VIRGINIA JOURNAL OF LAW & TECHNOLOGY

VOLUME 27 SUMMER 2023 NUMBER 1

DIGITAL CURRENCY INDUSTRY SELF-REGULATION: NOT ALL CONSENSUS IS AUTOMATIC

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ABSTRACT

The appropriate boundary between public and private regulation has long been of interest to law and economics scholars. Especially relevant for understanding the private regulatory dynamics of the digital currency industry are the ways in which self-regulation has existed in financial markets. These studies suggest that too much market concentration and too much competition both diminish the possibility for self-regulation in the interest of consumers. Similarly, certain exchange roles give rise to opportunities for market manipulation by sub-classes of actors in a way that make exchange self-regulation less likely, incentives for manipulation that are exacerbated due to jurisdictional competition. Nonetheless, the unique technical features of blockchain networks, and the way in which consumers and industry participants value transparency and immutability make the possibility for productive self-regulation to benefit retail consumers greater than skeptics make it out to be. Furthermore, industry self-regulation can preempt or substitute for

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more distortionary or ill-fitting regulation emanating from public authorities. Finally, given the inevitability of public regulation, this suggests that developing digital currency industry complementarities like those studied in banking and commodities and securities exchanges sheds light on the emergent dynamics of industry self-regulation likely to benefit consumers.

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I. INTRODUCTION

Self-regulation has a mixed record in terms of its viability and desirability in the extant law and economics scholarship on the topic. This mixed set of findings does not reflect poorly upon the literature, but instead reflects the institutional truism that specific context greatly defines the governance remedies that are viable, let alone optimal. Fortunately, though, these studies of self-regulation, both successes and failures, help identify industrial characteristics that are tractable to generating viable self-regulation. This provides a theoretical lens through which to consider nascent industries where there are calls for regulation, such as digital currencies and the numerous business models that have sprung up within and surrounding these distributed blockchain networks. There are also strong industry-level arguments for the benefits of self-regulation, as definition of rules for highly technical and specialized industries (like issuance and exchange of abstract financial instruments) can benefit from input by industry participants. Furthermore, in populist or uncertain political contexts, the benefits of self-regulation are argued to increase due to the comparative uncertainty that the policy-making system poses.

Given the novel regulatory treatment that digital currencies frequently require, and the current populist and divisive character of United States politics, this is a public regulation supply side context where the benefits of self-regulation are high relative to what is likely to emerge publicly in the absence of any industry self-regulation. This makes clarifying the margins of self-regulatory possibility within the complex and rapidly evolving digital currency space useful to regulators, scholars, and industry participants alike, a motivation which underlies the analysis here throughout. Careful analysis of specific areas within the digital currency industry reveals margins on which beneficial self-regulation is more likely to occur, as a function of lower information asymmetries, reputation's role as an input to participants' economic gain, and lower market concentration, all of which have arguably provided consumer-welfare-enhancing self-regulation in financial markets. But in the wake of the spectacular FTX collapse in November 2022, public regulation is soon forthcoming,[1] and likely to continue to emerge and

[1] Earlier in 2022, the White House issued an executive order announcing the regulation of cryptocurrencies as a priority for the upcoming year, well in

evolve. This creates an additional margin by which to analyze the digital currency industry's potential for self-regulation, as industry definition can both substitute for and complement the public institutional framework designed to mitigate classic incentive problems in the issuance and exchange of financial instruments among retail investors.

In certain areas, digital currencies (and their transparent and immutable ledgers) can directly substitute for regulation by preempting the need for it, and in others (including in well-publicized cases of criminal prosecution years after a prominent hack of a cryptocurrency network occurred), these digital currencies provide a complementary margin. These same technological features baked into decentralized protocol also make other margins of existing regulation intractable to industry application, such as the way in which certain decentralized financial instruments and exchanges cannot functionally identify their users' legal identities, let alone prevent transactions from occurring, due to their automated and immutable nature. This makes regulation of traditional financial institutions and cryptocurrency exchanges (and similar "off-ramps") relatively more important—absent banning transactions on these networks altogether, regulators can do little to mandate changes to protocol because permissionless cryptocurrency protocol changes are governed by a distributed process that no single actor controls.[2] Recent events surrounding FTX and Alameda Research have only emphasized the information asymmetries that make certain classes of financial intermediaries prone to poor governance leading to outright fraud.

More promisingly, certain digital currency activities are mechanically transparent. These present a set of self-regulatory margins that are intrinsically appealing, and with respect to certain classes of financial activity, transparent and immutable in novel ways. In contrast, though,

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advance of the abrupt market downturn triggered by the collapse of the Terra/Luna stablecoin project in June. *See* Exec. Order No. 14067 87 Fed. Reg. 14143 (Mar. 9, 2022).

2 For early legal academic commenters, this made the reliably final executability of code that was distributedly governed an important step toward "code is law." *See* PRIMAVERA DE FILIPPI & AARON WRIGHT, BLOCKCHAIN AND THE LAW: THE RULE OF CODE 51, 174 (2018) (citing Lawrence Lessig, *Code is Law*, HARV. MAG. (Jan. 1, 2000), https://www.harvardmagazine.com/2000/01/code-is-law-html).

many ancillary and economically massive classes of digital currency activity, such as stablecoin issuance and exchange services, are not mechanically transparent, and display strong network effects. This suggests that the former classes of digital currency activity, especially those occurring on less mutable blockchains, are necessarily more self-regulating than other classes of digital currency activity like exchanges and stablecoin issuers. Nonetheless, given competitive pressures and self-regulation as a substitute for more sweeping government regulation, the scope of digital currency activity that can optimally self-regulate may be larger than the notable class of industry participants whose blockchain-based activities subject them to transparency and immutability by default.

Despite this broader class of digital currency industry participants that are likely to self-regulate (due to the intrinsic, competitive, and preemptive motives discussed subsequently), there are other areas of digital currency activity unlikely to self-regulate to a socially optimal level for consumers, due to cases where massive firms and information asymmetries are both present in the nature of the service being provided to the market. Banks, clearinghouses, and exchanges stand as historical examples of massive firm scale in providing services directly related to information - debt and equity finance is fundamentally a question of information about future performance. While emergent business models in digital currency activities provide cause for cautious optimism, not all digital currency activities are fully self-regulating, which directly suggest initial priorities for public sector actors. These priorities have been brought into sharp relief by the collapse of FTX and Alameda Research in November 2022, for enforcement of public regulatory priorities should ideally deter and anticipate misconduct, as opposed to following in the wake of such a lengthy and massive misuse of customer funds.

Digital currencies have been around long enough to weather well-publicized frauds and hacks,[3] the withering critiques of many skeptical

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3 *See, e.g.*, Eric Alston et al., *Blockchain Networks as Constitutional and Competitive Polycentric Orders*, 18 J. INST. ECON. 707, 713 (2022) (discussing the DAO hack experienced by the Ethereum network in 2016). The collapse of "MtGox," a Japanese-domiciled cryptocurrency exchange, was an early case of a hack (and theft) that took down a major exchange due to poor internal controls. *See, e.g.*, Lee Pascoe, *Bankruptcy, Recognition Proceedings and Recoveries in a Cryptocurrency World*, 12 INSOLVENCY & RESTRUCTURING INT'L 6, 6-8 (2018). The ongoing resolution

economic and financial scholars,[4] a ban from the world's most populous nation,[5] and price volatility that makes traditional investors queasy.[6] This analysis brings to bear the wealth of insights from law and economics scholarship on how this nascent and disruptive industry should ideally be regulated to protect consumers. More specifically, this analysis clarifies the role of self-regulation in the digital currency industry, both through identifying where it is likely to emerge, and how it can prove to both preempt and complement the coming wave of public regulatory definition. To do so, a grounding in the law and economics of industrial self-regulation is first provided. Section II thus surveys the general

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of MtGox's bankruptcy is a testament to the complexities of bankruptcy in digital currency contexts. *See, e.g.*, Megan McDermott, *The Crypto Quandary: Is Bankruptcy Ready?*, 115 NW. UNIV. L. REV. 1921, 1941-45 (2020).

4 Among Bitcoin, blockchain or cryptocurrencies' most prominent academic critics are the economists Daron Acemoglu, Paul Krugman, and Nouriel Roubini. *See, e.g.*, Daron Acemoglu, *The Bitcoin Fountainhead*, PROJECT SYNDICATE (Oct. 5, 2021), https://www.project-syndicate.org/commentary/bitcoin-an-appealing-distraction-by-daron-acemoglu-2021-10?barrier=accesspaylog; Paul Krugman, *Blockchains, What Are They Good For*, N.Y. TIMES (Dec. 1, 2022), https://www.nytimes.com/2022/12/01/opinion/blockchains-what-are-they-good-for.html; Nouriel Roubini, *The Big Blockchain Lie*, PROJECT SYNDICATE (Oct. 15, 2018), https://www.project-syndicate.org/commentary/blockchain-big-lie-by-nouriel-roubini-2018-10?barrier=accesspaylog.

5 *See* Rain Xie, *Why China had to "Ban" Cryptocurrency but the US did not: A Comparative Analysis of Regulations on Crypto-Markets Between the US and China*, 18 WASH. UNIV. GLOB. STUD. L. REV. 457, 472-477 (2019) (detailing a history of Chinese regulation leading up to the ban on cryptocurrency exchanges and initial coin offerings). This 2017 ban was followed by a complete ban on cryptocurrency transactions in September 2021. *See, e.g.*, Francis Shin, *What's Behind China's Cryptocurrency Ban?*, WORLD ECON. F. (Jan, 31, 2022), https://www.weforum.org/agenda/2022/01/what-s-behind-china-s-cryptocurrency-ban/.

6 *See* Paraskevi Katsiampa et al., *High Frequency Volatility Co-Movements in Cryptocurrency Markets*, 62 J. INT'L FIN. MKTS., INST. AND MONEY 35, 37–41 (2019) (reviewing the financial economics literature on price volatility in cryptocurrency markets and an exploration of correlation between price volatility of different cryptocurrencies).

theory surrounding the role of private governance, before exploring the findings from law and economics scholarship as to self-regulation in the context of financial markets specifically. To apply existing self-regulation scholarship to digital currency industry participants, a firmer grounding in key industry categories (and their distinguishing features) is necessary, such that Section III introduces the legal academic reader to cryptocurrencies, stablecoins, and exchanges. An indication of the centrality of these topics is that the two biggest crises in cryptocurrency markets in 2022 were caused by the crash of a stablecoin and the collapse of a foreign-domiciled exchange, respectively, topics to which this analysis speaks directly. Finally, given the preceding insights as to the industrial characteristics that facilitate self-regulation and an overview of key digital industry participant classes, Section IV proceeds to examine the margins by which cryptocurrencies, stablecoins, and exchanges are more or less tractable to socially beneficial self-regulation in terms of consumer protection.

II. THE LAW AND ECONOMICS OF INDUSTRIAL SELF-REGULATION

The emergence of private ordering to govern economic activity is a testament to the efficiencies it provides to voluntary collective action at scale.[7] Some measure of self-regulation is therefore baked into the very act of private organization. But for this private regulation to be socially desirable requires that it not only serve the interests of the firm itself, but that such self-regulation must also achieve broader social benefits in terms of reducing the externalities and incentive problems that the firm's

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7 Seminally, the firm is thought to minimize on the costs of contracting on the market, including through the amelioration of time inconsistency problems and the reduction of uncertainty between counterparties. *See* R. H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386, 392 (1937). More specific private organizational forms can further be understood as structured to overcome holdup problems surrounding asset specific investments and sunk costs. *See* Oliver E. Williamson, *The Theory of the Firm as Governance Structure: From Choice to Contract*, 16 J. ECON. PERSP. 171, 183-84 (2002). The corporate form itself can be understood as revelatory of the deeper economic efficiencies this specific organizational vehicle has provided. *See* Henry Butler, *The Contractual Theory of the Corporation*, 11 GEO. MASON UNIV. L. REV. 99, 106-10 (1989) (reviewing the law and economics arguments about the benefits of incorporation).

activities carry with it. Industries that are highly specialized, technical, or reputation-based are linked to the emergence of effective self-regulation that can either complement or substitute for public regulation. Financial markets have long been subject to government regulation but have also played a key role in self-regulating important margins of the activities therein. Given the similarities of financial markets to digital currency markets, studies of successful self-regulation of financial intermediaries are germane for considering how consumers can be protected against information asymmetries and market power concentrations that are ubiquitous in these contexts.

