THE
BITCOIN
STANDARD
RESEARCH BULLETIN

Dr. Saifedean Ammous

September 2018, Volume 1, Issue 1

Bitcoin, Central Banking and Fractional Reserve Banking

Contents

In The Bitcoin Standard, I argued that Bitcoin is evolving and scaling in a manner similar to that of the gold standard, with on-chain transactions similar to the rare, expensive, and highly secure movements of physical gold, while second layer systems with less strict security requirements handle more common and frequent payments. In the same way that a bank under the gold standard would transfer ownership of a gold bar from a payer to a payee without physically moving the gold bar itself, Bitcoin banks, exchanges, and websites can all transfer bitcoins on hand without registering each movement on-chain, thus saving on transaction costs; For transfers among themselves, they'd net these movements to further reduce transaction costs. On-chain transactions, like physical movements of gold, will increasingly be used for final settlement instead of individual payments. The hardness of Bitcoin, like the hardness of gold before it, will likely make it the most attractive store of value, and thus the preferred method of payment over other digital or government currencies that don't have the same hardness.

While on-chain bitcoin transactions are clearly preferable to second layer off-chain transactions, engineering realities discussed in detail in *The Bitcoin Standard* mean on-chain transactions simply cannot be used for global mass payments. If demand for bitcoin as a hard money grows, the choice that many will face is not between bitcoin on-chain transactions and second-layer transactions, but rather, between bitcoin second-layer transactions and second-layer transactions on more centralized networks running on easy government money. Whatever one may think about second layer solutions and the trust involved in custodial and clearing services, their growth and development seem highly likely if the demand for bitcoin as a hard money is larger than the demand for it as a payment network with no trusted third parties.

In this, the first of The Bitcoin Standard Research Bulletin, we will delve in more detail into how this Bitcoin Standard can work, in particular with regards to central banking and fractional reserve banking. We begin by exploring the possibility of central banks adopting bitcoin as a reserve asset, before moving on to discussing fractional reserve banking, whether it is necessary or possible in a free market, the academic debate about it, and then assess how likely it is to develop on top of bitcoin. Building on that analysis, we analyze the likelihood that growing financial products and services on top of bitcoin could lead to the manipulation of its price.

I. Will Central Banks Adopt The Bitcoin Standard?

My book, and my writing in general, deliberately steers clear of making predictions about the future, because economic analysis is not a crystal ball that allows us to extrapolate what the future will look like. The best we can do is identify trends and patterns and then attempt to understand how they could evolve. The subtitle of my book describes The Bitcoin Standard as 'The Decentralized Alternative to Central Banking', but the text leaves open the possibility that central banks could purchase bitcoin and use it as a reserve asset if it continues to rise in value. International payment settlement happening with Bitcoin is already a reality, and the first viable alternative to the global cartel of government-protected central bank monopolies. If this network continues to develop and adds further layers that make it easier to spend bitcoin, then not only would central banks lose control over the international payment infrastructure, but their currencies would also lose value as more and more of their citizens ditch them and adopt Bitcoin instead. Would it not make sense, then, for central banks to buy bitcoin and use it as a reserve asset with which to back their currencies?

The case for such a move seems compelling at first: If Bitcoin increases in price, any country that uses it as a reserve will witness its international cash reserve account rise in value, which would make it less likely for their government or central bank to run into balance of payment problems. The more the reserves appreciate, the more leeway the government has with its own spending and

international payments. Further, it would allow central banks to sidestep restrictions imposed by the US government and its central bank on international capital movement. Countries like China, Russia, Iran, and North Korea have their international trade and finance restricted to varying degrees by US sanctions, and this could be ameliorated if they could settle payments with each other (or other countries' central banks) using bitcoin.

But on closer inspection, this possibility looks increasingly unlikely. While China, Russia, Iran, North Korea and other countries may hate the US Dollar-based world financial system, they love having their own fiat currencies far more than they hate it. Should one of these countries announce the replacement of even a small amount of reserve assets with bitcoin, the impact on Bitcoin's price would likely be massive and that small portion would grow into a not-so-small portion. Other countries could follow suit in an attempt to replicate the first country's success; the likely effect would be a significant drop in the value of national currencies used as international reserve assets, as each central bank scrambles to sell some of its international reserve currencies for the quickly-appreciating bitcoin to back their own currencies and preserve their value. The more this happens, the more precarious is the position of any central bank lagging behind, as they witness the demand, and thus the value, drop for the international reserve currencies held in their own reserves (leading to their own currency becoming increasingly worthless). Currencies lagging behind and with low bitcoin backing would be subject to speculative attacks by large bitcoin holders scenting blood in the increasingly weak international cash balances. Even countries with moderate bitcoin holdings would be vulnerable to these attacks until their currency is entirely, not just partially, backed by bitcoin. The end result of such a scenario is that the only currencies that survive will be the ones fully backed by bitcoin.

While not inevitable, it is quite possible that the first central bank that moves to use bitcoin as a reserve asset will trigger a central banks' "reverse bank run" on buying bitcoin, the end point of which is that only currencies that survive are the ones fully backed by bitcoin. It might just not be possible to bite from the apple of bitcoin hard money reserves without falling from the governmental Garden of Eden of fiat money.

China, Russia, and Iran may like to make a lot of noise about the unfairness of the US Dollar global monetary system, and how it privileges the US internationally, but these governments are not run by sound money Austrian-school educated economists who would like to see a return to the 19th century gold standard. Decades of western cultural imperialism mean that even these countries are ruled by the kind of leftist, socialist, Keynesian, and similarly inclined economists who idolize inflation as the key to solving all of life's problems. These governments do not hate the US Dollar for being fiat money, but rather merely for being another government's fiat money. They recognize and understand that their extremely elaborate states and bureaucracies, with their far-reaching control of their citizens' lives and large monopoly industries to benefit them and their cronies, are utterly dependent on their ability to continue creating their own money. The Chinese communist party, Putin's police state and budding global empire, Iran's Islamic republic and its budding regional empire are all utterly reliant on easy money. Without it, these governments and their powerful cronies would be neutered.

We know this because these countries have long talked about shifting to gold for international payment settlement and as a reserve asset without ever doing it. While they've accumulated gold as a wise hedge against their US Dollar reserves, they refuse to settle their own trade using gold and continue to rely on the swift network. As much as they would like to dethrone the dollar, they cannot dethrone it by replacing it with one of their own currencies; none of the other countries want to get rid of the dollar only to have another government introduce something identical. They certainly don't want gold to replace the dollar, as that would force them to operate under a gold standard and neuter their governments and the plutocrats who control it. Bitcoin poses a similar risk in that regard, and they're highly unlikely to even take the first step of using it as a reserve asset because, unlike gold (which has had this role for thousands of

years), a central bank's purchase of bitcoin would quickly boost its appreciation and monetization.

Aside from the self-interest of the ruling elites in these countries, US power is another important factor that may stop them from adopting gold. The IMF, which is a tool of US monetary policy, has long banned its members from tying their currency to gold. Many instances of "democratization" and "regime change" that the US has blessed countries with are arguably motivated by preventing alternative monetary arrangements. The US still has the world's strongest military and the strongest currency, and any global financial crisis that happens, while having its root causes in the dollar, is likely to only make the dollar stronger, not weaker, as happened in 2008. For all its flaws, the dollar is still the most liquid of all national currencies, and the one with the least default risk behind it, since all other countries have obligations in the dollar which none of them can print. Unlike Bitcoin, central banks are centralized, and so are the governments behind them. Any country that chooses to dabble with Bitcoin as a reserve currency is highly likely to risk arousing US foreign policy's interest in bringing it democracy and regime change. It will most likely never come to that however, because central bankers today have only managed to obtain their jobs by being so completely and thoroughly inculcated with Keynesian and statist propaganda of economics that they'll be the absolute last in the world to understand the significance of Bitcoin and how it's a viable alternative to what they do. The recent report by the Bank of International Settlement, and this interview with their chief economist, make it pretty clear that central banks thinking about bitcoin today is largely a recycling of 2015 nocoiner propaganda and concern trolling over fees for buying a cup of coffee, along with the obligatory claptrap about the disruptive potential for blockchain technology. They are completely oblivious to the possibility of second layer scaling solutions being introduced onto Bitcoin to make it function more like a settlement network among banks, i.e. a replacement for central banks. The central banker is the last person capable of understanding that money does not need the state, and the last person to get the significance of bitcoin.

