Blockchain Technology Impacting Property Rights and Transaction Cost Regimes

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Abstract

The convergence of the physical and virtual worlds radically challenges our legal, economic and other institutional regimes. In contrast, property rights and transaction cost regimes are still largely based on the pre-digital era. The blockchain architecture seems to offer a way for one Internet user to safely and securely transfer a unique piece of digital property to another in such a way that anyone knows that the transfer has taken place and no one can challenge the legitimacy of the transfer. Subsequently, transaction costs could diminish and property rights be unbundled and partially enforced on an unprecedented granular level. This paper explores the implications of blockchain technology for our established property rights and transaction cost regimes. It aims to discuss whether the established regimes and theories will prevail or will need to adapt to the advent of blockchain technology.

Keywords

Blockchain Technology, Property Rights, Transaction Cost, New Institutional Economics

Introduction

In contrast to physical goods, digital goods can be perfectly replicated and instantaneously distributed at near-zero marginal cost. This economic feature has spurred the distribution of free digital goods and services over the Internet. At the same time, this has complicated the protection and exchange of property and related interests. To safeguard these interests in a digital space, trusted intermediaries have frequently emerged to document, secure, and transfer digital property rights, such as through centralized digital rights management (DRM) systems. To prevent falsification or duplication, users must trust (and often pay) a single entity. As a result, transactions proceed with significant expense and delay (Fairfield 2015). Yet, it has been established that zero or near-zero expense drives Internet scalability. Hence, the commercial exchange of digital property has been limited, as digital property transactions are constrained by the cost of creating centralized trusted authorities.

The Internet of Things (IoT) and the convergence of the physical and virtual world leads to the creation of all kinds of digital property, such as digital signatures, digital contracts, digital keys (to physical locks or to online lockers), digital ownership of physical assets such as cars and houses, digital stocks and bonds, and digital money. Any machine-to-machine communication (M2M) requires autonomous, seamless, and real-time transactions of property and associated rights at an unprecedented granular level (Pureswaran and Brody 2015).
Blockchain technology and the pioneer example of Bitcoin (Nakamoto 2008) have been referred to as trustless public ledgers (TPL) or distributed ledger technology (DLT). Such technology allows for tracking and transferring property ownership. Blockchain is a collaboratively maintained database. Participants' computers regularly update the database using a 'consensus mechanism'. Due to complex cryptography, modifications – once settled – are rendered unchangeable; thereby, the data can be used as a reliable proof of ownership. Accordingly, blockchain technology enables two anonymous parties to securely reach a consensus by exchanging information over an unreliable and potentially corruptible network (i.e., the Internet). In this case, property and associated rights are exchanged through a distributed network that does not require reliance upon a central intermediary. Only the owner of an asset can send the asset and only the intended recipient can receive it. The asset can only exist in one place at a time, and everyone in the network can validate transactions and ownership of all assets at will anytime.

In this context, this exploratory paper discusses how blockchain technology may cause disruptive changes to the established property rights and transaction cost regimes, thereby affecting the economic interaction of individuals, the structure of organizations, and the economy at large.

**Property Rights and Transaction Costs as Determinants of Economic Activity**

The distribution of property rights and the existence of transaction costs determine a society’s economic activities (Coase 1937; Williamson 1975). The division of labor and specialization reduce scarcity and require control over goods and exchange of goods, which – in turn – are determined by property rights as "socially recognized rights of action" (Alchian and Demsetz 1973: 17) attached "to a physical commodity or service" (Demsetz 1967: 347).

Property rights subsume four individual rights, the right to use a good, the right to earn income from a good, the right to transfer a good to others, and the right to use up a good (Alchian and Demsetz 1973; Demsetz 1967). The value of goods and services depends on the rights assigned to them. The development, allocation, transfer, and enforcement of property rights are generally associated with transaction costs (Williamson 1975), which arise due to unforeseen contingencies and the costs of writing and enforcing a contract (Tirole 1999).

