THE BITCOIN STANDARD

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Bitcoin monetization scenarios and financial crises

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1- Bitcoin monetization scenarios

One of the common questions people have asked me recently pertains to how one can think of the move toward a global Bitcoin standard. While bitcoin is used in a growing part of the world economy today, its use as a primary money is almost nonexistent. If Bitcoin is to become a global monetary standard, it needs to have many orders of magnitude increases in transaction value over time, until it captures a significant portion of the global demand for cash balances. At that point, Bitcoin's market value would be far less volatile, as discussed in the paper I published at the Journal for Structured Finance, which I've attached to the end of this bulletin. As bitcoin holds no more than 0.5% of global demand for cash balances, it has huge potential upside, which in turn invites a lot of short-term speculation on its price. This speculation means it can appreciate significantly. Should bitcoin capture a large amount of demand for long term cash balances, the possibility of it appreciating in value significantly (e.g. the recent increases of 10x per year) becomes less and less likely, and thus less speculative capital will flow into it. Consequently, the demand for bitcoin will primarily tend toward its demand as a long-term store of value, and it'll function more as a monetary asset reflecting time preference only. In a hypothetical end-state in which bitcoin is the only currency used worldwide, variations in its value would precisely reflect variations in the collective demand for a store of value, which in turn is a measure of time preference.

Austrians economists understood that time preference is the prime determinant of interest rates. It is the lowering of time-preference that delays consumption and thus frees up resources for use in progressively longer processes of economic production. The lower a society's time preference, the more saved up capital is available, which means lower interest rates (i.e. a lower price of money). The growing stability of the price of bitcoin brought about by the declining volatility in its demand, combined with its entirely predictable supply, would likely result in the development of a mature lending market that provides a price for future bitcoin in terms of present bitcoin—an interest rate.

Austrian economist Eugen Bohm-Bawerk called the interest rate a measure of a nation's morality. In a world of hard money, the only way to bring capital about is through saving. A society in which people have good moral character is a society in which people save a lot, bringing interest rates downward. This is no longer accurate today in a world in which interest rates are centrally determined by a government monopoly, and so capital can effectively be borrowed into existence at the expense of the future, without people having to sacrifice consumption in the present. Low interest rates in this environment don't involve a sacrifice for the sake of the future, as Bohm-Bawerk would like, but on the contrary, they exist at the expense of the future, through the debasement of currency.

It is important here to stop and stress that I am by no means telling you these outcomes are certain or predictable. The world continues to be far more

complex than we would like it to be, and I am not interested in making prognostications. I present this as a vision of how bitcoin could develop into a monetary standard, but of course whether that happens is a completely separate question. And how this happens is yet another completely separate question. I will briefly discuss here one commonly-believed scenario before moving on to outline two less commonly discussed scenarios.

First scenario: Hyperinflation

The most widely held prediction about how a bitcoin economy develops usually involves the entirety of the world economy collapsing into a heap of hyperinflationary misery similar to the one you see in Venezuela today. The dollar, euro, sterling, and all global currencies would collapse in value as all their holders drop them and choose to move to the superior store of value of bitcoin. Governments would collapse, banks would be destroyed, global trade supply lines would come crumbling down. The kind of imaginations reared on watching Hollywood movies can be relied on to run wild with the scenarios here. But there are several reasons to be optimistic that this may not be the case; The move to bitcoin could instead look more like an economic upgrade which replaces manual political central bank policy with ruthlessly efficient engines, and could in retrospect be an even better deal for humanity than the replacement of horses with engines, or phone line operators with computers.