Finally, to understand Bitcoin's value proposition as a long-term store of value despite its short-term fluctuations requires a certain degree of low time preference, which you can't expect to find in any modern government bureaucracy or the individuals that staff them. The uncertainty and short-term nature of democratic rule instills a short-term orientation in these bureaucrats and all but guarantees that politics is a short-term power and money grab. Politicians or bureaucrats can be expected to rationally prioritize their self-interest in short periods in office over their constituents' long-term future. Chapter 1 in Hans-Hermann Hoppe's masterpiece, Democracy: The God That Failed, contains an excellent discussion of this point.

The mental models that govern rulers and bureaucrats and central bankers all over the world, the self-interest of these elites in maintaining inflationary money, and the threat of US military and economic power against any defections from the dollar standard all lead me to be highly skeptical of the possibility that central banks will adopt Bitcoin any time soon. It's far more likely we'll see a Bitcoin Standard develop as described in the subtitle of my book: a highly compelling decentralized alternative to central banks and a global payments settlement layer that runs on the hardest money ever invented, operating outside the purview of modern states. Best of all, this system is likely to continue to grow for a long time before the powers that be even notice its true significance or understand the devastating implications for their careers.

II. Can Fractional Reserve Banking Develop On Top Of Bitcoin?

Fractional reserve banking refers to banks lending out a fraction of the deposits they have available on demand to depositors. A depositor who places a sum of money in a demand deposit does so under the understanding that they are able to withdraw all

of that sum at any time they wish. But a fractional reserve bank will nonetheless lend out a fraction of that deposit. If the depositor demands their deposit back, the bank will have to provide him with money from other depositors. It is always possible that a larger fraction of deposits will be demanded for withdrawal than what the bank has available, and in that case, the bank is considered 'illiquid': it has assets to meet all its liabilities, but its assets are in the form of loans to others which the bank cannot liquidate for cash to redeem depositors. This lack of liquidity causes a bank run, wherein depositors rush to the bank to try to get their deposits out first.

Maturity transformation is a banking practice similar to fractional reserve banking, wherein a bank relies on continuously taking out short-term loans to finance long-term lending. A maturity transforming bank would make a ten year loan without having savers placing money at the bank for an agreed upon duration of ten years. It would make the ten year loan while relying on always having short-term lenders providing it with enough liquidity to roll over the debt. Similar to fractional reserve banking, a maturity mismatching bank is also under threat of a bank run if it runs into any difficulty in finding short-term borrowers.

If you would like more explanation of the nature of fractional reserve banking and how it works operationally, you can take my online Macroeconomics course on Udemy learning platform, which explains it in some detail in lectures 8 and 9. Use this link or promo code TBSRB1 to take the course for free.

Fractional reserve banking is a highly contentious topic among sound money economists. Because the global monetary and financial system has been under the control of the government-enforced monopolies of central banks for the past century, this debate was largely an academic one. Governments made fractional reserve banking legal and used their monopoly over the issuance of currency to protect banks that engaged in it. As a result, it was impossible to know whether such a fractional reserve system would develop in a free market. However, the budding development of an alternative and completely free market monetary and financial system on top of Bitcoin has resurrected this debate and is giving it a heretofore unprecedented significance in the real world. It is my contention that a fractional reserve system is not sustainable under a Bitcoin Standard. While there is nothing to stop individuals from engaging in fractional reserve lending in a free market bitcoin financial system, such activities would be doomed to failure, with a heavy cost to everyone involved. Even if central banks and governments were to adopt Bitcoin as a global currency, its distributed nature, digital settlement, and transparency make fractional reserve arrangements that thrived with government money (and even gold) untenable.

In *The Bitcoin Standard*, I quote the late Hal Finney discussing how Bitcoin can scale. With great foresight, Finney identified the inherent limitations of Bitcoin on-chain scaling, which still escape many Bitcoin fans and has led to doomed forks of Bitcoin that attempt it:

> *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.*

Finney then discusses how such a banking system could accommodate fractional reserve banks, and how it would be stable, inflation-resistant, and self-regulating:

> *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.*

While I find myself in agreement with Finney on the idea of Bitcoin on-chain transactions evolving to settle net transfers between financial institutions, I must disagree with him on the likelihood of fractional reserve banking developing. Before we dive into whether such a system can survive, I want to begin by examining whether there's a need for it to emerge in the first place.

III. Is Fractional Reserve Banking Necessary for a Growing Economy?

The argument for the necessity of fractional reserve banking ultimately boils down to the same arguments that Keynesians, inflationists, and monetary cranks of all hues use for monetary expansionism in general: an increase in the supply of credit to ameliorate any shortage of financial media and instruments will lead to more economic activity and growth. By this logic, banks have the ability to create loans in excess of the capital they hold in reserve, they could mobilize more capital and finance more projects, resulting in less unemployment and increased prosperity. Conversely, if banks are prevented from engaging in fractional reserve banking, a shortage of credit would hamper economic activity, reduce economic production, and reduce living standards. By decoupling available credit from the amount of savings, society overall benefits.

The problem with this logic is the same problem with all inflationist arguments. Money and credit, by themselves, are NOT productive assets. They merely represent receipts that allow their holders to purchase productive assets. An increase in the supply of money or credit will no more increase the stock of productive assets in an economy than an increase in printed football stadium tickets will increase the capacity of the stadium itself. The ticket is merely a proxy for a seat in the stadium, and money and credit are but claims on the final products and the capital goods used in their production. Should a football team wish to increase the maximum number of tickets it sells, it cannot do so by simply increasing the number of tickets it prints; instead, it would have to increase the stadium's capacity, which requires engineers, workers, and heavy capital equipment to complete. Printing tickets beyond the capacity of the stadium will result in more spectators than seats and conflict over these seats, but cannot, under any circumstance imaginable cause the increase in the number of seats beyond the capacity of the stadium.

The fundamental premise on which fractional reserve banking is built is inherently flawed: There can be no such thing as a shortage of money or a shortage of credit. Whatever supply of money is utilized in an economy is always sufficient to supply all the needs of the economy, provided the money itself is divisible enough. The demand for money, of course, is always higher than the supply, because people desire more things than they produce, because desiring is far easier than producing. These desires appear like they can be satisfied with more money, but the creation of money to meet these desires does nothing to produce them, which can only be done through dedicating scarce resources to their production. In a hard money free market, people dedicate their

time to production in order to make money, and as the quantity of goods and the amount of economic production increases, the supply of money need not increase, but its value will naturally rise.

Fractional reserve banking does not magically create more capital, labor or resources. It merely allows central banks to control the allocation of these resources, rather than the productive people who own them. It is a form of central planning that impoverishes society overall but enriches the banks and governments that engage in it. Without fractional reserve banking, capital and labor would flow to the highest bidder, the entrepreneur whose business plan utilizes them the most productively and pays them the highest return. With fractional reserve banking, it is no longer free market competition that drives this resource allocation decision, but rather the banker who gets to enjoy the upside while being protected from the downside. It's no wonder than subpar business plans and malinvestments get funded in such an environment, skin in the game matters.

IV. Can Fractional Reserve Banking Survive in a Free Market?

But if a fractional reserve banking system is not necessary, how can we explain its prevalence everywhere in the world today? In particular, how can we explain that economies that have utilized it seem to prosper? The answer lies in the fact that central banks that act as a lender of last resort to banks. Fractional reserve banking is inherently unstable without a lender of last resort that can increase the money supply. This guarantee allows banks to create more liabilities for the monetary unit than they have assets. Historically, fractional reserve banking was unsustainable in a free market, and the creation of central banks was primarily due to banks seeking government protection from the inevitable bank runs of fractional reserve banking.

