Journal of New Finance

Volume 3
Number 1 *Crypto-economics, Decentralized Finance (DeFi), and other monetary digital alternatives (2).*

Article 6

9-6-2023

Striving Toward Bitcoin Price Stability: Second-layer Money and the Case for Real Bills, Scrip & Notes

Eduardo Blasco
Universidad Francisco Marroquín, blasco.e@icloud.com

Carlos García de Enterría
Universidad Complutense, cargar31@ucm.es

Recommended Citation

Blasco, Eduardo and García de Enterría, Carlos (2023) "Striving Toward Bitcoin Price Stability: Second-layer Money and the Case for Real Bills, Scrip & Notes," *Journal of New Finance*: Vol. 3: No. 1, Article 6.
DOI: 10.46671/2521-2486.1024
Available at: https://jnf.ufm.edu/journal/vol3/iss1/6

Striving Toward Bitcoin Price Stability: Second-layer Money and the Case for Real Bills, Scrip & Notes

Abstract

Monetary systems comprise various layers of real and financial assets arranged hierarchically. Due to its properties, Bitcoin is a suitable asset to become the base money of a monetary system once its price has stabilized and people see it more like a medium of exchange than an investment. We review Bitcoin's characteristics and explain their effect on its intra- and inter-temporal liquidity. We argue that Bitcoin will lower its bid-ask spread once users adopt financial assets convertible to Bitcoin. We propose the use of three financial assets working as Bitcoin derivatives to reduce Bitcoin's demand shocks and lower its volatility: real bills, private scrip and cash notes. We explain when will this process take place and why people would have an incentive to rely on credit even under a Bitcoin standard.

Keywords

Bitcoin, financial assets, credit, liquidity

JEL Code

B53, E41, E42, E44, E51

Submission Date

12-15-2021

Approval Date

7-31-2023

Publication Date

9-6-2023

1. Introduction

Money is the necessary development of the division of labor, and thus of human progress. It is a technology that transports value over time and space without counterparty risk, and thus money is the good that economic agents employ as the general medium of exchange. The most liquid good becomes money in societies without legal hurdles to monetary evolution. Currently, that is not the case anymore. After most countries abolished the gold standard—a monetary system that originated spontaneously from the voluntary choices of individuals—governments the world over instituted a new monetary standard through legislation—that is why our current money it is called "fiat money." Some parts of it have evolved from the previous system. Nevertheless, the core of the fiat standard is based on government mandates. Governments employ central banks to control their national fiat money. This status causes several issues with the monetary system, mainly over-issuance of money and misallocation of capital.

Bitcoin presents an alternative to the status quo by introducing a decentralized, secure, scarce, immutable, irreversible, and censorship-resistant medium of exchange that settles digital transactions immediately. Many skeptics of the possibility of Bitcoin becoming a monetary standard base their argument on its poor track record regarding price stability. Many Bitcoin advocates, however, respond by saying that its price changes but keeps a long-term uptrend, which is good for Bitcoin holders. But if people were to use Bitcoin as money, it should maintain a stable price, otherwise it may be a good investment but not a good money. Therefore, we posit that introducing certain financial assets—contractual claims to economic goods—as second-layer money would greatly increase Bitcoin's liquidity and its possibility to become money.

We evaluate the effect of three types of financial assets convertible to Bitcoin, two of which (bills of exchange and scrip) are already in their early phases of development. Regarding banknotes convertible to Bitcoin, to the best of our knowledge, there are no current projects working on this. We debate why each of these assets would reduce Bitcoin's price fluctuations, and thus increase its liquidity and how these instruments would operate in a free banking system.

2. Bitcoin as Money

2.1. What money is

Money is the commonly accepted medium of exchange of an economy, which also makes it the most liquid good. Money tends to emerge spontaneously. But sometimes an asset can also become money through government coercion. Thus, we can distinguish good money (as the result of spontaneous order) from bad money (as the result of government regulation). Carl Menger (1892/2009, 29–32) lists the properties that increase the saleability of a commodity and thus possibly turn it into money—that is, those characteristics that narrow its bid-ask spread.[1] These properties include durability, scarcity, hoardability, divisibility, high unit-value, transportability, and verifiability, among others.

The real asset—goods that are not the liability of another agent—whose marginal utility decreases the least per additional unit will be the good that best maintains its value and the one that will emerge as money (Menger 2009; Fekete 2017, 28). Therefore, we can define money as "any real asset that, because of its superior stability of value, is used by economic agents to intermediate between the time of sale and the time of purchase or between the time of purchase and the time of sale" (Rallo 2019, 108).

We say that money is the technology that people use to transport value over time and space for two reasons. First, if after producing a good or a service individual A generates a value equal to X and in t_1 individual A only wants to consume a value equal to Y (being Y<X), A will exchange the remaining value, X-Y, for goods and services that will help him satisfy his needs in t_2. To carry out this exchange, A's best option is to

[1] Menger (1892/2009, 24-25) states that "The smaller the difference between the buying and selling of an article, the more saleable it usually proves to be." Antal Fekete's understanding of liquidity is in line with Menger's. To Fekete (2017, 27-29), marketability is the "rate of change of the bid/ask spread as a function of quantity".

trade the value of what A has produced for money, so that A can transport the value of X-Y over time. On the other hand, if A produces and wants to exchange the fruits of his production for goods and services, to gain access to the greatest quantity of goods is to sell the value of his production for money. That is, money is again the best option to exchange value, this time through space.

Also, we say that money has no counterparty risk because, following Carlos Bondone (2012, 29-30) and Juan Ramón Rallo (2019, 116), we distinguish between money (also called money proper or base money) and monetary substitutes. Money is a real asset and that is why it has no counterparty risk because real assets are no one's liabilities. Monetary substitutes, on the other hand, are financial assets and that is why they do have counterparty risk because they represent someone's liability. When we combine these two and any other highly liquid assets that can also serve to satisfy the demand for liquidity, we obtain the supply of liquidity.

Liquidity represents the spread between the asked and the bid price. We say that good X is more liquid than good Y if good X's bid/ask spread increases more moderately than good Y's spread. Money is the most liquid good in an economy because it is the medium of exchange with which individuals lose the least value per transaction, that is to say, whose marginal utility decreases the least.

2.2. Bitcoin monetary properties

We posit that Bitcoin is well suited to become the next good money to set a worldwide standard akin to the gold standard during the nineteenth century due to its properties. Bitcoin is a peer-to-peer software system that operates a payment network with its own currency: bitcoins. As such, the system functions as a decentralized public ledger that registers all transactions by collecting several of them in each block every 10 minutes. Miners verify the content of these blocks by guessing through trial and error the answer of a complex mathematical problem. If miners take longer or shorter to solve the mathematical problem than the stipulated ten minutes, the Bitcoin code will change its difficulty after 2016 blocks have been mined to generate easier problems to guarantee that a timestamp is created every 10 minutes. When the block is mined, the system rewards miners with bitcoins, increasing the total stock. Nevertheless, the reward is halved approximately every four years; thus, the flow of newly created bitcoins is constantly decreasing until finally the reward is only the transaction fee. Hence, eventually the supply of bitcoins will reach its peak at 21 million bitcoins and will never increase again.

We surmise that Bitcoin's founder, Satoshi Nakamoto, was well-aware of Menger's work, possibly through Nick Szabo who was familiar with it, as obvious by the various references to it in Szabo's text on the origin of money (Szabo 2002) and may have implemented Menger's teachings when creating this new commodity. Therefore, Bitcoin brings together all aforementioned characteristics, and makes it the most suitable commodity to serve the function of money. Bitcoin has infinite durability—as it does not wither nor erode—and good hoardability—it is intangible and thus occupies no space, its storage cost is quite low, and the risk of theft is minimal. These are some of the characteristics that make an asset become a good store of value according to Menger (1892/2009, 31). Nevertheless, Bitcoin still lacks one of the most important properties to become a good store of value: price stability. This is because Bitcoin's demand is volatile and its supply is rigid, so its supply cannot meet its demand. This mismatch is canalized via sudden and sometimes abrupt price shifts. This is the problem to which we offer a solution in this paper.

