.*

pay of that buyer. Explicit bargaining costs may also be, for example, in the form of lawyer fees or tolls incurred for completing the transfer (e.g., fees for registering transactions in land registries).

Finally, "policing and enforcement costs" arise when it is unclear whether the parties will breach the contract.[200] For instance, if the token holder and a willing buyer sign a written agreement promising to transfer the tokens under some specific circumstance, the buyer may fear that the seller will breach his promise and then refuse to trade. As explained below, this type of cost seems somewhat less relevant for cryptotokens, given the possibility to use so-called "smart contracts": algorithms that automatically transfer tokens conditioned on the fulfillment of mutually agreed terms.[201] If enforcement is automatic, transaction costs should be drastically reduced.[202]

It is, of course, also possible to break down TC into a more detailed framework that focuses on their determinants,[203] but for the sake of brevity, this discussion shall be restricted to the aforementioned three categories. As mentioned previously, the extent to which TC are present determines whether the assignment of property rights should affect efficiency. If TC are non-zero, scholars of law and economics typically argue that the law should instead try to allocate the right to the person who most values the good, meaning, who would have ended up with the good had TC

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[200] Note that some scholars use the term "monitoring" instead of "policing." *Compare id.* at 148, *with* Wim Marneffe & Lode Vereeck, *The Meaning of Regulatory Costs*, 32 EUR. J. L. & ECON. 341, 344 (2011).

[201] Massimiliano Vatiero, Smart Contracts and Transaction Costs, at 6 (Sept. 8, 2020) (unpublished manuscript), https://ssrn.com/abstract=3259958_[https://perma.cc/6WSE-YCGT].

[202] *See* Christian Catalini & Joshua S. Gans, *Some Simple Economics of the Blockchain*, 63 COMM. ACM 80, 82 (2020); Sina Shahab & Allam Zaheer, *Reducing Transaction Costs of Tradable Permit Schemes Using Blockchain Smart Contracts,* 51 GROWTH & CHANGE 302, 306 (2020). *But see infra* Part IV.C 0(presenting also some counterarguments).

[203] For instance, see COOTER & ULEN, *supra* note 25, at 88–91, for a list of factors which lead to low transaction costs. These include: standardized goods or services; clear and simple rights; fewer parties; parties who are friendly, reasonable, and familiar to each other; instantaneous exchange; fewer contingencies; low costs of monitoring; and cheap punishments in case of breach. *Id.*

been zero.[204] A related prescription says that, if TC are non-zero, lawmakers should examine who the cheapest cost avoider is and then grant an entitlement in the good to the opposite side.[205] This method ensures that the party who can prevent the harm at the lowest cost will have an incentive to do so.

While the Coase Theorem shines the spotlight on how transaction costs can affect *who* should be given an entitlement, it does not yield an explicit recipe of *how* to protect an entitlement once it is assigned. The next section thus discusses the follow-up question of how to protect the entitlement from violations, in other words, whether one should impose a property rule or a liability rule.

B. Property rules or liability rules

In their highly influential paper, Calabresi and Melamed lay out the relationship between property rules, liability rules, and TC.[206] In a nutshell, they argue that a property rule should be implemented when TC are low, as Coasean bargaining will then lead to an efficient outcome.[207] Respectively, when TC are high, a liability rule should be imposed instead.[208] As mentioned in the introduction, the key distinction between the two rules is whether a right can be

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[204] *Id*. at 103–04.

[205] *See, e.g.*, Douglas G. Baird & Anthony J. Casey, *No Exit? Withdrawal Rights and the Law of Corporate Reorganizations,* 113 COLUM. L. REV. 1, 8–9 (2013). For the application of the concept in tort law, see also Mary Lou Serafine. *Repudiated Compromise After Breach*, 100 YALE L.J. 2229, 2237 (1991); COOTER & ULEN, *supra* note 25, at 354. *See generally* Peder Østbye, Who is Causally Responsible for a Cryptocurrency? (Mar. 29, 2019) (unpublished manuscript), https://ssrn.com/abstract=3339537 [https://perma.cc/V27V-DKFY] (discussing causal responsibility for harm related to blockchain).

[206] *Id.* at 1094 (explaining Coasean bargaining refers to bargaining under zero transaction costs, as in the Coase theorem). For a discussion of the Coase theorem, see *id.* at 1094 n.12, 1118 n.59.

[207] Coasean bargaining refers to bargaining under zero transaction costs, as in the Coase Theorem. For uses of the term "Coasean Bargaining," see, for example, John J. Donohue*, Opting for the British Rule, or If Posner and Shavell Can't Remember the Coase Theorem, Who Will?,* 104 HARV. L. REV. 1093, 1095 (1991); Gideon Parchomovsky, *Publish or Perish,* 98 MICH. L. REV. 926, 948 (2000).

[208] *See generally* Calabresi & Melamed, *supra* note 9 (discussing not only efficiency, but also discussing distributions and other justice-related considerations).

non-voluntarily transferred.[209] A property rule prevents non-voluntary transactions by enabling the person whose rights are infringed to obtain an injunction, whereas a liability rule allows for non-voluntary transfers if the original right holder is compensated.[210] The decision criterion for choosing between a property rule and a liability rule depends on whether there are obstacles for trade (i.e., TC),[211] where high TC support a liability rule and low TC support a property rule.

This criterion offers a clear prescription but is subject to some limitations.[212] First, liability rules require courts to calculate damages, whereas property rules just dictate that the court should grant an injunction.[213] If the calculation of damages is either costly or imperfect (e.g., because the harm is difficult to estimate), the administrative costs alone may support the imposition of a property rule instead.[214] Second, a property rule merely implies that someone should get the entitlement but does not say who that person is (the plaintiff, the defendant, or none of them).[215] Thus, the choice between injunction and no-injunction may also require administrative costs (calculating the value of the good to each party).[216] Considering these difficulties, Robert Cooter and Thomas

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[209] *See supra* note 12.

[210] *See supra* note 11.

[211] COOTER & ULEN, *supra* note 25, at 100.