In a free market, a bank that engages in fractional reserve lending will find itself with a mismatch between its assets and liabilities. For instance, it may owe a depositor $100 available to them on demand, but will simultaneously loan out a fraction of that money to a borrower. Should the depositor request all their money when the borrower still has it, the bank has a problem. But since the bank of course has more than one borrower and depositor, it should be able to return the money back to the depositor by giving him some of the other depositors' cash. As the amount of lending increases (and the fraction of deposits lent out increases), the bank's position becomes increasingly precarious and vulnerable to a bank run. To make matters worse, once depositors and borrowers discover the increasing amount of unbacked credit issued by the bank, they become more concerned about the safety of their deposits and thus more likely to demand their withdrawal. If the amount of deposits suddenly demanded by depositors exceeds the bank's reserves on hand, the bank has a 'liquidity problem' (which is viewed as distinct from a solvency problem, because the bank does have enough assets to meet all the withdrawal demands of its depositors, but does not have them on hand). The liquidity problem is precipitated by a bank run: as depositors begin to realize their deposits might not be safe, they rush to the bank to demand them. But the bank can only satisfy a fraction of them.

There are a few different ways to address this problem: the bank can simply satisfy the withdrawal requests of the first depositors to demand it (until the bank runs out of reserves). Another way is for the bank to enact a percentage haircut on each depositor's balance until the bank's total reserves match the total of all depositors' newly adjusted balances; This method essentially transitions the bank to full-reserve banking, which then allows all depositors to withdraw their total (and newly reduced) balance simultaneously. Both options imply bankruptcy of the bank, as its assets are liquidated to meet its liabilities to depositors and lenders. While these options can be devastating for both the bank and its depositors, they are in fact the healthiest way to deal with this problem; at a bare minimum, both depositors and bankers learn not to engage in such activities again. An alternative option introduced

over the last century is the creation of a government-mandated central bank to 'inject liquidity' into the struggling bank and allow it to meet its obligations to depositors. Now, with a monopoly on the issuance of money, the central bank can effectively monetize the obligations of the bank and offload the risk of the banks' reckless actions onto all the holders of the nation's currency, not just the bank's depositors. It's bad enough that the conscientious banks and individuals who did not engage in fractional reserve banking now have to subsidize the irresponsibility of the ones who did, but even worse is that these banks can continue to operate with an ongoing subsidy from society at large; Full reserve banks then become unprofitable in comparison, as they bear the burden of responsible risk management which limits their upside relative to their fractional reserve counterparts.

As Guido Hulsmann put it:

> *[F]ractional reserve banking is not unrelated to central banking, fiat paper money, and international monetary institutions such as the International Monetary Fund. Ultimately, these institutions are abortive attempts to solve the problems of fractional reserve banking by centralizing cash reserves or by refusing redemption of money titles.*

The emergence of central banking cannot be understood separately from the problems caused by fractional reserve banking. To a historically unprecedented extent, central banks allowed governments to take control of the monetary, financial, and economic systems of their countries. Eventually, this nationalization of money and credit snowballed into the nationalization of other parts of the economy, as the government had recourse to a money printer it could abuse.

In the United States, the Federal Reserve was created as a response to the crisis of 1907, in which overextended fractional reserve banks faced a liquidity crisis that required J.P. Morgan to gather the bankers and play lender of last resort. Instead of understanding this event as a lesson for banks to reduce their fractional reserve banking, it led banks to create a government agency to protect them as they overextend credit. The two reasons given for the creation of central banks were: the protection of the banking system from bank runs or financial crises, and the stabilization of the Dollar's value. That these two goals were directly contradictory is the obvious kind of fact that was only noticed by economists like Friedrich Hayek, in his enormously important and widely unread *Monetary Nationalism and International Stability*:

> *…the fundamental dilemma of all central banking policy has hardly ever been really faced : the only effective means by which a central bank can control an expansion of the generally used media of circulation is by making it clear in advance that it will not provide the cash (in the narrower sense) which will be required in consequence of such expansion, but at the same time it is recognised as the paramount duty of a central bank to provide that cash once the expansion of bank deposits has actually occurred and the public begins to demand that they should be converted into notes or gold.*

Inevitably, the goal of protecting the value of the "cash" was to conflict with the goal of protecting banks from bank runs, and central banks almost always favor the financial system at the expense of reserve currency's value. After a world war, mass death and destruction, and many terrible economic mistakes1, the US could no longer maintain the Dollar's redeemability to gold; Most of the world's economies defaulted on their notes' promise of redemption in gold, and ended up revaluing their currencies in terms of gold. Although many economists discuss this episode, few call it by its true name: sovereign default.

What history shows is that fractional reserve banking can only function with a lender of last resort, and only when the lender of last resort has the capability to increase the money supply at will. In other words, fractional reserve banking can only survive with easy money. Given the modern availability of hard money options like gold and Bitcoin, the only way fractional reserve banking can survive today is through legal tender laws and

a government-enforced monopoly on the issuance of money. This is why the banking system of most western economies needed the abandonment of gold redeemability in the 1930s to survive.

V. The Scholarly Debate

Modern Austrian economists have extensively debated this topic. On one hand, Murray Rothbard, Jesus Huerta de Soto (see his book, or these articles (1 and 2)), Hans-Hermann Hoppe (1, 2, and 3), Guido Hulsmann (book, and these articles (1, 2, and 3)), and others argue against fractional reserve banking. On the other hand, Larry White (book) and George Selgin (book), (articles: 1, 2, and 3, and 4) among others, argue that fractional reserve banking is a good form of banking innovation that emerges on a free market[1].

It is not easy to summarize all the points of view of this debate, and the reader is encouraged to read the authors themselves to make their own mind up. After many years of reading on this question, I find the views of the first camp of economists more convincing. The pro-FRB arguments are theoretical and suffer from a serious problem of being able to demonstrate valid free market examples of stable fractional reserve banking systems. Their favorite example concerns the Scottish banking system, which they claim was independent of the Bank of England for a period at the turn of the 19th century during which Scottish banks suffered fewer crises than English banks. According to this view, fractional reserve banking in Scotland, by being independent of the English central bank, was a more sustainable alternative. But as closer research by Murray Rothbard shows, the actual record of events unfolding there contradicts with their views significantly, as to render their conclusions invalid. Contrary to White and Selgin's assertions, Scottish banks were pyramiding their debt obligations on top of Bank of England paper, just like English banks, and they suffered regular and recurring crises no different from those suffered by the English banks. To quote Rothbard:

> *From the beginning, there is one embarrassing and evident fact that Professor White has to cope with: that "free" Scottish banks suspended specie payment when England did, in 1797, and, like England, maintained that suspension until 1821. Free banks are not supposed to be able to, or want to, suspend specie payment, thereby violating the property rights of their depositors and noteholders, while they themselves are permitted to continue in business and force payment upon their debtors.*

So the pro-fractional reserve economists' claims that fractional reserve banking can be built in a free market without a central bank is based on a banking system that had a central bank allow it to suspend redemption of its paper in gold for a quarter century. Whatever one thinks of fractional reserve banking, one cannot present this as a valid example of it emerging on a free market. In a free market, depositors would be able to withdraw their gold from these banks as they had agreed, and there would be competitor banks that would offer full reserve redemption that would drive the non-redeeming banks out of business. As with every example of fractional reserve banking, it was the banks' monopoly power, enforced by the state, which allowed it.