Furthermore, it is divisible into 100 million satoshis without losing value, the number of decimal places that can be increased with the appropriate network consensus. Its relative scarcity—21 million bitcoins in total—also makes its unit value very high, and thus improves its suitability to be used as money. The last two characteristics of bitcoins which make them a good money are transportability and verifiability. Bitcoins can be transferred from one corner of the Earth to the other without any extraordinary costs and in a matter of seconds, and with the guarantee that it is not a falsification as it must be verified by the miners.

Some economists have emphasized that Bitcoin is one amongst many cryptocurrencies, which may very well be more suitable than Bitcoin to become money (Prasad, 2021; Dylan-Ennis, 2022). These arguments, however, fail to fully understand the advantages of Bitcoin that Ammous (2018, 254) highlights. Unlike other cryptocurrencies with similar properties, Bitcoin is unique in several ways. First of all, it was the first to arrive,

so it beats the rest in market adoption. If another similar cryptocurrency were to be introduced, it would find it difficult to overtake one that already has a market and whose users have invested work in it and therefore lack the incentive to move to another network. If the rival cryptocurrency has different characteristics to Bitcoin, these can be worse or better. If they are worse, agents betting on it will lose value over time and with each transaction. If they appear to be better, then they will encounter other adoption problems. Bitcoin has no administrators as the network is controlled by the rules written in the code, whilst other cryptocurrencies do have some team behind it. In fact, these administrators find themselves at a crossroad: Either they promote their coins to get noticed among the thousands of other alternative cryptocurrencies despite showing that they are a centralized network, or they disengage and do not get buyers. Despite having all the right properties to become money, the path to become money is not devoid of obstacles.

2.3. Obstacles to the spontaneous emergence of Bitcoin as money

Although Bitcoin's adoption is slow, it is also relentlessly growing and, since history has experienced several spontaneous shifts from one commodity to another, it may very well be the case that this effect happens with Bitcoin too. That said, that sometime is possible does not mean that it will happen. In this section we present three obstacles to Bitcoin's widespread adoption.

2.3.1. Bitcoin and network effects

The first problem that Bitcoin faces is one that any other new money-aspiring asset would also have to face, and that is the cost of changing from one money to another. Because, as the spatial liquidity of a good increases more agents increase their monetary demand for it—that is, the utility of money and the incentives to adopt it increase the more people accept it—we say that direct network effects arise (Klemperer, 2020a). And because money is a network good, the opportunity cost of changing from an already commonly accepted money to Bitcoin (or any other good) equals the switching cost of the network effect. This fact makes changing from one commonly accepted medium of exchange to another costlier one than if no network effects were in place. Switching costs arise when a buyer purchases a good repeatedly and finds it costly to switch from one seller to another and if the buyer also purchases follow-on products (Klemperer, 2020b). In this context, switching costs arise because people keep wanting to amass more of the asset that works as money.

Moreover, money is a special of network good, which means that there are different hinderances and advantages for any money-aspiring to replace a settled money. On the one hand, we have two forces that make the switch from one money to another difficult. First, because people trade the value they generate for money to hold the value created in it, it is necessarily costly—and risky—for a user to trade their current money for a prospective new one as each of these transactions supposes a clear loss of value and only a possible pay off. Second, the network effects on money are particularly strong because money is not a consumption good, but rather a production good (Barnett and Block 2005; Rallo 2019, 109), money's main utility does not come from its private consumption but from its ability to be exchanged for consumption goods (Nair and Cachanosky 2017, 265).

On the other hand, however, we have two other phenomena that facilitate that a new asset becomes money. First, we see that while one is amassing and using the aspiring money, one could still amass and use of the settled money—e.g., if you were an Ecuadorian who realized his country was becoming dollarized, you could increase your demand to hold dollars and even use them in some cases, while you keep some, and transact in, some Ecuadorian sucre. This means that the network effects of the aspiring money are compatible with those of the settled money. When two substitute goods are compatible, users can enjoy the network effects of both (Klemperer, 2020a). Second, because the correct prediction of a new money creates private non-network benefits, entrepreneurs will create opportunities for consumers to use the new currency and obtain net private benefits; and thus, incentivize them to do so (Nair and Cachanosky 2017, 270-3).

Thus, it is hard to compare both forces and predict whether a new money will have an easier or tougher time substituting the previous one. What we can at least assert is that the network effects that arise from a

settled money are not enough to stop a new asset from becoming money. One way this could go is the following: Different people have different monetary demands for the same asset. Some of these people will observe that Bitcoin has the right properties to become money or replace the current good used as money; that is, that they expect Bitcoin to have a high saleability. These perceptive individuals will demand and amass more of Bitcoin to be used as money because they can do so while still holding their current currency. If they are correct and that good continues increasing its liquidity, two things will happen. First, other agents with a higher liquidity threshold for their monetary demand will start demanding Bitcoin. When they see that Bitcoin is or can become a good store of value or a good medium of exchange, they will buy more of it. Second, Bitcoin entrepreneurs such as different exchanges (e.g., Binance or Coinbase) will start to offer profitable deals for people to buy, hold and use some of it. As more people demand it, be it because they do liquidity speculation or they want to enjoy the opportunities that entrepreneurs created, more people will even demand it, thus creating a virtuous cycle. Then, people will reach a point in which they transition from one medium of exchange to the other. This switch will take place when the more cautious money holder starts considering this new medium of exchange as money. This individual is the downtick marginal money accepter, and marks the point in which an economy changes from one monetary standard to another. While we cannot say when this marginal user will accept the new money, we surmise that this will happen when most of the population is already holding this new money. The following quote of Satoshi Nakamoto reflects this insight: “It might make sense just to get some in case it catches on. If enough people think the same way, that becomes a self-fulfilling prophecy.”

2.3.2. Bitcoin and its transaction costs

The second problem regarding Bitcoin’s adoption are its operating costs. The Bitcoin network resembles a bookkeeping ledger where each block represents a page, and the transactions miners add to these each of the lines that fill each page. This ledger, the Bitcoin network, requires a very expensive ink; that is, registering movements directly on the first layer—trading bitcoins from wallet to wallet. This fact deteriorates Bitcoin’s spatial liquidity, which translates into it being a worse medium of exchange. There are, however, already solutions to this problem, mainly the Lightning Network. This is a second layer solution that enables transactions to be carried out in milliseconds at no cost, which significantly increases the intra-temporal liquidity of Bitcoin. Movements on the Lightning Network operate in a higher layer between two wallets that have a Lightning Network created between them or between wallets that, although they do not have a Lightning Network directly opened between them, have Lightning Networks opened with other wallets and can indirectly connect through these other Lightning Networks. A Lightning Network can be closed at any moment and the operation nets out in the first layer, the Bitcoin layer. So, through the Lightning Network, A can send 10 bitcoins to B and them B can send 1 bitcoin per month for nine months and close the Lightning Network. Then, instead of having to pay for ten transactions (the original plus the nine monthly ones), they will only have to pay for one, the 1-bitcoin one from A to B at the end. This mechanism greatly reduces Bitcoin operating costs.

