BLOCKCHAIN CODE AS ANTITRUST

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ABSTRACT

In this Commentary, we show that blockchain may supplement antitrust law, especially in situations where the rule of law does not fully apply. Against this background, we detail what needs to be done for blockchain and antitrust to achieve greater decentralization, together, from both a technical and legal standpoint.

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I. INTRODUCTION

The rule of law does not govern all human interactions. Sometimes, the state bypasses legal constraints and evades accountability mechanisms, as documented by the World Justice Project.[1] Other times, jurisdictions are mutually unfriendly and refuse to enforce foreign judgments[2] or are simply

1. *See* WORLD JUSTICE PROJECT, WJP RULE OF LAW INDEX 2020 (2020), https://worldjusticeproject.org/sites/default/files/documents/WJP-ROLI-2020-Online_0.pdf [https://perma.cc/2VW9-NR82] (showing that the rule of law is continuing to see a negative change worldwide for the third year in a row, and more specifically, that government powers are not as effectively limited by the legislature and the judiciary, nor subjected to independent auditing).

2. *See* Yuliya Zeynalova, *The Law on Recognition and Enforcement of Foreign Judgments: Is It Broken and How Do We Fix It?*, 31 BERKELEY J. INT'L L. 150, 151 (2013) (indicating that the enforcement of U.S. court judgments abroad can prove especially difficult in light of divergent rules on jurisdiction, requirements for special service of process, reciprocity, and some foreign countries' public policy concerns); *see also* Samuel. P. Baumgartner, *How Well Do U.S. Judgments Fare in Europe?*, 40 GEO. WASH. INT'L L. REV. 173, 173 (2008) (suggesting that U.S. judgments face significant enforcement obstacles in Europe); Yaad Rotem, *The Problem of Selective or Sporadic Recognition: A New Economic Rationale for the Law of Foreign Country Judgments*, 10 CHI. J. INT'L L. 505, 508 (2010) (highlighting that China's courts rarely recognize foreign judgments, despite Chinese law formally entertaining the possibility of doing so); Brandon B. Danford, Note, *The Enforcement of Foreign Money Judgments in the United States and Europe: How Can We Achieve a Comprehensive Treaty?*, 23 REV. LITIG. 381, 417 (2004) (suggesting that, in the absence of a judgments treaty with the U.S., foreign nations have no incentive to enforce U.S. judgments in their own courts and will often choose not to do so).

unable to detect illegal behaviors.[3] Nonetheless, other means can increase the common good[4] where application of the rule of law falls short.

Against this background, we intend to show that blockchains are a great candidate for increasing the common good. More specifically, we show that blockchains can complement antitrust law in realms where the latter is inapplicable or underenforced.[5]

Blockchains create trust between contracting parties by eliminating top-down control. The absence of top-down control in turn leads to increased consumer welfare by opening economic opportunities, or differently said, by freeing individuals from economic coercion.

Antitrust laws share that objective, but there is a catch. Blockchains can supplement antitrust law only if the latter does not impede blockchains' development. The law should thus support the decentralization of blockchains so that blockchain-based mechanisms may take over (even if imperfectly) where economic transactions escape antitrust laws.

With that in mind, law and technology should be thought of as allies—not enemies—because they feature complementary strengths. Doing so leads to a new "Law and Technology" approach,[6] the advantages of which are twofold: an increase in the number of transactions by virtue of the trust that blockchain engenders (discussed in Part II) and an overall increase to the degree of decentralization of economic transactions (discussed in Part III). On that basis, adapted enforcement policies and a renewed regulatory framework can promote the above-mentioned approach (discussed in Part IV).

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3. *See* John M. Connor, *Cartel Detection and Duration Worldwide*, COMPETITION POL'Y INT'L: ANTITRUST CHRON., Sept. 2011, at 2, 4 (underlining that the percentage of detected cartels is only between 10% and 33% in the post-World War II era).

4. "Common good" is defined as "the common goal of all those who promote justice in a community . . . ." *Common Good*, THE OXFORD DICTIONARY OF PHILOSOPHY (2d rev. ed. 2008), https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095627569#:~:text=Quick%20Reference,share%20in%20the%20just%20arrangements (last visited Nov. 12, 2020).