The pro-fractional reserve banking side have also argued that fractional reserve banking allows for the free market to adjust the supply of credit and money in the economy in response to changing demand conditions. But this is no different than Keynesian conceptions of the money supply and the role of the government in managing it, by accepting the flawed premise that the supply of money itself needs to be adjusted to the demand for it, when in reality, money is the one unique good whose quantity is irrelevant to its performing its functions. As any quantity of money is enough

[1] You can also see this Lawrence White essay and pursuant conversation on the Library of Economics and Liberty. You can watch this recent debate between Robert Murphy and George Selgin. Stephan Kinsella has compiled all these resources, and much more, on his website.

for any economy, the quantity of the money does not need to be adjusted to fluctuations in demand; rather, the changes in demand will cause the value of the money to vary accordingly, offering valuable economic signals. As Hulsmann explains:

> *It is also wrong to suppose that fractional reserve banks are particularly well suited to "adjust" the supply of money in response to prior changes in the demand for money balances. The reason is that no such special adjustment is necessary in the first place. That somebody has an increased demand for money means that he is willing to pay a higher price to obtain money or that he requires a higher price for the money he sells. In both cases, the increased demand ipso facto increases the purchasing power of money, thus equilibrating demand and supply of money. And the same thing holds true, of course, for the case of a reduced demand for money. Therefore, the supply of money does not have to be adjusted to the demand for money. Unlike all other commodities, money itself constantly adjusts to the conditions of the market. The services rendered by any unit of money are constantly adjusted under the impact of changes in the demand for and supply of money. Of course, this self-adjustment does not work out to everybody's benefit. No adjustment does, and no institutional arrangement such as fractional reserve banking can change this fact.*

Another error that the pro-fractional reserve banking side make is in their appropriation of the term "free banking" to mean fractional reserve banking. Some of the anti-fractional reserve banking Austrians, most notably Jesus Huerta de Soto, argue from legal principles and historical case studies that fractional reserve banking is fraud, and that a legal system that protects against fraud should ban it. Selgin and White argue, convincingly, that if people are willing to agree to dealing with a bank practicing fractional reserve banking, then there is no fraud involved[2]. Selgin and White can thus appropriate the term "free banking" to refer to government allowing a free market in banking, which, in their view, would lead to fractional reserve banking growing and thriving, such as in their favorite example, Scotland.

But de Soto's argument, regardless of its validity in legal terms, is not the economic argument against fractional reserve banking. For a legal authority looking to regulate banking, it may make sense to ban fractional reserve banking, to prevent banking collapses and boom and bust cycles, but that is hardly a free market argument against fractional reserve banking.

The economic argument against fractional reserve banking is that it could not survive in a free market without government coercion, and that the absence of a central bank and legal tender laws would render fractional reserve banking unsustainable. The larger the scope of the fractional reserve banking, the larger the impact it will have on the economy at large. A free market would punish people who take part in these businesses with bankruptcy, thus prevent them from having the capital necessary to repeat this experiment, and deter others from emulating them. In more modern times of low-cost information and relatively open financial markets, fractional reserve banking is unsustainable because any bank that is practicing can be rendered insolvent by what I like to call a "liquidity vulture attack", as described below in Section IX.

The free banking school thus takes Mises' support for a free market in banking as support for fractional reserve banking, but a more accurate reading of his words would clearly show he understood that fractional reserve banking was the driving force of the business cycle:

> *The notion of "normal" credit expansion is absurd. Issuance of additional fiduciary media, no matter what its quantity may be,*

[2] An effective counter-argument here is that people who agree to a fractional reserve banking contract are being misled about the actual details of how it functions, particularly in the notion that demand deposits are advertised as being available on demand, when they in fact are not, and that accurate non-fraudulent claims would reduce the customers that deal with banks.

always sets in motion those changes in the price structure the description of which is the task of the theory of the trade cycle. Of course, if the additional amount issued is not large, neither are the inevitable effects of the expansion.

He also understood full well that banks must hold full reserves in order to operate safely:

It is very easy for a bank to increase the number of people who are ready to accept loans granted by credit expansion and paid out in an amount of money-substitutes. But it is very difficult for any bank to enlarge its clientele, that is, the number of people who are ready to consider these claims as money-substitutes and to keep them as such in their cash holdings. To enlarge this clientele is a troublesome and slow process, as is the acquisition of any kind of good will. On the other hand, a bank can lose its clientele very quickly. If it wants to preserve it, it must never permit any doubt about its ability and readiness to discharge all its liabilities in due compliance with the terms of the contract. A reserve must be kept large enough to redeem all banknotes which a holder may submit for redemption. Therefore no bank can content itself with issuing fiduciary media only; it must keep a reserve against the total amount of money-substitutes issued and thus combine issuing fiduciary media and money-certificates.

It was a serious blunder to believe that the reserve's task is to provide the means for the redemption of those banknotes the holders of which have lost confidence in the bank. The confidence which a bank and the money-substitutes it has issued enjoy is indivisible. It is either present with all its clients or it vanishes entirely. If some of the clients lose confidence, the rest of them lose it too. No bank issuing fiduciary media and granting circulation credit can fulfill the obligations which it has taken over in issuing money-substitutes if all clients are losing confidence and want to have their banknotes redeemed and their deposits paid back. This is an essential feature or weakness of the business of issuing fiduciary media and granting circulation credit. No system of reserve policy and no reserve requirements as enforced by the laws can remedy it. All that a reserve can do is to make it possible for the bank to withdraw from the market an excessive amount of fiduciary media issued. If the bank has issued more banknotes than its clients can use in doing business with other clients, it must redeem such an excess.

VI. Fractional Reserve Banking and Bitcoin

My conclusion from reading this debate for years is to believe that fractional reserve banking cannot emerge on a free market. Beyond the arguments above, I will provide below a synthesis of my views on the topic, particularly as they relate to Bitcoin.

The processing of payments can be understood as a market good that becomes more valuable as the scale of an economy grows, and the circle in which a person trades expands, since there are clear economies of scale for banks in clearing, netting, and settling large numbers of transactions over individuals carrying these out individually. Some examples are paper notes backed by gold, bills of exchange, modern credit cards, and paypal accounts.

In any monetary system, such networks for banking and settlement will emerge, and they will benefit from economies of scale by holding many accounts for people and netting transactions, bypassing the need to physically transfer money (or in the case of Bitcoin, the need to transfer assets on-chain). Under the gold standard, the physical movement of gold was expensive and insecure, and economies of scale accrued to those that physically amassed reserves and thus could provide a centralized clearing mechanism. As a result, only a few global central banks emerged who could cost-effectively trade gold with one another. The emergence of fractional reserve

banking on top of this system can then be understood as a result of banks' ability to expand credit, backed by their operational capital and aided by a trusted network of banks with which it can clear.

In a sense, fractional reserve banking could be sustainable when the alternative to dealing with banks is too expensive, and banks' reserves are high enough to make mass withdrawals unlikely. If the physical settlement is expensive and the network of banks is very valuable to its customers, banks could conceivably get away with not keeping all deposits on hand without experiencing a bank run. It is possible for fractional reserve banking to continue in a bank that is the only one in a town, or where it enjoys some monopoly privilege from government, because there are no easy alternatives for clients to process payments if they choose to withdraw their money from the bank. This becomes particularly easy if the money is easy.

The degree to which a bank can get away with fractional reserve banking is a positive function of the cost of final settlement of the monetary asset, and the ease of debasing the monetary asset. Under a gold standard, the cost and time required to move gold around physically is relatively high, so the economies of scale from centralization will provide existing banks a degree of leeway in extending unbacked credit without their depositors noticing or being able to do anything about it. Yet this system is not very sustainable, because the longer it lasts, the safer banks feel, the more risks they take, until it comes crashing down, as was the case during the 19th century. Since it is not easy to increase the supply of gold on demand, and no lender of last resort is able to print it to bail out banks engaged in fractionally lending gold-backed notes, fractional reserve banking was the bug that kept on derailing the gold standard. Eventually the gold standard itself was sacrificed to keep fractional reserve banking alive, when a dollar-based standard was used for settlement. This makes settlement entirely centralized with a government monopoly while leaving the currency elastic to the demands of the banking sector.

Here we see an advantage that bitcoin has over gold: It can provably perform hundreds of thousands of settlements a day, each in under an hour. Compared to the physical movement of gold, the final settlement costs are much lower, which translates to less economies of scale for centralized bitcoin clearing, and thus even less incentive for a central banking ecosystem around Bitcoin to emerge. Any system for bitcoin settlement would be far more distributed at its core than gold. That means a central banking ecosystem around Bitcoin would be far more distributed at its core. The benefits from economies of scale are not as pronounced as with the case of gold. There is room for far more institutions able to perform settlement with one another.