A. Private Ordering and the Potential for Self-Regulation

The question of industry self-regulation has long been part of the study of the margins of public and private ordering.[8] Governance of complex human social groups is an emergent phenomenon above a given size, such that frontier industries developed means of ordering absent the presence and enforcement capacity of the public government.[9] Self-regulation is therefore emergent in economic activity

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8 An early example of legal scholarship in this area surrounds how diamond industry participants developed a set of private customs that exceeded the enforcement any given legal system could provide. *See* Lisa Bernstein, *Opting Out of the Legal System: Extralegal Contractual Relations in the Diamond Industry*, 21 J. LEGAL STUD. 115, 130-53 (1992). Other legal scholars have since deepened the understanding of private systems of ordering. *See, e.g.*, Barak D. Richman, *Firms, Courts, and Reputation Mechanisms: Towards a Positive Theory of Private Ordering*, 104 COLUM. L. REV. 2328, 2338-51 (2004); *see also* BARAK D. RICHMAN, STATELESS COMMERCE: THE DIAMOND NETWORK AND THE PERSISTENCE OF RELATIONAL EXCHANGE 63-86 (2017).

9 This was the case in mining camps on the U.S. Frontier, wherein claim dispute procedures emerged to deter and resolve conflict surrounding the scarce resource that was the primary economic engine of the community. *See,* JOHN R. UMBECK, A THEORY OF PROPERTY RIGHTS WITH APPLICATIONS TO THE CALIFORNIA GOLD RUSH 92-96, 115, 132 (1981); *see also* David Gerard, *Transaction Costs and the Value of Mining Claims*, 77 LAND ECON. 371, 374-76 (2001). In the case of range cattle on the U.S. frontier, cattle brands and their collective enforcement emerged to reduce transaction costs associated with open range ranching; Lee J. Alston et al., *The Development of Property Rights on Frontiers: Endowments, Norms, and Politics*, 72 J. ECON. HIST. 741, 756-760 (2012).

above a certain scale, but whether such regulation is beneficial to society writ large beyond the industry producing the regulation itself is a primary question animating studies of the topic. In a context where public regulation has the authority to prevent social welfare losses (such as those resulting from the impersonal exchange of abstract financial instruments), this means that a precondition for industry self-regulation is that such regulation must operate to both social *and* industry benefit. For the regulator to forebear further regulatory definition, the net social benefit associated with self-regulation (including public regulatory cost savings) must be positive. For private industry actors to voluntarily regulate, they must also expect net private benefits from doing so.

Arguments for the public benefits of self-regulation tend to be grounded in social welfare considerations. Certain industries with relatively high levels of private regulation, like lawyers and doctors, ground the justification for their private governance in the highly specialized nature of the service meaning that self-regulation is likely to harness local knowledge of the industry in a way that third parties cannot.[10] One consequence of the "market for lemons"[11] is that industry participants in contexts of significant information asymmetries may take costly steps to the signal the quality of their goods and services to convince otherwise skeptical consumers. This indicates that in industry contexts where information asymmetries are especially high, like the issuance and exchange of financial instruments, the consumer benefits to successful self-regulation are also high. Furthermore, to the extent that self-regulation can achieve the same or similar objectives as would

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10 *See, e.g.*, Camille Chaserant & Sophie Harnay, *Self-Regulation of the Legal Profession and Quality in the Market for Legal Services: An Economic Analysis of Lawyers' Reputation*, 39 EUR. J.L. & ECON. 431, 444-46 (2015) (discussing the justifications for self-regulation as desirable due to specialized knowledge in reputational industries, as applied to the context of legal services themselves).

11 Although later extended in theoretical and empirical detail to many contexts of economic and financial exchange, Akerlof seminally used the example of used car markets, and the "lemons" that can plague them as exemplars of contexts where information asymmetries can define important market features, including their institutions of governance. *See* George A. Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488, 490-91 (1970).

public governance, this outcome can arguably save on the costs of regulatory definition and enforcement.[12]

Given this argument, this implicates another model of industry self-regulation – a complement to government regulation.[13] There are numerous ways in which private and public regulation can complement one another, potentially yielding a better outcome than either approach would exclusively, an outcome that has been identified in both banking[14] and securities issuance contexts.[15] In some instances, industry associations have served to enforce existing legal requirements,[16] and in

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12 Many scholars have considered the benefits and limitations of industry self-regulation. *See* VIRGINIA HAUFLER, A PUBLIC ROLE FOR THE PRIVATE SECTOR: INDUSTRY SELF-REGULATION IN A GLOBAL ECONOMY 12–14, 29–30, 121 (2013) (examining the complementarities between private and public regulation); *accord* JOHN BRAITHWAITE, REGULATORY CAPITALISM: HOW IT WORKS, IDEAS FOR MAKING IT WORK BETTER 64-87 (2008).

13 In the case of environmental regulation in Europe, industry self-regulation was argued to have worked better given the credible threat of government regulation. *See* Adrienne Héritier & Sandra Eckert, *New Modes of Governance in the Shadow of Hierarchy: Self-Regulation by Industry in Europe*, 28 J. PUB. POL'Y 113, 123-25 (2008).

14 Relative to tight government oversight of banks, guidelines that involve active bank participation in terms of accurate information disclosure and facilitation of corporate control seem to be associated with bank development, efficiency and resilience in a sample of 107 countries. *See* James R. Barth et al., *Bank Regulation and Supervision: What Works Best?*, 13 J. FIN. INTERMEDIATION 205, 244-46 (2004).

15 Laws that mandate disclosure and facilitate private enforcement through liability rules tend to be associated with more developed stock markets relative to markets that rely on more uniformly public enforcement of securities laws and regulations. *See* Rafael La Porta et al., *What Works in Securities Laws?*, 61 J. FIN. 1, 20 (2006).

16 The desirability of these legal requirements is very much a context-specific question, though, for in the case of Oklahoma dry cleaners studied, the Board which licensed new dry cleaner entrants in the state was highly effective at enforcing minimum price requirements, which points to a potential for oligopolistic markets resultant from industry complementarities with law and regulation. *See* Charles R. Plott, *Occupational Self-Regulation: A Case Study of the Oklahoma Dry Cleaners*, 8 J.L. & ECON. 195, 222 (1965). The fact that smaller dry cleaning firms predominated on average within the state of Oklahoma at the time of the study, *id.* at 209, indicates higher prices to consumers, a fact which was borne out in law in terms of minimum price requirements. These specific

others, industry participants have internalized compliance requirements as a means of controlling the costs associated with publicly reporting price-sensitive information.[17] In most industries, though, the ability to escape regulatory authority altogether is impossible, which raises the question of how the public system should treat the private self-regulatory bodies' rules (and findings of transgressions thereto).[18] Furthermore, the role of liability insurers as providing more efficient private governance of risk-taking behavior is well-identified[19] as a specific example of the more general phenomenon by which public governments outsource risk regulation to private insurance companies through insurance mandates and other requirements for insurance as a condition of obtaining government support.

The means by which self-regulation can benefit industry itself are more obvious. Both arguments about specialized local knowledge as an input to self-regulation (that either substitutes for or complements public regulation) hinge on the industry defining its own terms of regulation, whether partially or fully.[20] Furthermore, contexts of information asymmetry suggest direct benefits to industry of convincing

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outcomes point to the significant possibility for consumer welfare losses resultant from industry capture of the terms of regulation.

17 In a case where regulation surrounding reporting requirements for publicly traded companies was enacted, European firms developed reporting standards in furtherance of public requirements that minimized disclosure of sensitive information relevant to competitors in the same industry. *See* John Holland, *Economic Incentives for the Self-Regulation of the Release of Price-Sensitive Information*, 3 EUR. J.L. & ECON. 221, 238-40 (1996).

18 *See* Julia Black, *Constitutionalising Self-Regulation*, 59 MOD. L. REV. 24, 32-43 (1996) (reviewing the issues raised by the extent of legal review of the determinations of self-regulatory associations).

19 Liability insurers engage in granular premium differentiation that suggests a direct role by which insurers expect prices to reduce the problems of adverse selection and moral hazard endemic to insurance contexts. *See, e.g.*, Niels J. Philipsen & Michael G. Faure, *The Role of Private Insurance in Governing Work-Related Risks: A Law and Economics Perspective*, 66 ZEITSCHRIFT FÜR SOZIALREFORM 285, 289-93 (2020).

20 In contexts where public regulation is sufficiently likely, and consumer support for regulation is higher than that of the regulated industry, a beneficial equilibrium involving industry definition of some measure of regulation may be optimal. *See, e.g.*, John W. Maxwell et al., *Self-Regulation and Social Welfare: The Political Economy of Corporate Environmentalism*, 43 J.L. & ECON. 583, 613 (2000).

consumers of the quality of their goods and services.[21] By construction, any private actor given choice of regulatory terms should obtain or exceed the benefits under the expected terms of public regulation. The recognition that specialized industries may better define regulatory terms than less specialized public authorities is heightened as inputs to the public regulatory process make the process more uncertain or politicized. As a justification for self-regulation within the United States in particular, comparative economists have identified uncertainty over institutional implementation, populism, and political polarization as characteristics that increase the social welfare benefits from self-regulation due to the negative effect each of these characteristics has on the supply side of public regulation.[22] Given the rise of populist wings in politics globally, and the first impression nature of many digital currencies to regulatory authorities, this makes benefits to self-regulation especially high in this industry. To the extent that regulation is both likely to be forthcoming and more stringent or poorly fitting than industry participants would prefer, this provides an additional way to understand the extent to which self-regulation aligned with social welfare is potentially emergent in an industry. Thus, in areas where structural characteristics lend themselves to the emergence of self-regulation, there may be additional benefits to self-regulation beyond those that the self-governance choices themselves pose directly due to these choices substituting for or preempting worse regulation likely to emanate from public authorities.

Of course, it would be foolish to conclude a discussion of the benefits that industry incumbents can expect from self-regulation without raising the anti-competitive specter of supply side restriction of

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21 *See* Akerlof, *supra* note 11, at 499-500; *see also* Eric W. Bond, *A Direct Test of the "Lemons" Model: The Market for Used Pickup Trucks*, 72 AM. ECON. REV. 836, 839 (1982) (suggesting that the institutions to reduce quality uncertainty that Akerlof referred to may predominate in used truck markets in terms of maintenance per mile driven being shown to be roughly equivalent between new and used trucks). This is suggestive evidence of the more generally understood phenomenon of private institutions like warranties and receipts emerging to display a seller's good faith intent to stand behind their products to reduce the transaction costs created by information asymmetries.

22 *See* Peter Grajzl & Peter Murrell, *Allocating Lawmaking Powers: Self-Regulation vs Government Regulation*, 35 J. COMPAR. ECON. 520, 540–541 (2007).

industrial output to benefit existing producers.[23] This can both be a function of the extent of competition within a given industry, as well as the specific nature of relationships among industry participants, for in multi-sided markets like those coordinated by many financial institutions, competition in one sector may not prevent incentives for manipulation in another side of the market. Several of the current problems in digital currency markets mirror those in existing financial markets, such as front-running large trades to extract rents associated with the price movements such large trades entail,[24] a point to which I return in the following section. At a general level, this indicates the tradeoff surrounding costly self-regulation: smaller firms and startups will face a greater compliance cost per unit of output, which creates a wedge by which larger firms can benefit from regulation that could nonetheless be social welfare enhancing.

Where social and industry motives align, there is thus a possibility for emergent self-regulation that is sustainable in equilibrium. But both industry and public arguments for self-regulation hinge integrally on the characteristics of the industry itself, which makes more granular studies of self-regulatory successes and failures additionally revelatory for the purposes of assessing the digital currency industry's potential in this area. Self-regulation therefore unsurprisingly varies in terms of effectiveness as a function of industry characteristics.[25] Reputation-based industries,

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23 For a cross-national survey of the ways in which government regulation can be subject to industry capture or otherwise reduce consumer welfare, see Shanker A. Singham & U. Srinivasa Rangan, *Anti-Competitive Market Distortions: A Typology*, 38 ECON. AFF. 339, 339–47 (2018). *See also* Plott *supra* note 16 for a salient example of this outcome in the case of Oklahoma dry cleaners benefiting from minimum price enforcement on the part of the state licensing board.