5. The present Commentary is entitled "Blockchain Code *as* Antitrust," precisely for the reason that blockchain may *supplement* antitrust, rather than *replace* it.

6. *See* Thibault Schrepel, *Law and Technology Realism*, MIT COMPUTATIONAL L. REP. (Aug. 14, 2020), https://law.mit.edu/pub/lawandtechnologyrealism [https://perma.cc/G72H-AU83] (describing the current "Law and Technology" approach as one in which law and technology are opposed to one another).

II. BLOCKCHAIN AND TRUST

Despite being static,[7] game theory has proven useful for analyzing the dynamic of business transactions (games) among companies (players).[8] This application of game theory allows us to understand the chief role of the rule of law in economic exchange, which is to make games cooperative by binding players together. The same principle applies to blockchains' smart contracts (discussed in Section II.A). Blockchains applied in this way translate into an increase in the universal number of transactions, which is intrinsically beneficial to, but also has negative consequences for, our society (discussed in Section II.B).

A. A PRIMER ON GAME THEORY AND BLOCKCHAIN

In game theory, Nash equilibrium is a non-cooperative game[9] outcome whereby no players can independently change their position and be "better off." One may find a Nash equilibrium for every finite game. That being said, the Nash Equilibrium of a particular game is not necessarily Pareto-optimal, i.e., a state in which the improvement of one player's situation comes only at the expense of another. In other words, there are non-cooperative game results in which one participant may be better off, but which would not require another to make altruistic sacrifices.[10]

Game theory helps to understand *why* players may be willing to transact. When games are non-cooperative, each player ignores the strategy that other players will employ. Uncertainty about whether other players will follow a Pareto-optimal course of action can make players reluctant to enter into transactions. As a result, players are left with a stochastic Nash equilibrium in

7. *See* W. BRIAN ARTHUR, COMPLEXITY AND THE ECONOMY 183–84 (2014) (parsing conventional economic theory methodology, elements of which are based on the "rational" agent and consistent pattern-finding—a departure from "what economists call multiple equilibria").

8. *See generally* Christopher R. Leslie, *Antitrust Amnesty, Game Theory, and Cartel Stability*, 31 J. CORP. L. 453 (2006); *see also* Dennis W. Carlton, Robert H. Gertner & Andrew M. Rosenfield, *Communication Among Competitors: Game Theory and Antitrust*, 5 GEO. MASON L. REV. 423 (1997) (discussing the advantages of using game theory to analyze business transactions in an antitrust context).

9. A "non-cooperative game" does not allow for binding agreements. *See* LOUIS KAPLOW, COMPETITION POLICY AND PRICE FIXING 177 (2013) ("[C]ooperative games allow binding agreements while noncooperative games do not." (quoting JAMES W. FRIEDMAN, GAME THEORY WITH APPLICATIONS TO ECONOMICS 148 (1986))).

10. *See* Steven Kuhn, *Prisoner's Dilemma*, STANFORD ENCYC. OF PHILOSOPHY (Edward N. Zalta ed., Winter 2019 ed.), https://plato.stanford.edu/entries/prisoner-dilemma/ [https://perma.cc/SX3B-MTAA] (describing how, in the classic prisoner's dilemma, when both players stay silent, one may observe an improvement in Pareto's sense).

which each one decides whether or not to transact simultaneously with, and independently from, other players.[11]

The rule of law helps restore certainty by allowing each player to bind the others contractually. When a product is sold on a website, for example, whoever completes part of the transaction first (for instance, paying before receiving the product) is in a vulnerable position.[12] Laws can help create trust by constraining the co-contractors to comply with their respective obligations. In turn, trust transforms transactions into cooperative games, and thereby makes it in participants' individual interests to engage in productive transactions more often.[13] Such a transformation benefits the common good as an increase in the number of these transactions leads to more welfare creation.[14]

The same goes for smart contracts.[15] Each player is assured that the others will collaborate as they are tied by code, potentially, with automatic sanctions in case of breaches of contract.[16] Smart contracts give players more certainty about the game, leading toward Nash equilibria with Pareto-optimality.