With half a million transactions daily, 1,000 global banks can perform daily final settlement with one another (since the number of transactions would be equal to (n*(n-1)/2). Should we consider settlement on a quarterly basis on average, we would have around 10,000 banks. There are many optimizations to Bitcoin transactions that can be applied, using existing provably working technology that would allow a large increase in transaction capacity by combining multiple outputs in each transaction. As a best case scenario, we could think of 5 million payments per day as being a possible upper limit on on-chain Bitcoin daily payments, and with settlement between each institution and the other happening on average only quarterly, there is scope for having around 27,000 central banks able to settle final transactions on a quarterly basis with one another. This would mean that on average, each 300,000 people would have a central bank able to perform final clearance of payments with any other bank in the world at least once quarterly. With such a large number of banks, most banks will likely not need to settle with one another per quarter, but will have more frequent settlements with closer banks. This is a level of decentralization far beyond what the gold standard could ever afford.

In terms of hardness, Bitcoin's supply growth rate will continue to decline and eventually end up at zero, while gold's supply growth rate is largely constant at around 1-2% as discussed in The Bitcoin Standard; The important distinction here

though is that Bitcoin is deterministically and strictly capped, whereas the real gold supply is never really known for certain. One can never really know for sure how much gold there is, and there is no way for easily verifying whether a bank is honest in the holdings it report, except through a very meticulous audit. Given that bitcoin's supply is strictly capped and the coins are always visible on a public ledger, the tracking of bank reserves is less difficult a problem.

The strict cap and transparent supply make it extremely unlikely that fractional reserve banking with Bitcoin will be sustainable. Any entity that engages in it is subject to the threat of bank runs without the safety net of a bail-out from lenders of last resort. Aside from its lower final settlement costs (and thus less incentive for centralization) discussed above, bitcoin is also less susceptible to fractional reserve banking than gold simply because it's much harder to confiscate. But before we discuss the relevance of that, we need to first explain how fractional reserve banking works in the modern financial system.

VII. Shadow Fractional Reserve Banking

The relevance of the question of fractional reserve banking and bitcoin is twofold: First, to understand whether a fractional reserve system can develop on top of bitcoin. Second, to understand how the current financial system can interact with Bitcoin.

Fractional reserve banking, in the institutional manner discussed in the old works of Mises and the Austrian economists, is no longer the serious problem it once was. As mentioned above, the tension between banking solvency and currency hardness was resolved in favor of the former. With time, the FDIC, and international equivalents came along to play the official role of lender last resort. Laws like Glass-Steagall act segregated banking from investment banking, and protected only the former with the protections of a lender of last resort. Supposedly strict lending criteria were implemented to prevent too much credit expansion, and the central bank would set the interest rate. This highly complex edifice of central planning of course did not work too well: the currency continuously lost value, and business cycles were a constantly recurring phenomenon, but for many major economies it did succeed in averting major crisis for many decades through putting some tenuous limit on credit expansion. But this tenuous arrangement is deceptively unstable, for its own stability sows the seeds of its collapse.

By placing a lender of last resort facility at the service of the banks, it is unthinkable that such an exorbitant privilege would go unabused. The banking sector may have ring-fenced retail banking into a highly-regulated industry to prevent bank runs, but they still branched out into other models of banking and finance. These institutions are known as the *shadow banking system*: financial institutions that engage in fractional reserve banking without having a formal lender of last resort like the FDIC. They include investment banks, mortgage companies, money market funds, repurchase agreement markets, asset-backed commercial paper, and securitization vehicles.

The shadow banking system is effectively government-subsidized by the guarantee of the central bank as a lender of last resort, in various explicit and implicit forms. First, these financial institutions can secure funding at a lower rate than other businesses, which is why financial companies began acquiring larger and larger sectors of the economy, and even non-financial companies resort to a large degree of financial operations, as discussed in *The Bitcoin Standard*. This implicit subsidy is itself a privilege to these financial institutions that allows them to engage in mismatched-maturity lending, since they have access to a lower rate than any outsiders.

Second, repeated episodes of the Federal Reserve bailing out financial institutions deemed too systemic to fail reinforced the idea that financial risk-taking was unlikely to be allowed to fail. As far back as 2004, in *Too Big to Fail*, Stern and Feldman warned of the pervasiveness of a bail-out mentality in the financial system, arguing that "not enough has been done to reduce creditors' expectations of [Too Big To Fail] protection."

Stern and Feldman outline several episodes that have, over two decades, fostered creditor bail-out expectations. The first was the bailing out of creditors of Continental Illinois in 1984, which was summarily followed by the comptroller of the currency testifying to Congress that policymakers would also protect creditors of the eleven largest banks in the country, since they were too systemically connected to fail. This incentivized banks to become too big and interconnected to fail, and to take excessive risks. Several other banks and Savings and Loans Associations failed in the subsequent years, and federal protection seemed to become more generous towards creditors and depositors with time, going beyond legal requirements under the pretext of guarding against systemic effects. Stern and Feldman argue that the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) was insufficient to counter growing bail-out expectations. Further, increased bailing out of debtor countries, as well as the government-induced rescue of Long-Term Capital Management (LTCM) in 1998, all contributed to heightened expectations of creditor protection. In time, these warnings have proved prescient.

Third, Yet perhaps even more important was the growing deployment of monetary policy as a means of rescuing failed institutions and forestalling creative destruction. Under what came to be known as "Greenspan's Put", former Federal Reserve Board Chair Alan Greenspan repeatedly lowered official Fed funds rates in response to asset price falls and solvency problems for large firms, allowing them to borrow on favorable terms to save themselves. The 1987 stock market crash, Russia's debt default, the collapse of LTCM, and the bursting of the dot.com bubble were all followed by the Fed cutting rates. Investors and creditors had found a way of privatizing their gains while socializing their losses. Straightforward solvency problems—market losses—were now treated as liquidity problems which a lender of last resort could alleviate, and in the Federal Reserve, the shadow banking system came to increasingly believe they had a lender of last resort upon which they could rely.

Fourth, the increasing political influence of the banking industry which succeeded in formally repealing Glass-Steagall Act, allowing retail banks to enter into investment banking. Rather than being the main culprit of this episode, the repeat of Glass-Steagall is more of a symbolic confirmation of the reality that had creeped over decades of government-enforced control of banking: A giant shadow banking system was now responsible for creating far more of the US Dollar money supply than the government or the formally regulated retail banking system. The shadow banking system's ability to increase the supply of credit is hard to measure or understand, as its many organs move in many different ways, and harder to regulate, since no formal authority has control over these banks, as in narrow retail banking. Instead of regulating it or controlling it, the US Federal Reserve has chosen the wholly submissive position of bailing out virtually unconditionally.

All of this means that today, the inflationary money creation and business cycles are not mainly being generated in the traditional or retail banking system as was the case in the eras of most Austrian economists' analysts. The analysis of fractional reserve ratios, lending criteria, and interest rates for depository institutions are becoming an increasingly quaint irrelevancy in the modern economic system, where far more money is being created outside the traditional retail banking system than inside it. The layers and degrees to which maturity mismatching and fractional reserve banking can exist in the shadow financial system is not easy for anyone to survey.

Now, if you thought fractional reserve banking was complicated when done with bank reserves, then that is nothing compared to the complexity of performing the equivalent of fractional reserve banking with all financial assets and instruments that are held by the shadow financial system. Stocks, bonds, commodities, and all different kinds of debts are now part of maturity mismatched lending, which effectively means the claims for ownership of these assets are larger than the assets. The 2008 financial crisis was merely the collapse of this fractional reserve shadow banking system. By bailing out the majority of financial institutions directly, and by letting them borrow at

lower rates, the central bank played the role of lender of last resort, allowing these banks to profit from mismatched maturity lending in the financial markets, and to continue doing it.

The problem today is quite severe, as Ciatlin Long has been tirelessly repeating.[3] Whether it is stocks, bonds, or collateralized debt obligations, the brokers and financial entities handling these financial assets are engaged in large amounts of rehypothecation, no different in essence, from what banks do with their reserves. Bitcoin is entering a world of shadow banking institutions engaging in mismatched maturity lending without a formal central bank, but with an informal central bank guarantee that bails them out. The amount of fraud and manipulation likely to take place in such markets is large, and many are concerned about what this might mean to Bitcoin. Would the maturity mismatched lending of the shadow banking increase the supply of Bitcoin-tracking financial instruments that provide exposure to the price of bitcoin without having full backing in bitcoin? Wouldn't that reduce the demand for holding bitcoin itself?