24 *See* Philip Daian et al., *Flash Boys 2.0: Frontrunning in Decentralized Exchanges, Miner Extractable Value, and Consensus Instability*, 2020 IEEE SYMP. SEC. & PRIV. 910–927 (2020)(In this example, specific cryptocurrency industry participants benefit from a given status quo ability under the rules of transaction validation to order transactions within a given block. This ability to order transactions has led to a market for block ordering, wherein smaller players capture some of the price effects of larger trades that can be observed in the memory pool and reliably predicted to be in a given block of transactions for validation.).

25 *See* Florencia Marotta-Wurgler, *Self-Regulation and Competition in Privacy Policies*, 45 J.L. STUD. S13, S31 (2016) (Data privacy and data security practices varied considerably across company policies as a function of industry characteristics,

like legal services, have been argued to display effective self-regulation, especially because reputation's value is greater as information asymmetries become more acute in a particular industrial setting.[26] Increased competition has been linked theoretically to higher quality of output from self-regulating professional service contexts.[27] This is germane to the digital currency industry context because the network effects that cryptocurrencies, stablecoins, and exchanges display mean that voluntary adoption by users is a major input to their success, both competitively and absolutely. Therefore, a reputation for consumer protection is a necessary input for many of these digital currency activities to achieve the potential that current adherents ascribe to them, especially given that information asymmetries abound in an industry whose underlying technology, blockchain, is not well understood. This makes financial markets self-regulation that has emerged to protect the consumer specifically revelatory of margins of digital currency industry tractable to self-regulation, and so the following sub-section surveys generalizable lessons from the extant scholarship in this area.

B. Regulation and Self-Regulation in Financial Markets

With respect to financial markets in particular, industrial concentration is a characteristic that has been identified as determining the viability of self-regulation. Price manipulation in commodities futures contracts can result from exercise of market power; coupled with the specific nature of long positions in storable commodities, this makes holders of such positions potentially able to squeeze short position holders as a function of the costs of commodity delivery to the location specified in the future contracts. The fixed location(s) specified for satisfaction of commodities futures creates an increasing price margin

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where privacy predominated in adult websites, while data security was comparatively salient in cloud computing contexts).

26 *See* Chaserant & Harnay *supra* note 10.

27 *See* Krzysztof Szczygielski, *A Model of Competitive Self-Regulation*, 70 INT'L REV. L. & ECON. 1, 6 (2022) (In professional service contexts like legal practice and auditing, reputation plays an especially salient role in determining market institutions, including the tiered provision of services often observed in these industries).

that squeezes short positions in a way that does not reflect the underlying price fundamentals of a commodity, creating an opportunity for price manipulation on the part of large market actors.[28] This stands as one example of market manipulation that exchanges have historically been lax in regulating directly absent government intervention. More generally, the historical record of commodities and capital market regulation is at best mixed in terms of these exchanges' observed ability to constrain market manipulation.[29]

In a context more directly germane to certain digital currency industry participants (like exchanges and similar network industries undergirding decentralized financial instruments), the growth in scale of a market intermediary has been linked to changes in the ability to self-regulate.[30] Given the extent to which many digital currency applications' viability hinges on sufficient scale through adoption by individual users (and more sophisticated financial institutions), reputation of the industry is likely an input to emergent self-regulation, in addition to the information asymmetries which the highly technical nature of blockchain projects create. Furthermore, to the extent different cryptocurrency networks differentiate themselves and entrench their individual network

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28 *See* Stephen C. Pirrong, *The Self-Regulation of Commodity Exchanges: The Case of Market Manipulation*, 38 J.L. & ECON. 141, 150-57 (1995) (This suggests that a narrow view of the benefits of industry self-regulation can ignore more complex relationships and transactions costs within and between those relationships undergirding markets that make manipulation an efficient equilibrium for financial market exchanges that could in theory prohibit such behavior. Given sufficient collective action costs or information asymmetries, a theoretically optimal level of self-regulation may not be obtained).

29 *See, e.g.*, Stephen C. Pirrong, *The Economics of Commodity Market Manipulation: A Survey*, 5 J. CMDTY. MKTS. 1, 1–17 (2017) (In practice, commodities markets provide a range of ways in which market participants may influence outcomes to their benefit, including exploiting market power, trade-specific characteristics, or information asymmetries; the range of context-specific forms of influence (which may or may not rise to the level of impermissible manipulation in a given regulatory regime) makes effective regulation challenging, not to mention comparative assessment of a given regulation's effects across industries or jurisdictions).

30 *See* Slavi T. Slavov, *Manipulation, Monopoly, and the Chicago Board of Trade's Transition From Self-Regulation to Government Regulation*, 37 J.L. & ECON. 329, 329–336 (2001) (Major growth in scale of a Chicago futures exchange has been linked to ultimately weakening its ability to self-regulate).

effects,[31] these stand alongside exchanges and stablecoins as digital currency industry players that may not be as likely to create viable self-regulation, due to the role increased market power can play in reducing incentives to self-regulate generated by competitive pressures. In contrast, though, other commentators have noted how too many competitors in an industry can prevent viable self-regulation.[32] Coupled with the way in which coordination costs may increase convexly within a given industry, these two factors indicate that highly competitive industries with low entry costs may also be intractable to emergent self-regulation. This suggests some measure of market power or equilibrium firm scale that limits actors to numbers that can feasibly coordinate surrounding self-regulation may be a better characterization than the benefits of self-regulation as strictly increasing or decreasing as industrial concentration increases.[33]

Another concern surrounds heterogeneities among market participants, and the opportunities for manipulative behavior they can create.[34] Impersonal exchange of abstract financial instruments entails

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31 *See* Eric Alston et al., *Blockchain Networks as Constitutional and Competitive Polycentric Orders*, 18 J. INST'L. ECON. 707, 716 (2022) (Numerous cryptocurrency projects rely on a scale of adoption that involves millions, if not billions of users, which implies a major role for network effects in determining which blockchain networks will ultimately prove to be economically sustainable).

32 *See* Margot Priest, *The Privatization of Regulation: Five Models of Self-Regulation*, 29 OTTAWA L. REV. 233, 278 (1997) (This derives from the fact that if social harms from productive activity are not fully internalized by producers, any competing producer that voluntarily internalizes these costs is at a competitive disadvantage).

33 *See* JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY 77-78, (6th ed. 2003) (This is also consistent with standard economic theory about the need for a firm to make revenues exceeding production costs to innovate. If compliance (whether to public or self-defined regulation) is a cost beyond that of direct production, then producers need to be able to charge a price higher than marginal cost of production, which entails some measure of market power needed to produce at a supply above marginal cost. Schumpeter is credited with the seminal articulation of this insight about how the profits from market power can prove an input to improvements in consumer welfare through innovation).

34 Pirrong, *supra* note 28, at 159-60. (Commodities sellers and buyers' relative geospatial locations facilitated market manipulation that exchanges did not

many market participants whose individual decisions can alter prices in the aggregate, but the price effect of sufficiently large market actors' purchases and sales can provide its own margins for manipulation. To give but one example of the incentives for price manipulation that financial markets can create, large trades can have a sufficient price impact that getting trades in ahead of larger trades can whittle away some of the gains associated with a given price movement.[35] This practice of front-running has its own analog in the context of distributed blockchain networks like those supporting major cryptocurrencies such as Ethereum and Bitcoin.[36] Relatedly, the role information plays in informing investors in large-scale impersonal financial markets creates its own incentive to manipulate. Whether the information in question surrounds energy prices as an input to settlement of derivatives,[37] or more purely financial market reference rates like those tied to LIBOR and money markets,[38] how financial markets settle more complex instruments tends to depend integrally on the reliability of information reporting. This directly creates an incentive for manipulation on the part of parties with the ability to do so. This is an acute problem limiting the

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resolve of their own volition, another example of heterogeneity among market participants that can create incentives for manipulation).

35 *See* Pirrong, *supra* note 29.

36 *See* Daian et al., *supra* note 24, at 911-912. (Discussion of this phenomenon in the context of blockchain networks). *See also* Haoqian Zhang et al., *Flash Freezing Flash Boys: Countering Blockchain Front-Running*, 42 IEEE INT'L CONF. DIST. COMP. SYST. WORKSHOPS, 90, 90 (2022).

37 *See* Allan Horwich, *Warnings to the Unwary: Multi-Jurisdictional Federal Enforcement of Manipulation and Deception in the Energy Markets After the Energy Policy Act of 2005*, 27 ENERGY L.J. 363, 367-68 (2006) (Enron was among the companies seen to have engaged in price manipulation tactics in California energy markets, leading to regulatory intervention by the Federal Energy Regulatory Commission).

38 *See, e.g.*, David Hou & David Skeie, *LIBOR: Origins, Economics, Crisis, Scandal, and Reform*, 667 FRB OF N.Y. STAFF REP. 1, 7 (2014) (Large banks whose interbank funding costs reporting was a major input into the London Interbank Offered Rate ("LIBOR") reference rate misreported their liabilities, arguably to project a stronger public image as to their financials and benefit from derivatives positions that were influenced by the effect core banks' reporting could have on LIBOR itself. While the settlements reached with major banks is suggestive of misreporting at a minimum, these same authors note at best mixed empirical evidence regarding manipulation with intent to reap financial rewards).

automation of smart contracts, to which oracle manipulation in DeFi markets stands as an ongoing testament.[39]

Finally, any discussion of self-regulation would be incomplete without reference to how complex markets can develop specialized roles whose incentives check one another in terms of the problems noted thus far. Despite the requirements for initial and ongoing reporting associated with securities issuance in the United States, the performance of firms is still one that provides considerable incentives for deception on the part of firm managers. Even absent outright deception, though, a firm manager's fiduciary duty tends to require that they present the firm in the best possible (non-fraudulent) light to potential investors. This creates a role for short sellers who can profit from identifying overvalued firms. These two competing forces create significant countervailing benefits to independent investors who think a firm's outlook is too rosy (if not outright fraudulent). The ability to borrow shares intending to purchase them later when the price falls aligns private profit incentives with that of the market more generally. Especially given the fact that short selling can occur publicly, this provides a useful signal to market

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[39] *See, e.g.*, Abdullah Albizri & Deniz Appelbaum, *Trust but Verify: The Oracle Paradox of Blockchain Smart Contracts*, 35 J. INF. SYS. 1, 3–4 (2021) (For contracts to automatically execute conditional on the occurrence of an event, information about that event's occurrence (or not) is central to providing an algorithmic contractual vehicle. For information not native to a particular network on which smart contracts are executed, this creates a means by which parties to smart contracts can influence the information reported to the smart contract during a key period in ways that benefit the parties financially. While notable instances of this oracle manipulation problem have unsurprisingly occurred in decentralized financial derivatives, this problem also affects information calls on real world events, such as for automation of crop insurance systems. This problem is especially acute if real world information must be recorded or input manually into the oracle for validation to occur, as this stage would be subject to considerable error). *See* Liyi Zhou et al., *SoK: Decentralized Finance (DeFi) Incidents*, 4 PROCS. OF THE ACM CONFERENCE ON ADVANCES IN FIN. TECH. 1, 2 (2022) (Discussing the high frequency of "price oracle" attacks in decentralized finance systems).

participants about the expected value of a publicly traded security over a specific period.[40]

The complementarity of short-selling (as paired to directly investing as an affirmative positive signal of an investor's assessment of the relative productive capacity of a given publicly traded company) is an example of how horizontal roles within a given market can counterbalance one another to self-regulate aggregate outcomes in a way that is individually and socially beneficial. Vertical relationships within these markets also can emerge to play a self-regulating role. Securities exchanges have an incentive to ensure the quality of products on their exchanges beyond a given level. The extent to which this incentive is strong enough to be self-reinforcing absent public regulation has been a much-debated issue among financial regulatory scholars over the years.[41] However, given the extent of regulation of major exchanges in the United States, the presence of no regulation whatsoever seems more of a theoretical than a live policy question, including in terms of digital currency exchanges. Indeed, this inevitable (and preexisting) question of regulatory authority in the United States may be a reason for the price premium associated with listing on a US-domiciled exchange that is discussed subsequently.

Nonetheless, the study of securities and commodities exchanges suggests a strong role for complementarities between regulators and

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40 *See* FRANK J. FABOZZI ET AL., FOUNDATIONS OF GLOBAL FINANCIAL MARKETS AND INSTITUTIONS 440-42; 540-41; 568-69 (2019) (Discussing the informational role that short selling can provide).