Property rights and transaction costs are major determinants of economic activities. In 1970, transaction costs amounted to more than 55% of the US GNP (Wallis and North 1986); such costs have been used to explain negative externalities in light of poorly defined property rights (Coase 1960). Due to the fundamental economic importance of property rights and transaction costs, changes to established regimes entail fundamental changes to all kinds of economic activities.

Technological progress serves as an exogenous factor that affects the specification of property rights and the occurrence of transaction costs (Furubotn and Pejovich 1972). Blockchain-based public ledgers are a rather new form of property rights management allowing for radically reducing transaction costs (Tapscott and Tapscott 2016).

**Blockchain Technology-Based Transactions of Digital Goods**

Blockchain technology may enable a distributed Peer-to-Peer solution for property exchange without a central trust-ensuring third party. The virtual exchange of property and associated rights has struggled with the non-scarcity challenge of digital property. The non-scarcity attribute of digital goods and services allows for potential duplication, which makes it difficult to "make information into property" (Arrow 1996: 125). To prevent duplication, intermediaries have historically provided costly centralized solutions (e.g., clearing houses), thereby placing an artificial restriction on the scope of transactions.

From a legal perspective, property refers to "the law of lists and ledgers. County land records, stock certificate entries, mortgage registries, UCC [Universal Copyright Convention] filings on personal

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1 Nakamot has been linked to the Australian entrepreneur Craig Wright (Greenberg 2016). However, the real identity of Satoshi Nakamoto remains unknown and subject of speculation (Bitcoinwiki 2018).
property, United States Copyright and Patent registries of interests in intellectual property, bank accounts, domain name systems, and consumers' Kindle eBook collections in the cloud – all are merely entries in a list, determining who owns what" (Fairfield 2015: 805). Likewise, blockchain is simply a publicly accessible, cryptographically secured [ledger] of property interests.

Crypto-property and associated rights (i.e., cryptographically secured and controlled property rights) can be directly transferred between peers. However, a settlement risk remains for physical and hybrid property. To mitigate that risk, property registries (Mizrahi 2015) or blockchain notaries initiate the virtualization of property; that is, they validate that someone is the rightful owner of physical property. Such 'tokenization' of physical property requires unique property identifiers (IDs). In the case of a dispute, property registries have to ensure the physical settlement of a transaction. The documentation of physical settlement could be automated by multi-signature escrow transactions (Mizrahi 2015). This demands over-the-top (public or private) certification entities or service providers. Crypto-property could provide new ways to formalize and secure digital relationships, making them more functional than their paper-based predecessors.

Impacts of Using Blockchain Technology

Although this paper highlights the impact of blockchain technology on property right and transaction cost regimes, we acknowledge that so far, most economic impacts of blockchain technology occur in the context of monetary transactions. In addition to democratizing financial transactions and reducing transactions costs, the growing resource intensity of, for example, Bitcoin's proof of work (PoW) consensus formation algorithm is criticized for being unsustainable due to its fast growing need for computing power, i.e. energy (Deetman 2016), and has already been challenged by other consensus mechanisms such as proof of stake (PoS; e.g. Casper) and node-to-node (N2N; e.g. R3 CEV Corda). As more people adopt blockchain-based solutions (i.e., as more nodes enter the network) the growing computing power of the entire network makes it difficult for a single entity to control more than 51% of it, which may increase its security and attractiveness through network effects (Economides 1996).

Affecting Property Rights and Transaction Costs

Technical progress has enabled people to create digital property. "Musicians, playwrights, journalists, photographers, artists, fashion designers, scientists, architects, and engineers all were beholden to record labels, publishers, galleries, film studios, universities, and large corporations that insisted these inventors assign their [...] property rights to what essentially are large rights management operations in exchange for less and less of their [...] value" (Tapscott and Tapscott 2016: 320).