2.3.3. Bitcoin and its fixed demand

The third problem we address, and the one on which our paper focuses, is Bitcoin’s volatility. In order for a commodity to show inter-temporal liquidity—a stable price—a strong interdependence between supply and demand is required, so that if demand increases supply will also do so, neglecting the price increase that will otherwise take place, and vice versa (Rallo 2019, 87–88). The problem that Bitcoin shows is that its supply is perfectly inelastic, and thus demand shifts will have a direct effect on the price. Bitcoin is vulnerable to demand shocks, either increasing or decreasing demand drastically, causing prices to move in all directions, and thus be quite unstable. Volatility is contrary with the use of a commodity as a store of value to transport value over time.

The Lighting Network helps with this issue, but it alone does not fix it because this mechanism does not create any additional units of bitcoins. It can help increasing the velocity of money, but it still requires other

tools to increase the quantity of substitutes of money for the supply of money to match its demand and avoid the negative effects of demand shocks.

We argue for the creation and use of financial assets that could act as a short position against Bitcoin to help it improve its inter-temporal liquidity. Holding real bills, scrips, or bank notes imply shorting Bitcoin, as individuals will give their bitcoins up in exchange of these financial instruments. These assets can be created or liquidated in short time spans, so its supply would be elastic enough to meet liquidity demands as opposed to Bitcoin's. Therefore, if a sudden increase in demand were to take place, businesses will have the chance to issue real bills, scrips, or shares—which increase the velocity of money—and banks could issue notes with the same effects and avoid the deflation that would otherwise take place. Should, on the contrary, the demand for money decrease, businesses would redeem real bills for bitcoins at a discount, employees will spend their scrips, shares could be liquidated, and bank notes repaid in Bitcoin. These instruments serve, for now, as imperfect substitutes of money and will help to strive towards price stability.

Furthermore, the creation and use of financial assets convertible to Bitcoin would also help with the other two problems, since it would allow entrepreneurs to create derivates suited for their business and useful for them to incentivize consumers to demand them and would vastly reduce the transaction costs of Bitcoin[2]—or rather, its monetary substitutes that would presumably circulate at face value.

3. Perfecting Bitcoin as Money

3.1. Second-layer Money

Monetary systems are a combination of money and credit structured in a layered hierarchy according to their liquidity. Money and credit serve different functions, and both are necessary to sustain a stable system. We find money proper, a real asset, at the base and different forms of credit, financial assets, on top. We can distinguish between these two elements, understanding money as the means of final settlement and credit as a promise to pay money, or a means of delaying final settlement (Mehrling 2013, 394). We call all forms of common exchange media in an economy, both real and financial assets, currency, following Bondone's (2012, 29–30) classification.

Real and financial assets are both essential as they serve different purposes, and thus should also have different properties. The real asset that functions as money should be relatively scarce because money needs to be a good store of value to function as a good medium of exchange—you need to be able to amass it until the right exchange for you to trade it arises. Increases in the quantity of real assets tend to decrease its value. Thus, if this real asset could be obtained effortlessly, it would be a bad store of value. But because demand for money is exogenous to its supply, we need to find a way to increase or decrease the quantity of media of exchange in an economy according to monetary demand should we want a stable price of money. And as we have explained, we cannot increase the supply of real assets as much as we want or else any change in the demand for money will alter its price, and thus make it a bad money. That is why we need financial assets to complete the monetary system.

Financial assets represent second- or higher layer monies redeemable in base money. The value of financial assets does not necessarily decrease with an increase of its quantity (Rallo 2017, 12) because excess of credit refluxes back to the issuer (Glasner 1992, 877), and thus they could effectively meet any increase in the demand for money lessening any price alteration (Rallo 2017, 13). Therefore, a stable monetary system should be predicated on a solid real-asset base with enough financial assets for the supply of money to adjust to its demand flexibly.

Financial assets' value not only depends on the value of the real assets to which they grant value, but also to the creditor's expectation that the debtor will pay the claim (Rallo 2017, 12). Second and higher layer

[2] The same happened with gold. It had high transportation costs, but thanks to the emergence of monetary substitutes it became easier to establish it as a monetary standard.

monies thus have counterparty risk (Bhatia 2021, 20). Throughout history, we see how people accepted this risk and exchanged not only gold and silver coins, but also bills that were redeemable to them. In fact, we see that the freer the banking system, the more financial assets were exchanged instead of the base money (Selgin and White 1987, 448). This risk is the price we pay for the flexibility a layered system grants us. As Bhatia (2021, 20–22) states:

Layers of money came to exist because people trusted forms of money that carried counterparty risk of the issuer. […] The layers become a way to think about money's natural hierarchy whereupon monetary instruments are ranked in order of superiority from top to bottom, instead of placed next to each other on accounting tables. […] Despite the default risk, bills served as an instrument of monetary exchange and an accelerant to the velocity of money.

What we propose in the following pages is three different financial assets that would work as second-layered money because even a monetary system based on a Bitcoin standard would need credit to operate. That said, we do not think the Bitcoin hierarchy ought to stop at the second layer,but should grow organically according to the needs of the market, in a similar manner as happened under the gold standard (Bhatia 2021, 17–31). Bitcoin would be the ultimate means of payment, the final instrument to settle debts, but people would exchange financial assets convertible to Bitcoin as their common media of exchange to allow the greatest number of desirable exchanges between two parties to take place. Financial assets are a feature, not a bug.

3.2. Real Bills

In this section, we describe what would occur should real bills convertible to Bitcoin were to be introduced under a Bitcoin standard. According to the Bills of Exchange Act 1882, a bill of exchange is "an unconditional order in writing, addressed by one person to another, signed by the person giving it, requiring the person to whom it is addressed to pay on demand or at a fixed or determinable future time a sum certain in money to or to the order of a specified person, or to bearer." These bills are financial instruments for deferred payment; they are promises to pay, documents certifying a debt from the drawer to the payee. The drawer issues them and instructs the drawee, if accepted, to pay the payee. The payee, the holder of the bill of exchange, may be the seller of goods to the drawer, but the drawer may find himself in need of the necessary liquidity to finish producing the goods he is manufacturing and put them on sale to pay this seller. Thus, the drawer issues a bill of exchange for the drawee, the bank, for example, to compensate the payee. Real bills are a type of bill of exchange that represent "titles to real value or value in the process of creation" (Green 1989, 310). Therefore, real bills circulate as monetary substitutes that the drawee redeems with a discount.

The issuance of these bills would follow the mechanism the Real Bills Doctrine describes. This monetary rule, labeled by Fullarton (1845, 207) as "the decried doctrine of the old Bank Directors of 1810", posits that "if banks lend only on the security of real bills representing actual goods in process, they cannot issue too much money" (Glasner 1992, 867). What banks or other financial intermediaries do when issuing real bills is "*monetize in advance* a commercial claim—to provide temporarily the money that was forthcoming anyway, and not much later either" (Palyi 1962, 11). Under a Bitcoin standard, this would translate to "If banks create second-layer money convertible to Bitcoin only on the security of real bills representing actual goods in process, they cannot issue too much credit."

Traditionally, under the Real Bills Doctrine, bills circulated with a discount of a period around sixty to ninety days. For example, John Fullarton (1845, 209) posited that this period should be no longer than sixty days. To Antal Fekete (2005), however, the right time is 91 days, the length of a season because it was thought that consumption patterns changed with the seasons and if something could not be sold then, it would take a year before it could be sold again.