41 *See* Simeon Djankov et al., *The Law and Economics of Self-Dealing*, 88 J. FIN. ECON. 430, 430-31 (2008) (For a discussion of the incentives in corporate governance that lead to defalcation or "tunneling", and the extent to which this practice remains underregulated comparatively worldwide); *see* Howell E. Jackson & Mark J. Roe, *Public and Private Enforcement of Securities Laws: Resource-Based Evidence*, 93 J. FIN. ECON. 207, 210–33 (2009) (This directly suggests that certain incentive problems inherent to trading in abstract financial instruments are less tractable to primarily industry self-regulation. A complementary finding surrounds the relationship between public enforcement (as proxied by budget and staffing levels of securities regulators) and development of a nation's capital markets. Comparing these public enforcement measures to private legal remedies available for those injured by securities violations suggests important complementarities between private and public enforcement, although these particular authors viewed the role of public enforcement as primary in the class of securities enforcement they considered).

major exchanges,[42] with benefits derivative from a broad regulatory standard that is then specifically achieved through private policy defined by exchanges,[43] a specific example of the more general benefit of regulatory complementarities in financial markets.[44] The specialized and complex nature of financial products and services is mirrored in the highly technical and rapidly evolving digital currency industry. Just as exchanges emerged to facilitate trade in distinct financial instruments, many of the largest actors in digital currencies provide exchange functions, which makes lessons from this area of financial regulation also central for understanding the regulations likely to emerge to govern digital currency exchanges. For the readers unfamiliar with digital currencies, the following section thus examines the margins on which these novel financial instruments resemble and differ from more traditional issuance and exchange of such instruments. These similarities and differences directly inform the extent to which self-regulation is viable in digital currency activities.

III. PROMINENT CLASSES OF DIGITAL CURRENCY INDUSTRY ACTIVITY

While the enumeration of every margin of digital currency activity is beyond the scope of this article, certain classes of activity within these markets are sufficiently central that these participant classes

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42 *See* Paul G. Mahoney, *The Exchange as Regulator*, VA. L. REV. 1453, 1457-1464 (1997) (An argument for strengthened self-regulation with respect to capital markets surrounds how in globalized capital markets where investors have jurisdictional choice, some measure of industry input is a competitive advantage compared to jurisdictions whose regulation is primarily or exclusively centrally determined.) For a more extensive treatment of this argument, see Douglas Cumming et al., *Exchange Trading Rules and Stock Market Liquidity*, 99 J. FIN. ECON. 651, 652 (2011) (Comparative empirical practice provides evidence of how exchanges can benefit from self-regulation. Detailed trading rules that "specifically recognize and prohibit certain acts in the marketplace enhance investor confidence." The presence of these types of trading rules was associated with greater liquidity, which directly suggests a way in which exchanges can benefit from adopting self-regulatory practices).

43 *See* La Porta et al., *supra* note 15, at 7.

44 *See* Barth et al., *supra* note 14, at 208.

receive specific treatment to explore the margins of self-regulatory opportunity that the history of financial markets self-regulation suggests these participants possess. Cryptocurrencies (defined herein as units of account issued on cryptographically secured and distributedly governed ledgers) are what spurred this industry in the first instance, but cryptocurrencies' price volatility and the need for stable digital units of account swiftly brought about stablecoins as a distinct digital asset class. Given the low entry costs that long characterized cryptocurrency activity, the number of distinct digital assets (cryptocurrencies and stablecoins alike) and complex smart contracts built upon them has led to the demand for exchange services, which have taken centralized and decentralized forms. This section defines cryptocurrencies, stablecoins, and exchanges and explores the similarities and differences of these digital currency activities to traditional financial markets that directly influence digital currency markets' self-regulatory potential.

A. Cryptocurrencies

Cryptocurrencies are the hallmark digital currency, preceding any central-bank-produced units of digital account,[45] as well as the exchanges and stablecoins that emerged to facilitate exchange of these digital units of account. Cryptocurrencies can be defined as the class of digital currencies that use distributed and cryptographically secured blockchain networks to ensure validity of the underlying ledger of uniquely-identified units of digital account, and proposed transactions surrounding these digital units of account.[46] While a complete account

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45 For a detailed introduction to distributed blockchain networks' role in facilitating the production of network-native units of accounts and more complex transactional processes, see ARVIND NARAYANAN, BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES: A COMPREHENSIVE INTRODUCTION 91 (2016).

46 The reason for this level of technical specificity in the definition is deliberate, because it excludes certain classes of digital currencies that are sufficiently centrally managed, or do not rely on cryptographic time stamping and hash pointers to secure a ledger of digital units of account. This is the class of blockchains typically called "permissionless", "public", or "open." In practice these blockchain networks that are sufficiently distributed have low barriers to entry and exit in terms of network use and participation in the processes of network governance and validation. For an extended discussion of what makes

of cryptocurrencies' emergence with the Bitcoin white paper[47] and the continued diversification in their governing protocols[48] is outside the scope of this paper, several of these currencies' hallmark characteristics warrant mention given the implications of these characteristics for the regulatory potential of the industry. Distributed ledger networks create an incentive-compatible equilibrium for network validators associated with faithful execution of valid transaction requests. This makes transactional validation automated on important margins, and a valid transaction request, once accepted and sealed into a block, is irreversible. This makes blockchain ledgers immutable – a sealed block on a robust network cannot be altered after the fact. As importantly, the nature of distributed consensus relies on ledger transparency for network validators to independently confirm the results of other validators' proposed blocks of new transaction data.[49]

These characteristics mean the terms of exchange, for better and for worse, are perfectly enforced by network validators. This removes

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these networks' governance processes unique in comparative and polycentric perspective, see Eric Alston et al., *Can Permissionless Blockchains Avoid Governance and the Law?*, 2 NOTRE DAME J. EMERGING TECH. 1 (2021).

47 The now-famous Bitcoin white paper was released on October 31, 2008 on a cryptographic listserv under a pseudonym. The paper outlined the benefits of cash for many transactions, and then spelled out a means of governing a network through distributed authority, and how this would facilitate the credibility of the scarcity of units of account native to that network. While the individual cryptographic components of blockchain well pre-dated the white paper, their combination was novel, and led to a subsequent explosion in the emergence of similarly governed distributed blockchain networks. *See* Satoshi Nakamoto, *A Peer-to-Peer Electronic Cash System*, BITCOIN.ORG (2008), https://bitcoin.org/en/bitcoin-paper.

48 While the Bitcoin white paper outlined a vision for the creation of digital cash native to a given distributedly-governed network, subsequent protocol designers envisioned a broader set of digital interactions facilitated by a single base layer whose processes were knowable to all and governed by no singular central authority. This vision of decentralized applications (dApps) and organizations (DAOs) is most closely associated with the Ethereum network, one of the largest cryptocurrency networks by market capitalization. *See* Vitalik Buterin, *Ethereum Whitepaper,* ETHEREUM.ORG (2014), https://ethereum.org/en/whitepaper/. For an economic analysis of the competitive industrial forces shaping the emergence and differentiation of cryptocurrency networks, see Alston et al. *supra* note 31.

49 *See* Narayanan, *supra* note 45.

possibility for ex-post dispute over transactional validity, a deliberate design choice based upon the language of the Bitcoin white paper, which envisions tokens whose transfer, once executed, is like that of handing cash to a stranger – no third party exists that can revert cash payments absent other proof of exchange occurring.[50] As discussed in the subsequent section, the features of automated execution, transparency, and immutability make use of these networks which have elements that can be considered beneficial inputs to regulatory and criminal enforcement. However, other characteristics directly derivative of these network structures are less tractable to centralized enforcement motives – for example, the network cannot be shut down by any enforcement authority because there is no organization that has singular control of the network. Indeed, this novel structure meant the Securities and Exchange Commission ("SEC") did not have the authority to regulate permissionless distributed blockchain networks.[51]

Another area of cryptocurrency activity worth distinguishing surrounds the way in which designing and launching a permissionless distributed network shares characteristics with other startups. This means that the law governing entrepreneurial finance has been applied to many companies who issued digital coins in exchange for funds they intended to use to develop the blockchain network that would eventually facilitate exchange of those digital coins. Initial coin offerings (ICOs) were erroneously (or opportunistically) believed by many promoters to not require registration with the SEC, and issuers developed increasingly convoluted schemes intended to avoid the exchange of financial value from third parties as being linked to the productive efforts of the ICO promoters.[52] While it is likely that some ICO promoters believed in good

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50 *See* Nakamoto, *supra* note 47.

51 For a discussion of the difficulties that distributedly governed blockchain networks present under the predominant Howey test for securities law application, see Neil Tiwari, *The Commodification of Cryptocurrency*, 117 MICH. L. REV. 611, 619-25 (2018).

52 The ways in which blockchain networks, and startups that intend to launch such a network eventually, can raise securities law issues are more complex than they might initially appear. Nonetheless, most of these tokenized networks are likely to be deemed a security at the time of their network launch and initial issuance of tokens, which had strong implications for the extent to which ICOs were subject to securities regulation. *See* Michael Mendelson, *From Initial Coin Offerings to*

faith that they were not issuing securities, this means of raising funds by issuing initial tokens that would eventually be exchanged using a permissionless blockchain network was one that resulted in rampant levels of outright fraudulent activity.[53] Thus, the startup phase wherein companies plan, promote, and launch a cryptocurrency network is already covered by securities regulation in the United States, and the level to which speculative investors were duped by outright fraudulent ICO white papers stands as a clear testament to the presence of information asymmetries that have long been a predicate for regulation of securities offerings to the public. Thus, the issuance of cryptocurrencies in the first instance is likely to either be limited to the network's founders or to accredited investors like other early-stage startups. This is distinct from the regulatory treatment that permissionless cryptocurrency networks are subject to once they are fully distributed and governed by a decentralized group of independent actors.

A final class of cryptocurrencies (and smart contracts subsidiary to these distributed networks) warrants discussion considering ongoing

Security Tokens: A US Federal Securities Law Analysis, 22 STAN. TECH. L. REV. 52, 71-82 (2019).

53 One journalist investigation found numerous red flags in hundreds of ICO listings, including the reuse of stock portraits in ICO white papers for company executives and employees. *See* Shane Shifflett & Coulter Jones, *Buyer Beware Hundreds of Bitcoin Wannabes Show Hallmarks of Fraud*, WALL ST. J. (May 17, 2018), https://www.wsj.com/articles/buyer-beware-hundreds-of-bitcoin-wannabes-show-hallmarks-of-fraud-1526573115#. *See also* Shane Shifflett & Coulter Jones, *A Flood of Questionable Cryptocurrency Offerings*, WALL ST. J. (Jan. 9, 2019), https://www.wsj.com/graphics/whitepapers/#:~:text=The%20Journal%20reviewed%20nearly%203%2C300,and%20promises%20of%20improbable%20returns.

regulatory activity. Networks like Monero[54] and Zcash[55] harness the reliability of final algorithmic processing of validly signed transaction requests while obscuring payment trails to observers and recipients. On this class of distributed networks, the units of account are native to them, which makes network use or validation the actions by legal persons that are likely to be subject to application of regulatory authority. In contrast, mixers and tumblers are smart contracts subsidiary to a given digital currency network in which individual transaction requests are blended with other transactions in such a way that payment trails are also obscured.[56] This latter class of transaction-anonymizing network has

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54 Monero's genesis as a user-privacy-focused cryptocurrency network began as a fork from ByteCoin, which relied on a protocol called CryptoNote. Because of the way in which forks operate, much of the network's design has its origins in CryptoNote, although Monero developers have since heavily audited and updated the underlying protocol such that the two networks are no longer identical. For the CryptoNote white paper, see Nicholas van Saberhagen, *CryptoNote v. 2.0*, BYTECOIN.ORG (2013), https://bytecoin.org/old/whitepaper.pdf. For an audit of the CryptoNote protocol performed on behalf of the Monero network (which can be understood as a roadmap by which to understand subsequent changes to the Monero protocol), see Surae Noether, *Review of Cryptonote White Paper*, GETMONERO.ORG 2014, getmonero.org/resources/research-lab/pubs/whitepaper_review.pdf.