[212] *Id.*

[213] *See id.* at 96 ("[T]he right to an injunction should be regarded as a clear assignment of a property right."); Emily Sherwin*, Introduction: Property Rules as Remedies,* 106 YALE L.J. 2083, 2085 (1996) ("[T]the great body of property rules are enforced by courts through equitable remedies such as injunctions . . . .").

[214] *See, e.g.*, Alan Schwartz*, The Case for Specific Performance, 89* YALE L.J. 271, 271–72 (1979) (arguing that damages may be hard to compute, especially for unique goods, leading to imperfect compensation); Gerrit De Geest, *N Problems Require N Instruments*, 35 INT'L REV. L. & ECON. 42, 47 (2013) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2079747 [https://perma.cc/2KQB-7U5P] (stating that "damages are no more than rough guesses. They can be substantially undercompensatory or overcompensatory in individual cases").

[215] Calabresi & Melamed, *supra* note 9, at 1092.

[216] In order to figure out whether TC are sufficiently high to preclude agreements, the court must assess what is the surplus that can be achieved through negotiations. *See id.* This requires, among other things, an estimation of the

Ulen propose to adopt the following rule for the case when TC are high:[217] the court should grant an injunction (i.e., implement a property rule) if it knows which party values the good relatively more, but should grant damages (i.e., a liability rule) if it knows how much one of the parties values the good absolutely.[218]

A final aspect of the paper by Calabresi and Melamed, that is relevant for the discussion herein, is so-called "inalienability" rules, which prohibit some transfers even when both parties to the transaction trade willingly.[219] For instance, if a court decided to grant an injunction against a third party (e.g., a crypto exchange) the result indirectly imposes an inalienability rule for the transaction between the hacker and the client of the exchange. Note that such rules may make sense when there are serious externalities, for example, when a trade causes massive harm to others (here, to the original owner). Two specific cases of externalities are then relevant here. First, inalienability rules can protect the original owner, in the case that the damage he incurs is non-monetizable, due to a fear of imperfect compensation.[220] Second, when goods are appropriated through theft (or blackmail), insisting on inalienability protects the integrity of the legal system from arbitrary impositions of liability rules.[221] This reasoning can also be related back to TC: a thief may steal precisely because TC are too high, so that acquiring the good through negotiations is not feasible.

Calabresi and Melamed's conclusions regarding the relationship between TC and the choice of property versus liability rules have been thoroughly discussed by later work, yielding some refinements

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valuation of each party. *See id*. at 1093 (highlighting the role of administrative costs for the choice of granting entitlements).

[217] COOTER & ULEN, *supra* note 25, at 101.

[218] The intuition for this distinction is as follows: if trade is hindered by TC, it is better to instead imitate the result that would have occurred had zero-TC trade taken place, by granting the right to the one who values the good most. *Id.* However, when the court has difficulties identifying which party values the good more but does know the exact valuation of at least one party, it should prefer to save on the administrative costs and instead award damages. *Id.*

[219] Calabresi & Melamed, *supra* note 9, at 1112.

[220] *See id.*

[221] *See id.* at 1126.

in support of the theory as well as some criticism,[222] but their analysis remains a central figure in the economic analysis of law, providing a framework to evaluate how entitlements in cryptocurrencies should be protected.[223]

C. Applying the right rule

Consider the following example: Alice owns 100 tokens, which she is planning to transfer to another account. Bob secretly hacks into Alice's computer and switches the address of the target account, causing Alice to transfer the tokens to Bob's account instead of the intended account. Bob quickly transfers the tokens again to Carol. Alice files for an injunction against Carol, demanding to receive her tokens back.

From an efficiency perspective, the main goal is to adopt a rule that ensures that the token ends up in the hands of the individual who values it the most (either Alice or Carol). The first question is then whether there are barriers to negotiation and trade between Alice and Carol, i.e., are TC too high? To answer this question, one must consider the three categories of TC: (1) search and information costs, (2) bargaining and decision costs, and (3) enforcement costs.

In some cases, it is clear that search costs are low. For example, if a token is traded on a crypto exchange, there is liquidity and a publicly available market price,[224] reducing the need to search for a prospective buyer. Both Carol and Alice presumably then have a low search cost for other buyers. If Carol, who currently holds the

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[222] *See* Arial Porat, *Economics of Remedies*, 2 OXFORD HANDBOOK L. & ECON. 308, 312–13 (2017); Yun-Chien Chang, *Optional Law in Property: Theoretical Critiques and a New View of the Cathedral*, 9 N.Y.U.J.L. & LIBERTY 459, 463–64 (2015).

[223] *See, e.g.*, COOTER & ULEN, *supra* note 25, at 100; Vincent SJ Buccola, *Bankruptcy's Cathedral: Property Rules, Liability Rules, and Distress*, 114 NW. U.L. REV. 705, 724 (2019); Limor Riza, *Rawls, Taxation and Calabresi & Melamed's Rules*, 15 REV. L. & ECON. 43, 44 (2019); Andrew W. Torrance & Bill Tomlinson, *Property Rules, Liability Rules, and Patents: One Experimental View of the Cathedral,* 14 YALE J.L. & TECH. 138, 146–47 (2011); Richard Craswell, *Property Rules and Liability Rules in Unconscionability and Related Doctrines*, 60 U. CHI. L. REV. 1, 7–12 (1993).

[224] *See generally* Wei, *supra* note 33 (finding no evidence of illiquidity premiums).

token, does not value the token the most, she can sell it to any random buyer on the exchange. If that buyer values the token more than Alice, it is actually efficient that the token ends up in that buyer's hands (although it seems unjust, as Alice's tokens were stolen). Conversely, if Alice is the one who most values the token, she will eventually buy it back from said buyer.

As long as there is an effective channel of trade (in this case, a crypto exchange), search costs will stay relatively low. Respectively, tokens that are not listed for trade will imply a high search cost. An alternative reason for high search costs may be that Carol cannot be easily located, for example, because Carol actively attempts to hide her identity. Sometimes, Carol's anonymity would even be inherent to the token's technology,[225] making it very costly (or impossible) for Alice and Carol to negotiate.