Regardless of whether that presumption was true or false, the establishment of a fixed period for all goods is arbitrary. Because the period should reflect the remaining time until the sale of the goods, maybe the ninety-days arbitrariness was useful enough that it provided a stable system and was cheaper than the alternative: Keep constant track of each independent set of goods during its production process. This difficulty,

however, can be easily overcome under a Bitcoin standard, not so much for the current properties of Bitcoin but for other technologies that were inspired by and developed after it.[3]

Blockchain and open-source research have permitted the development of new financial tools. Real bills, for instance, could potentially benefit from Martin Westerkamp, Friedhelm Victor, Axel Küpper's (2020) proposal of "tracing manufacturing processes using blockchain-based token compositions". This technology could develop to the point at which customers could track the progress of the manufacturing process, the percentage of the good produced to date, the time remaining and the amount of goods the company has in its inventory, managing to correctly estimate the discount applicable to each real bill. This would reduce the risk of issuing, accepting, and exchanging real bills, increasing their marketability. Real bills would thus circulate as off-chain Bitcoin payments, second-layer money following the Real Bills Doctrine applying a more accurate discount rate depending on the percentage of the good produced, and thus reducing business error.

We use an example to illustrate this mechanism: A is producing a chair worth one hundred satoshis. The chair takes twenty days to produce from the date all materials arrive to the workshop until it is ready for A to place it on the market. Days one to five of production, or phase 1, A saws wood into different pieces. Days six to ten, or phase 2, A pieces the parts together. The chair is ready for people to sit on it on day ten. Days ten to twelve, or phase 3, A paints and coats the chair. In the remaining days, or phase 4, it only needs to be left to dry out. The chair can be considered to be 50% done by phase 1 or day five, 80% done by phase 2 or day ten, 98% done by phase 3 or day twelve, and 100% done by the end of phase 4 or day twenty. Depending on when the payee wants to exchange the bill, it will be worth 50, 80, 98 or 100 satoshis. It is even possible to conceive that the tracking would allow a day-to-day or minute-to-minute price change depending on the status of the good being produced.

Real bills are the most marketable instrument banks can hold, second only to the base money (Fekete 2017, 45). Therefore, the Real Bills Doctrine needs no monetary regulator to enforce it because real bills circulate spontaneously. Even if the current system collapses before a Bitcoin banking infrastructure is ready to operate, these financial assets will most likely emerge because they are backed by real goods and people will not stop producing. One example of a spontaneous emergence of real bills is Lancashire before the Bank of England opened its branch office in Manchester (Fekete 2017, 51)

What this implies is that monetary substitutes would be created under a Bitcoin standard in an invisible-hand process in proportion to the new supply as it was produced. This process is a natural process of Say's law: The creating of new products (the supply of real goods) generates new financial assets (meets the demand for money), that then circulate the economy (the supply of money) to pay for those real goods (matches the demand for real goods). One can then wonder what would control the overissue of credit if there is no central figure to regulate it. First, it is this central figure the one that has the incentive to overissue (Selgin 1987). And second, the other side of the Real Bills Doctrine is the Law of Reflux, that states that "Banks cannot overissue money, because any overissue would quickly flow back to them in debt repayments or as demand for redemption" (Glasner 1992, 868).

Moreover, the real bill doctrine does not cause inflation because it matches the monetary demand with the new goods being introduced into the market. Thus, the new credit will be non-inflationary because by being self-liquidating it does not cause inflationary expectations (Palyi 1962, 11). Not all money or credit creating is inflationary, only "when the additional purchasing power has no counterpart in goods and services people want to buy—when too much money chases too few goods" (Palyi 1962, 4).

3.3. Scrips

Scrips are "promissory notes payable in goods at company stores" (Tan 2011, 237). They are private currencies issued by companies, local governments, or any other organization that grant a title to a certain value of their

[3] We emphasized that it may not be possible under current Bitcoin properties but these may change in the future and allow for the Bitcoin network to track goods. Whether it is currently possible using Bitcoin or not is indifferent to our analysis.

goods. As compared to money, which is widely accepted as the most liquid good, scrips' acceptance is quite restricted. Scrips are commonly used inside businesses to pay for part of the employees' salaries—such was the case of most mining companies in West Virginia (Fishback 1986, 1022–23)— or in times of "general shortage of circulating cash" (Roberds 1990, 22)—as in 1930, after the bank holidays. It is very common for businesses to use scrips with their clients in activities such as theme parks, where customers have tokens redeemable for rides in different attractions.

Moreover, the use of scrips was widespread during many of United States' major crises in late nineteenth and early twentieth century (Shafer and Sheehan 2013), when the government restricted the issuance of new money. During the 1893, 1907 and 1914 crises, businessmen with a good reputation that offered highly marketable goods issued their own scrip for the purchase of their merchandise. These promissory notes replaced bank notes, which were markedly scarce at the time—not because of bank policy, but because of the artificial scarcity imposed by government regulations. Businessmen managed to ease trade with their own coins, which would have normally been the task of banks, had issuing money not been proscribed. Roberds (1990, 27) asserts that "Scrip issues essentially represented attempts to create forms of private money whose acceptability would match that of cash, at least in the community where they were issued."

Historically, scrip was also used in isolated communities where it emerged either because of the difficulty of obtaining money—as was the case in long sea voyages (Timberlake 1987, 440) and some mining communities where the mining company owned all stores as there were no settlements nearby—or to enhance trade where money was scarce, and its demand increased faster than its supply. Such was the case in West Virginia, where mining companies gave miners the option to "request […] the wages [they] had already earned, and it was redeemable in standard money on the next payday" (Timberlake 1987, 441). As companies controlled most of the stores nearby and they all accepted these scrips, which were close to becoming money. Thus, issuing scrips enabled these businesses to meet their payment obligations before selling their final product—mined resources.

Scrips were also used inside leper colonies. These were communities inhabited exclusively by people suffering leprosy. This practice dates to the Middle Ages, where monastic orders took care of them, usually far away from civilization. Various Asian and South American countries, such as the Philippines (Lannon 2017) or Colombia (Rodríguez Salazar and Arévalo Hernández 2017) have had their public health offices issue a currency to use exclusively in leper communities during the late nineteenth and early twentieth century. It was believed that leprosy was transmitted by touch, and to avoid the spread of the disease, they created these "leprosy coins".

We, however, would like to focus on the stamp scrip. Silvio Gesell devised these types of coins to "stimulate spending dates" in 1890 (Champ 2008). They originally consisted of a card with boxes drawn on its back, which must be stamped periodically to continue to be valid. These stamps usually carry a cost because they act "like a deposit account in a bank with negative interest rates" (Hoffman 2019, 21), therefore disincentivizing the act of hoarding. Stamp scrips were used in Austria and Germany in the 1930s after the collapse of their monetary standard (Monbiot 2015). Our paper presupposes the existence of a Bitcoin standard, which most certainly will be deflationary due to its fixed supply. Therefore, any tool that may increase the velocity of money by incentivizing consumption or discouraging hoarding will favor the stabilization of the purchasing power of money, and thus the progress of the economy.

With regard to the problem of over-issuance, Hoffman (2019, 24) correctly points out that "A company has no incentive whatsoever to increase the supply of his scrip in the same way a fractional reserve banking system increases the money supply through loans, because if it did, it would essentially be giving away its goods for free". We, however, disagree with Hoffman's (2019, 25) notion that the purchasing power of the scrip "is in direct proportion to the remaining goods lying idle on the store's shelves." Each company would set the purchasing power of their scrip when it decided on how many units of money in their goods it gave a claim to. What would alter depending on the company's goods is its liquidity—i.e., the scrip would circulate with discount depending on how much demand were there for the goods it gave claim to and how many were available.

Ideally, any economy should coordinate its monetary production with its real production, increasing the monetary supply when goods are abundant, and decreasing it in times of shortage, *ceteris paribus*. This is the main tenant of objective the Real Bills Doctrine. Accordingly, scrips should increase their market value when the issuer's goods are plentiful and circulate at a discount when scarcity arrives. However, to be informed is costly, and individuals cannot manage to know the amount of goods each company has in stock. Thus, if it was possible to implement some mechanism that would enable individuals to value scrips correctly without a high opportunity cost, it would improve the intra-temporal coordination of an economy.