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11. *See generally* Kirshnendu Chatterjee, Rupak Majumdar & Marcin Jurdziński, *On Nash Equilibria in Stochastic Games*, COMPUT. SCI. LOGIC 26 (Jerzy Marcinkowski & Andrzej Tarlecki eds., 2004), https://doi.org/10.1007/978-3-540-30124-0_6 [https://perma.cc/CHM5-PS63].

12. *See* Benjamin Klein, Robert G. Crawford & Armen A. Alchian, *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297, 298 (1978) ("After a specific investment is made and such quasi rents are created, the possibility of opportunistic behavior is very real.").

13. Laws are just one of many ways to create trust. *See* Steven L. Schwarcz, *Private Ordering*, 97 NW. U.L. REV. 319, 320 (2002) (highlighting sectors in which parties prefer private ordering over legal enforcement, such as public accounting standards-setting, the internet domain system, and the assignment of internet protocol numbers).

14. *See* EDMUND S. PHELPS, MASS FLOURISHING: HOW GRASSROOTS INNOVATION CREATED JOBS, CHALLENGE, AND CHANGE 81, 288–89 (2013) (arguing that the common good, and the "good life," have drastically increased thanks an increasingly complex economy and "productivity gains from exchange of heterogeneous inputs"); *see also* STEVEN PINKER, ENLIGHTENMENT NOW: THE CASE FOR REASON, SCIENCE, HUMANISM, AND PROGRESS 80 (2018) (explaining that new institutions have allowed millions of new transactions, leading "[the world's income to triple b]etween 1820 and 1900[,] . . . again in a bit more than fifty years[,] . . . only twenty-five years for it to triple again, and another thirty-three years to triple yet another time").

15. *See* Thibault Schrepel, *Collusion by Blockchain and Smart Contracts*, 33 HARV. J.L. & TECH. 117, 125 (2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3315182 [https://perma.cc/442Q-8RK6?type=image] (highlighting how the immutability of transactions that blockchain makes possible encourages colluders to trust one another).

16. *See Governance, Part 2: Plutocracy Is Still Bad*, VITALIK BUTERIN'S WEBSITE (Mar. 18, 2018), https://vitalik.ca/general/2018/03/28/plutocracy.html [https://perma.cc/N67W-TMW3] (deducing that blockchain is "trying to reduce social trust assumptions by creating systems where we introduce explicit economic incentives for good behavior and economic penalties for ban [sic] behavior").

Generally speaking, cryptographic rules are comparable to legal rules in that they both produce predefined outcomes. In the case of cryptography, trust results from the execution of code written in a computer language, rather than a human language.

B. TRUST WITHOUT ANTITRUST

Transforming a non-cooperative game into a cooperative one builds player confidence, which eventually translates into a greater willingness to transact.[17] That is one of the positive outcomes of the rule of law.

As we have seen so far, blockchain could supplement the rule of law in compelling cooperation, but the use of blockchain is not without drawbacks. An increase in the number of transactions also leads to an increase in the number of illegal ones. For example, the frequency at which firms agree to fix prices could rise.

Legal systems seek to prevent and sanction fraudulent conducts by striking a balance between legal certainty among participants and agency enforcement. Private law, including corporate and contract law, ensures trust between co-contractors, while public law, such as antitrust, seeks the broader objective of ensuring the proper functioning of markets.

But what about situations where gaps exist in the rule of law? For example, instances pertaining to cross-border issues in which jurisdictions are mutually unfriendly, internal issues in which a state does not enforce legal limitations on agents' or private entities' exercise of power, or where illegal practices go undetected? How can markets sustain a balance between certainty and enforcement? In other words, does the increase in the number of transactions resulting from widespread use of blockchains where the law does not apply still benefit the common good, despite the possible surge of illegal transactions along the way? Specifically, should developers design blockchain's applications with antitrust objectives in mind? And, if so, how?

