

Rethinking Money and Credit in a Cryptoeconomy: Securing Liquidity without the Need for Central Control of Issuance

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Abstract

We aim to show that functionalist definitions of money (unit of account, means of exchange, store of value, standard of deferred payment) shut down the broader question of what money is in the era of its digital redesignability, and instead limit the definition of money to operationalizing ‘fiatness’. We show that the basic functions of money (unit of account, means of exchange, store of value, standard of deferred payment) should be disaggregated and protocolized separately, because they are different building blocks of the social, and furthermore, that by understanding money as a set of protocols (and not as a “coin”), it can be redesigned to acquire further functionality. We first identify a different framing for the functions of money that emerges out of distributed issuance - money issued through a distributed exchange protocol. We then turn to perhaps the most conspicuous apprehension about mutually-issued tokens: how to secure their liquidity? We then show how a distributed issuance of credit can ensure that the economy does not freeze when there is a blockage in the distributed ledger matching process. In a system where all agents can participate in issuance within the distributed exchange protocol and network, when offer matching is mediated through a common asset (or unit of account), netting enables exchange and settlement to occur without the need to actually hold the common asset (or unit of account). It means a non-money-intermediated means of liquidity: a distributed monetary system that can secure liquidity without the need for central control of issuance/un-issuance of a money instrument. The distributed exchange protocol constitutes the backbone of a distributed clearing house and payment system. The goal of the mutual liquidity protocol we propose is not to issue credit with the objective of seeking an income stream (interest payment of debt), but a mutual responsibility for securing inter-temporal matching on a ledger. Credit-for-mutual-liquidity and equity-for-mutual-stakeholding represent a profound change in our understanding of the economic roles of debt and equity.

1. What changes with distributed issuance?

Amongst the prevalent critiques of cryptocurrencies coming from the mainstream of the economics profession - usually invoking bitcoin as their ideal type - is the contention that cryptocurrencies cannot be ‘money’ because they fail to perform each of the conventional ‘functions’ of money.¹ That is, they may offer a unit of account (it is easy to nominate your own unit of measure, but who is listening?), but they are not widely accepted as a means of exchange, and they cannot be a store of value because they are so volatile. The remarkable success of bitcoin - the fact that it even exists a decade on from its launch is itself remarkable, leave aside its current turnover, value and popularity - gets explained in terms of naive buyers, fraudulent users and speculative bubbles. The game-changing significance of bitcoin-as-money and, indeed, post-bitcoin innovation in cryptocurrencies, is reduced to advocacy of regulatory repression and conjecture about how quickly the bubble will burst.

This framing involves two key presumptions that we will challenge so as to open the path to a different agenda.

One presumption is that, in their monetary roles, *cryptocurrencies are coins that seek to replicate the functions of fiat currency*. By coins we mean centrally issued digital tokens designed to perform the functions of unit of account, store of value and means of exchange. Some crypto currencies are coins and perform these conventional money functions with varying degrees of success.²

But money should not be reduced to coins; nor to the conventional functionalist definition of money. This reduction

¹ For example, Krugman, Paul (2017): “Bitcoin is a more obvious bubble than housing was”. Business Insider, December 15; Krugman, Paul (2013): “Bitcoin is Evil”. New York Times, December 28; Rogoff, Kenneth (2018): “Cryptocurrencies are like lottery tickets that might pay off in future”. Guardian, December 10; Roubini, Nouriel (2019): “The Great Crypto Heist”. Project Syndicate, July 16; Roubini, Nouriel (2018): “Why Central Bank Digital Currencies Will Destroy Cryptocurrencies”. Project Syndicate, November 19; Roubini, Nouriel (2018): “The Big Blockchain Lie”. Project Syndicate, October 15; Stiglitz, Joseph (2017): “Bitcoin ‘Ought to Be Outlawed’”. Bloomberg News, November 29.

² There is no requirement in the functionalist definition of money that all roles are performed ‘well’; just that they are performed. Even with fiat currency, a high inflation currency is not a good store of value; a pegged currency is not a real unit of account, and fiat currency outside its state-of-issue is a poor means of exchange, with very high transactions costs.

effectively defers to fiat money as ‘real’ money and cryptocurrency as an aspiring, but always inferior, replica. Moreover, functionalist definitions of money (unit of account, means of exchange, store of value) do not define what money is, but only the roles that fiat money is called on to perform. If we start with fiat money, the functionalist definition of money immediately shuts down the broader question of what money is, or could be, in the era of its digital redesignability, and instead limits the definition of money to operationalizing ‘fiatness’.