Individuals could use the same mechanism we explained above that could track the production of the goods that real bills backed. In addition to that, smart contracts make stamp scrips easier to deal with. Smart contracts, in the words of Marco Schletz, Darius Nassiry, and Myung-Kyoon Lee (2020, 3), are "computer applications that automatically verify, enforce and execute the terms and conditions as specified in the codified contract." If they were applied, there would no longer be the need to actually stamp a card, but the process would initiate automatically after being programmed. Companies could issue stamp scrips to incentivize the purchase of their products on a regular basis, or else their scrip would expire automatically. For example, McDonald's could offer a promotion where for every 100 satoshi spent 20 satoshi would be given to him in McDonald's's scrip, and every week if at least 2 satoshis are not spent, the balance of his scrip would decrease by 1 satoshi. Every business could decide on which numbers to choose, and customers would decide if they found the exchange advantageous or not, depending on their risk-bearing and their preference for hoarding. Nevertheless, stamp scrips would undoubtedly increase the velocity of money, as they reduce the demand for Bitcoin—by paying with another means of exchange—and incentivizing consumption.

Finally, Hoffman (2019, 19–40) explores the possibility of paying wages with scrip, and how it could accelerate the economic recovery out of a crisis. During crises, hoarding increases and businesses face liquidity problems. The demand for their products sees itself severely reduced, and they suffer from excess stocks. Furthermore, their obligations, payable in money, may be greater than their income, and so they may need to lay off some of their employees to avoid bankruptcy. Thus, the possibility of paying wages by issuing scrip looks very appealing, as workers will spend their money inside the business, reducing excess stocks, and the business' obligations in money will decrease. Stamp scrips could also be an option, as they will also decrease hoarding and increase consumption, avoiding the deflationary phase of most crises.

3.4. Banknotes

Bitcoin is native to the Internet. That is why, thus far we have only focused on digital alternatives as second-layer money. In this third section, we argue the case for the use of banknotes denominated and convertible to Bitcoin. The advantage of cash payments is that they are two-party transactions, immediate and final, that work without a trusted third party to verify the operation (Ammous 2018, 169). Bitcoin "brings the finality of cash settlement to the digital world, it has created the fastest method for final settlement of large payments across long distances and national borders" (Ammous 2018, 207).

Although Bitcoin has the capacity to move most monetary transactions to the digital world, we posit that some will remain in traditional cash. Therefore, if Bitcoin is the monetary standard, that would mean that a new type of payments will emerge: Bitcoin-backed cash payments. The need for cash payments arises because they have some advantages over digital payments, namely that they do not rely on electricity to work. Quoting Ryan McMaken (2017): "In a cashless world, you'd better pray the power never goes out." We believe that Dowd (2019, 394) puts forth a compelling case for cash when he states that:

> The abolition of cash would deprive us all of the benefits of cash. There are many transactions for which cash is the ideal medium of payment, and it is not for nothing that cash is used in 85 per cent of global transactions. Cash is a very efficient way of handling small transactions. It is costless and easy to use. Cash transactions are immediate and flexible. Cash is anonymous and, traditionally, the anonymity of cash was considered to be one of its greatest benefits. Cash does not need a password and, unlike a bank account, can't be hacked. The state of the art in anti-counterfeiting technology – think here of the

> Canadian dollar, not the US dollar!—makes it more difficult to corrupt than many digital currencies. The usefulness of cash is not dependent on technology that might break down: most of us have experienced situations where we had to resort to cash to pay a bill at a restaurant after some system failure on the part of our card provider. These are major benefits that would be lost if cash were abolished.

A case in point is what happened in Puerto Rico in 2017. Hurricane Maria caused power cuts across the island, which translated in inoperable ATMs and credit card verification systems and people unable to buy goods. That is why the Federal Reserve had to fly a jet with cash (Levin 2017).

We see why cash is useful and how it would be unwise to establish a cashless monetary system. We posit that a system where cash circulates alongside digital payments, as is the case today, is quite likely. Instead of having unconvertible fiat money, economic agents could use banknotes that they could later be redeemed for Bitcoin on an exchange. When you go to the ATM, you could withdraw bitcoin or satoshis denominated bills, which would be subtracted from your wallet and go into the exchange's reserve, which would transfer them to another customer who deposits the bill in their bank.

In addition to those benefits, Bitcoin-redeemable cash would also function as a currency of last resort for possible victims of "hyperbitcoinization": a scenario in which Bitcoin becomes money and some individuals who had not previously acquired it would have difficulty doing so due to problems related to its value or technological accessibility, such as the high cost of mining, for example.

This would also make it difficult for potential regulators to force transparency of their clients' wallets to exchanges to claim tax on these assets. Exchanges could be the ones holding much of the Bitcoin while the rest circulates in the form of cash. This would be the antithesis of possible central bank digital currencies (CBDC).

A possible criticism would be that exchanges would not accept notes from other exchanges so no one would accept banknotes issued by exchanges other than their own and this would reduce the intra-temporal liquidity of Bitcoin. However, this counterargument is also leveled at free banking for the private issuance of currency. What we see is that banks have incentives to pact with each other to accept each other's bills so that each bank increases the liquidity of its financial assets (White 1999, 14–16). Let us assume that there are four exchanges. If Ex1 does not accept the cash issued by Ex2, but the latter makes a commitment to Ex3 and Ex4 to accept theirs, Ex2-4 could issue notes with a higher intra-temporal than those of Ex1, which customers could only exchange nots for goods at par with other customers of Ex1. That is, there would be the right incentives to expect that, as has been the case in all periods of free banking, banks—or exchanges in this case—would accept each other's notes and interbank clearing houses would be formed to settle payments between them.

Tangem[4] is a company that offers something similar—although not identical—to what we have described here. Tangem Note is a card with certain amount of Bitcoin in it—as much as the user wishes to add—that one can hand over like cash. Similar to a gift card. The product is not exactly cash because you still need an app to check how much money there is inside.

4. The Chicken or Egg Dilemma: What Comes First, Price Stability or Bitcoin Derivates?

In this paper we argue that to reduce Bitcoin's volatility enough that the downtick marginal money accepter demands it as money, Bitcoin entrepreneurs will need to issue a financial asset to reach some price stability. But one could argue that due to the price volatility of Bitcoin no one will issue financial assets convertible to it, as it carries too much risk; therefore, it will never be able to become money. Without Bitcoin derivates, its supply will never become stable relative to its monetary demand; and thus, Bitcoin will never reach enough price stability. Without price stability, the issuance of assets convertible to bitcoins will be too risky; and thus, its price's volatility will not decrease. It feels like one needs the other to take place, but one cannot happen without the other, and since both are requisites for an asset to become money, one could conclude that Bitcoin cannot become money. Our goal, however, is to explain why and how it can; and thus, we present a solution to this chicken or egg dilemma.

[4] More information available at: https://tangem.com.

Our answer is that Bitcoin derivates come first. Price stability is a range, not point. An asset has price stability when its demand is stable relative to its supply. We can measure the stability of the price of a good by the size of its spread through time. The thinnest the spread between the asking price and the bidding price and the longer this size lasts, the more stable the good is.[5] There is no point for Bitcoin—or any other asset—to reach in which we could say "that asset finally has price stability".[6] Bitcoin, and any other monetary asset, can function as money even though its price is not perfectly stable—although, that would be the goal of any money. What the price of Bitcoin needs to be is stable enough: it needs to reach a money-like stability. We cannot know how thin Bitcoin's spread needs to be to reach this price stability. We can only know that it has reached that stability when we see people using it as money; following the "I know it when I see it" principle.