Next, bargaining costs would depend on the circumstances. If Alice and Carol can freely communicate, negotiations are possible. However, Carol might be, for example, located in another country—so that negotiations would require compliance with foreign law,[226]

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[225] One example would be the underlying privacy mechanism of "Zero Cash," also known as "Zcash," which relies on so-called "zk-SNARKS" or "Zero Knowledge Proofs." Eli Ben-Sasson et al*., Zerocash: Decentralized Anonymous Payments from Bitcoin*, *in* PROCEEDINGS OF THE IEEE SYMPOSIUM ON SECURITY AND PRIVACY 459 (2014). These obscure the identity of the parties to the trade. *See, e.g.,* Jesse Kloss, *Securing Crypto: Exempting Certain Cryptoassets from the Arkansas Securities Act*, 73 ARK. L. REV. 631, 639 (2020) ("Zero cash shields addresses and balances from being visible on the blockchain"). Noah Walters, *Privacy Law Issues in Public Blockchains: An Analysis of Blockchain, PIPEDA, The GDPR, and Proposals for Compliance,* 17 CANADIAN J.L. & TECH. 276, 297 (2019) ("zk-SNARK technology allows users to hide their identities, transaction amounts, and account balances . . . ."). The most prominent use case for this technology is ZeroCash, also known as "Zcash." *The Basics*, ZCASH, https://z.cash/the-basics [https://perma.cc/RJ89-WRH5] (last visited Mar. 5, 2021).

[226] For example, suppose that a seller sells a stablecoin to a buyer who resides in the EU but is incorporated in Switzerland. As the EU and Switzerland have different definitions of whether a stablecoin is subject to some regulation, e.g., to KYC procedures. *See* Thomas A Frick, *Virtual and Cryptocurrencies—Regulatory and Anti-money Laundering Approaches in the European Union and in Switzerland,* 10 ERA F. 99, 101 (2019). The seller is likely to require legal counsel on which rule applies, leading to legal costs. *Id.*

leading to legal costs. Moreover, there may be many different "Carols," each holding some of the tokens that were illegally extracted from Alice. The multiplicity of parties then typically increases the cost of bargaining.[227] Another aspect is information asymmetries regarding the token's value, as the parties must figure out each other's willingness to trade at a given price. This informational asymmetry may be complicated if the token's value is not standardized, i.e., it will depend on the circumstances.

Finally, enforcement costs depend on how agreements related to tokens are designed. If transfers are guaranteed technologically using smart contracts, there are (theoretically) zero enforcement costs, as the algorithm ensures that the transfer occurs. However, the parties could face difficulties in programming ad-hoc smart contracts, either due to lack of technological knowledge (requiring parties to hire paid experts) or other TC that arise during the negotiation over the choice of mechanism in the smart contract.[228] Moreover, as smart contracts are not adaptable to relevant changes in the world (as everything is programmed), it has been argued that TC may increase for that reason.[229] This argument relies, among others, on behavioral grounds such as the parties' bounded

[227] When multiple parties are involved, negotiations can easily become complex, i.e., because the parties have different interests or different time constraints. In addition, some parties may try to freeride on others' negotiation efforts, which can lead to delays (e.g., parties delaying their responses in anticipation of others' behavior) or even to a negotiation breakdown (in the extreme case where no one invests effort). *See also* COOTER & ULEN, *supra* note 25, at 91 (naming "few parties" as a factor that reduces transaction costs).

[228] For example, suppose that the parties agree that any amount transferred from the buyer to the seller will first be transferred to an escrow account. Even if the parties agree on this concept, the details must be determined (who controls this account, who programs the smart contract, what happens in case of dispute, and so on). All the related details are also subject to negotiations and, respectively, to transaction costs.

[229] Vatiero, *supra* note 201, at 6 (arguing that smart contracts "are constructed to avoid . . . external adaptation. Hence, although [smart contracts] reduce uncertainty in economic relationships, they also preclude any ex post efficiency-enhancing adaptation of contractual terms by an external third party.").

rationality when designing the smart contract,[230] which can prevent them from addressing the relevant contingencies correctly *ex-ante*, thus resulting in disputes *ex-post*.

From a practical perspective, proper implementation of the Calabresi and Melamed proposition thus seems to require a case-by-case distinction, depending on the specific TC that arise. However, as a case-by-case approach is always costly, a reasonable middle ground can be to use a proxy for different types of transactions, such as the existing taxonomy laid out above—dividing the tokens into utility, security, and currency. As enforcement costs are unlikely to vary across these categories, the following analysis will focus on search or information costs and bargaining or decision costs.

As currency tokens are usually tradeable on exchanges, or directly accepted as a form of payment, search and information costs are arguably low, therefore it is very easy to find parties with whom to trade. Similarly, such tokens are unlikely to have heterogeneous valuations, so that there is almost no need to ascertain whether the terms of a transaction in the token itself are mutually agreeable. However, two issues should be considered. First, agreeing on the transfer of currency tokens is typically secondary to a main agreement, where parties negotiate on another matter that involves tokens as payment. TC would then depend also on the main agreement. Second, regulators may decide to exploit the fact that even currency tokens have unique identifiers and can be traced.

For example, Christian Rueckert considers the possibility to regulate cryptocurrency trade using "blacklists," which would force market players to always compare the transaction history of the token with a public list of suspicious entities who have been accused of various law violations.[231] If such a policy is implemented, the obligation to check the blacklists would create information costs, as blacklisted tokens are likely to be in demand only for a lower price. Nonetheless, there seem to already be some technological solutions

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[230] *See* Meunier & Zhao-Meunier, *supra* note 177, at 28 (noting that "smart contracts remain inherently incomplete because they are written by boundedly rational people").

[231] Rueckert, *supra* note 37, at 3.

that will circumvent the efficacy of blacklists, for example, the so-called "Zero Knowledge Proofs" that enable the masking of the identity of the token's address.[232] Thus, the market may be able to reduce potential TC through technological improvements. Overall, for currency tokens, TC are thus plausibly low.