55 Due to the way in which network protocols tend to be open-source, design in one context can lead to application by a different network, either through the new creation of a network, or through updates to an existing protocol. While the Monero fork from Bytecoin can be understood as an adaptation of an existing protocol, the Zcash network was based on a protocol originally designed by several university researchers. *See* Eli Ben Sasson et al., *Zerocash: Decentralized Anonymous Payments from Bitcoin*. 2014 IEEE SYMP. SEC. & PRIV 459-474 (2014). In the case of Zcash, a distinct set of protocol developers implemented the standard outlined by Sasson et al. to launch a shielded payment network which combines features of the Bitcoin network with user privacy. *See* Daira Hopwood et al., *Zcash Protocol Specification*, ELEC. COIN CO. (Sept. 15, 2022), https://zips.z.cash/protocol/protocol.pdf.

56 The terms mixer and tumbler are used interchangeably to describe the same service within a given cryptocurrency network which uses an intermediary to obfuscate the original intended recipient. A single such smart-contract-facilitated service will take many transactions to its public address coupled with those transactions' intended recipients, which makes it considerably more difficult for third parties to establish the originating and receiving wallet addresses. For a detailed discussion of mixing services on blockchain networks, and their

recently made headlines due to one such mixer for Ethereum network transactions, Tornado Cash, being added to the US Department of Treasury's Office of Foreign Assets Control ("OFAC") sanctions list,[57] although a mixer on the Bitcoin network, Blender.io, received similar treatment earlier in the year.[58] This is undeniably a major regulatory intervention into digital currency markets that will spur continued debate and possibly judicial clarification as to the extent of regulatory authority in this area. At the heart of the Tornado Cash issue is the extent to which OFAC can sanction use of a protocol, as opposed to individuals, whether those running financial institutions, or holders of individual accounts at such institutions. OFAC's action in this case suggests it considers that individual users' privacy interests are outweighed by the extent to which this technology facilitates financial crimes, including the

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distinguishing technical features, see Qi Feng et al., *A Survey on Privacy Protection in Blockchain System*, 126 J. NETWORK & COMPUT. APPL. 45-58 (2019).

57 The Treasury's OFAC has faced the challenges associated with enforcement proceedings brought against distributed networks. OFAC began by sanctioning the protocol itself, using as justification an executive order of President Obama which was intended to facilitate the government's ability to block funds transfers of cybercriminals. *See* Exec. Order 13694, 3 C.F.R. 13694 (2015); and *see U.S. Treasury Sanctions Notorious Virtual Currency Mixer Tornado Cash*, U.S. DEP'T. OF THE TREASURY PRESS RELEASE (2022), https://home.treasury.gov/news/press-releases/jy0916. Ultimately, though, this has required the construction of a theory of legal personhood for a mixer or tumbler service on a blockchain network, which for OFAC involves "founders and other associated developers" as well as the Tornado Cash DAO itself. For OFAC, this yet-untested legal theory involves individual liability for developing and maintaining a privacy network. *See Treasury Designates DPRK Weapons Representatives*, U.S. DEP'T. OF THE TREASURY PRESS RELEASE (Nov. 8, 2022), https://home.treasury.gov/news/press-releases/jy1087; and *see 1095. Who is the Tornado Cash "person" that OFAC designated pursuant to E.O. 13722 and Executive Order (E.O.) 13694, as amended?*, DEP'T. OF THE TREASURY FAQS (Nov. 8, 2022), https://home.treasury.gov/policy-issues/financial-sanctions/faqs/1095.

58 OFAC listed the prior enforcement against Blender in its announcement of the TornadoCash sanctions. Throughout this sequence of enforcement actions, OFAC has noted the use of mixers by North Korean hackers as a primary reason for its enforcement against the protocols (and their founders, developers, and distributed stakeholders). *See U.S. Treasury Issues First-Ever Sanctions on a Virtual Currency Mixer, Targets DPRK Cyber Threats*, U.S. DEP'T. OF THE TREASURY PRESS RELEASE (May 6, 2022), https://home.treasury.gov/news/press-releases/jy0768.

laundering of cryptocurrency proceeds from major hacks. For the purposes of this analysis, though, the legal question of the limits of digital privacy technologies' use by individuals hinges on a different issue than consumer welfare losses due to information asymmetries or market power, because consumers that value privacy clearly derive value from these networks, even if these privacy networks' existence makes criminal law enforcement on digital currency networks more difficult. While likely a central question for regulators globally in the coming months and years, the question of privacy networks does not specifically implicate consumer protections, which is the primary thrust of the analysis of self-regulatory margins herein.

B. Stablecoins

Price volatility in digital currency markets has been an endemic problem, with markets cratering precipitously in 2022, down over 75% from their all-time highs during the pandemic. Although not always so severe, this long-standing price volatility created a need for digital units of account whose convertibility to stable and therefore liquid asset classes is more predictable. Stablecoins emerged to fill this gap and have since proven to be a major means by which individuals enter and exit cryptocurrency positions, with more than half of Bitcoin and Ether traded on exchanges being done so via a stablecoin.[59] The means by which stablecoins maintain a reliable peg to the dollar surrounds a commitment to redeem units of a given stablecoin on a one-to-one basis, typically with the U.S. dollar. In holding liquid assets that match the amount of stablecoins issued, a stablecoin issuer creates an incentive for arbitrage when its value falls below the intended par level. Arbitrage traders can gain through buying units of the stablecoin below par value and redeeming at par, or vice versa in cases when the price exceeds the

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[59] *See, e.g.*, *President's Working Group on Financial Markets, the Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency*: *Report on Stablecoins*, U.S. DEP'T. OF THE TREASURY (Nov. 2021), https://home.treasury.gov/system/files/136/ StableCoinReport_Nov1_508.pdf. *See also* Morgan Stanley Research, *Cryptocurrency: High Leverage Meets Regulation*, MORGAN STANLEY (Nov. 1, 2021), https://advisor.morganstanley.com/christopher.j.bruce/documents/field/c/ch/christopher-bruce/2cc1f060-36ec-11ec-a17a-e2e5e2187122.pdf.

reference currency.[60] This model hinges integrally on the credibility of the issuer's redemption promise, which makes the reserve assets of stablecoin issuers central to this class of digital currency activity.

For observers of the history of banking, this model may sound quite familiar and for good reason.[61] The viability of the institution offering stable digital units of account is fundamentally a function of the liquidity and stability of the reserve assets backing the claim that redemption of a stablecoin is always available at a 1:1 ratio with the specified reference asset. This makes the specific reserve assets chosen, and the terms of redemption available to stablecoin holders, the central governance questions for this class of digital assets.[62] One of the most prominently used stablecoins, Tether, has faced considerable scrutiny surrounding the reserve assets supporting the redeemability of its stablecoin, and settled with U.S. regulators for $41 million surrounding its previous claims that the company's token was fully backed by dollars and other currencies.[63] The incentive surrounding stablecoin reserve assets shares important similarities with the banking industry – where

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60 A stablecoin treasury plays a central role, akin to that of a central bank, in adhering to a given peg; if the price falls below the peg, the treasury should purchase units of the stablecoin to reduce circulating supply until the price reaches an acceptable threshold with parity, and vice versa if the price increases sufficiently above the peg. This also creates an opportunity for private investors: if the price of a stablecoin rises above the pegged rate of exchange with the U.S. dollar, then investors can deposit Tether with the treasury and gain more than this amount until the circulating supply increases sufficiently to reduce the price to parity with the dollar. For a more detailed study of the role of arbitrage incentives in stablecoin issuance, see, e.g., Richard K. Lyons & Ganesh Viswanath-Natraj, *What Keeps Stablecoins Stable?*, J. INT'L. MONEY & FIN. 102777 (2022).

61 One financial scholar and regulatory economist has likened the role of stablecoin issuers to that of fractional reserve depository institutions and envisions a regulatory path forward for these services through the application of relevant depository institution regulations. *See* Charles W. Calomiris, *Will Fractional-Reserve Stablecoin Banking Replace Bitcoin and Some Traditional Banking Payments?*, 33 J. APPLIED CORP. FIN. 70, 70–75 (2021).

62 *See supra* note 59.

63 *See* David Yaffe-Bellany, *The Coin That Could Wreck Crypto*, N.Y. TIMES (June 17, 2022), https://www.nytimes.com/2022/06/17/technology/tether-stablecoin-cryptocurrency.html.

banks have an incentive to loan more of their depositor's funds, stablecoin issuers have a strong incentive to back their tokens with less liquid and therefore more lucrative assets.[64] Stablecoin issuers like those behind Tether continue to back their tokens with large amounts of commercial paper.[65] Given the stark bear markets into which digital currencies have descended since the Terra/Luna and FTX events of 2022, the truth underlying the eponymous stability of this class of digital currencies has again come under considerable scrutiny.[66]

In addition to the liquidity of the assets backing a given stablecoin's issuance of new units, the terms of redemption for token holders present another important margin. Some stablecoin issuers' terms enable them to postpone redemption payments for a period of seven days or suspend redemption at any time. Other limitations include caps or floors on the amounts redeemable, both intended to prevent runs by limiting either the class of token holders that qualify for redemption, or the number of tokens that can be redeemed in any given

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64 In financial economic terms, this means the choice of reserve assets implies a volatility as against the reference asset that defines the relevant risk profile for coin holders. Furthermore, the choice of governance model, whether algorithmic or centrally managed, has important implications for the choice of reserve assets and the risks to which a given stablecoin network is susceptible. *See* Christian Catalini & Alonso de Gortari, *On the Economic Design of Stablecoins* (Aug. 6, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3899499.

65 *See* Yaffe-Bellany, *supra* note 63.

66 Without a rigorous audit of the company's financials, Tether's risk profile remains opaque with respect to key questions as to where their reserve assets are custodied or which money market investments back these reserve assets. Absent such information, it is difficult to assess the risk profile of the company's stablecoin backing. *See* Emily Nicolle, *Why Tether and Stablecoin USDT Have Become a Big Crypto Worry*, WASH. POST. (Dec. 19, 2022), https://www.washingtonpost.com/business/why-tether-and-stablecoin-usdthave-become-a-big-crypto-worry/2022/12/18/debd9e14-7f29-11ed-8738-ed7217de2775_story.html#. A further concern that has emerged in the wake of the FTX exchange's dubious use of FTT tokens to prop up balance sheets surrounds the issuance of stablecoin-denominated loans by Tether, which raises questions as to the amount of derivative instruments in circulation denominated in the stablecoin, and how these rank compared to the backing the company attests is behind its issuance of new units of the USDT coin. *See* Jonathan Weil, *Rising Tether Loans Add Risk to Stablecoin, Crypto World*, WALL ST. J. (Dec. 1, 2022), https://www.wsj.com/articles/rising-tether-loans-add-risk-to-stablecoin-crypto-world-11669875590#.

time period.[67] The value redeemed for a given stablecoin may also transfer into an account that faces considerable delays or costs in terms of transferring that value into the traditional banking system. A final margin of regulatory concern in this area of digital currency activity is the nature of the claim that token holders have against the stablecoin issuer as against other creditors.[68]

Beyond reserve assets and redemption claim issues, a final distinction in stablecoin issuance is worth noting. The governance of the stablecoin issuer can resemble that of traditional private firms with centralized decision-making and finance obtained through debt and equity issuance. In contrast, though, a distinct class of stablecoins are governed algorithmically, meaning their reserve maintenance and redemption settlement are subject to a decentralized decision-making process.[69] This latter class of stablecoins appeals to the underlying ethos of cryptocurrency communities associated with skepticism of the traditional financial and monetary systems. Governing these stablecoins through a decentralized process has not been without its challenges, perhaps most notably surrounding the choice of reserve assets. Many digital currency users skeptical of the dollar are similarly skeptical of a digital unit of account that is fundamentally tethered to the dollar in terms of its reserve assets, which led several algorithmic stablecoins to instead back with cryptocurrencies (or commercial paper from cryptocurrency companies). While this results in greater decentralization of control of the stable units of account (both in terms of direct governance as well as indirect governance of the stablecoin's reserve assets), this also subjects these algorithmic stablecoins to the risks associated with cryptocurrencies. Most acute for the business model of

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67 *See supra* note 59. *See also* Mitsu Adachi et al., *Stablecoins' Role in Crypto and Beyond: Functions, Risks and Policy,* EUR. CENTRAL BANK 1, 1-14 (2022).