Codifying property rights in software code could allow for economically viable documentation, delineation, unbundling, and – to a certain degree – enforcement of property rights. Each right could be tied to an individual blockchain token at virtually no cost. This could allow for enforcing property rights in a predefined manner without engaging legal or other intermediaries. Thus, using blockchain technology may reduce transaction costs by eliminating trust-ensuring third parties and by reducing opportunism and uncertainty based on deterministic and cryptographically secured promises. Crypto-property could provide a clear distinction of property and associated rights and allow two untrusting parties to reach a binding agreement and engage in a transaction. Furthermore, token-based transactions result in lower transaction costs, which in turn are likely to foster market-based exchanges and extend 'the market' compared to 'organizations/hierarchy' (Williamson 1975).

Smart Contracts

So-called 'smart' contracts are electronic transaction protocols that execute the terms of a contract (Fairfield 2015). Technically, they are programs stored on a blockchain that can control blockchain-based property and can be executed without the possibility of outside interference. Smart contracts differ from traditional contracts in terms of six characteristics (see Table 1) as they reduce mental and computational transaction costs, which were imposed by either principals or third parties – or their tools. They seem most suitable for transactional contracts or elements thereof (e.g., a spot market purchase).
Agreements that involve human performance can rarely be fully expressed in code or executed by a computer. Hence, smart contracts generally face a conflicting notion of (intended) determinism and the real-world requirement of flexibility and reversibility. They barely seem to be applicable to relational transactions, such as long-term employment, which are placed in a broader social context with implicit understandings embedded in behavioral aspects (MacNeil 1974). However, relational contracts govern many of today's economic interactions, with contingencies frequently unforeseen ex-ante. They are often purposefully incomplete and thereby "less costly and more robust than complete contracts" (Brousseau 2001: 85; MacNeil 1974).

**Smart Property**

So-called 'smart property' in the context of IoT may turn every device into a point economic value creation for owners and users, fostering 'catallaxies', a "special kind of spontaneous order produced by the market by people acting within the rules of the law of property, tort and contract" (Hayek 1978: 109). An example of smart property impacting property rights and transaction costs is that of decentralized ride-sharing apps. Based on a ride request in the form of a smart contract, the system searches and verifies participating cars, matches availability and current location [reduces search and information costs], sends the driverless car to the renter, disburses payment according to an ex-ante standardized agreement [reduces bargaining costs], and repeats the process when the vehicle reaches its destination. If a party breaches its obligations, the smart contract could automatically initiate a protocol to financially penalize the defaulting party, i.e., automatically enforce property rights, and provide the aggrieved party with a monetary remedy.

The economic implications of such a service could be manifold. A rental system could increase the utilization of cars and thereby reduce car sales, sales of car insurance policies, sales of car loans, and the income of traditional taxi and ride hail companies. Hence, the app could transfer parts of the transportation sector from a centralized model to a Peer-to-Peer model.

**Conclusion and Outlook**

Although – similar to previous ICT-based innovations such as the Internet and the web browser – no blockchain element is genuinely new, we concur that the interaction and complementarity of various blockchain elements create a potentially disruptive innovation (Avital et al. 2016; Iansiti and Lakhani 2017). However, so far, "no currently extant theory has provided an adequate foundation for bringing the virtues and values of property to the Internet" (Fairfield 2015: 843).

In line with Shirky's (2009: 105) observation that technologies "don't get socially interesting until they are technologically boring", we hope to stimulate a discussion regarding whether a wider diffusion of blockchain technology would impact (the theory of) property rights and transaction costs in a digital era (see also Loebbecke et al. 2018). Will theories have to be adapted to (new) technologies? Or vice versa, will researchers and practitioners have to interpret impacts of technological developments along established theory? And, with enough and appropriate technology, will there ever be a true saving of transaction costs at virtually no price? Will technology ever allow for "a free lunch"?
REFERENCES