As security tokens might not be traded on an exchange, search costs may be very high: sellers must locate a suitable buyer who is willing to invest in the underlying project to which the token is attached. Moreover, bargaining costs are also likely to be high, due to the need to conduct due diligence and possibly comply with extensive regulation under securities laws. Furthermore, evaluating the worth of the token may be costly irrespective of the underlying investment, as investors would need to examine the smart contract and evaluate whether there are any loopholes in the code that hinder the specific project's distribution of revenues.[233]

As utility tokens are more intricate and can encompass different sets of rights, it is difficult to provide a clear intuition regarding TC. Currently, IEOs on crypto exchanges are generally limited to utility tokens,[234] implying that utility tokens are more liquid so that search

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[232] *See* Kloss, *supra* note 225, at 639; Nicholas J. Ajello, *Fitting a Square Peg in a Round Hole: Bitcoin, Money Laundering, and the Fifth Amendment Privilege Against Self-Incrimination*, 80 BROOK. L. REV. 435, 438 (2015). For further details on the technology, see Mathew Green & Ian Miers, *Bolt: Anonymous Payment Channels for Decentralized Currencies, in* PROCEEDINGS OF THE 2017 ACM SIGSAC CONFERENCE ON COMPUTER AND COMMUNICATIONS SECURITY 473, 476 (2017).

[233] Note that these arguments are mostly applicable for private sales of tokens. If tokenized securities are traded on public exchanges, e.g., due to a cooperation between stock exchanges and blockchain companies, TC may decrease. As one example for said cooperation, the Israeli Tel Aviv Stock Exchange (TASE) announced that it will partner up with a blockchain lending platform ("BTP"). *See* Carrie Ramirez, *Israeli Exchange, BTP Team up on Blockchain Securities Platform,* FIN. MAGNATES (Feb. 10, 2020), https://www.financemagnates.com/cryptocurrency/news/israeli-exchange-btp-team-up-on-blockchain-securities-platform/ [https://perma.cc/M54N-24GB].

[234] Albeit crypto exchanges can technically decide to sell security tokens, they are then bound by the regulation related to such tokens. *See* SEC, INITIAL EXCHANGE OFFERINGS (IEOS) – INVESTOR ALERT (Jan. 14, 2020), https://www.sec.gov/oiea/investor-alerts-and-bulletins/ia_initialexchangeofferings

costs are sometimes low. In other instances, complex algorithms behind a utility token can lead to both high search costs and high bargaining costs,[235] since the parties may find it challenging to pin down the correct value of the token and determine the willingness to pay and accept that value.

Table 1 below summarizes the expected relationship between the type of token and TC.[236]

[https://perma.cc/F7MT-KFXB]. If the tokens are issued in compliance with the regulation, the IEO becomes an STO. However, many exchanges purposefully avoid that result by marketing only utility tokens and thus require token issuers to supply a legal opinion that classifies the token as a utility token. *See, e.g.,* Sergey Baloyan, *How To Launch Your IEO: Guide For Projects + List of Exchanges,* HACKERNOON (Apr. 6, 2019), https://hackernoon.com/how-to-launch-your-ieo-guide-for-projects-list-of-exchanges-dcebca23bcac [https://perma.cc/TDZ2-9Z2U]; *IEO (Initial Exchange Offering) Review: Pitfalls and Advantages*, INMIND (Apr. 25, 2020), https://innmind.com/articles/1867 [https://perma.cc/V4EU-NVRP].

[235] Evaluating the worth of a utility token is a difficult task, as the value may depend on the exact functionality features as well as the number of people using the token. *See* Lars Schlichting & Rossella Dressi Petrini, The Qualification of Digital Assets according to Swiss Law, with Particular Reference to Stable Coins 4 (July 15, 2019) (unpublished manuscript), https://ssrn.com/abstract=3424571 [https://perma.cc/2EKL-P7CS]; Benedict J. Drasch et al., *The Token's Secret: The Two-faced Financial Incentive of the Token Economy*, 30 ELECTRONIC MKTS. 557, 557 (2020). *See also* Luz Parrondo & Andrei Boar, *DLT-Based Token Classification Towards Accounting Regulation* 6 (UPF Barcelona Sch. of Mgmt. Working Paper No. 6, 2020), https://www.bsm.upf.edu/sites/default/files/working_paper_6-_luz_parrondo_andrei_boar.pdf [https://perma.cc/6TP4-SUYR] (arguing that the value of the utility tokens should be established by their functionality and not be linked to speculation). For the user to assign an exact value to the token, she must therefore understand not only the programmable contingencies of the token but also how the value changes depending on the manner of use by others. Furthermore, utility tokens that provide access to a decentralized app depend on the features of that app—which are also created using (potentially complex) code.

[236] *See supra* Parts II.B (discussing the taxonomy of tokens) and IV.1 (discussing the distinction between different types of transaction costs).

Table 1: TOKEN TAXONOMY AND TC

	Search/Information costs	Bargaining/Decision costs
Currency tokens	Low	Low
Security tokens	High	High
Utility tokens	Low/High	Low/High

Note: This table summarizes the transaction costs that typically apply to each category of tokens (Currency, Security, and Utility).

This rough division suggests that a liability rule should be applied to security tokens (as TC are overall high), a property rule should be applied to currency tokens (as TC are overall low), and a case-by-case decision should be made for utility tokens (as TC are ambiguous).

However, there seems to be at least one argument in favor of always imposing a property rule for utility tokens as well: for such tokens, it may be too costly to calculate damages, due to subjective valuations. Furthermore, as each holder may gain a different utility from the same token[237]—depending on how much an individual benefits from the service to which the token relates—there is a fear of imperfect compensation.

There are, however, several additional points to consider. First, ordering a third party to transfer Bitcoins to a plaintiff can also reside under a property *tracing* rule, rather than a property *following* rule.[238] For instance, suppose that Alice owns tokens that are

[237] As a utility token's value often hinges on the uses within a specific platform, Louise Fjord Kjærsgaard & Autilia Arfwidsson, *Taxation of Cryptocurrencies from the Danish and Swedish Perspectives*, 46 INTERTAX 620, 622 (2019), users may differ in the value they get when using the platform, *see also* Lin William Cong et al., *Tokenomics: Dynamic Adoption and Valuation*, 34 REV. FIN. STUD. 1105, 1111 (2021) (developing a theoretical model wherein agents gain heterogeneous benefits from using tokens).