68 The legal definition of stablecoins raises a host of issues for interpretation of commercial law surrounding property and contracts, as well as the statutory definition of stablecoin providers themselves. *See* Jess Cheng, *How to Build a Stablecoin: Certainty, Finality, and Stability Through Commercial Law Principles*, 17 BERKELEY BUS. L. J. 320, 344–45 (2020) (Reviewing these issues from the perspective of commercial law). Stablecoin issuance also raises novel questions for resolution of these companies upon insolvency. *Id.*

69 *See, e.g.*, Gordon Y. Liao & John Caramichael, *Stablecoins: Growth Potential and Impact on Banking*, 1334 FED. RSRV. INT'L. FIN. DISCUS'N. PAPERS 1, 4-5 (2022).

stablecoin issuance is price volatility in terms of the reserve assets backing the stablecoin, and two of the most prominent algorithmic stablecoins have both suffered because of backing with cryptocurrency reserves.

What is increasingly clear to industry observers is that stablecoin issuance carries its own incentive problems surrounding liquidity of reserve assets trading off in terms of financial returns,[70] as well as redemption rights of users being a margin that companies are incentivized to constrain in pursuit of these same returns. Transparency in reserve assets continue to plague the most widely used stablecoin, Tether, whose company executives maintain that their specific choice of reserve assets is part of their competitive advantage, and accordingly choose not to divulge publicly. More problematically, Tether also has yet to be audited by any major accounting firm associated with such certification in US financial markets, with Tether claiming that these firms are wary of working with them due to the risky nature of digital currency activities more generally.[71] However, absent mentioning Tether's major competitor, U.S. Dollar Coin ("USDC"), this could paint too dismal of a picture of the industry, for in contrast to Tether's opacity in reserve assets, USDC maintains a transparent accounting of its reserve backing.[72] Similarly, algorithmic stablecoins are transparent about their backing by design, although the choice of algorithmic stablecoin backing has literally led some to ruin, as the June 2022 events surrounding the

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70 *See* Calomiris, *supra* note 61; *see* also, Catalini & de Gortari, *supra* note 64.

71 *See* Peter Rudegeair, *Short Sellers Bet Tether, Crypto's Central Bank, Is Vulnerable to a Run*, WALL ST. J. (Apr. 3, 2022), https://www.wsj.com/articles/short-sellers-bet-tether-cryptos-central-bank-is-vulnerable-to-a-run-11648978202#.

72 The company that issues USDC, Circle, releases monthly reports showing their backing in treasuries and cash deposits, although these highly liquid instruments have recently been consolidated into a money market mutual fund managed by BlackRock Advisors, LLC. For the latest discussion of USDC's reserve backing, *see* Jeremy Fox-Geen, *Circle Continues to Enhance Details in the USDC Reserve Attestations*, CIRCLE.COM (Dec. 23, 2022), https://www.circle.com/blog/circle-continues-to-enhance-details-in-the-usdc-reserve-attestations. The company also provides monthly reserve attestations from the accounting firm Grant Thornton. For the latest as of this writing, *see* Grant Thornton LLP, *USDC 2022 – Circle Examination Report November 2022*, GT.COM (Dec. 22, 2022), https://www.centre.io/hubfs/USDC%202022-Circle%20Examination%20Report%20November%202022.pdf?hsLang=en.

stablecoin Terra emphasize.[73] Nonetheless, the presence of centralized and algorithmic stablecoins with transparently liquid backing display how competitive forces have generated consumer benefits within the industry. But the continued success of Tether suggests that despite competitive forces, path dependent network effects are quite strong, and/or users are uninformed. Given the centrality of these "stable" digital units of account to digital currency activities in general, and decentralized finance in particular, it is no surprise that stablecoins are increasingly referenced by financial regulators as a discrete margin of concern.[74]

As stablecoins grow in use, and their backing similarly grows in magnitude within traditionally low-risk classes of financial assets like treasuries or money market funds, this makes a run on a stablecoin potentially significant for traditional credit markets more broadly.[75] Stablecoins' systemic role in digital currency markets has meant systemic-scale fee revenues, such that cryptocurrency exchanges have themselves gotten into the issuance market, with Coinbase providing part of the funding to start Circle, the company behind USDC. Similarly, Binance created its own stablecoin, BUSD, and recently announced to users that deposits in other stablecoins would be automatically converted

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73 The Terra stablecoin was backed by algorithmic derivatives of the network's native cryptocurrency, Luna. Once enough of the stablecoins staked on a closely linked lending platform were liquidated, the peg between the Terra stablecoin and the dollar collapsed. *See* Scott Chipolina, *Terra crisis fans regulatory concerns over $180bn stablecoin market*, FIN. TIMES, (May 11, 2022), https://www.ft.com/content/48d82c7a-495f-4d5e-a87a-a56bea58e760. This may be a specific expression of the more general principle underlying economic design of stablecoins – algorithmic stablecoins may be susceptible to death spiral price dynamics in ways that centrally governed stablecoins are not. See *supra* note 55. In short, stablecoins backed in an algorithmic relationship to a cryptocurrency may work under conditions of price stability or continued increases in the reserve cryptocurrency's price, but are especially fragile in times of downward price volatility.

74 *See supra* notes 59 and 67. *See also* Committee on Payments and Market Infrastructures, *Application of the Principles for Financial Market Infrastructures to stablecoin arrangements*, BANK FOR INT'L STLMNTS 1, 4–22 (2022).

75 *See* Gary B. Gorton & Jeffery Zhang. *Taming Wildcat Stablecoins*, 90 U. CHI. L. REV. 909, 909–964 (2021) (Analyzing the margins by which private stablecoin issuers are prone to runs).

to their proprietary stablecoin. To scholars of financial and capital markets, the market power of these major exchanges should at least raise concerns as to their occupying another area of systemic importance within digital currency markets. It is these concerns as to the systemic role of exchanges, their market power due to network effects, and the information asymmetries they enjoy due to their unique role, with which the following subsection is concerned.

C. Digital Currency Exchanges

As with other classes of abstract financial instruments, exchanges have emerged to facilitate the scope and depth of the market for digital currencies, as well as exchange of more complex smart-contract-facilitated decentralized financial instruments and more traditional futures surrounding these currencies. For the broad purposes of this analysis, two major distinguishing features of exchanges warrant discussion. First, there are exchanges based in the United States, whether primarily or doing business with US-based customers, and exchanges based elsewhere, most of which prohibit US customers from using their platform. This distinction directly correlates with the number of digital currencies available on a given exchange. US-based exchanges, like Coinbase and Binance, tend to be more stringent as to which digital assets can be traded on their platforms, due to the way in which cryptocurrency start-ups are likely to be governed by securities issuance laws. If an exchange permits US customers to purchase an unlicensed securities offering, the exchange itself is potentially liable for this activity, including the possibility of being directly liable for operating an unlicensed securities exchange. As but one example of this, due to the SEC's ongoing investigation of Ripple's XRP token issuance,[76] customers whose IP addresses indicated they were in the US immediately became unable to purchase new units of XRP on exchanges.

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[76] *See generally* Lindsay Martin, *Ripple Effects: How In Re Ripple Labs Inc. Litigation Could Signal The Beginning of the End of the Payment Platform*, 19 DUKE L. & TECH. REV. 1 (2021) (summarizing the case in its early phases and discussing the legal justification for the application of SEC regulatory authority); Robel Tsegu, *Cryptocurrency and Security Issues: The Tide Awaiting Ripple's Decision*, 25 SMU SCI. & TECH. L. REV. 95 (2022) (providing a survey of the more recent developments).

A second distinction in digital currency exchanges is a salient margin distinguishing regulatory possibilities. Some exchanges of digital currencies are automated and decentralized. These decentralized exchanges (DEXs) do not rely on order books, and instead use liquidity pools in which independent investors have deposited major cryptocurrencies to facilitate exchange demands in exchange for transaction fees. The most used DEX is called Uniswap, which leverages the Ethereum blockchain to facilitate this exchange process for the many distinct ERC20 tokens which are traded on the Ethereum blockchain.[77] Changes to these decentralized exchanges are not managed by a private organization and are instead subject to a community process of voting. While this is still subject to some measure of centralization of control (and may be more inefficient than a single firm's management of traditional order books in terms of costs or settlement time),[78] this makes direct regulation of this form of exchange more difficult. This is a direct corollary to the problem of regulating networks like Bitcoin and Ethereum because of their lack of a single central authority, and the previously discussed challenges in attaching regulatory liability in the case of the TornadoCash protocol. However, these DEXs' facilitation by smart contracts means they are fundamentally more transparent than traditional exchanges, such that information asymmetries among informed users are necessarily lower than cases of privately managed exchanges using traditional order books.

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77 Decentralized exchanges tend to maintain liquidity pools of pair-matched tokens, with holders of liquidity tokens incentivized to provide liquidity through the fees they make on token swaps, although this can be subject to the indirect cost of loss of capital if an arbitrageur has traded against a given liquidity pool in which an investor has liquidity deposited. *See* Alfred Lehar & Christine A. Parlour, *Decentralized Exchange: The Uniswap Automated Market* Maker (Aug. 8, 2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3905316 (exploring how this distinct market structure affects the incentives of participants and market performance relative to limit order markets).

78 Indeed, due to some of the benefits of traditional order books, some networks use off-chain order books and rely on the blockchain only for settlement of tokens exchanged. *See* Fabian Schär, *Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets*, 103 (2) FED. RSRV. BANK ST. LOUIS REV. 153, 160-63 (2021).

Whether centrally or distributedly governed, these exchanges are naturally large market players, and so are understandably salient points of regulatory interest. The scale economies associated with exchange provision suggest they necessarily possess considerable market power. As but one example of this, the price effect of listing on Coinbase is the largest of any exchange and has been estimated to range from anywhere between 29% over five days[79] to 91% over the same period.[80] While the magnitude of these effects likely reflects the surge of speculative interest in digital currencies during the pandemic, it is interesting to note that Coinbase's listing effect is larger than any other exchange. For example, despite Binance having a larger transaction volume globally, Coinbase's listing effect is still the strongest. This suggests an interesting complementarity between the US regulatory system and the due diligence individual investors assume is associated with regulatory compliance.

As notably, this effect is despite the relative deterrence of investors who want to maintain their financial privacy, as Coinbase's compliance with US regulations entails considerable identity verification and reporting to US tax authorities. US-based exchanges are thus subject to considerable regulation already. This is a testament to their centrality to these markets, as well as their nature as the conduits by which most cryptocurrency users and investors convert digital asset gains into real economic purchases, and the implications for tax and money laundering enforcement of these "off-ramps" to the traditional financial system.[81] Finally, despite the intrinsic scale economies associated with exchange activities, the presence of global exchanges alongside US-domiciled ones means competition for users (and digital currency issuers) is substantial in what is an increasingly global class of financial activity.

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79 *See* Kyle Heise, *What is the Coinbase Effect*, BSC NEWS (2021), https://www.bsc.news/post/cryptonomics-what-is-the-coinbase-effect.

80 *See* Roberto Talamas, *Analyzing the Crypto Exchange Pump Phenomenon*, MESSARI.IO (Mar. 31, 2021), https://messari.io/report/analyzing-the-crypto-exchange-pump-phenomenon.

81 *See* Schär, *supra* note 72. *See also* Percy Venegas, *Blockchain Consortia for the Social Good: An Introduction for Non-Technical Audiences*, INNOV. SOC. FIN. 319, 319-346 (2021).

IV. REGULATION AND SELF-REGULATION OF DIGITAL CURRENCIES

Identifying the characteristics of existing financial markets that make them tractable to self-regulation provides a means by which to assess the self-regulatory potential of various forms of digital currency activity. Competition coupled with market transparency can itself serve as a regulatory force when entry costs are low and market participants are sufficiently informed. While assuming informed investor activity in current digital currency markets is optimistic, modest reductions in price comovement[82] coupled with the increasing presence of institutional investors[83] are suggestive evidence that informed investor behavior is increasing. Given low entry costs in digital currency markets, and the high levels of transparency that blockchain networks involve, this suggests that competition among digital currency issuers is likely to provide some measure of self-regulation in terms of the way in which these networks reduce the possibility for manipulative behavior by specially informed or empowered participants therein.