Hence, we arrive at the second presumption to be challenged: if money is not definitionally centrally-issued coin, the capability of a distributed ledger protocol should open the possibility of distributed - as opposed to centralized - issuance. *With distributed issuance, we need not privilege the standard functionalist criteria for defining money, but instead look to conceiving of other definitional roles.*

In this paper, we first identify a different framing of the functions of money that engages the capability for distributed issuance. We then turn to perhaps the most conspicuous apprehension about mutually-issued tokens: *how to secure liquidity via the distributed issuance of credit, or how to ensure that the economy does not freeze when there is a blockage in the ledger matching process.*

2. Moneyness in a distributed ledger protocol

We need to loosen the shackles of the conventional ‘what is money?’ question. What if we start not from the concept of money (an absolute, singular category), but of ‘moneyness’? The latter invokes a spectrum where assets of all kinds have both value and some degree of liquidity and hence some attributes of money; or ‘moneyness’. The need to differentiate a discrete, categorical asset called ‘money’ disappears. Money roles then become a component of ‘asset’ markets, rather than a discrete domain separated from the ‘real’ economy.³

In this framing the focus shifts from an issue of trust in the state (trust in the exchangeability of the state-issued bits of plastic/paper and cheap metal for goods, services, assets, etc.) to trust in the blockchain (trust in the verifiability of an exchange ledger entry as expressing a change of ownership). In a ledger focus rather than a state focus, anything readily tradable and transferable on a blockchain has some degree of moneyness. Accordingly, *liquidity is not to be benchmarked to cash* - which would immediately invoke a fiat

norm - *but to transferability on a ledger*. Here, money is not ‘coins’, but a set of protocols and an artefact on them. It is more a set of verbs (accounting, netting, staking, issuing, matching), than a noun.

Further, if instead of central issuance, we look to the capabilities of distributed ledger technology, we see immediately that the *issuance of moneyness* can be decentralized: there can be mutual (p2p) issuance of this necessary artefact (i.e. distributed participation in the use of the ‘verbs’). Acceptance of an offer (a proposal for a ledger entry) from another agent generates a verifiable exchange on a blockchain. It can not only transfer titles to ownership of new goods and services, but of new ‘money’ too. An offer to issue, when accepted, brings a token into being. Verification on the ledger expires the token. In effect, each new exchange both initiates and eliminates a token. In this framing, money is issued so as to facilitate the ledger and once its ledger role is performed, the token expires. A new offer leads to a new token, not to be in perpetual circulation. This is a very different conception of money from that is associated with fiat, but if we think of the ledger framing, *settlement involves confirming the balance rather than transferring the coin.*

With distributed issuance we can immediately re-frame the roles that define money. Instead of the fiat specifications of unit of account, means of exchange and store of value, we can reframe the roles of tokens in a cryptoeconomy as a unit of account, means of exchange, means of ownership transfer and means of liquidity (transforming ‘money’ into a set of protocols). *Trade, ownership and liquidity are the three irreducible roles of tokens in a cryptoeconomy. And they can be defined as separate protocols.* Indeed, each role can be performed by a different token (different protocol), for if there is no circulating coin but instead verifiable ledgers, these three roles can be thought discretely without being reduced to a single ‘money’. We can consider each role briefly.

2.1. Re-framing the functions that define moneyness

A unit of account is fairly straightforward. Any money system needs a unit of account, and units of account are simply decreed. They are nothing but shared denomination agreements. For fiat, it is the state that decrees when it launches the official currency. In a distributed system the decree must be agreed in the launch of a token system, albeit that it remains open that other units of account could supplant the first instantiated one. This contestation is not uncommon for fiat currencies, too, in the case of new or unstable states, where the US dollar, for example, may operate alongside the state’s official currency.

³ On ‘moneyness’, see Dick Bryan and Michael Rafferty: *Decomposing Money: Ontological Options and Spread*. Journal of Cultural Economy. Vol 9, 2016, 27-42; Also Allan Malz: *Financial Risk Management: Models, History, and Institutions*. Wiley 2011; Salih Neftci: *Principles of Financial Engineering*. Academic Press, London 2008.

Medium of exchange is similarly a familiar monetary role: there is a direct parallel between offers and acceptances on a ledger and any other ‘on-line’ transaction. In a distributed system, the distributed exchange protocol *is* the medium of exchange.