17. The management consulting firm Bain & Company predicts that, by 2026, distributed ledger technology and blockchain could increase the volume of global trade by $1.1 trillion from $16 trillion today; in other words, continued use of the technology represents a 6.9% increase in world trade. Press Release, Bain & Company, Blockchain Could Increase Global Trade Volumes by $1.1 Trillion by 2026, Off the Current Base of $16 Trillion (Oct. 22, 2018), https://www.bain.com/about/media-center/press-releases/2018/hsbc-blockchain-report/ [https://perma.cc/J7EF-F9VH]. According to the consulting firm PwC, "[b]lockchain technology has the potential to boost global gross domestic product (GDP) by US$1.76 trillion over the next decade." PWC, TIME FOR TRUST: THE TRILLION-DOLLAR REASONS TO RETHINK BLOCKCHAIN 4 (2020), https://image.uk.info.pwc.com/lib/fe3111707564047570 1c74/m/2/434c46d2-a889-4fed-a030-c52964c71a64.pdf.

III. DECENTRALIZATION OF ECONOMIC TRANSACTIONS

Antitrust laws and blockchain are made of different substances.[18] As Lawrence Lessig put it, the first is "East Coast Code," while the second is "West Coast Code."[19] But they both promote the decentralization of economic opportunities. After showing how antitrust law and blockchain each proceed to ensure such decentralization (in Section III.A), we address how blockchain may help in maximizing it in the absence of antitrust law (in Section III.B).

A. DECENTRALIZATION AS A COMMON LANGUAGE

Antitrust law seeks to enhance consumer welfare by freeing markets from all forms of economic coercion resulting from anticompetitive practices.[20]

The Sherman Act, often the centerpiece of U.S. antitrust enforcement, has two sections. Section 1 prohibits companies from combining their resources to achieve illegal centralization,[21] and Section 2 prevents a firm from abusing its centralized market power to eliminate competition.[22] On top of the Sherman Act, the Clayton Act uses market power as a measure to prevent new entities from achieving harmful concentrations.[23] The acts ensure that market players' decision-making remains free from coercion, i.e., decentralized.

European competition law prohibits similar kinds of practices under the Treaty on the Functioning of the European Union Articles 101 and 102, and the European Commission Merger Regulation.[24] Nevertheless, European competition law permits centralization when it results from competition on the merits (i.e., from a decentralized process), like in the United States. The capture of economic power must indeed remain possible for all market players, none of whom should be able to live "a quiet life."[25]

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18. We will confine ourselves to discussing U.S. and E.U. antitrust laws. Because these jurisdictions have proven to be among the most active regulators of blockchain, we have decided to direct our regulatory proposals toward them. *See infra* Part IV.

19. *See* LAWRENCE LESSIG, CODE: VERSION 2.0, at 72 (2006) (defining East Coast Code as formal, congressionally enacted statutes and West Coast Code as the work of coders in Silicon Valley).

20. *See* Herbert Hovenkamp, *Is Antitrust's Consumer Welfare Principle Imperiled?*, 45 J. CORP. L. 101, 109 (2019).

21. *See* 15 U.S.C. § 1 (2012).

22. *See* 15 U.S.C. § 2 (2012).

23. *See* 15 U.S.C. § 12 (2018) (Clayton Act).

24. *See* Consolidated Version of the Treaty on the Functioning of the European Union art. 101, May 9, 2008, 2008 O.J. (C 115) 88–89; Consolidated Version of the Treaty on the Functioning of the European Union art. 102(a), May 9, 2008, 2008 O.J. (C 115) 89.

25. J.R. Hicks, *Annual Survey of Economic Theory: The Theory of Monopoly*, 3 ECONOMETRICA 1, 8 (1935) (arguing that achievement of a quiet life—defined as a life in which monopolists may not be bothering to get very near the position of maximum profit—

Blockchain's *raison d'être* is also to achieve decentralization through the absence of coercion. Emerging from the cypherpunk and open-source movements,[26] blockchain's decentralization is the primary reason why the technology could eventually disrupt centralized platforms, namely by providing users with trustful features.[27] Like the United States and Europe with respect to their respective antitrust laws, blockchain's communities nonetheless accept centralized outcomes when they emerge from decentralized processes. At the protocol layer, users welcome centralization if one core design is evidently better than others. At the application layer, centralization is welcomed when one idea turns out to be widely adopted. Here again, decentralization is seen as a means.