The example of front-running displays how these markets are subject to similar incentive problems to other financial markets, but also emphasizes how community identification of the problem was facilitated through network transparency. On permissionless blockchain networks, network validators can choose the order in which they submit

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82 Although cryptocurrency markets display high price comovement from 2017 onwards, there is evidence of a modest reduction in this comovement beginning in 2020. *See* Pierangelo De Pace & Jayant Rao, *Comovement and Instability in Cryptocurrency Markets*, 83 INT'L REV. ECON. & FIN. 173, 175 (2023). Given fiscal discipline during market downturns, it may be that reductions in comovement occur during the 2022 period onwards, as less viable and/or well-financed projects fail.

83 Although a more recent academic publication accounting for institutional investors in cryptocurrency markets is not available as of this writing, it is likely that the findings of steady increases of these investors over the course of 2021 was unlikely to have continued during the bear market throughout 2022. Up until the end of 2021, however, evidence displayed a continued increase of institutional investors over the four-year period from 2018 onward. *See* Xiaoran Huang et al., *Are Institutional Investors Marching into the Crypto Market?*, 220 ECON. LETTERS 110856 (2022). Relative to periods other than the march up to the most recent crash, institutional investors' presence is likely still considerably higher.

transactions in each block they are pseudo-randomly chosen to validate. This creates a margin by which validators have sold the right to come earlier in their block proposals, which has enabled third parties to front run large trades due to the ability to perceive large trades in the network's pool of proposed transactions from which validators are selecting.[84] The open nature of blockchain networks means that the ability to front-run became open knowledge, and has subsequently generated considerable debate in the communities surrounding these networks. Technological solutions also provide a potential self-regulatory route forward, in which network participants may be prevented by protocol updates from ordering transactions for frontrunners in exchange for revenue.[85]

Similarly, while the most well-capitalized stablecoin, Tether, displays notably low transparency as to its reserve assets to satisfy redemption requests, two predominant competing stablecoins display considerably more transparency as to their reserve assets, a disparity that has led short sellers to "short" Tether.[86] From the margin of consumer safety alone, there is cause for some optimism that beneficial private institutions are emerging to satisfy consumer demands for transparency in stablecoin issuance and governance. Nonetheless, stablecoins pose larger questions surrounding the possibility for disintermediating the banking system, destabilizing the broader financial industry through risk contagion, and making monetary policy less effective. Given that these are clearly concerns which major regulators of financial institutions have repeatedly voiced[87] this analysis has focused less on how this new digital asset class can disrupt traditional financial institutions, and more on the consumer welfare implications of the business model of stablecoin issuance. Nonetheless, from a predictive perspective, government regulation of stablecoin issuance companies is likely forthcoming soon in the United States, although whether motivated by digital currency consumer welfare or other government objectives remains to be seen.[88] Given the market

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84 *See generally* Daian et al., *supra* note 24.

85 One such solution surrounds making transaction requests in the memory pool invisible to malicious third parties until they have been validated by an additional step involving network members at relatively low cost to latency. *See generally* Zhang et al, *supra* note 36.

86 *See generally* Rudegeair, *supra* note 71.

87 *See generally President's Working Group on Financial Markets et al.*, *supra* note 59.

88 *See* Exec. Order No. 14067, *supra* note 1.

turmoil precipitated by the collapse of the algorithmic stablecoin Luna,[89] consumer welfare justifications may prove to be part of the foundation for government intervention, even if such intervention simultaneously achieves other government purposes for regulation like systemic risk or monetary policy considerations.

The very presence of short sellers in capital markets displays how complementary economic functions can be obtained to ameliorate incentive problems in financial markets. Alongside activist hedge funds more generally, the presence of short sellers displays how market participants can have functions that are complementary to one another.[90] The emergence of futures markets surrounding major digital currencies, as well as decentralized financial derivatives themselves, directly display how digital currency markets are developing horizontal complements that have yielded self-regulatory benefits in more traditional financial markets. As institutional investors take sizable public positions with respect to the positive or negative outlook for a given company and engage in active governance of the firm given this outlook, passive investors also benefit.[91] Relatedly, exchanges that develop detailed rules regarding market manipulation, insider trading, and broker conflicts of interest benefit from greater velocity and lower volatility.[92] Some of these functions are obtained through horizontal agents—different classes of share purchasers play different regulatory roles in ameliorating incentive problems. Other complementary functions are obtained from vertical relationships—exchanges that adopt beneficial rules can offer better services to a broader class of market participants.

This provides a lens by which to understand the roles of different digital currency market actors, and how they can potentially check and balance one another to yield a Pareto-improving level of voluntary economic exchange. This involves the essential recognition that greater levels of market activity can occur through regulation by parties with balanced incentives—balancing authority in markets may itself be

89 *See* Chipolina, *supra* note 73.

90 *See generally* FABOZZI ET AL., *supra* note 40.

91 A natural experiment involving a sudden increase in market liquidity increased participation by active and passive investors alike. *See* Alex Edmans et al., *The Effect of Liquidity on Governance*, 26 REV. FIN. STUD. 1443, 1444–82 (2013).

92 *See* Cumming et al., *supra* note 42.

emergent to the extent this can result in greater gains. More mature financial markets, regulated in great part through private commercial law, may provide sufficient gains relative to smaller less concentrated markets, such that considering market concentration or firm scale in a single class of industry actors may obscure how distinct countervailing incentives can operate to check and balance one another. Exchanges like Coinbase (complementing existing regulatory requirements under US law) can adopt due diligence in terms of new coin listings in ways that ameliorate the incentive problems associated with issuance. The ability to short digital currencies is by now well-established, and it is likely that these complementary horizontal trading roles will continue to improve market information for consumers as institutional investors come to play an increasing role.

Of course, this discussion would be incomplete without a more explicit consideration of the recent cryptocurrency exchange collapse that may rank among the most noteworthy cases of financial fraud in modern history: the demise of the foreign-domiciled exchange, FTX. While a comprehensive picture of events has yet to unfold in U.S. courts, this case has clear relevance for the analysis here throughout.[93] Many studies of corporate governance focus on use of inside information or control to personally gain in ways that are considered unjust. Insider trading and defalcation pose fascinating questions as to their identifiability and justiciability,[94] but their importance suggests a relatively healthy equilibrium in robust capital markets with respect to

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93 This draft was first written in May 2022, before both the Terra/Luna crash and the FTX collapse, which emphasizes the predictive value of drawing from longstanding lessons as to regulation of financial markets to understand problems likely to emerge in digital and decentralized variations on these markets. While some margins of digital currency industry are novel, others still suffer from long-understood incentive problems surrounding firm scale and information asymmetries that are unlikely to go away.

94 For a survey of the development of modern U.S. law governing insider trading, see JOHN P. ANDERSON, INSIDER TRADING: LAW, ETHICS, AND REFORM 25–59 (2018). There are numerous ways that corporate insiders can divert or misappropriate funds for purposes of individual benefit. See Vladimir Atanasov et al., *Unbundling and Measuring Tunneling*, 2014 U. ILL. L. REV. 1697, 1703–07 (2014). For a study showing the extent to which tunneling is a problem even in high enforcement capacity jurisdictions, see, *e.g.*, Simon Johnson et al., *Tunneling*, 90 AM. ECON. REV. (PAPERS & PROC.) 22, 22–27 (2000).

outright fraud. Granted, this is not to argue capital markets are without their fair share of prosecutable frauds, but a focus on subtler forms of distortionary market activity suggests a reasonable level of deterrence of frauds at grand scales. Nonetheless, Enron,[95] LIBOR,[96] Madoff,[97] and Theranos all present single-word notorious examples of how the incentives to outright lie remain present in financial markets from the fundraising through reporting through auditing stages.[98] FTX will undoubtedly be added to the above list of misconduct at a massive scale perpetrated through various margins associated with the impersonal exchange of abstract financial instruments.

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95 Enron can be understood as a combination of a failing business model and a management culture that perpetuated risk-taking and accounting misconduct to prevent the inevitable reckoning associated with bad debts that management kept off company balance sheets, with the apparent involvement of the company's auditor, Arthur Andersen, LLP (if that accounting firm's indictments and convictions for improperly shredding documents are any indication). One survey of the available evidence suggests that the board itself shares responsibility for the company's spectacular bankruptcy. *See* Charles M. Elson & Christopher J. Gyves, *The Enron Failure and Corporate Governance Reform*, 38 WAKE FOREST L. REV. 855, 856 (2003).

96 *See* Hou & Skeie, *supra* note 38.

97 The Bernie Madoff fraud is complicated by how early authorities were warned by multiple whistleblowers that serious concerns existed about practices at Madoff's firm. A consideration of the complex web of information asymmetries, misaligned bureaucratic incentives, and external capture emphasizes how difficult ex-ante regulation to protect consumers is in the context of delegated exchange of abstract financial instruments. *See* Donald C. Langevoort, *The SEC and the Madoff Scandal: Three Narratives in Search of a Story*, 2009 MICH. ST. L. REV. 899, 900-02 (reviewing the existing narratives as to the cause of the Madoff scandal given its magnitude and ex-post obviousness); 903-913 (considering in turn the explanations of constrained resources at the SEC, endemic conflicts of interest for SEC administrators, indifference to the whistleblower claims amidst the sheer amount of claims the SEC reviews every year, and the lack of political will to sufficiently fund the SEC to level that would render enforcement more capable).

98 A notable feature of the Theranos fraud surrounds the privately held nature of the company itself, which is argued to have contributed to the information asymmetries that facilitated the explosive growth of the company despite the lack of viable technology central to the company's advertised business model. *See* Verity Winship, *Private Company Fraud*, 54 U.C. DAVIS L. REV. 663, 667 (2020); *see also* Elizabeth Pollman, *Private Company Lies*, 109 GEO. L.J. 353, 353 (2020).

While digital currency markets do present unique opportunities for market manipulation associated with exchange listings,[99] oracle validation of smart contracts,[100] and block ordering,[101] FTX instead appears to be a more classic case of egregiously lacking internal controls at a major exchange in a context of financial speculation during the digital currency market's most spectacular bull run to date. That the exchange was both closely associated with an investment fund and several of its own interest-conflicted investments makes the ensuing outcomes even clearer in hindsight,[102] although the fact that the company was domiciled in the Bahamas may further indicate why some of these lacking controls as against classic examples of financial fraud were not identified prior to the company's implosion with unfunded liabilities running in excess of $8 billion.[103]

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99 *See, e.g.*, Ester Félez-Viñas et al., *Insider Trading in Cryptocurrency Markets* (Aug. 12, 2022) (unpublished manuscript), https://ssrn.com/abstract=4184367.

100 *See* Albizri & Appelbaum, *supra* note 39; Zhou et al., *supra* note 39.

101 *See* Daian et al., *supra* note 24.

102 This perspective is only strengthened when the nature of the fraud perpetrated is considered in further detail. From what is currently understood, FTX and a closely affiliated research firm, Alameda Research, benefited on numerous margins from the exchange's privileged market position, as well as opacity in assets and liabilities associated with an FTX-issued token ("FTT"). FTX apparently both diverted investor and customer funds to Alameda Research and issued FTT that Alameda Research then claimed as an asset on its balance sheets to further obtain investor funding. As the cryptocurrency market declined precipitously in the wake of the Terra/Luna crash, a variety of Alameda Research investments became increasingly insolvent, which led to continued tunneling of FTX funds (including, seemingly, exchange customer's account balances) to prop up a failing investment venture whose fortunes were at this point inextricably bound up with those of FTX, and vice versa. *See, e.g.*, Niha Masih & Julian Mark, *What to Know About Sam Bankman-Fried and the FTX Crypto Exchange Collapse*, WASH. POST (Dec. 13, 2022), https://www.washingtonpost.com/business/2022/12/13/sam-bankman-fried-ftx-collapse-explained/; *see also* David Z. Morris, *FTX's Collapse Was a Crime, Not an Accident*, COINDESK (Nov. 30, 2022), https://www.coindesk.com/layer2/2022/11/30/ftxs-collapse-was-a-crime-not-an-accident/.

103 *See, e.g.*, Antoine Gara et al., *FTX Held Less than $1bn in Liquid Assets Against $9bn in Liabilities*, FIN. TIMES (Nov. 12, 2022), https://www.ft.com/content/f05fe9f8-ca0a-48d5-8ef2-7a4d813af558.