For Bitcoin to reach a money-like stability first it needs financial assets that circulate on par and are convertible to bitcoins.[7] But, then again, how would that be possible if price stability is a prerequisite for the issuance of Bitcoin credit? Because for Bitcoin to become money we need money-like stability, but we do not need that level of price stability for entrepreneurs to issue Bitcoin derivates. As we have said above, entrepreneurs will play a key role in the process of increasing Bitcoin moneyness. Different entrepreneurs will have a different liquidity threshold for which they will start demanding Bitcoin for their monetary use. Inside monetary demand, we can see three types of uses for which people would want to hold a liquid asset: transaction demand, used for day-to-day purchases and expenses at the lowest cost possible; security demand, held in anticipation of future investment opportunities; and speculative demand, kept as a safety net for unexpected expenses or emergencies (Rallo 2019, 136).

Most of the early demand of a money-aspiring asset is of the speculative type. As more people hold Bitcoin, its liquidity increases; and thus, its volatility decreases. As its volatility decreases, more people adopt it, and at some point some entrepreneurs—with speculation in mind—see a business opportunity and create Bitcoin derivates to incentivize others to adopt it when the price stability is right for them. That is, they do not need a money-like price stability to demand bitcoin, because they do not demand it for transaction or security purposes, but for business gain. Exchanges, by offering Bitcoin, are already serving this purpose, acting as market makers, to reduce its volatility. By selling Bitcoin—probably in the short term in many cases—with the intention of re-buying it, they are holding a short position against Bitcoin and increasing its velocity. With the aid of some agents who hold the belief that the commodity is overpriced and opt to establish short positions against Bitcoin, they are playing a fundamental role in the pursuit of price stability.

We also cannot know what the liquidity threshold is for which each individual that holds Bitcoin for its speculative demand will think of issuing financial assets convertible to bitcoins. They will also follow the "I know it when I see it" principle: They will see Bitcoin, its properties and the market and decide whether it's a sensible decision or not. What we can say is that this process has already started, and we can see that by the examples we provided here or those Nair and Cachanosky (2017) give on their paper. The presence of economic agents, such as Klay Thompson or Andre Iguodala, who have chosen to receive partial or total payment in Bitcoin, shows a significant advancement towards the establishment of the aforementioned financial instruments. These agents benefit from protection in their Bitcoin positions against price fluctuations, allowing them to issue Bitcoin derivatives or other liabilities without exposure to commodity-related risks. This safeguard is a result of their income being denominated in bitcoins rather than tied to any other commodity. As a result, this development lays a solid foundation for the proliferation of these instruments within the financial landscape.

[5] One could say that the size does not matter to determine the price stability, only that whatever size it adopts lasts for a significant amount of time. But that is incorrect because the bigger the spread, the more chances there are to arbitrage the price, and the result of that intermediation is volatile and unknown ex ante. The price could be close to the ask price or to the bid price, that depends on the negotiation power of sellers and buyers and the competition among sellers and among buyers.

[6] Unless, of course, we theory about an ideal money with a perfect price stability.

[7] This is a necessary condition, but not sufficient.

Moreover, this process is neither unique to Bitcoin nor a quick one. After all, it took gold thousands of years to become the global monetary standard according to the most conservative estimates of the origin of money, dating back to Mesopotamia and tens of thousands of years according to other estimates[8] and it only happened when banks and other financial intermediaries started issuing financial assets convertible to it on demand.

Therefore, to summarize this dilemma, some people will buy Bitcoin for speculative reasons, because they analyzed their properties and think it can become money or, at least, a good medium of exchange. Some of these Bitcoin holders, to incentivize others to adopt Bitcoin, will issue derivates when the price is stable enough for the risk they are willing to incur. Then, this will stabilize even more the price as more supply is created to meet the incoming demand and as more people decide to amass it. And, finally, at some point, when it has reached a money-like stability, the downtick marginal money accepter will demand it as money and it will become the monetary standard.

5. Aren't Trusted Third Parties Security Holes?

People require no trusted third party to hold bitcoins. In cryptography, a trusted third party (TTP) is an entity that facilitates interactions between two parties who both trust the third party. Once you purchase bitcoins, you can hold them in a cold (offline) or hot (online) wallet that only you control, and no other agent has control over them. Thus, one of the properties of Bitcoin is that you can store bitcoins cheaply and easily with no trusted third party involved. Nick Szabo (2001) claims that trusted third parties are security holes, and thus:

> The best "TTP" of all is one that does not exist, but the necessity for which has been eliminated by the protocol design, or which has been automated and distributed amongst the parties to a protocol. The latter strategy has given rise to the most promising areas of security protocol research including digital mixes, multiparty private computations, and Byzantine resiliant [sic] databases. These and similar implementations will be used to radically reduce the cost of current TTPs and to solve the many outstanding problems in privacy, integrity, property rights, and contract enforcement while minimizing the very high costs of creating and operating new TTP institutions.

Szabo wrote this text before Satoshi Nakamoto released Bitcoin. Nakamoto most likely took Szabo's insight into account when creating Bitcoin because it was part of Nakamoto's goal to design a peer-to-peer electronic cash system with no trusted third party (Nakamoto 2008). We agree with Szabo's position and understand and share Nakamoto's purpose for Bitcoin. The fact that Bitcoin requires no trusted third parties to operate means it works better as money. That said, we believe that the fact that it can circulate with no TTP does not mean that it does always and everybody has to work like that. For some people for some time, it may be more efficient to own claims to bitcoins rather than the base money itself.

Under the gold standard, gold was the ultimate extinguisher of debt. Not all payments, however, were made in gold. As we have stated above, in places where fewer banking regulations were in place, such as Scotland, Canada and New England, "during the nineteenth century, gold virtually disappeared from circulation" (Selgin and White 1987, 448). People lack the need to always pay with base money. If, as in the case of gold, doing so is more expensive than the alternative, we can expect that monetary substitutes will emerge. This is also the case for Bitcoin. First-layered payments are expensive and will only become more expensive. We should think of these transactions as the equivalent for when countries used to charter ships to freight gold. Under a Bitcoin standard, it will not be economical to conduct every transaction on the first layer. If these are now expensive, they will only become more so the more people adopt Bitcoin and want to pay thus.

That Bitcoin allows you to become your own bank because it works with no TTP is one of its big appeals. But this is expensive. Or at least more expensive than the alternative: Trust third parties with the issuance of liquid financial assets convertible to be used as a media of exchange. Some may argue that people did make

[8] *See* Wikipedia's entry History of money, available at: https://en.wikipedia.org/wiki/History_of_money.

that mistake under the gold standard before their claims to gold were transformed to claims to the claims to gold—i.e., to fiat money. But this time it would be different for two main reasons.

First, there would be a much higher accountability under a Bitcoin standard. People could always check on the address of the trusted third party to make sure they have a prudent amount of bitcoins in their reserves. During the free banking period in Scotland, because shareholders had unlimited liability, they publicized their wealthiest shareholders as a proof of liquidity (White 1995). In the United States, banks too publicized financial statements to attract depositors by showing a large buffer for absorbing asset losses, in this case the banks' net worth—capital plus surplus. This policy was common in clearinghouse agreements (Timberlake 1984, 9). People found ways of assuring their intermediaries' good standing before states established the precedent of bailing out banks, thus generating the incentives for bankers to gamble with other people's money and for creditors to ignore whether their debtors acted recklessly with their money. With Bitcoin, these policies would be unnecessary as, again, people could corroborate for themselves the liquidity in terms of money reserves that their banks have, thus reducing any security gap.