However, in neither layer is the pursuit of decentralization at all costs. Blockchain participants seek decentralization as a process toward efficiency, not as a moral or political stance. Rather, decentralization is a means for all market players to retain the ability to make decisions without having to follow the instructions of centralized economic power, i.e., what we have referred to as the decentralization of economic opportunities.[28]

Although the objective is similar, antitrust and blockchain seek to achieve it in different ways. Antitrust punishes anticompetitive practices and prevents harmful concentrations of market power while blockchain implements decentralization in its core functioning. In that regard, antitrust scholars continuously assess the decisions of courts and agencies in evaluating whether

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is indicative of the achievement of monopoly power and the reaping of the ultimate monopoly profits).

26. *See generally* David Chaum, *Security Without Identification: Transaction Systems to Make Big Brother Obsolete*, 28 COMMS. ACM 1030 (1985).

27. For instance, the absence of vertical control within public permissionless blockchains creates trust. Trust is a major feature explaining why users would use a technology or not. *See, e.g.*, Casey Newton, *The Verge Tech Survey 2020*, THE VERGE (Mar. 2, 2020), https://www.theverge.com/2020/3/2/21144680/verge-tech-survey-2020-trust-privacy-security-facebook-amazon-google-apple [https://perma.cc/F6WN-X4DR] (showing that trust is the first reason why part of the US population refuses to use Facebook).

28. *See* Thibault Schrepel, *Is Blockchain the Death of Antitrust Law? The Blockchain Antitrust Paradox*, 3 GEO. L. TECH. REV. 281, 308 (2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3193576 [https://perma.cc/4GRH-9NV8?type=image] (showing that unilateral practices are more likely to be implemented into private blockchains than public ones because, figuratively speaking, there is a pilot in the cockpit). Decentralization is all the more impactful for centralized firms' ability to retain autonomous decision-making power. *See, e.g.*, Rachel Frank, *Antitrust Law and the Protection of Open Standards, Interoperability, and Competition*, PUB. KNOWLEDGE (June 10, 2016), https://www.publicknowledge.org/blog/antitrust-law-and-the-protection-of-open-standards-interoperability-and-competition/ [https://perma.cc/86E7-8M9Z]; Thibault Schrepel, *The Subject of "Predatory Innovation" in the Google Hearing*, CONCURRENTIALISTE (Feb. 14, 2020), https://leconcurrentialiste.com/predatory-innovation-google-hearing/ [https://perma.cc/PUC2-UWYC].

antitrust *enforcement* is in line with the purpose of the law. Similarly, one may question whether the *design* of blockchains enables the optimal level of decentralization, especially where antitrust laws are inapplicable.

B. BLOCKCHAIN'S OPTIMUM DECENTRALIZATION

In the current digital economy, most companies develop products and services on top of the infrastructure they create. In contrast, blockchains can facilitate more decentralized industry structures, by allowing markets to split into two layers: a foundation layer (or an "infrastructure" layer) with numerous participants, and a "network" layer that connects providers.

When no one provider can exercise a direct form of control on the foundation, no one blockchain participant can possibly abuse any natural monopoly at that level. The fact that a network will not suddenly change its rules makes participants more willing to join that network.[29] Because the foundation layer may help decentralize economic opportunities by preventing one layer's having leverage over another, it is beneficial to analyze the foundation layer further.

The foundation layer can be either private/permissioned (or "consortium") or public.[30] Permissioned layers have historically been considered easier to adopt because of their more familiar security model,[31] though more recently, we have seen increased adoption of public blockchains in the context of enterprise as well.[32] The ongoing stable operation of public

29. In public blockchains, the network layer cannot be changed unilaterally to fit one participant's own interests. *See Engineering Security Through Coordination Problems* (May 8, 2017), VITALIK BUTERIN'S WEBSITE, https://vitalik.ca/general/2017/05/08/coordination_problems.html [https://perma.cc/25NK-2VZW] (articulating the effectiveness of light client techniques in preventing hostile cartels of participants from engaging in unfavorable or fraudulent conduct without participant consent). The case is different for *centralized* products and services. *See, e.g.*, Casey Newton, *Twitter Officially Kills Off Key Features in Third-Party Apps*, THE VERGE (Aug. 16, 2018), https://www.theverge.com/2018/8/16/17699626/twitter-third-party-apps-streaming-api-deprecation [https://perma.cc/JGH5-UW7P] (illustrating the situation of API changes breaking third-party applications dependent on some underlying centrally controlled network); *see also* Thibault Schrepel, *Predatory Innovation: The Definite Need for Legal Recognition*, 21 SMU SCI. & TECH. L. REV. 19, 22 (2018) (defining "predatory innovation" as "the alteration of one or more technical elements of a product to limit or eliminate competition").