[238] *See* Fox*, supra* note 40, at 27–28. For an additional discussion of token traceability see, *e.g.,* Stephen M. McJohn & Ian McJohn, *The Commercial Law of Bitcoin and Blockchain Transactions* 11–14 (Suffolk Univ. L. Sch. Research Paper No. 16-13, 2016), https://ssrn.com/abstract=2874463 [https://perma.cc/P3DM-L534]. For a discussion of tracing in security laws, see Peter B. Oh, *Tracing*, 80 TUL. L. REV. 849, 851–54 (2005).

unwillingly transferred to Bob, e.g., due to hacking or extortion (by Bob himself or by another person), and eventually traced to Bob's account. There are then two possible conceptual constructs that lead to the conclusion that Alice is entitled to receive back the tokens: The court can determine that Alice has the right of property *following*, i.e., the Bitcoins are in fact her original property, or that Alice has a right of property *tracing*, i.e., the located tokens are a computerized conversion of Alice's tokens into a new conceptual token. The latter conclusion is in line with an argument raised by Sarra and Gullifer, according to which Bitcoin does not truly "exist" as an intangible item because only transactions are recorded on the blockchain.[239] Thus, conceptually a transfer of a token can be thought of as eliminating an item in the sending account and creating a new item in the receiving account. The implication of applying property tracing (rather than following), is that the rule becomes a quasi-liability rule: the plaintiff is entitled to receive other tokens, which have the exact same value as the lost tokens, much like the outcome of awarding damages.

Second, the analysis above focuses only on *ex-post* efficiency, following the Coase Theorem. However, other theories in law and economics—such as "incomplete contracts" theory[240]—focus instead on *ex-ante* efficiency[241] and on the fear of underinvestment

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[239] Sarra & Gullifer*, supra* note 155, at 271 ("[I]n one sense, Bitcoin does not exist at all. What exists is a record of transactions that is held immutably on a distributed ledger (a blockchain). The subject matter of those transactions has no physical existence, not even as a line of code. Instead, it is a construct that, by common consensus, has value in that people will exchange fiat currency, goods, or services (things that are considered to have value in the 'real world') for it.").

[240] For details on incomplete contracts theory, see Oliver Hart & John Moore, *Incomplete Contracts and Renegotiation*, ECONOMETRICA 756, 756 (1988); Philippe Aghion & Patrick Bolton, *An Incomplete Contracts Approach to Financial Contracting,* 59 REV. ECON. STUD. 473, 490 (1992); Jay P Kesan & Marc Banik, *Patents as Incomplete Contracts: Aligning Incentives for R&D Investment with Incentives to Disclose Prior Art,* 2 WASH. U.J.L. & POL'Y 23, 29 (2000).

[241] In the context of contracts, economists use the term *ex-ante* efficiency to describe actions taken before the dispute arises, mostly focusing on investments that the parties make as part of the contract. *See, e.g.,* Robert E Scott & George G. Triantis, *Incomplete Contracts and the Theory of Contract Design,* 56 CASE

in the property prior to negotiations.[242] For instance, suppose that a token holder can invest money to increase its value. If the holder anticipates ex-post negotiations, he will only invest if he expects to keep a sufficiently large share of the surplus that he creates by investing; otherwise, there will be underinvestment.[243] Hence, incomplete contracts theory argues that bargaining power should be given to the party who can invest.[244]

Applying this insight to the token's taxonomy reveals an interesting distinction. In security tokens, especially those issued explicitly as a substitute for equity, buyers in an STO are comparable to traditional financial market investors. Such investors may well be able to increase the value of the issuing firm, just as angel investors might invest precisely when they expect their personal connections and abilities to provide additional value.[245] The same might also hold for utility tokens, when the underlying service is such that external investments can increase their value,[246] but does

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W. RES. L. REV. 187, 189 (2005). For an application to intellectual property, see Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129, 130 (2004).

[242] Lemley, *supra* note 241, at 130.

[243] *See, e.g.,* Susanne Ohlendorf, *Expectation Damages, Divisible Contracts, and Bilateral Investment,* 99 AM. ECON. REV. 1608, 1614 (2009).

[244] *See*, *e.g.*, William P. Rogerson, *Efficient Reliance and Damage Measures for Breach of Contract*, 15 RAND J. ECON. 39, 51 (1984); Hart & Moore, *supra* note 240. Note that the theory also addresses the fear of over-investment, which would occur if the token holder is fully insured because the remedy guarantees a full refund. *See, e.g.,* Scott Baker & Kimberly D. Krawiec, *Incomplete Contracts in a Complete Contract World*, 33 FLA. ST. U.L. REV. 725, 727 (2005) ("contractual incompleteness also can lead to overinvestment"). *See also* Aaron S. Edlin & Alan Schwartz, *Optimal Penalties in Contracts,* 78 CHI.-KENT L. REV. 33, 43–44 (2003) ("Contract law, however, awards the buyer the difference between the buyer's valuation given his investment and the price when the parties do not trade; the buyer thus is fully insured against lost valuations regardless of the investment level he chose. Therefore, the buyer will invest too much.").

[245] *See* Darian M. Ibrahim, *The (Not So) Puzzling Behavior of Angel Investors*, 61 VAND. L. REV. 1405, 1411 (2008).

[246] As the value of utility tokens may depend on how each user uses the token, token holders who have a sufficiently large stake may be able to influence the value of the token. *See also supra* text accompanying note 233. For instance, in the popular platform Steemit.com, users can buy a "Steem Power" token that

not seem to hold for currency tokens. Thus, from an *ex-ante* perspective, the conclusion is again that property rules are better applied for security tokens, and possibly for utility tokens.