Banks and other financial intermediaries may not need to hold all the Bitcoin they own in their cash balances, but only enough to guarantee their payment in bitcoins when it is due. This system is not impossible as this is how banks have always operated: They held only a fraction of the total money they owed in reserves and loaned the rest. As long as people could pay with their financial assets, the liquidity of which is not restricted to the issuer's reserves but their expected ability to pay—which includes a track of successful past payments and other assets the issuer holds—, people would loan their money willingly to banks and other intermediaries that offered them these liquidity services—i.e., easier and cheaper payment methods.

The second difference with a non-Bitcoin commodity standard is that Bitcoin allows for the creation of smart contracts on its network. Due to the division of labor, banks and other intermediaries would specialize in the development of financial instruments other than the ones we have proposed here that regular users did not think of or did not know how to create, but that could be useful for them. Agents could use this innovation to develop a myriad of new financial assets and contracts. Creditors could establish clauses that gave them their bitcoins back if the working capital became negative. Mechanisms like that would prevent maturity mismatch from intermediaries. Another possible automatic clause would be an option clause. Option clauses:

> Give banks the option of deferring redemption of their notes provided that they later pay compensation to the noteholders whose demands for redemption are deferred. They therefore allow banks to protect their liquidity if they are faced with an unexpected increase in demands for redemption. In addition, the knowledge that the banks had this protection would reassure the public that the banks were not likely to become illiquid, and this knowledge would reduce the likelihood of a bank run occurring in the first place. Option clauses are therefore a potentially important form of protection for banks that have redeemable liabilities and operate on a fractional reserve. (Dowd 1993, 41)

These worked because the penalty interest rate at which banks had to pay back the deferred redemption were high enough for banks to avoid paying them at all costs and for some creditors to prefer them over non-OC notes.

Szabo (2001) offered four reasons why organizations may choose to operate with TTPs: Limitations of imagination, effort, knowledge, or time amongst protocol designers; the temptation to claim the "high ground" as a TTP of choice are great; entrenched interests; and mental transaction costs. We believe that Szabo downplayed the last reason. As we said above, being your own bank can be more expensive than not. First, people would need to become their own payment processors, which carries certain transaction costs. Not only will agents have to pay for first-layer Bitcoin transaction fees, but also mental transaction costs such as keeping a clear balance or remembering when to make certain payments. Second, people would become their own "financial intermediaries"—i.e., there would be none—which would mean that more first-layer transactions would take place, and thus more value would be spent in exchanging that was needed. Furthermore, people would need to conduct time-consuming research before loaning money; that is, more transaction costs and a higher risk premium than in a system with banks as financial intermediaries.

For many Bitcoin users, their motto is “not your keys, not your coins.” And while this is partially true, it does not translate to “not your keys, forget that you will ever see your coins back or receive anything valuable to you in return.” And, again, people would only trade their bitcoins for a financial asset valuable to them, the value of which would come from its saleability. If A has previously accepted Bitcoin second-layer substitutes because A believe that these could be redeemable to bitcoins when demanded, A wanted to pay something to B, B accepted these substituted for the same reason A did, and the payment had fewer or no transaction fees, it would make sense for both parties to use this system. A does not have to hold only financial assets in his cash balances. A may decide on the appropriate money-credit ratio that best fits his needs. A may own 100 satoshis and convert 30 of these to Company X Bitcoin Credit because A buys from them frequently. Company X may then decide where that money is best employed, kept in their cash balances to face future payments, or invested on future production. That would be Company X evaluation, in the same manner that banks have been making similar decisions throughout history. There is no reason to believe it would be different under a Bitcoin standard.

Furthermore, we see some people already converting their bitcoins to claims to bitcoins. When you buy bitcoins from an exchange, if you keep your bitcoins there, what you own is a claim to those bitcoins that are under the control of the exchange. (Thus, the “not your keys, not your coins” phrase.) Therefore, it is no longer a supposition that Bitcoin credit will emerge, it has already done so, and this business has incontrovertibly passed the market test. Some reasons for why people would prefer claims to bitcoins from the exchange to actual bitcoins are that exchanges could be easier to use than most wallets, that once people buy bitcoins they do not want to have to transfer elsewhere if they can keep them on the same “place” and that some exchanges offer their clients demand loans with higher interest rates than checking or saving accounts. Both hypothetical reasons were cases of mental transaction costs at play, and the latter financial incentives generated by better contracts that the specialized financial intermediary—the exchange—offers, which prove the point we made earlier.

6. Conclusion

Money tends to be one and from all the possible options, we believe that Bitcoin has the best changes to become the globally used medium of exchange. Before that happens, individuals need to build an infrastructure around Bitcoin such as banking, user-friendly platforms, and financial assets convertible to it. In this paper, we focus on the development of this third component, credit instruments that could work alongside Bitcoin as the base money in an economy. Credit is necessary in any monetary system. With it, some payments become more flexible, and thus possible. The price of money stabilizes, too, because there are now media that operate as substitutes to match monetary supply to its demand by increasing the velocity of money.

We propose three different second-layered money that could work with Bitcoin and stabilize its price. First, individuals producing goods in the late stages of production could finance their activity by issuing real bills. These could be sold or discounted in Bitcoin and operate following the Real Bills Doctrine in an enhanced manner, as now it is possible for creditors to track the goods in real time, and thus offer an accurate discount for the bills and incur less risk.

Second, businesses would issue stamp scrip to incentivize the purchase of their products. People will decide then whether to pay with this medium of exchange or trade it for bitcoins with a discount. In case a company has excessive stock, managers will tend to offer stamp scrip with a premium high enough for them to pay with this asset instead of exchanging it to Bitcoin, thus increasing the money’s velocity.

Third, cash convertible to Bitcoin would suppose a great increase in its liquidity. People could exchange cash convertible to Bitcoin knowing that there is Bitcoin behind to back it up without needing to redeem it for convenience purposes, as people did under gold-standard systems. Exchanges and banks would have an incentive to issue it.

In an online Bitcoin forum, a user called a “wobber” asked a similar question to the one we answer in our paper, “Did anyone think at [sic] this? How would a bank work? How could you loan bitcoins and get interest

for them in an economy with just 21 million [sic] BTC limit?" in 2010. Hal Finney, one of the original Bitcoin developers replied with the following:

> Actually there is a very good reason for Bitcoin-backed banks to exist, issuing their own digital cash currency, redeemable for bitcoins. Bitcoin itself cannot scale to have every single financial transaction in the world be broadcast to everyone and included in the block chain. There needs to be a secondary level of payment systems which is lighter weight and more efficient. Likewise, the time needed for Bitcoin transactions to finalize will be impractical for medium to large value purchases. Bitcoin backed banks will solve these problems. They can work like banks did before nationalization of currency. Different banks can have different policies, some more aggressive, some more conservative. Some would be fractional reserve while others may be 100% Bitcoin backed. Interest rates may vary. Cash from some banks may trade at a discount to that from others. George Selgin has worked out the theory of competitive free banking in detail, and he argues that such a system would be stable, inflation resistant and self-regulating. I believe this will be the ultimate fate of Bitcoin, to be the "high-powered money" that serves as a reserve currency for banks that issue their own digital cash. Most Bitcoin transactions will occur between banks, to settle net transfers. Bitcoin transactions by private individuals will be as rare as... well, as Bitcoin based purchases are today. [9]

[9] *See* Hal Finney answer in the Bitcoin Bank thread at Bitcoin Forum. Available at: https://bitcointalk.org/index.php?topic=2500.msg34211#msg34211

References

Ammous, Saifedean. 2018. *Bitcoin Standard: The Decentralized Alternative to Central Banking*. Hoboken, United States: Wiley.