30. KEVIN WERBACH, THE BLOCKCHAIN AND THE NEW ARCHITECTURE OF TRUST 58 (2018) (explaining the functioning of permissioned blockchains).

31. Permissioned layers feature similarities with the infrastructures outside the blockchain.

32. *See, e.g.*, Press Release, EY, EY Launches Baseline Protocol, an Open Source Initiative for the Public Ethereum Blockchain (Mar. 4, 2020), https://www.ey.com/en_gl/news/2020/03/ey-launches-baseline-protocol-an-open-source-initiative-for-the-public

blockchains over time is likely to alleviate concerns that their security model is unproven.

Additionally, arguments that public chains are "anarchic" and therefore unsuitable for enterprise use are increasingly losing ground. Foundation layers with no central points of control are fully compatible with higher-layer applications that add such points of control as needed; a historical precedent of such practice being corporations using decentralized networks such as BitTorrent to distribute files that they centrally upload.[33] Hence, all in all, the adoption of public blockchains will likely continue to increase since they can also serve private uses. For this reason, we shall compare private and public foundation layers when it comes to our subject.

When evaluating the gains that a blockchain-based structure provides in terms of maximizing decentralization, a few key questions are useful:

- Is the underlying blockchain (foundation layer) private or public?
- To the extent that *private* components exist:
    - Are there legal barriers preventing incumbents from blocking legitimate new participants attempting to join?
    - Is the governance structure providing incumbents equal or similar control to that of centralized firms?
- If the blockchain is *public*:
    - Is joining the network technologically and legally barrier-free? For example, is public open-source software for performing all necessary functions available?
    - What is the type of consensus algorithm? How resilient is the network against commonly known attacks? What are the risks that one or a small group of participants will capture the system? How quickly could attacks or capture happen?

When the blockchain is public, resistant to the most well-known attacks, and free to use, it maximizes decentralization by sharing control amongst all participants. This optimal blockchain design is the ideal supplement to

-etherum-blockchain [https://perma.cc/MH38-64PK] (illustrating the proliferation of public blockchain in enterprise applications).

33. *See, e.g.*, Ryan Paul, *Exclusive: A Behind-the-Scenes Look at Facebook Release Engineering*, ARS TECHNICA (Apr. 5, 2012, 11:30 AM), https://arstechnica.com/information-technology/2012/04/exclusive-a-behind-the-scenes-look-at-facebook-release-engineering/ [https://perma.cc/AP4F-DFAT].

antitrust law that can ensure decentralization of coercive economic power, because no single dominant player controls the infrastructure layer.

Of course, this optimal blockchain design will not preclude all anticompetitive practices from being implemented, but it will drastically reduce them at the infrastructure layer.[34] Part IV discusses how policymakers should take this advantage into account.

IV. THE REGULATORY PATH TOWARD DECENTRALIZATION

Ensuring decentralization via blockchain requires adaption of antitrust and regulatory policies (discussed in Section IV.A). It also has long-term implications, namely, shifts in the way we approach the matter of law and technology (discussed in Section IV.B).

A. SHORT-TERM IMPLICATIONS

We have shown that blockchain can be used to enable new transactions that decentralize the economy. For that reason, we encourage antitrust agencies to engage in two complementary actions.

First, agencies should welcome blockchain as an ally, and focus on enforcing the law against the artificial centralization of blockchain ecosystems, i.e., centralization that does not result from a competitive process.[35] If, on the contrary, antitrust agencies were to use their enforcement power toward all practices that result from the characteristics of blockchain—such as making information public—they could put the entire blockchain ecosystem at risk by destabilizing internal governance mechanisms and removing an essential part of the technology's value.