A related aspect of *ex-ante* efficiency is discussed in an influential paper by Louis Kaplow and Steven Shavell.[247] Among other things, Kaplow and Shavell argue that property rules may be superior even when TC are high, e.g., because a liability rule may hinder the victim's *ex-ante* incentive to mitigate harm[248] (since the victim's anticipation of damages is a form of insurance that crowds out the incentive to take precaution), or because the threat of damages is ineffective if the injurer is judgment-proof (i.e., he who cannot afford to pay and is thus undeterred by damages).[249] Such arguments may actually favor a one-size-fits-all property rule. On the flip side, some arguments may favor a one-size-fits-all liability rule. For instance, property rules have an inherent risk of being too wide, as it is difficult to ensure that injunctions will only be enforced to protect an infringed entitlement.[250] As the courts should be able to name a unique identifier for the token (e.g., the public address) in an injunction, this concern seems weaker.[251] However, none of the

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grants more influence on the platform. STEEM, STEEM: AN INCENTIVIZED, BLOCKCHAIN-BASED, PUBLIC CONTENT PLATFORM 1 (2017), https://steem.com/SteemWhitePaper.pdf [https://perma.cc/U6HU-HA8C]. A large investment in such tokens can directly change the value of the platform and hence the value of the tokens tied to that platform, such as the token "Steem." Such influence is usually not possible with currency tokens, as they are not tied a specific platform. *See id.*

[247] *See* Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713, 718–20 (1996).

[248] *Id.* at 721. Kaplow & Shavell also argue that liability rules may be superior when TC are low. *Id.* at 734–35. However, their argument seems to be based on a narrow definition of TC that excludes information costs (as they assume that low TC can occur alongside asymmetric information). *Id.*

[249] *Id.* at 721.

[250] *See* Mark A. Lemley & Philip J. Weiser, *Should Property or Liability Rules Govern Information*, 85 TEX. L. REV. 783, 784 (2006).

[251] *See id.* at 785 ("[C]ourts cannot easily tailor injunctions to forbid only the prohibited conduct. In these situations, injunctive relief can systematically overcompensate plaintiffs and overdeter defendants, with significant negative consequences for innovation and economic growth. Stated simply, where property rules have pernicious consequences, liability rules look better by comparison.").

cases above mention any specific identifier, so that the fear of over-arching injunctions is plausible.

An *ex-ante* perspective is also helpful in justifying why any property rule should protect the rights of the original owner (Alice) rather than others' rights: Alice might only invest in enhancing the value of her token if she can be sure that it will not be appropriated later. Moreover, if the theft of tokens is permitted, such theft can lead to wasted resources by both Alice, in an attempt to protect herself against theft (e.g., paying for security software to protect herself against hackers), and Bob, in an attempt to increase the chance that the theft will be successful (e.g., by paying for hacking tools).[252]

Third, frictions in the cryptocurrency market may cause TC to always be high. For instance, search costs always apply to some extent, as even on the Bitcoin blockchain, there is pseudo-anonymity: the holder of the public key does not need to identify himself when opening an "account."[253] The parties may then have to invest resources in unmasking the identity behind a given wallet, e.g., by hiring a private investigator. When these costs dominate, the distinction ceases to be helpful, and theory would imply that only liability rules should be adopted.

Fourth, smart contracts make it possible for market players to choose between property rules and liability rules and implement them automatically, using an appropriate algorithm.[254] However, as this choice of rules would require some form of negotiation to establish the rules, high TC may make this approach infeasible anyway.

Fifth, while most tokens are fungible, i.e., each token is equivalent to all other tokens that bear the same title, some non-fungible tokens ("NFTs") have also emerged.[255] For instance, some projects tie

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[252] *See generally* Gordon Tullock, *The Welfare Costs of Tariffs, Monopolies, and Theft,* 5 ECON. INQUIRY 224, 228–32 (1967) (discussing why theft is inefficient).

[253] *See* Rueckert*, supra* note 37, at 3.

[254] *See* Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 376 (2017).

[255] Michael Fröwis et al., *Detecting Token Systems on Ethereum, in* 11598 FINANCIAL CRYPTOGRAPHY & DATA SECURITY 93, 94 (2019).

tokens to unique items[256] ("tokenized items"), such as works of art or items in a computer game. These tokens derive their value precisely from their non-fungibility, as the uniqueness of the token ensures that no one can create an equivalent item.[257] NFTs intuitively fall closer to utility tokens (albeit one can create a unique financial instrument as well), but TC are amplified: tracking-down others who are willing to buy and estimating their valuations seems even harder; monetary compensation may be insufficient; and the incentive to misappropriate the token is higher. Thus, NFTs provide a clear case where a property rule should be enforced.[258]

Sixth, the discussion above revolves around a token owner and does not consider derivative rights. Consider the following hypothetical situation: Alice owns a utility token that grants access to premium services in hotels, but unfortunately cannot take a vacation in some year. Instead, she rents out her token to Bob. Bob now controls the token but does not own it. A dispute arises between Alice and Bob, where each claim that he or she now owns the token.

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[256] For instance, "VGO skins" tokens capture unique items that gamers can find in computer games, such as "Counter Strike: Global Offensive." *See* Brett Abarbanel, & Joseph Macey, *VGO, NFT, OMG! Commentary on Continued Developments in Skins Wagering,* 23 GAMING L. REV. 23, 23 (2019). Other examples are ERC-721 tokens (which are registered on the Ethereum blockchain) which are used, for instance, in the computer game "CryptoKitties" to reflect collectable digital cats. *See* Thomas Ankenbrand et al*., Proposal for a Comprehensive (Crypto) Asset Taxonomy,* IEEE 2020 CRYPTO VALLEY CONFERENCE ON BLOCKCHAIN TECH. (CVCBT) 16, 23 (2020).

[257] *See, e.g.*, Mugdha Patil, Land Registry on Blockchain (May 14, 2020) (Master's Thesis, San José State University) (on file with SJSU ScholarWorks) ("Games like CryptoCup, CryptoFighters and CryptoKitties [thirty] use ERC-721 as virtual collectibles. Their value is obtained from their scarcity, and NFT application to the real world is an active research domain.").

[258] Note that currency tokens are always fungible, as they are intentionally designed to be perfect substitutes for one another. However, this fungibility is also applicable for many security and utility tokens. *See* Yuliya Guseva*, A Conceptual Framework for Digital-Asset Securities: Tokens and Coins as Debt and Equity,* 80 MD. L. REV. 166, 174 (2020). For example, a token representing a share in a company grants the same value as another token representing a share. Thus, the issue of fungibility, by itself, does not seem to change the conclusion based on Table 1.

The hotels which take part in the service also join the case and object to Bob's use of the token.