The major problem with the hyperinflation scenario is that it misunderstands the nature of the current monetary system in a way that is unfortunately far too common among those familiar with Austrian economics, and whose conception of the current monetary system has failed to keep up with the developments of the past few decades. In particular here, I refer to the issue of money creation, and how the current shadow monetary system is responsible for an inordinately large amount of money creation, far more than the currency and the bank deposit loans that used to be responsible for most money creation in the past. The key issue to understand here is that the supply of money is not an outcome that can be precisely controlled by a lever at the central bank, since fractionally reserved banks don't necessarily have to exercise their money creation ability to its full capacity. Central banks can respond to market changes and affect the supply of their currency, up to a point, but the fractional reserve based monetary credit system itself, through its own movements and dynamics, can contract or expand the money supply. Demand for money can thus vary significantly, but the supply of money can also vary as the credit creation mechanisms contract as demand for borrowing drops1.

The hyperinflationary scenario assumes that demand for the currency would collapse, leading to the value of the currency collapsing, regardless of what would happen with the supply. It assumes that even if the supply of fiat money is likely to remain constant or vary only slightly, the decline in demand will lead to the value of the currency

collapsing. However (and this is the first important problem the hyperinflation scenario runs into), hyperinflation is always and everywhere a result of the drastic increase in the money supply, and not a sudden decline in demand.

Demand for Rai stones, glass beads, seashells, salt, and cattle, and various other monetary media discussed in The Bitcoin Standard and elsewhere did drop over time as harder alternatives were introduced, but that would likely have led only to a gradual decline of their value. The real decline of their value occurred due to the ease of overproduction. Every example of government hyperinflation has been the result of government manipulation of the money supply, much as governments would love to pretend otherwise. While the decline in value of a money is likely to put people off, taxes still need to be paid (and in whichever currency the government so chooses) to avoid going to jail, and as a result people will still use government money for everyday uses, even if its value does decrease consistently over time. Only as a result of government and central bank increases of the money supply can hyperinflation happen, as a close study of any and every modern hyperinflation would show. Looking at a place like Venezuela today where the local currency has dropped to less than a millionth of its value in just a few years, even if one knows nothing about Venezuelan monetary policy, one can dismiss the idea that the destruction of the Bolivar can be explained by a drop in demand. Venezuela the country is still there, its population at largely the same numbers as before the currency collapse, and still in need of money and demanding more of it. While there is no doubt that demand for holding the bolivar has dropped significantly, it could not possibly have dropped to a millionth of where it was simply due to steady decreases in purchasing power, as Venezuelans still need the currency to settle all their government-related business (an ever-growing occurrence thanks to the demented socialization of the economy). The only way to understand the collapse in value is as a result of the rapid increase in supply, and any reduction in demand was rather an effect, not a cause, to that currency's value dropping. Therefore, even if Bitcoin continues to increase its share of demand for money as a percentage of government demand, government moneys could avoid hyperinflationary collapse so long as they manage to avoid spiking the rate at which they expand their money supply.

Global central bank in the past 30 years have clearly been unable to centrally-plan their economies to achieve the economic outputs they seek, which no central planner could ever succeed in doing (since it is the very nature of central planning to fail, as excellently explained by Mises, Hayek, and Rothbard); what they've nonetheless developed enough competence to understand is the basic idea that accelerated creation of monetary instruments will bring the value of their currency crashing down. Despite all of their pseudoscientific macroeconomic voodoo rituals, they have nonetheless learned to find ways to keep credit creation from spiraling out of control to avoid severe hyperinfla-

tion. There will likely still be central banks making these mistakes, but don't expect the major ones that have managed their moneys' purchasing power at a slow decline for decades to start suddenly increasing their supply drastically any time soon. Central banks can fail at all their policy objectives but still maintain the slow pace of increase of the supply of their currencies over time.

The second and more important problem with the hyperinflation scenario lies in the fact that it ignores the second order effects that come with society's acceptance of bitcoin as a long-term store of value, particularly its influence on the supply of government money. This is a matter that I have not seen discussed anywhere else, and it was one of the prime motivations for me to start this research bulletin. I wanted to sit down, work through this, and quickly send it out to my intelligent and interested readers for feedback, rather than spending months toiling and looking for a platform with their own agendas and concerns.