In addition to adequate enforcement, antitrust agencies should set up various mechanisms to promote blockchain optimum decentralization. Blockchain-supportive legal mechanisms require the creation of regulatory sandboxes and safe harbors to protect blockchain developers and users from antitrust concerns when, for example, designing compatibilities or changing consensus protocols.[36]

Sandboxes and safe harbors create comfort zones where the technology can be tested in ways that would otherwise be illegal or require overly

34. Schrepel, *Is Blockchain the Death of Antitrust Law?*, *supra* note 28, at 308 (explaining that private blockchain components tend to foster anticompetitive practices).

35. *See generally* Thibault Schrepel, The Theory of Granularity: A Path for Antitrust in Blockchain Ecosystems (Jan. 29, 2020) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3519032.

36. This is so long as blockchain is designed in such a way to maximize decentralization.

burdensome regulatory approval.[37] Sandboxes are testing grounds for businesses supervised by regulatory institutions. They could push blockchain developments toward more decentralization, precisely by incentivizing decentralized designs such as those we described earlier. If sandbox results are positive (i.e., they lead to decentralization of economic opportunities, thereby increasing consumer welfare), agencies might also consider promoting safe harbors, which are similar to sandboxes but with no limit in time or scale.

B. LONG-TERM IMPLICATIONS

In the long term, antitrust and blockchain both have concessions to make. Antitrust scholars and agencies must reconceptualize the law as an ally to technological developments instead of just a method of punishment for anticompetitive practices. Such reconceptualization implies permanently anchoring regulatory instruments in our legal systems. Only when the legal environment permits blockchain to flourish will blockchain prove to be particularly helpful where the law does not apply. As for blockchain developers, they must be willing to continue ensuring the process of decentralization, although it might create temporary barriers to greater adoption or scalability. Developers must also facilitate enforcement activities seeking to eliminate artificial forms of centralization.

There is a long way to go before both antitrust enforcers and blockchain developers fully agree to these concessions. Policymakers might be tempted to point out the existence of a consistent, dominant legal strategy of systematically punishing all illegal practices, while blockchain developers might be tempted to consistently ignore legal constraints. But neither approach would be a dominant strategy because the law cannot be applied to all illegal practices (e.g., because of detectability issues or mutually unfriendly jurisdictions), and technology cannot systematically trump the law. Here, depending on whether the technology collaborates or not, the law must adapt to technology's strategy. When technology chooses collaboration, the law must choose collaboration despite the concessions it may imply in enforcement activities. This joint strategy maximizes the common good. When technology chooses confrontation, the law must also choose confrontation and prevail, as it must remain the overriding constraint on our society.

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37. *See* Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law*, 33 BERKELEY TECH. L.J. 487, 540–41 (2018) (evaluating the benefits of sandbox and safe harbor models as applied to blockchain-based startups, the former of which "would encourage the kind of 'permissionless innovation' that was critical to the development of the Internet marketplace," and the latter of which would incentivize capable firms to "take sufficient steps to police themselves").

V. CONCLUSION

Trust in blockchain cryptographic rules makes games more cooperative, thereby spurring new transactions in areas where the law does not apply. Although new anticompetitive practices will arise along the way, blockchain's benefits of optimum decentralization will outweigh the negative impacts of such practices.

All genuinely decentralized blockchain infrastructures—such as we have defined them—should benefit from various legal protections, whether in law enforcement or regulation. Absent such protections, antitrust agencies would most certainly create a disincentive for all potentially interested parties to invest in such blockchains.[38] Without investment, decentralization would be suboptimal, in contradiction with the very objective of blockchain.

The most challenging part lies ahead of us in convincing governments and antitrust authorities that, despite the creation of some anticompetitive practices, the increase in the number of transactions should nonetheless be encouraged when it results from a technology designed in a way to achieve the same objective as antitrust law. A "Law and Technology" approach is the optimum way of playing the decentralization game.

38. *See generally* Robert S. Pindyck, *Irreversibility, Uncertainty, and Investment*, 29 J. ECON. LITERATURE 1110 (1991) (examining how uncertainty in market factors generally leads to less overall investment).