VIII. Manipulation of Bitcoin

A frequently discussed topic in Bitcoin circles is whether Wall Street could manipulate bitcoin's price by generating bitcoin-backed financial assets that eat up much of the demand for bitcoin itself; The argument is that futures, ETFs, and other financial instruments offer exposure to Bitcoin's price, and that while Bitcoin itself may be strictly scarce, the amount of bitcoin-backed financial assets Wall street can generate is not. Thus, financialization will kill Bitcoin's scarcity, and a price ceiling will develop and prevent any further growth and success.

The same argument applies to suspected manipulation in the gold and silver markets, especially given how opaque official government policy is with regards to precious metals' monetary role. In particular, GATA is an organization that has spent decades arguing that large bullion banks (i.e. the market makers for precious metals) collaborate with central banks to use futures markets in order to suppress the price. If it can be done to gold and silver, can't it be done to Bitcoin?

Not quite. Financial instruments based on an asset are only bets on the underlying market dynamics of the asset itself, in terms of its supply and demand. For example, futures markets cannot themselves influence the spot market; The exception is when futures are physically settled/deliverable and real bitcoin switches hands, but this can hardly be called manipulation as it's equivalent to any other spot trade that moves the price.

In a free market, manipulation is extremely difficult due to the 'burying the body problem': it's possible for a rich man to spend an enormous fortune buying gold, which raises its price and allows him to profit on previously placed gold futures bets. The problem is that after the bet settles, he now has an enormous amount of gold on hand, and should he try to sell this gold the price would come crashing down. The futures market bet is only profitable if he can move the underlying physical market, but that's not possible without a large position on the spot market (which ties up liquidity and involves even further exposure to market risk). It's quite possible that the price slippage even causes a net loss overall. In other words, it's possible to purchase a large amount of a monetary asset and increase its price, since the limited nature of the supply makes the price easy to raise, but it is not possible to keep the price high without continuing to hold on to the supply of the gold. And even then, the manipulator is exposed to significant risk that if the market moves in a different direction due to factors he cannot control, he would lose significantly.

But nobody suspects that precious metals are being manipulated upward, and central bank would have no interest in such a thing. The more interesting case is the manipulation of precious metals' prices downward, which is what GATA and many

[3] Ciatlin had a very informative discussion with Trace Mayer on his podcast.

analysts conclude is the only reason preventing the return of precious metals to their natural monetary role. Here, the problem for manipulators is far more difficult. The only way to profit from manipulation of precious metals downward is to find a way to sell these metals on the physical markets, bringing the price down, and making your futures' contracts profitable. The tricky part about this is that you cannot sell them on the physical delivery market without buying them in the first place, which is likely to raise their price. In other words, this kind of manipulation is likely to be a wash-out in its impact on the price. If someone buys gold in massive quantities and brings the price up from $1,200 to $5,000 an ounce, they could then bring the price downward by selling their gold onto the market, and profiting on the futures' exchange markets. But they can only really manipulate the price downward to where they had started buying. Once their demand is removed from the market, the price should settle where it was previously, and they would be unable to bring the price further downward. So, manipulating price downward on a free market is only possible by selling, and is limited by how much the seller holds. You cannot after all, acquire more of something to sell without bidding up its price. Unless, of course, you are a violent government! And that is the punchline: gold manipulation only works because of government gold confiscation. What drives gold prices downward is not the manipulation of the futures' markets, it is the fact that governments have been able to accumulate a very large portion of the world's gold supply at very little cost, and can use that supply to suppress the price downward when needed. The futures' markets are just a way for banks and individuals to profit on betting on this price being held down by central banks holding so much confiscated gold; they are not what drives the price downward.

As fractional reserve banking started becoming more widespread in the late nineteenth century due to the centralization of banking clearance, central banks were created to help prevent bank runs. When the crash of 1929 happened, large-scale systemic defaults across various sectors of the economy put significant pressure on over-leveraged banks. Instead of letting the discipline of the gold standard clear out that monetary mess, write-off losses, and let everyone begin anew, governments chose to sacrifice the gold standard to maintain the overleveraged fractional reserve banking system. From then on, it had a lender of last resort instituted as a matter of policy, in the shape of the FDIC. The key to the stability to the fractional reserve system since then has been the lender of last resort. And the key to the sustainability of this lender of last resort has been its ability to fall back on a money whose supply could be easily increased.

But the problem that this sort of system faces is in the sustainability of the monetary unit it uses. If the money supply is easy to increase, the free market would move to another money. If everything I said in my book on monetary competition has some merit, then people would choose to have more cash balances in harder forms of money, like gold, and that would in turn lead to a significant drop of the value of the dollar. How did the dollar not collapse next to gold, even after 85 years of the function of lender of last resort? The answer is that gold ownership was prohibited, and banks banned from dealing with it. Government confiscated banks' gold easily and was able to recapitalize the banking system with the extra dollars while not worrying about the dollar collapsing in price next to gold, since individuals could not return to a gold standard when all the banks and central banks were prohibited from dealing with gold.

So when conspiracy theorists decry financial market manipulation of gold prices downward, they are likely fixating on the symptom, not the cause. The financial manipulation is largely due to the fact that central banks have confiscated large supplies of gold across the world from the 1910's onward. As discussed in *The Bitcoin Standard*, central banks in the twentieth century held many multiples of times more gold than they held in the nineteenth century. In the nineteenth century, with their currency largely backed by gold, they held gold for purposes of clearance among one another, and among banks in their respective economies. In the twentieth century, governments hoarded gold in obscene quantities to prevent the emergence of a free market and banking system based around it.

The story of how central banks have managed to maintain their currencies in operation is inseparable from their ownership of large quantities of gold. Ferdinand Lips' Gold Wars has an excellent discussion of this. To go back to our parable on manipulation, it is not possible to manipulate the price of something downward except by selling it, which, on average will mean no more than being able to bring it to the price at which it would be without you having bought it in the first place. But if a government is able to coercively ban the trading of gold, and prevent its clearance through the banking system, gold's monetary role is severely crippled in a modern economy where trade happens over large global market networks.

Central banks have consistently sold gold into the market when the prices have risen. Given central banks' massive reserves, such sales act as an inflation of the supply, bringing the market price down in national currencies, and making gold less attractive as a store of value. Examples of these sales are plenty, but the most famous might be the Central Bank Gold Agreement and its sales of thousands of tons throughout the 90s and early 2000s.

Another example of the ways in which central banks can prevent the reemergence of mass use of gold is to prevent free market alternatives for the settlement of gold from emerging. The example of e-gold is instructive. E-gold was a business that allowed digital payments backed by a physical safe full of gold. When you as a consumer would send a sum of US Dollars to e-gold, they would purchase a corresponding quantity of physical gold for you, and give you an account at the institution. You are then able to perform digital payments through their system, paying anyone on the network with the gold you own in their facility. It was, effectively, a centralized Bitcoin with a physical gold safe instead of digital coins. E-gold was successfully growing in the 1990s, and arguably was a cheaper more convenient and simpler way of achieving Bitcoin's goals. But it had one fatal flaw: the government could easily shut down their safe and their infrastructure and prevent them from continuing to operate. This is exactly what happened in 2008, with e-gold forced to shut down even though the judge had ruled they had no intent to engage in criminal activity, and that there is no reason to shut them down. If government had opened the door for E-gold to continue operating, and other similar businesses emerged worldwide, the use of gold as money could have spread worldwide, raising the value of gold compared to national currencies. As many businesses have tried this model and come across an iron wall of regulatory barriers, most notably, the fact that gold faces capital gains tax, which makes its use as a daily money highly complicated. The pressing need for gold to have physical settlement and the economies of scale from centralization of its reserves continue to make it vulnerable to government capture.