How does the growth of Bitcoin affect the growth of a government's money supply, you ask? The key is to remember that the process of money creation in the current monetary system is driven by lending and credit creation, whether in the narrow banking system or the shadow banking system. As discussed in my Udemy class (which you can take for free by clicking **here**) the narrow banking system creates new money whenever it generates a new loan. The shadow banking system creates money through the monetization of the endless shuffling of financial assets, or the rehypothecation process. In both cases, lower interest rates, relaxed lending criteria, and the central bank's readiness to intervene as a lender of last resort to save the financial institutions will all lead to increasing money supply. The reason that debt has continued to grow since the 1970s, of course, is that ever since money was completely decoupled from gold, there's significantly less restraint on capital markets' ability to create credit for consumers or investors. Governments have of course abused this privilege to allow themselves to buy their voters (and themselves, and their wives, and cousins, and cronies) several free lunches, each of which comes at the expense of the value stored for the future. As discussed above, low interest rates in the past used to come at the expense of the present in order to finance the future, while low interest rates in today's manipulated credit markets come at the expense of the future in order to finance the present. With artificially manipulated interest rates, it becomes harder and harder for people to save for the future, and thus more likely that they get into debt. Fractional reserve based credit creation does not just increase the money supply, the flip side of this coin is that money supply increases and lower interest rates drive demand for more credit creation.

So, again, how does this help us understand how widespread adoption of Bitcoin as a long-term store of value affects the growth of the supply of money? When the value of money is constantly dropping, and interest rates are artificially low, people will move from saving to borrowing. But when

a new and completely decentralized, depoliticized, and automated hard new money enters into the economic calculations of the individual today, that individual's relationship with credit is likely to change. With the presence of a hard money that can appreciate in value over time, people's need for credit will likely decline. As those who move to Bitcoin witness its value appreciate, they find themselves able to pay off their debts sooner. As they become debt free with hard savings that nobody can inflate, they're likely to start living off of their savings and accumulating more, rather than continuing to borrow and pay interest.

Many bitcoin holders have already gone through this process, and many have been able to pay off all their debts thanks to the appreciation of bitcoin. When people have a healthy store of value that appreciates over time, they're less incentivized to borrow. If bitcoin continues to grow, and more people do this, then the demand for credit from the traditional financial system will likely decline.

Bitcoin not only destroys demand for government money, it also hampers the mechanisms for creating new supply.

As more people pay off their loans and fewer people demand new loans, the financial system's credit creation is contracted significantly, and as a result, the growth in the supply of money slows down, or possibly even reverses into a shrinking supply. The availability of bitcoin as a hard store of value will seriously undermine the value proposition of going into debt that keeps the current monetary system able to create money. It is true that demand for government money would be reduced as people move to bitcoin, but the flipside of this process is that supply is also reduced, rather than expanded, as the appreciation in bitcoin's value makes individuals less likely to demand credit.

If governments in the advanced economies, which have done a semi-respectable job in managing their currencies over the past few decades, manage this process wisely, they would allow the credit and money contraction to happen naturally. If they try to react with inflation, they will likely witness quick reduction in the value of their currency. The wiser among them are likely to adopt strict monetary policy, and in that case, rather than go out on a whimper, the current global monetary system would just slowly and naturally get downsized into irrelevance as its currencies lose their value slowly next to Bitcoin, but the size of the people using the currency is also being reduced.

The current monetary system's history shows that its inflationary tendencies are likely to end with a collapse of the currency and economic disaster as people have no monetary alternative. But Bitcoin might fundamentally change this, by being the peaceful and intelligent way to unwind this monetary system by upgrading to a new one that frees people from being dependent on debt, which is what this current monetary system is dependent

on. We can think of the significance of bitcoin as being a superior alternative system to the current modern system, which allows us unwind the current system by simply depriving it of the oxygen it needs in the form of debt.