Linking token issuance to ownership is less familiar, but it follows from treating tokens as assets with degrees of money-ness. Where there is no clear line between ‘assets’ and money, the issuance and transfer of stakes in other agents’ activities is akin to treating the stock market as a money market. As a protocol it takes form as a mutual stakeholding and risk-sharing agreement.

Defining a liquidity dimension of money-ness is the most important and perhaps controversial dimension of our depiction of the money-ness of tokens as a p2p credit issuance protocol. In the following sections it will be the focus of analysis, but it warrants brief introduction also here.

In conventional economics, liquidity is a presumed attribute of money, because the two are defined simultaneously: money is the most liquid of assets.⁴ But, as we have seen historically and especially in the last dozen years, economic events of illiquidity - the financial crisis of 2007-2008 and the 2019 repo market illiquidity are two conspicuous examples - serve to ‘isolate’ other assets from cash. The discount required to convert to cash becomes increasingly large. Framed this way, *responsibility for maintaining liquidity lies outside of the role of money: it is something regulators do to/in asset markets so as to create/restore liquidity; it is not a role of money to itself secure liquidity.*

In a cryptoeconomy without state regulators and central banks managing liquidity, liquidity must itself be brought inside the definition of the role of tokens (as protocols), and with mutual issuance of tokens, there must be *a set of protocols to secure the conditions of mutual issuance of liquidity.*

Before we address the issue of *how to think about the issuance of liquidity as a token function (a protocol) within a cryptoeconomy*, it is important to highlight the transformational significance of the combined framing of the *stake role of tokens* and the *liquidity role*. In conventional finance, there are two ways of funding investment: equity and debt. The stake role of tokens is akin to equity and the liquidity role to debt. But the differences between the conventional framing and the distributed issuance framing are critical. In the conventional economy, issuance of shares and debt are the two modes of raising capital, and least-cost calculations will determine the optimal combination in any context. But

⁴ See for example James Tobin: *Properties of Assets*, in *Money, Credit, Capital*. McGraw Hill 1981. Fabozzi, Modigliani & Jones: *Foundations of Financial Markets and Institutions*. Pearson 2009.

when these issues are framed inside a token economy the emphases are different. The objective is not to be framed as a least-cost method of funding, but as tools of ledger-based system building and consolidation: of mutual stakeholding and risk-sharing on the one hand and mutual issuance of liquidity on the other. In particular, *the goal of mutual liquidity protocols is not to issue credit with the objective of seeking an income stream (interest payment of debt) but a mutual responsibility for securing inter-temporal matching on a ledger.*

This process, critical to mutual issuance, warrants detailed consideration. Simply nominating a liquidity token does not explain a process of self-generating liquidity, and it is to this issue that we now turn.

3. Credit: an anthropological background

Offer matching recorded on a distributed ledger cannot be assumed to be instantaneous. There may be direct matches, but there may also be time delays, and these may require ‘links’ between other offers and acceptances before a ‘set’ of matches is achieved across a network (netting). This ‘indirect’ process could manifest as illiquidity if there were not some form of credit. But we should be careful in how we depict credit in this specific context. Credit is not the invention of banks or other money lenders: credit has its origins in the relations of the gift and counter-gift. This is a process explored by anthropologists, not economists, and it exists not around the profitability of exchange, but around social issues of honour and status - a social logic beyond profit extracting exchange.⁵

In the language of ledgers, the gift-giver can be said to make an offer to his counterpart whose acceptance incurs a social obligation. The offer is thus a potential social claim upon the other, who understands that if he accepts the gift (poison) he will be expected to produce a counter-gift, the timing of which is often left uncertain. In some sense the size of the counter-gift confirms the value of the original gift whose value fluctuates with whatever happens in the interval. The value of the gift depends upon the value of the counter-gift, which depends upon the social volatility of the time interval between gift and counter-gift. Actually, since the initial offer is within a range of possible offers and the counter-gift is selected from a range of counter-offers, the gift/counter-gift relationship is really actually the overlapping of two

⁵ Marcel Mauss: *The Gift. The Form and Reason for Exchange in Archaic Societies*. Routledge, London: 1990 [1950]; Pierre Bourdieu (1977): *Outline of a Theory of Practice*. Cambridge: Cambridge University Press. Ed Li Puma (2017): *Social Life of Financial Derivatives*. Duke University Press. Benjamin Lee (2016): *From Primitives to Derivatives*. In B. Lee & R. Martin (eds.) *Derivatives and the Wealth of Societies*. Chicago: University of Chicago Press. Benjamin Lee (2018): *Token as a Gift and as a Derivative*. ECSA Economic Papers.

spreads, with the alternative gifts and counter-gifts reflecting what might be called a "social volatility spread".