Therefore, it is not the futures' markets and rehypothecation that allows for the manipulation of gold price downward. It is government confiscation of large amounts of gold, estimated at around a sixth of global stockpiles, and its monopoly over settlement institutions. It is this banning of monetary competition that allows for the survival of governments' inferior currencies as they engage in being the lender of last resort for fractionally-reserved banks. Commodities other than gold, which are consumed in large quantities, have live liquid markets where large supplies are moved very quickly. It is possible for short-term manipulation of these assets to happen, but it cannot deviate too much from the realities of the market dynamics of millions of people supplying and demanding it. With these commodities, like with securities, the shadow banking system is able to create more claims on the assets that they have, and effectively monetize the increase in their supply, primarily because they have liquid markets settled in US dollars, and the shadow banking system has a lender of last resort who can print these dollars. As Nassim Taleb explains, the presence of a central bank guarantee behind a financial institution is a free option, with a positive expected value. All losses are written-off to the central bank's printing press, while all gains remain private. In this kind of arrangement, as all securities are settled in dollars, it becomes possible for fractional reserve banking to thrive.

This will lead us to a deeper appreciation of the astonishing potential of Bitcoin, and what it could do. By being built on an entirely decentralized basis, by having no single point of failure, no indispensable individuals or organizations, and no critical physical infrastructure, Bitcoin is very hard to shut down like E-gold. By being digital, Bitcoin settlements allow for at least half a million daily transactions that settle across the world in under an hour, which makes the final layer of settlement far more decentralized than gold's, which makes it much harder to capture and control. By being non-physical, Bitcoin is also far easier to move around the world, to escape from places seeking to confiscate or destroy it. And this is why Bitcoin matters: it improves on gold in all the ways in which gold is vulnerable to capture by government. Only time will tell whether this is enough for it to continue to grow and succeed, of course, but it seems to have a better chance at resisting gold's fate than gold did.

To come back to the question of the manipulation of Bitcoin. The way I would understand it is that the manipulation of Bitcoin through the creation of financial instruments is not sustainable without a lender of last resort who can print bitcoin, or as was the case with gold, who can print receipts for bitcoin and force their acceptance as if they were bitcoin. Any financial institution that engages in fractional reserve banking, rehypothecation, or maturity mismatching with its bitcoin assets and liabilities is always in danger of being subject to a bank run.

With Bitcoin being digital and its ledger far easier to audit, it becomes easier for customers and speculators to notice discrepancies in a bank's balance sheet, and so they are more likely to notice discrepancies between bank obligations and assets, and more likely to demand their assets quickly. There are little barriers to entry when it comes to operating bitcoin, or moving from one service to another, and therefore, the cost of demanding deposits from a bank are likely far smaller than the government-protected monopolies were fractional reserves flourish. The most likely outcome from any bank engaging in maturity-mismatching is that its own notes will be discounted on the market. Whereas in a fractional reserve banking system, a bank creating new liabilities is able to effectively divide the cost by the holders of all the currency whose value is being reduced by inflation, in a free market with a hard money, the only people whose holdings will be devalued are those who choose to hold assets that are liabilities of the bank. Since they cannot force acceptance of their version of bitcoin to others, since they cannot demand that their partially-backed bitcoin assets are accepted at par, the rest of the market will likely discount their bills to the ratio at which they are backed. This does not need any central body to regulate or decide; the simple supply and demand dynamics of an increasing number of bitcoin-backed assets from the bank circulating and being cleared on the market will cause their price to drop compared to other forms of assets fully-backed by bitcoin.

More pressingly, there is a specific operational mechanism for free liquid markets to bankrupt anybody who engages in fractional reserve banking, and that is through what I like to call "liquidity vulture attack". A large speculator could short-sell a bank's stock price, and then make a large demand deposit in the same bank. Should the bank be engaged in fractional reserve lending, they would then proceed to lend out part of the speculator's deposit. The speculator then demands their entire deposit back. The bank would be unable to meet his demand for withdrawing his deposit, and instead would scramble to offload illiquid loans in exchange for liquid cash to settle with the depositor. But this liquidity crunch only makes cash more expensive for the bank as its long-term liabilities are discounted heavily, and instead, the bank's increasingly precarious position is likely to lead to more depositors asking for their deposits back. The bank's stock price would likely collapse as it goes bankrupt, and the depositor, even if they fail to get all their deposit back, would likely profit from the collapse of the price of the stock.

All of these reasons lead me to believe it is unlikely that fractional reserve banking would develop atop Bitcoin, and that all forms of financialization can only succeed in the long-term if practicing strict and full reserve backing of their instruments with Bitcoin. Bitcoin's liquidity and hardness mean that markets will be ruthless in punishing any financial

institution that tries to sell obligations to bitcoins it does not own. And unlike gold, which governments could confiscate and control and prevent from developing its own settlement market, Bitcoin is much harder to confiscate, monopolize, or centralize. This does not mean that we will not see financial institutions attempt unbacked bitcoin financial products, but that when we do, the most likely outcome is an edifying lesson in the harsh realities of hard money on free markets. In fact, the real implications of a hard asset will likely only begin to dawn on most financial professionals after such an episode and lesson. Perhaps a large financial institution will assume that its large fiat-based assets can allow it a large room for maneuver in rehypothicating Bitcoin holdings. But a large swing in price upward and some speculative bets against the institution could leafd to it becoming illiquid and needing injections of Bitcoins to survive. Since Bitcoin cannot be printed, it would need to be buying on the open market, but its own shady finances mean it will be buying as the price is rising fast. The institution would then require a large amount of dollar liquidity to stay solvent and buy more Bitcoins. Regulators would then be in a serious bind: Bail the institution out, and they are essentially directly printing more dollars to use to buy Bitcoin and raise the Bitcoin price further, making it appear more attractive for potential holders. Refuse to bail out the financial institution, and then it and the many counterparties to which it is exposed are in trouble, possibly causing a systemic crisis.

Generations of bankers and financiers reared on the soft ill-discipline of easy money and the unlimited generosity of central banks' subsidized low interest rates may struggle to understand these implications of hard money, and I find it hard to imagine that they would all refrain from engaging in the lending of deposits. Surely, some institutions will try, and that may just be the lesson that wakes people up to the hard realities of hard money.

In conclusion, I see the threat of fractional reserve banking in Bitcoin as a threat to those who engage in it, and not a threat to Bitcoin itself. I expect that whatever attempts at fractionally-backed Bitcoin are introduced, they will likely fail the market test and cause losses to those who engage in them. The bitcoin holder who remains in control of their private keys is not affected by this in the long-run, and the long-run is what primarily concerns a long-term bitcoin holder.

IX. What would bitcoin finance look like?

If my conclusion that a bitcoin financial system cannot develop fractional reserve banking sustainably, what would be a bitcoin financial system look like? How would credit and investment markets work? Would it be easy to borrow money? How would interest rates be determined? The detailed answer to these questions will come in a future edition of The Bitcoin Standard Research Bulletin, but for today, the broad features will be outlined.

A Bitcoin financial system would consist of financial institutions that engage only in maturity-matched lending, in other words, for every quantity of bitcoin that a bank lends for a particular period of time, there would be a lender who has contractually agreed to lend that quantity for the exact period. With this rule, we can see that the two traditional functions of banking could survive and function normally and independently in a bitcoin economy: deposits and credit.