Given this analysis, though, the FTX debacle is not an indictment of blockchain technology itself, or the possibility for privately produced digital currencies existing alongside those issued by central banks. It is instead an example of why governance standards have emerged in the exchange of abstract financial instruments, and why these standards have eventually received regulatory definition to a level that permits empirical identification associated with public financial institutional variation.[104] It also emphasizes a reason for distinguishing relatively tight and loose regulation of cryptocurrency activities that has animated this analysis. To reason through analogy, if tight regulations on banks prevent them from engaging in a set of investment activities that the banks' scale or informational role permits, this creates an opportunity for non-depository institutions to engage in those activities in a relatively less regulated way.[105] While the ambit of U.S. regulatory authorities engaged in consumer protection is primarily domestic, the global nature of digital currency markets means that jurisdictional competition will create a riskier system in jurisdictions that are more loosely regulated than the United States. This emphasizes the problematic incentives created by exchange functions in capital markets more generally, and how those governed by less transparency or reliable auditing will fool both institutional and retail investors alike in a context of historical gains. Put more simply, in global digital currency markets, well-regulated entities will have shadow versions that benefit from regulatory arbitrage, just as tightly regulated depository institutions have shadow banking counterparts that operate in areas that have been deemed off limits for banks strictly construed.

The FTX example highlights how this analysis of the potential for self-regulation could come across as overly rosy absent recognition of the role that existing public regulation does play in the same financial markets that have benefited from the specific forms of self-regulation already described. Banks, exchanges, and securities issuers are all subject

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104 *See* La Porta et al., *supra* note **Error! Bookmark not defined.**.

105 From the perspective of law and economics alone, shadow banking presents a range of definitional, theoretical, and governance challenges. *See* Hossein Nabilou & Alessio M. Pacces, *The Law and Economics of Shadow Banking, in* RESEARCH HANDBOOK ON SHADOW BANKING 7, 7–46 (Iris H.-Y. Chiu & Iain G. MacNeil eds., 2018).

to considerable regulatory oversight,[106] such that many of the cited studies' identification strategies are taking a nation's regulatory framework as given for the purposes of the analysis. This suggests a polycentric complementarity like that displayed through the way in which exchanges can create terms for securities issuers that would not emerge absent the centralized exchange function. At a minimum, exchange of abstract financial instruments depends fundamentally on credible enforcement, which suggests a minimum level of impersonal enforcement of economic institutions as a necessary complement to scalability of a given market.[107] This is potentially an input to the notable premium that listing on the largest U.S. based exchange carries with it, directly suggestive of strong complementarities in self-regulation within a broader regulatory framework that credibly and impersonally enforces economic rights.

Interestingly, though, the reliably automatic nature of many cryptocurrency networks is what makes them effective at coordinating pseudonymous, and therefore fundamentally impersonal, exchange of economic value. This characteristic that makes them desirable for pseudonymous online transactions also exemplifies the technological margins of digital currencies that do productively make aspects of them self-regulating.[108] Certain terms of economic exchange are automatic and

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106 *See generally* FABOZZI ET AL., *supra* note **Error! Bookmark not defined.**.

107 In the context of Native American (or "American Indian", as certain tribes prefer) reservations, the relatively inferior and chronically uncertain treatment by the federal government arguably led to systematically lower development. *See, e.g.*, Eric Alston et al., *The Chronic Uncertainty of American Indian Property Rights*, 17 J. INST'L. ECON. 473, 473–88 (2021). This is a specific example of the more general phenomenon of how socially beneficial institutions act as a scalar mechanism in facilitation of voluntary interactions within a given social order. These interactions importantly include the economic and financial, such that one way to understand normatively preferable economic and financial institutions is the means by and extent to which they scale economic and financial activity, given the same underlying set of inputs. For a more extensive exposition of this synthesis of institutional and complexity theory, see ERIC ALSTON ET AL., INSTITUTIONAL AND ORGANIZATIONAL ANALYSIS: CONCEPTS AND APPLICATIONS 307–15 (Marguerite Dupree et al. eds., 2018).

108 For a discussion of the governance benefits and legal implications of automatically executing protocols, *see* NARAYANAN, *supra* note 45 and DE FILIPPI & WRIGHT, *supra* note **Error! Bookmark not defined.**. These self-regulating m argins can be understood as a private constitutional framework, with many of the

irreversible—although this limits the scope of contracts tractable to smart contracting,[109] it also reduces the need for ex-post enforcement of contractual terms in those cases suited to automated resolution. Credibly automatic enforcement is just one technological margin that reduces the costs of regulation through self-regulatory characteristics being embedded in protocol design choices. Other examples surround the innate transparency of most cryptocurrency networks, and how this transparency lends itself to enforcement of criminal activity taking place directly, such as movement of proceeds from a network or exchange hack,[110] as well as indirectly, in cases of drug trafficking and money laundering.[111] Furthermore, the incentive problems on the part of firm controllers that beget regulatory intervention can potentially be ameliorated through distinct forms of distributed governance that blockchain technology facilitates—the DAI stablecoin's reserve assets are not only publicly known, but their ongoing governance is subject to community control. This means self-regulation in digital currency markets is facilitated through protocol design, transparency, and distributed governance.

Finally, the level of community engagement surrounding cryptocurrency networks can both bewilder and bemuse observers. Whether it be skepticism of traditional monetary institutions or large-scale financial intermediaries, those that actively participate in the governance processes of these networks tend to value transparency,

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constitutional, political, and economic concerns that can entail. *See* Eric Alston, *Constitutions and Blockchains: Competitive Governance of Fundamental Rule Sets*, 11 CASE W. RSRV. J.L. TECH. & INTERNET 131, 134 (2020).

109 There are numerous margins by which real world exchange, and the property and contract institutions supporting this exchange, are not tractable to automated resolution. For a law and economics perspective on these limitations, see*, e.g.*, Benito Arruñada, *Blockchain's Struggle to Deliver Impersonal Exchange*, 19 MINN. J.L. SCI. & TECH. 55, 57 (2018).

110 *See* Ryan Lucas, *DOJ Arrests New York Couple and Seizes $3.6 Billion in Bitcoin Related to 2016 Hack*, NPR (Feb. 8, 2022), https://www.npr.org/2022/02/08/1079220600/doj-arrests-new-york-couple-and-seizes-3-6-billion-in-bitcoin-related-to-2016-ha.

111 *See* Andy Greenberg, *The FBI Finally Says How It "Legally" Pinpointed Silk Road's Server*, WIRED (Sep. 5, 2014), https://www.wired.com/2014/09/the-fbi-finally-says-how-it-legally-pinpointed-silk-roads-server/.

accountability, and adherence to protocol. This means competitive firms that better achieve these aims are more likely to succeed, and community members are intrinsically motivated to observe ongoing governance of processes beyond their individual financial benefit. As the example of front-running and ex-post criminal enforcement both indicate, actions detrimental to a given network's integrity can be observed relatively quickly, although it should be noted that distributed governance also can be prone to deadlocking like traditional public democratic ordering, such that community responses to governance challenges should not be seen as a panacea.[112] Nonetheless, the synergy of intrinsic community valuations with the unique characteristics of distributed ledger technologies (and their governance) makes this an additional margin by which self-regulation is arguably likely to be an emergent phenomenon within the cryptocurrency industry.

V. CONCLUSION

To regulate or not to regulate is *not* the question. Digital currency markets, and participants therein, resemble preexisting financial and capital markets. Units of permissionless cryptocurrencies behave like commodities, while units issued by startups and permissioned cryptocurrency networks more closely resemble securities. Stablecoin issuers share many characteristics with depository institutions, and cryptocurrency exchanges serve similar functions to those of the enduring organizations that have long facilitated exchange of financial instruments worldwide. The lessons from these existing financial markets suggest that the optimal level of public regulation to protect consumers is non-zero, although this regulatory role is one that permits (and benefits from) considerable industry self-regulation in the world's most liquid and deep financial markets. This suggests that industry self-regulation will therefore play a central role in the complex balance of public and private institutions that serve to ameliorate the incentive

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112 For resolving certain incentive conflicts among participants to a joint enterprise, the field of corporate governance may offer as many institutional design solutions as do more decentralized public democratic contexts frequently evoked by cryptocurrency proponents. *See, e.g.*, Sinclair Davidson & Jason Potts, *Corporate Governance in a Crypto-World* (May 6, 2022) (unpublished manuscript), https://dx.doi.org/10.2139/ssrn.4099906.

problems inherent to the impersonal and intertemporal exchange of economically valuable units of account that digital currency markets centrally entail.

It should be emphasized in closing that this analysis is non-normative with respect to the applicability of distinct regulatory authorities to digital currency activity. The motivation herein is primarily descriptive, identifying areas of digital currency activity most tractable to self-regulation, areas already subject to considerable regulatory authority, and others that are unlikely to continue to be lightly regulated due to the factors identified throughout. It is only when distinct information asymmetries and incentive problems surrounding market manipulation have been clearly identified that the challenging question can be approached of how to best regulate to protect the consumer given these specific issues. This is also not to take a regulatory positivist view that any policy treatment will achieve its intended consequences without harmful unintended consequences. The numerous critiques of existing regulatory authorities (and the costs and distortions their policies create) are non-trivial and should be assessed in light of each policy's intended benefits weighed against its potential for unintended consequences. Yet absent a clear understanding of this complex and rapidly evolving industry, including the margins where beneficial self-regulation is likely, the chance for ill-fitting public regulation only increases. This analysis serves to argue that while the digital currency industry's self-regulatory potential is greater than skeptics acknowledge, the writing is on the wall that further regulation of these markets is coming from US financial regulatory authorities. This analysis is thus intended to clarify the incentive margins most likely to demand regulatory treatment due to their similarity to other incentive problems in financial markets.

The history of financial markets in terms of exchange of capital or commodity instruments is not one that provides an unambiguously optimistic vision for self-regulation to benefit the retail consumer; where information asymmetries are high and competition is low, the gains from market manipulation can exceed the costs, suggesting that cryptocurrency and DeFi exchanges are a natural locus for public regulation of digital currencies more generally. This likelihood is only strengthened given the pseudonymous nature of cryptocurrency networks and the inability of authorities to shut them down altogether;

exchanges and traditional financial intermediaries thus become more important regulatory loci due to the predominant use of them to convert digital currency profits into real economic purchasing power. Nonetheless, permitting exchanges considerable latitude to define the standards under which they comply with regulatory requirements is one example where less stringent regulation has been argued to harness industry complementarities in ways likely to also apply in the case of digital currencies.

More unique to digital currency industry participants, though, is the fact that characteristics of blockchain technology and the way in which the industry has attracted users that radically value transparency and distributed governance of financial activity both provide a margin for self-regulatory potential that should make public regulators optimistic. Existing examples of successful criminal prosecutions years after the fact stand as ample testaments to the enforcement benefits of an immutable ledger. The landscape with respect to digital currency industry self-regulation is thus not a simple one but nonetheless provides considerable margins for optimism even as some measure of public regulation of large-scale exchanges and stablecoin providers is forthcoming. Furthermore, where industry participants intrinsically value the innovations in governance that have emerged, the recognition that self-regulation can preempt more stringent (or ill-fitting) public regulation is likely to be even more predictive of self-regulation substituting for or complementing more overarching public governance.

In a context where users with criminal intent can mask their IP address and continue to easily access these networks, this suggests that regulators hoping to ban their use altogether should instead consider harnessing the self-regulatory margins digital currency actors provide to facilitate honest use and innovation in this transformative digital asset class. As the global economy increasingly integrates and digitizes, the importance of reliably scarce digital units of account will similarly grow. Rather than attempting to prohibit the inevitable, U.S. regulators can continue to secure the role of U.S. financial markets as world leaders by embracing the self-regulatory potential of the industry while monitoring those margins whose similarity to quintessential problems with firm scale and information asymmetries in financial markets make them more suitable loci for public regulatory enforcement.

Like with other complex social questions, the nature of the digital currency industry's self-regulatory potential is thus non-binary. Given that the large-scale voluntary adoption of digital currencies is necessary to achieve efficient scale of production governed by strong network effects, the reputation of digital currencies creates self-regulatory motives within the industry. Furthermore, low entry costs and high levels of competition in digital currency issuance also arguably create incentives for well-regulated cryptocurrency networks. Even stablecoins, with stronger network effects and higher entry costs, display self-regulatory potential based upon competitive innovation in terms of the transparency and governance of reserve assets. This analysis of the margins of digital currency activity tractable to self-regulation is thus useful to industry participants as well as adds to the perennially vibrant area of law and economics scholarship situated at the intersection of private and public ordering.