Since people in gift societies are constantly exchanging gifts and counter-gifts, each person or group has a "portfolio" of social claims and obligations - the forerunner to Perry Mehrling's "assets and liabilities" flow accounting and the entries in distributed ledgers - whose value depends upon what happens over time. If the original gift is the underlier, then the counter-gift is an option whose value depends upon its interaction with the other obligations in the portfolio; its value is fixed when it is exercised. All of this is done without money or ratio-scaled quantitative calculation.

We introduce the history of 'the gift' not in the aspiration of writing a history of credit, but to highlight the *importance of the inter-temporal spread in social relations*. Credit is, in this context, not first and foremost about 'borrowing' (leading to questions of debt levels, interest rates, default rates, etc.) but about the *form of mutuality over time, and indeed about the volatility that is innate to that relationship*. Credit as discussed in contemporary economics (around interest, debt servicing and spreads between borrowing and lending rates) is but a special case of the gift, framed in the depiction of profit maximizing as the natural state of affairs rather than a set of protocols.

4. Credit in a modern economy

A short-cut to an understanding of the role of credit in a modern economy can come from an engagement with the ideas of the famous early 20th century economist John Maynard Keynes. Keynes was the leading economic figure early to mid 20th century economics who framed the problem that *market interactions do not systematically secure the optimal balance of aggregate supply and aggregate demand*. Moreover, he was addressing these questions in the 1920's and 30's, at the time of the expiry of the Gold Standard for international money, where the critical question was what would replace gold as the foundation of money, and how a new monetary system would operate. The fact that he was analyzing the nature of money at a critical turning point in its history resonates with the current period and the initiatives of cryptocurrencies.

His answer from the 1920's was that it is the state that must 'back' money - called 'chartalist money'. His view was that while money could logically be denominated in any unit that has its own rate of interest (for example corn or coal, where the rate of interest is the change in its own price), the state's

money is superior for it is generally accepted and required for the payment of state taxes. A century on, with the capacities of cryptocurrencies, the notion that commodities could be money - provide the numeraire or unit of account - looks interesting and not purely hypothetical, and not at all challenged by the need to convert to the state's chosen unit of account in order to meet taxation payments. But once Keynes determined that the state should nominate the unit of account and provide the money, the possibility that there could be multiple monies performing different roles was eliminated. Cryptoeconomics offers the potential for vastly different answers, *but the core questions Keynes posed are broadly consistent with what we face in cryptoeconomics*.

What resonates from Keynes is the notion that *money comes into being as credit*. Money is not minted and distributed by the state: it is banks that create credit by making loans that then (eventually) re-enter the banking system as deposits. The state seeks only to regulate the conditions under which banks issue credit. Moreover, though it is not the focus of Keynes, money as a means of exchange historically came into being not to 'solve' the double coincidence of wants that constrains direct barter (as conventional economists often mistakenly contend), but as promises to pay and credit (i.e. akin to the logic of 'the gift').

According to Keynes, in his 1930 *Treatise on Money*,

"Money[-of-Account] comes into existence along with Debts, which are contracts for deferred payment, and Price-Lists, which are offers of contracts for sale or purchase."

The tokens in cryptoeconomics resonate with Keynes' insight. With distributed and mutual (p2p) token issuance rather than centralized (state) issuance, *money as a medium of exchange does not exist prior to the opening of a process of exchange: the offer*. An offer of a token in return for a commodity (be it a good, service or another financial asset) is itself the creation of money: first as available credit (the offer) which is matched (the mediation or 'medium' in the exchange) and validated and settled through the verifiable exchange of commodity-backed tokens.

5. Rethinking credit

We are usually inclined to think of credit and debt as being about financial institutions making loans for a house or car, with contracted terms of repayment of principal and interest.

⁶ Perry Mehrling (2014): The Economics of Money and Banking. Lectures Fall 2014, Columbia University. Perry Mehrling (2011): The New Lombard Street. How Fed Became the Dealer of Last Resort. Princeton: Princeton University Press.