Barnett, William, and Walter Block. 2005. Money: Capital Good, Consumers' Good, or (Media of) Exchange Good?. *The Review of Austrian Economics* 18: 179–94. https://doi.org/10.1007/s11138-005-6826-1

Bhatia, Nik. 2021. *Layered Money: From Gold and Dollars to Bitcoin and Central Bank Digital Currencies*. United States: Self-published.

Bondone, Carlos A. 2012. *Teoría de La Moneda*. Buenos Aires, Argentina: Self-published.

Champ, Bruce. 2008. "Stamp Scrip: Money People Paid to Use." *Economic Commentary*, no. April.

Dowd, Kevin. 1993. *Laissez-Faire Banking*. London, United Kingdom: Routledge.

Dowd, Kevin. 2019. "The War on Cash Is About Much More than Cash." *Economic Affairs* 39: 391–99. https://doi.org/10.1111/ecaf.12377.

Dylan-Ennis, Paul J. 2022. "The Rise and Fall of Bitcoin Culture." *CoinDesk.* Available at: https://www.coindesk.com/layer2/2022/10/11/the-rise-and-fall-of-bitcoin-maximalism/

Prasad, Eswar. 2021 "The Future of Crypto Is Bright, But Governments Must Help Manage the Risks." *Time*. Available at: https://time.com/6108232/bitcoin-cryptocurrency-future-blockchain-regulation/

Fekete, Antal E. 2005. "The Principle of Liquidity." *24hGold*. Available at: https://professorfekete.com/articles/AEF7thPillarOfMoneyAndCredit.pdf

Fekete, Antal E. 2017. *Critique of Austrian Economics in the Spirit of Carl Menger*. Aarschot, Belgium: Pintax cvba.

Fishback, Price V. 1986. "Did Coal Miners 'Owe Their Souls to the Company Store'? Theory and Evidence from the Early 1900s." *Journal of Economic History* 46 (4): 1011–29.

Fullarton, John. 1845. *On the Regulation of Currencies: Being an Examination of the Principles, on Which It Is Proposed to Restrict, Within Certain Fixed Limits, the Future Issues on Credit of the Bank of England, and of the Other Banking Establishments Throughout the Country*. 2nd ed. London, United Kingdom: John Murray.

Glasner, David. 1992. "The Real-Bills Doctrine in the Light of the Law of Reflux." *History of Political Economy* 24 (4): 867–94. https://doi.org/10.1215/00182702-24-4-867.

Green, Roy. 1989. "Real Bills Doctrine." In *Money*, edited by John Eatwell, Murray Milgate, and Peter Newman, 310–13. London, United Kingdom: Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-19804-7_38.

Hoffman, Michael. 2019. *Monetary Kaleidics*. Self-published.

Klemperer, Paul. 2020a. "Network Goods (Theory)." In *The New Palgrave Dictionary of Economics*, edited by Matias Vernengo, Esteban Perez Caldentey and Barkley J. Rosser. London, United Kingdom: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-349-95121-5_2178-1

Klemperer, Paul. 2020b. "Switching Costs." In *The New Palgrave Dictionary of Economics*, edited by Matias Vernengo, Esteban Perez Caldentey and Barkley J. Rosser. London, United Kingdom: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-349-95121-5_2181-1

Lannon, Donald. 2017. "Disinfect Before Handling: The Story of Culion Leper Colony and Its Coinage." *The California Numismatist* 14 (2): 28–40.

Levin, Jonathan. 2017. "New York Fed President Sent Puerto Rico a Jet Filled with Cash." *Bloomberg*, October 9, 2017. Available at: https://www.bloomberg.com/news/articles/2017-10-09/fed-s-dudley-sent-puerto-rico-a-cash-filled-jet-as-money-ran-low

McMaken, Ryan. 2017. "In a Cashless World, You'd Better Pray the Power Never Goes Out." *Mises Wire*, October 10, 2017. Available at: https://mises.org/wire/cashless-world-youd-better-pray-power-never-goes-out

Mehrling, Perry. 2013. "The Inherent Hierarchy of Money." In *Social Fairness and Economics: Economic Essays in the Spirit of Duncan Foley*, edited by Lance Taylor, Armon Rezai, and Thomas Michl, 394–404. London, United Kingdom: Routledge.

Menger, Carl. 2009 [1892]. *On The Origins of Money*. Auburn, United States: Ludwig von Mises Institute.

Monbiot, George. 2015. "A Maverick Currency Scheme from the 1930s Could Save the Greek Economy." *The Guardian*, February 17, 2015.

Nair, Malavika, and Nicolás Cachanosky. 2017. "Bitcoin and Entrepreneurship: Breaking the Network Effect." *The Review of Austrian Economics* 30 (3): 263–75. https://doi.org/10.1007/s11138-016-0348-x.

Nakamoto, Satoshi. 2008. "Bitcoin: A Peer-to-Peer Electronic Cash System."

Rallo, Juan Ramón. 2017. *Contra La Teoríoa Monetaria Modern*. Barcelona, Spain: Ediciones Deusto.

Rallo, Juan Ramón. 2019. *Una Crítica a La Teoría Monetaria de Mises*. Madrid, España: Unión Editorial.

Roberds, William. 1990. "Lenders of the Next-to-Last Resort: Scrip Issue in Georgia during the Great Depression." *Economic Review*, Economic Review, no. September: 16–30.

Rodríguez Salazar, Oscar, and Décsi Arévalo Hernández. 2017. "Currency and Social Segregation, the Case of the Leper Colonies in Colombia." *Économie et Institutions* 26. https://doi.org/10.4000/ei.6058.

Selgin, George. 1987. "The Stability and Efficiency of Money Supply Under Free Banking." *Journal of Institutional and Theoretical Economics* 143 (3): 435–56. http://www.jstor.org/stable/40751005.

Selgin, George, and Lawrence H. White. 1987. "The Evolution of a Free Banking System." *Economic Inquiry* 25 (3): 439–57. https://doi.org/10.1111/j.1465-7295.1987.tb00752.x.

Shafer, Neil, and Tom Sheehan. 2013. *Panic Scrip of 1893, 1907 and 1914: An Illustrated Catalog of Emergency Monetary Issues*. Jefferson, Estados Unidos: McFarland & Company, Inc., Publishers.

Shackle, George. 1942. "A Theory of Investment-Decissions." Oxford Economic Papers 6: 77-94. https://www.jstor.org/stable/2663465

Szabo, Nick. 2001. "Trusted Third Parties Are Security Holes." *Satoshi Nakamoto Institute*, 2001.

Szabo, Nick. 2002. "Shelling Out: The Origins of Money," 2002.

Tan, Elaine. 2011. "Scrip as Private Money, Monetary Monopoly, and the Rent-Seeking State in Britain." *The Economic History Review* 64 (1): 237–55. https://doi.org/https://doi.org/10.1111/j.1468-0289.2010.00549.x.

Timberlake, Richard H. 1984. "The Central Banking Role of Clearinghouse Associations." *Journal of Money, Credit and Banking* 16 (1): 1–15. https://doi.org/10.2307/1992645.

Timberlake, Richard H. 1987. "Private Production of Scrip-Money in the Isolated Community." *Journal of Money, Credit and Banking* 19 (4): 437–47. https://doi.org/1992612.

Westerkamp, Martin, Friedhelm Victor, and Axel Küpper. 2020. "Tracing Manufacturing Processes Using Blockchain-Based Token Compositions." *Digital Communications and Networks* 6 (2): 167–76. https://doi.org/https://doi.org/10.1016/j.dcan.2019.01.007.

White, Lawrence H. 1995. *Free Banking in Britain: Theory, Experience and Debate, 1800–1845*. London, United Kingdom: The Institute of Economic Affairs.

White, Lawrence H. 1999. *The Theory of Monetary Institutions*. Maiden, Untied States: Blackwell Publishers.