For the dispute between Alice and Bob, imposing a liability rule would seem strange because the TC of parties that have already reached one agreement are unlikely to be very high.[259] However, for the dispute with third parties (the hotels), TC may increase rapidly. Alice now must bargain with several parties, each with a different interest, and it is unclear how Bob's derivative right of using the token should be evaluated. Furthermore, if Alice gives Bob her private key, it is no longer clear who the owner is, unless one turns to the written agreement and incurs litigation costs to prove what the correct interpretation is (where the litigation costs constitute a form of enforcement costs for the original agreement between Alice and Bob). The analysis may become even more elaborate if, for instance, Bob becomes insolvent,[260] and multiple parties join the dispute (creditors, crypto exchanges, companies providing online "wallets," etc.) and compete for a right in the token. It then depends on the exact circumstances of the case, so that there may be no way out other than resorting to a case-by-case analysis.

Seventh, whether third parties hold the token in good faith seems important from both a legal and an economic perspective. From a legal perspective, good faith constitutes a fairness argument for granting innocent third parties rights in tokens, even if the seller was not the lawful owner.[261] In particular, although the list of transactions may be transparent, it does not indicate what happened off-chain. For instance, it is unclear whether crypto exchanges have any feasible way of checking whether their clients obtain the token lawfully. The economic reasoning is strong as well: imposing a burden of ascertaining what happened off-chain translates into high TC. Thus, protecting the rights of third parties who acquire a right

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[259] *See supra* note 203 and accompanying text (noting that that familiar parties are one indicator of lower TC).

[260] *See* Sarra & Gullifer, *supra* note 155 (discussing implications of insolvency).

[261] Ashton Hawkins et al., *A Tale of Two Innocents: Creating an Equitable Balance between the Rights of Former Owners and Good Faith Purchasers of Stolen Art*, 64 FORDHAM L. REV. 49, 53 (1995).

in good faith sits well with a law and economics approach.[262] This relationship implies that a property rule, favoring the rights gained in a good-faith acquisition, should be adopted. A similar conclusion can also be supported by the concept of the "least-cost avoider":[263] arguably, token owners possess superior information on the tokens they own, enabling them to track them down when needed. Granting a right to the opposite side—the third party—then incentivizes token owners to take reasonable precautions (e.g., safeguard their private key). Naturally, this logic does not extend to third parties who act in bad faith, as such parties can also easily prevent the harm by refusing to accept the tokens.

The difficult question is, however, how one should determine whether a right was acquired in good faith. If regulators adopt the proposal to establish blacklists,[264] good faith would require the receiver of the tokens to check such lists. This solution sounds easy enough but may raise practical difficulties in cross-border transactions, as some states might include a token on a blacklist that others do not.

Eighth, as technology advances, cryptocurrency trade may take on new forms that raise additional questions. For example, blockchain technology has been criticized for lacking scalability, due to the high computing power required to verify each transaction

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[262] *See* Arthur F. Salomons, *Good Faith Acquisition of Movables*, *in* TOWARDS A EUROPEAN CIVIL CODE 13 (Arthur Hartkamp et al. eds., Kluwer L. Int'l 4th ed. 2009).

[263] In the Law & Economics literature, scholars argue that, generally, liability should be assigned to whichever person can avoid risks or harm at the lowest cost. *See* Stephen G. Gilles, *Negligence, Strict Liability, and the Cheapest Cost-avoider*, 78 VA. L. REV. 1291, 1292 (1992); Giuseppe Dari-Mattiacci, Nuno Garoupa, *Least Cost Avoidance*, 25 J. L. ECON. & ORG. 235, 245 (2008); COOTER & ULEN, *supra* note 25, at 343 ("Thus, the law assigns liability for harm suffered by incompetent contractual partners to the competent people who can avoid the harm at least cost. In this matter, the law follows the general principle of tort law, according to which liability for accidents should fall on the party who can avoid them at least cost.").

[264] Rueckert*, supra* note 37, at 3.

in a decentralized way.[265] As a partial solution, so-called "layer-two protocols"[266] has been developed, which allows parties to trade off-chain in some way, then register the balance back on-chain. One example is Bitcoin's "lightning network,"[267] which enables parties to create "payment channels" between parties who trade repeatedly.[268] Then, instead of registering each and every transaction between these parties on the blockchain, only the end-of-day balance is registered.[269] However, the registration of interim transactions often goes through the same computers (same "nodes"), leading to (technical) centralization.[270] When disputes arise with respect to registration during the bilateral off-chain trading, one may argue that the object of the dispute is identical to traditional financial disputes, as some centralized registration does exist. Similarly, as some central banks take steps to enter the token market by issuing their own digital currency,[271] the role of the players becomes blurry.

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[265] *See* Jordi Herrera-Joancomartí & Cristina Pérez-Solà. *Privacy in Bitcoin Transactions: New Challenges from Blockchain Scalability Solutions, in* 9880 MODELING DECISIONS FOR ARTIFICIAL INTELLIGENCE 26, 31 (Vicenç Torra et al. eds., 2016).

[266] *See generally* Lewis Gudgeon et al., *Sok: Layer-two Blockchain Protocols*, *in* 12059 FINANCIAL CRYPTOGRAPHY & DATA SECURITY 174, 218 (Joseph Bonneau & Nadia Heninger eds. 2020) (explaining that "layer-two protocols rely on challenge-response protocols to detect and prove misbehavior using the blockchain as a recourse for disputes").

[267] Jian-Hing Lin et al., *Lightning Network: A Second Path Towards Centralisation of the Bitcoin Economy*, 22 NEW J. OF PHYSICS 1, 1 (2020).

[268] *Id.*

[269] *See, e.g.,* Craig Wright*, Why Lightning Will Never be Currency, and Why BSV Matters*, MEDIUM (Mar. 15, 2019), https://medium.com/@craig_10243/why-lightning-will-never-be-currency-and-why-bsv-matters-60dfa5c9ac4d [https://perma.cc/96XJ-DKUP] (stating that "[t]he concept is simple; the parties to the transaction maintain an offline ledger that is settled periodically. The difficulty comes as there is no recording of the intermediary states. When there are many routes and many hops, the parties to a transaction on either end do not see the intermediary exchanges, only the balance. When it finally settles on chain, all of the intermediate steps are lost.").

[270] *Id*.