⁷ Keynes, John Maynard (1936): *The General Theory of Employment, Interest and Money*. London: Macmillan, ch.17

⁸ Keynes, John Maynard (1930): *Treatise on Money*. London: MacMillan, p. 3.

But, in its simplest form, *credit is about a time interval involving money*: even ‘trade’ involves a time interval between paying for a commodity and receiving it. In many contexts, this may be a trivial observation: the coffee paid for before it is delivered is the customer giving credit to the coffee maker, where we see no significance in this time interval.

But in a distributed economy framing, this time interval is critical, for when ‘the offer’ is published, it becomes a line of credit, whether it be in the form of *commodity credit* (an offer to deliver output in the future) or *financial credit* (an offer of liquidity). Hence ‘the offer’ stands as an option on credit proper, where the *right to exercise the option* - to draw down on the line of credit by accepting the offer of credit - *is itself a form of liquidity*. Hence the offer is liquidity, and the acceptance of that offer brings (token) money into being. *This is a significant proposition. In a distributed cryptoeconomy the offer-as-line-of-credit is the starting point, and mutual (p2p) token issuance is its appearance.*

Keynes gave significance to this time interval. His focus was to account for the way agents deal with uncertainty, and the way the state manages potential illiquidity (and crisis) implied by uncertainty. This is of central importance also in a distributed cryptoeconomy, and we can follow Keynes’ approach. In 1933 he wrote an important essay called *The Monetary Theory of Production*:

“The distinction which is normally made between a barter economy and a monetary economy depends upon the employment of money as a convenient means of effecting exchanges - as an instrument of great convenience, but transitory and neutral in its effect. [...] That, however, is not the distinction which I have in mind when I say that we lack a monetary theory of production. An economy, which uses money but uses it merely as a neutral link between transactions in real things and real assets and does not allow it to enter into motives or decisions, might be called - for want of a better name - a real exchange economy. The theory which I desiderate would deal, in contradistinction to this, with an economy in which money plays a part of its own and affects motives and decisions and is, in short, one of the operative factors in the situation, so that the course of events cannot be predicted, either in the long period or in the short, without a knowledge of the behaviour of money between the first state and the last. And it is this which we ought to mean when we speak of a monetary economy.”⁹

⁹ Keynes, John Maynard (1933): “A Monetary Theory of Production” in D. Moggridge (ed.) 1973. *Collected Writings of John Maynard Keynes*, vol.

Consistent with this insight, in a distributed cryptoeconomy a token system cannot offer merely ‘monetised barter’ (or what Keynes called a ‘real exchange economy’): it must also provide credit (which Keynes described as linking the present to the future), and it must do so in a way that engages and motivates decisions of agents.¹⁰ In short, *we need protocols for securing liquidity in a distributed cryptoeconomy*.

6. Mutual credit

The issuance process for credit starts, as with other tokens, with the exchange offer: an agent makes an offer to the market for others’ acceptance of a quantum of tokens backed by a certain bundle of ‘outputs’, be they goods, services, capital or, indeed other tokens of a different denomination (we will use the term ‘commodities’, and hence ‘commodity tokens’, throughout to depict this diverse range of possible assets). Other agents will similarly back their issuance of a commodity token with a different bundle of outputs. Alongside these exchanges, the issuance of credit tokens (via offers and acceptances) will enable a time delay in the matching process that records and confirms the change in commodity ownership.

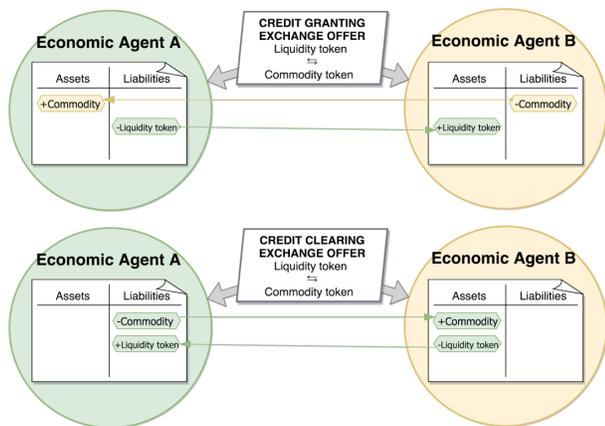
The issuance of credit tokens could present the same logic: an offer of credit, accepted and recorded as a credit transfer. But if this responds simply to and ‘rectifies’ mismatches in commodity exchanges, the problem is poorly addressed: illiquidity is shortened, but not resolved. A credit agreement is an automated ‘topping up’ of credit, such that when any credit is cleared by an act of exchange of liquidity tokens, the line of credit is topped up to its agreed limit. This ensures that credit offers are a constantly-adjusting stock, enabling credit itself to manifest as a flow.