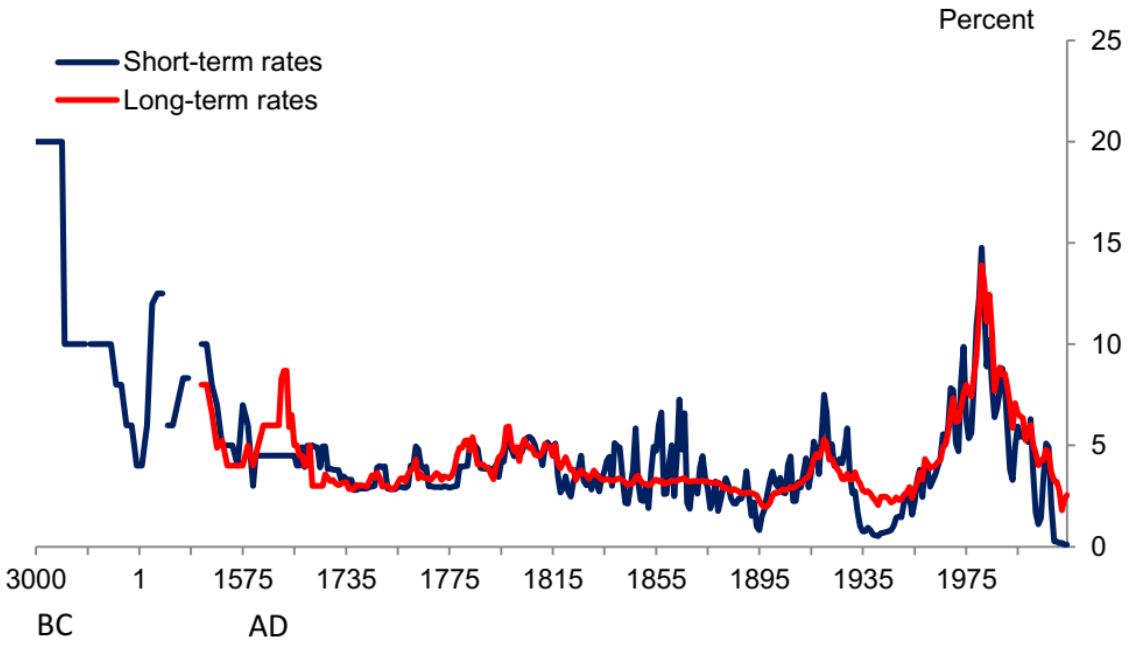
Both these models of banking are normal market services that have been demanded throughout human history, regardless of the form of money used. People will always like the convenience and safety of having their money stored in professionally-secured facilities, rather than have them on hand at all time risking loss theft, or extortion, and that business will likely continue in a digital economy. But without maturity mismatched lending, there can be no interest on demand deposits, since the bank will have to hold them all on reserve, and cannot earn returns on investing or lending them. Depositors will instead pay money to have their money handled by institutions that provide superior security and regular access to it.

In a world in which lending is maturity-mismatched, the incentive for saving rises dramatically. Banks can no longer resort to rolling over short term assets to finance long-term liabilities, as that form of maturity mismatching can always collapse or be attacked. Given that the money on deposit is hard money, and that no fractional reserve is built on top of it, it would be expected to appreciate slightly over time. Having a sum of money saved as a financial safety net would in fact allow people to think more of the long-term, and plan for it with the rest of their money. People will find higher interest rates for longer savings, and having a financial bedrock of hard money would allow people to save for the long-term, and to take more and more risks.

The incentivizing of long-term savings would in turn lead to more capital accumulation and investments taking place, and in turn, that would act to bring down interest rates, naturally. The low interest rates that Keynesians attempt to mandate via central bank edict cannot work unless they are a true market signal of an abundance of capital caused by an abundance of savings. The process of human civilization, as the lowering of time preference, is driven by, and in turn drives, more savings and lower interest rates. Austrian economist Eugen Bohm-Bawerk said that cultural level of a nation is mirrored by its rate of interest, as explained by Schumpeter:

> *[Interest] is, so to speak, the brake, or governor, which prevents individuals from exceeding the economically admissible lengthening of the period of production, and enforces provision for present wants—which, in effect, brings their pressure to the attention of entrepreneurs. And this is why it reflects the relative intensity with which in every economy future and present interests make themselves felt and thus also a people's intelligence and moral strength—the higher these are, the lower will be the rate of interest. This is why the rate of interest mirrors the cultural level of a nation; for the higher this level, the larger will be the available stock of consumers' goods, the longer will be the period of production, the smaller will be, according to the law of roundaboutness, the surplus return which further extension of the period of production would yield, and thus the lower will be the rate of interest. And here we have Böhm-Bawerk's law of the decreasing rate of interest, his solution to this ancient problem which had tried the best minds of our science and found them wanting.*

Historically, interest rates have been declining in the long-term, and by the end of the nineteenth century had begun approaching zero. The turn to government money and its destructive impact on human society has made them rise sharply in the



twentieth century. They have been in decline since the 1970s, but this is after they have become purely government-mandated prices, and not a correct reflection of people's propensity to save and provide capital for investors. The following chart, taken from Andrew Haldane's Growing: Fast and Slow shows the historical relationship.

A world of hard money that resists inflationary credit creation would bring back the process of lowering time preference and lowering interest rates. The Austrian economists understand that the ultimate determinant of interest rate is time-preference, and a hard money will likely lead to a progressive lowering of time preference and interest rates.

Credit markets would work only with fully-backed debt. Actual savings need to go into a bank for a pre-agreed duration for the bank to lend them out. This means that an actual saver must forgo consumption of real resources in order for someone else to borrow them. As the incentive to save rises, capital accumulation and technological progress increase productivity and living standards, interest rates would continue their decline, particularly if hard money saves humanity from the catastrophe that was twentieth century's easy-money-fueled warfare states and the trail of destruction they leave behind.

One question I have considered for a while is just how low can interest rates go? I suspect that the end result of developing hard-to-confiscate strictly scarce hard money with very high capacity for decentralized fast global settlement is that interest rates would naturally go to zero, to the point that interest-based lending would seize to exist. Given that money would be expected to constantly appreciate, a zero percent rate of interest is a positive interest rate in real terms. And given that the holding of deposits would usually incur a cost, there is an opportunity cost to holding on to money rather than lending it, which effectively increases the real rate of return of a 0% nominal loan. Combined with increased savings and lower time preference, all this is likely to lead to there being a zero percent nominal rate on credit. Creditworthiness will be all that matters in these loans, and not an interest rate.

I also often consider whether in such a world we would likely transition from debt-based financing to equity-based financing. Given that banks cannot engage in fractional reserve banking, it is not possible for banks to make any guaranteed returns on any of their investments. With any investment, there is the possibility that it goes to zero, but in a fractional reserve banking system, central banks protect depositors against such an outcome, through generating new easy money. In a hard money monetary system, there is no amount of financial risk engineering that can protect savers from loss of their capital in a venture. Banks can diversify, but can never make a guarantee for a minimum return, or maximum loss. Without the ability to protect the downside of the saver, there is no reason why the saver should not prefer to be fully exposed on the upside as well. Why settle for a fixed return on their investment if it succeeds, but unlimited downside if it fails? The more attractive model for savers will be one in which they make the real return from the businesses in which the bank invests their money, sharing in the profit and loss. The role of the bank will be in matching maturities and risk profiles between borrowers and lenders, and identifying the correct projects in which to invest.

Outlining the working of the capital markets, and the role of interest rates in a bitcoin-based economy, is the topic of a forthcoming edition of *The Bitcoin Standard Research Bulletin*. I will continue researching this topic, and likely make it the topic of next month's bulletin. Another potential topic is the following.

Forthcoming Bulletin: A closer look at the impacts of continued Bitcoin growth.

Most discussions of Bitcoin assume that its rise can be catastrophic to the old economy and monetary system. But maybe it doesn't have to be that way. People generally tend to think of Bitcoin's rise as being akin to hyperinflation, focusing on the collapse of government money and the economic catastrophes that might unleash. But in hyperinflation, the collapse of the currency brings about the disappearance of a monetary system, leading to the collapse of economic trade, division of labor, and production across society,

with a devastating effect on society. But the adoption of bitcoin will itself come through people moving to a new monetary standard that's relatively easily accessible globally. Perhaps a better comparison for the rise of Bitcoin would be the episodes of societies adopting harder monetary standards from easier ones. A forthcoming edition of The Bitcoin Standard Research Bulletin will look at several examples of *dollarization*—economies that moved from their local easy money to the harder dollar, analyzing how that transition came about, its effects on capital markets, government, and society in general, and what lessons it has for understanding the larger macroeconomic impacts of Bitcoin should it continue to grow in economic significance. A comparison will be made with hyperinflationary episodes and their impact and relevance.

These are preliminary thoughts, and I might end up significantly changing the topics of the forthcoming bulletins, particularly in response to your suggestions and feedback. Please feel free to email me at any time with your suggestions and questions.

Thank you very much for subscribing to *The Bitcoin Standard Research Bulletin.*

Please feel free to share this bulletin with any friends you would think might be interested in subscribing to this newsletter, and also, to share excerpts or screenshots from the text on social media. I only kindly request that you not mass distribute the newsletter itself to mailing lists, websites, telegram groups.

All the best,

Saifedean Ammous

To subscribe: www.patreon.com/saifedean.

Or email thebitcoinstandard@gmail.com for instructions on how to subscribe through bitcoin or paypal.