[271] Xuan Han et al., *A Blockchain-Based Framework for Central Bank Digital Currency*, *in* 2019 IEEE INT'L CONF. ON SERV. OPERATIONS AND LOGISTICS, AND INFORMATICS (SOLI) 263, 263 (2019).

Ninth, the examples given above relate to infringements that completely prevent a token holder from utilizing her token (e.g., because the token was transferred), whereas the Coase Theorem and the arguments of Calabresi and Melamed are mostly motivated by the scenario of a nuisance.[272] From a theoretical standpoint, it does not seem to matter whether the damage to the token holder amounts to a full or partial interruption, but nuisances may, of course, also occur with cryptocurrencies. For example, Bob may use Alice's internet bandwidth, thereby slowing down her trade, interfere with the service to which Alice's utility tokens grant access, or disrupt the computer protocol in other ways.[273] The arguments made above equally apply to these scenarios, i.e., whether a property or liability rule should be adopted will depend on TC.

Finally, the analysis above focuses on TC but considers neither distribution effects nor justice arguments, which can outweigh efficiency concerns in some contexts. For instance, suppose that, in the future, pension funds will hold a large share of tokens. When such tokens are stolen, a loss to the pension fund has quite different consequences than a loss to an individual, as the retired workers' population will suffer the consequences.[274] Similarly, even if the pension fund can prevent the harm more easily than a third party, it seems unfair to punish the workers for the carelessness of the

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[272] Calabresi & Melamed, *supra* note 9, at 1105–06, consider nuisance law as an example where the law often assigns a liability rule, as the person causing a nuisance can continue doing so conditional on paying compensation nuisance. Then, if there are high transaction costs, e.g., because the nuisance infringes on the rights of multiple victims at the same time, an efficient allocation is not necessarily achieved (as the Coase Theorem implies that low transaction costs are needed for an efficient allocation).

[273] For a discussion of liability when a blockchain protocol fails, see Peder Østbye, Who is Liable if a Cryptocurrency Protocol Fails? 1 (July 21, 2019) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3423681 [https://perma.cc/DCB5-R35S].

[274] Workers save money for pension in anticipation of redeeming their savings when they retire. However, pension funds typically invest the saving in investments, reflecting different degrees of risk, depending on where the money is invested. If a pension fund invests the money in cryptocurrencies but does not take ample precaution to protect the private key (e.g., due to a principal-agent problem, where the pension fund managers do not sufficiently care about the savers) a theft of token reflects a direct loss to the savers.

pension fund. In other words, the optimal choice of rules should consider all the relevant considerations, including, but not limited to, transaction costs.

V. CONCLUSION

Cryptotokens and blockchain technology are transforming various markets and offer a disruptive technology, which bears clear advantages[275] but is not yet fully understood. As the technology matures and its adoption spreads, more and more conflicts surrounding cryptotokens are naturally expected to arise. Both the academic literature[276] and several court cases[277] have already identified the conceptual difficulties of classifying tokens, mostly because of their decentralized registration method. However, as disputes should not be resolved arbitrarily, the law should evolve and find suitable principles and rules that can be reasonably applied to cryptotokens.

The existing court rulings around the world provide mixed policies, some of which adopt a property rule[278] while others adopt a liability rule.[279] However, the courts seem to neglect the implications of adopting a one-size-fits-all rule (of either kind), and do not dedicate sufficient attention to the fact that tokens are not homogenous.

This Article proposed to examine the question of how one should protect entitlements in cryptotokens under the prism of law and economics. This approach greatly simplifies the conceptual problem, as tokens are easily classifiable as property, but highlights

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[275] Cryptotokens bear advantages such as a decentralized transaction registration (eliminating the need for intermediaries), immutable registration (preventing the risk of data manipulation), and a global market that does not depend on local constraints. *See* Jabotinsky & Sarel, *supra* note 65, at 19.

[276] Fox, *supra* note 40, at 3–4; Ng*, supra* note 40, at 327.

[277] *See* AA v. Persons Unknown & Ors, Re Bitcoin [2019] EWHC (Comm) 3556 § 58 (U.K). *See also* Babie, *supra* note 20, at 1 (reviewing the discussion in Ruscoe & Moore v. Cryptopia Limited (In Liquidation) [2020] NZHC 728).

[278] *See, e.g.*, AA v. Persons Unknown & Ors, Re Bitcoin [2019] EWHC (Comm) 3556 § 63; Ruscoe and Moore v. Cryptopia Limited (In Liquidation) [2020] NZHC 728 at [120].

[279] *See, e.g.,* B2C2 Limited v. Quoine PTC Ltd.*,* [2019] SGHC (I) 03 [144, 149] (Sing.).

the need to examine the types of transaction costs that arise in the trade of cryptotokens. This Article's suggestion of using the usual taxonomy of tokens as a benchmark for transaction costs is in line with the argument that "differently designed cryptocurrencies need to be regulated differently depending on their technological characteristics."[280]

Focusing on the token's category can then assist in determining whether search and information costs, bargaining and decision costs, and enforcement costs are likely to be high—in which case economic theory suggests liability rules—or low—in which case property rules are recommended. Dealing with the heterogeneous nature of tokens may be a difficult task and some case-by-case distinctions may be inevitable. One option might be to take a three-step approach: classify the token as belonging to a certain category, apply the rule that typically fits the category as a default, and examine whether it makes sense considering case-specific transaction costs. Such an approach would appear to strike a fair balance between selecting a "one-size-fits-all" solution and individual solutions for each token.[281] However, selecting the exact approach goes beyond the scope of this Article. Indeed, this Article does not intend to provide a detailed prescription, but rather to highlight the problem and the relevance of the law and economics framework for its possible solution.

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[280] Rueckert*, supra* note 37, at 4.

[281] Note that the discussion of how much one should rely on pre-existing categories mirrors the dilemma that courts face when deciding whether to adhere to the legal precedent and when to invest effort into making a more ad-hoc rule that is better-suited for the case at hand. From a law and economics perspective, following the categories is preferable if the "information costs" incurred by searching for the best rule are large compared to the transaction costs of the parties whose rights the court wished to (re)allocate. *See* COOTER & ULEN, *supra* note 25, at 94.