Mutual clearance is specific to credit. It is the process of settling multiple debt balances. The need arises because of the intervals that occur in the absence of immediate matching. In banking, as it currently exists, this process - called the clearing system - occurs at the end of the day, when banks net their positions with each other. But in a distributed economic system where the ledger matches all debts, the act of clearance happens in real time. When clearance happens in real time, *all debts become liquid*. Indeed, this itself constitutes a key source of liquidity in the system.

XIII - *The General Theory and After, Part I - Presentation*, 1973, London: Macmillan, pp.408-409.

¹⁰ See also Mehrling, Perry (2017): *Cryptos Fear Credit*. Blog post, September 29.

In our vocabulary of commodity, stake and liquidity tokens, the process of liquidity creation can be shown diagrammatically:



7. Implications

Money ‘issued’ through a distributed exchange protocol has novel characteristics that override the Keynesian claims that universality derives from attachment to the state. This ‘protocol money’ of a distributed cryptoeconomy has a capacity to scale, giving it universality within any population that seeks to adopt it (unlike local currency) and as it scales, its liquidity grows. Universality comes not via the imposition of state authority, but by the expanding reach of a network (expanding participation in the protocol). Network protocols define ‘legal tender’ within the new economic space, and a liquid token market secures convertibility to fiat money for taxation if not also other purposes.

In all forms of money, including cryptomoney, the process of offer matching is the source of spontaneous liquidity. In contrast with fiat (state) money, in a system where all agents can participate with the same rights within the same exchange protocol and network, when offer matching is mediated through a common asset (or unit of account), netting enables exchange and settlement to occur without the need to actually hold the common asset (or unit of account). It means a non-money-means of liquidity: *a distributed monetary system that can secure liquidity without the need for central control of issuance/un-issuance of a money instrument.* The distributed exchange protocol therefore constitutes the backbone of a distributed clearing house and payment system.

But what links gift societies and peer-to-peer relationships in contemporary capitalism? Offers and acceptances, like gifts and counter-gifts, are also the product of volatility in that there is a spread of alternative offer and acceptances of which the actual agreement is a specific realization. In mon-

etized capitalist societies, the ‘portfolios of social claims and obligations’ of gift societies become assets and liabilities and the time interval in contracts shrinks to close to zero. Buyers have a highest price they are willing to pay and minimum price in which they will sell. Distributed exchange algorithms sell to highest buyer and/or buy from lowest asker. As offers are matched, a shared index emerges, which turns out to be a reduction of a distributed order of volatility spreads. Netting and clearing turn out to be the segmentation of transactions into causal dependencies. As Perry Mehrling puts it, "*all banking is essentially a swap of IOUs*".¹¹

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The 1997 Nobel Prize for Economic Sciences was awarded to Myron Scholes and Robert Merton for the development (with Fischer Black) of the options pricing model - a model that is in many ways the foundation of contemporary finance. In his acceptance speech Scholes made the following statement:

"Standard debt and equity contracts are institutional arrangements or boxes. They provide particular cash flows to investors with their own particular risk and return characteristics. These institutional arrangements survive because they provide lower cost solutions than competing alternative arrangements. . . Time will continue to blur the distinctions between debt and equity".¹²

Scholes was not conjecturing about the potential of cryptoeconomics, but his point resonates deeply. Instead of 'institutional arrangements' we can posit 'design protocols'. Equity and debt in a capitalist economy are protocols: shared understandings and communication agreements according to which the capitalist economy as a network operates. Under different protocols these ‘arrangements’ can take different forms and play different roles; not driven by a lower-cost rationale but by the changing capabilities that come with distributed computation. 'Debt' and 'equity' blur in the sense that they can both become the basis of tokens. But *credit-for-mutual-liquidity* and *equity-for-mutual-stakeholding* represent a profound change in our understanding of the future economic roles of debt and equity.

¹¹ Perry Mehrling (2017): Financialization and Its Discontents. Finance and Society (3):1, p.7.

¹² Scholes, Myron (1997): "Derivatives in a Dynamic Environment". Lecture to the Memory of Alfred Nobel, December 9, pp. 146-47.

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