The third reason we can expect there to be no hyperinflationary collapse as a result of the rise of bitcoin is that hyperinflation happens when the entire monetary system of a society collapses, thus destroying the complex web of calculations and interactions that coordinate the activities of individuals across a large modern society. A modern society relies on money as the medium in which prices are expressed, and these prices are what coordinate economic activity and allow individuals to figure out what to produce and consume. No modern society, with its sophisticated infrastructure, is possible without a highly complex division of labor dependent on the price mechanism to coordinate economic activity. The collapse of money brings this network crashing down, and makes economic coordination impossible. Prices cannot be expressed in terms of barter, and there are no easy ways for people to calculate the true opportunity cost of their actions or the most efficient use of resources. The entirety of the division of labor of society collapses and life in the modern cities unravels into disaster. But all of this happens when the only monetary system of a society collapses, it isn't because the people lost their government's monetary system in particular. If people move to an alternative monetary system, then there would be no corresponding collapse in the economy and the division of labor. Anybody who moves from fiat to bitcoin is accessing a global network of buyers and sellers that they can interact with. Should bitcoin become widespread enough to destroy demand for government currencies, then these networks will be large enough to support an increasing amount of coordination, trade, and investment. Unlike in a hyperinflation scenario, a move to bitcoin that does not see a large increase in the supply of government money would not lead to a catastrophe; it would be a global upgrade—a peaceful technological upgrade of the monetary infrastructure of society. Anyone who wants to keep using government money can continue doing so, but as bitcoin undercuts both the demand and the supply of government money as discussed above, the government money bubble shrinks and withers away, while the bitcoin economy grows. To use an analogy, hyperinflation is like the sinking of a boat due to a leak in its hull. An upgrade to bitcoin looks more like people voluntarily leaving an old boat for a superior one. The old boat will slowly lose business and get decommissioned (and eventually destroyed), but nobody would be hurt by this upgrade, as nobody will be on the boat when it gets destroyed; it purely gets destroyed because it was abandoned. People can keep using central bank currencies if they want, but increasingly, it is difficult for governments to stop others from using bitcoin, or to stop bitcoin from appreciating in value. As more and more of the users of government currency move to bitcoin, the world economy upgrades to a better and more sound monetary standard.

Second Scenario: Monetary Upgrade and Debt Jubilee

For people under the age of 60 today, life in debt is what normal life looks like. As soon as a person needs to do anything more expensive than survive childhood, they need to get into debt. You need to borrow to own a car, own a house, go to college, survive emergencies, or even just to get your consumer electronics. The world is full of blowhards railing against debt and how much of a problem it is, but very few people seem aware of the underlying cause of this debt epidemic. How can everybody get to borrow so much? Who's lending them the money and how can this lender never run out? And why is it that only in the twentieth century did this consumerist orgy start.

Readers of The Bitcoin Standard will know that my answer to all these questions comes in two words: easy money. The more that a money is likely to depreciate, the more that its holder will seek to spend it quickly, and the less they will consider saving it. In a free market, people will continue to spend the easy forms of money whenever they can, and only hold on to the hardest forms of money, which will, in the long-run, lead to only the hardest forms of money maintaining their role as a monetary medium. This would in turn lead to the collapse of easy money and start providing people with a strong incentive to save again. But if government enforces the use of the easy money, then it can survive for a while, and its negative effects on saving and borrowing can persist and metastasize as is the case today.

Another way of understanding this dynamic, which is the monetary flipside of the money supply explanation, is through the price of money, or the interest rate. When central banks manipulate interest rates downward, they are financing investments and borrowing through the devaluation of all existing money, and not through the saving of capital by people lowering their time preference. The effect is that savers now face a low return on their savings, while borrowers face a low cost for their borrowing. The incentive to save is thus weakened, as people get lower rewards for delaying gratification, and savings are no longer necessary to provide capital, for government can simply finance loans from devaluing existing money supply. The incentive to borrow is enhanced, as people are given a subsidy for indulging themselves and seeking immediate enjoyment rather than long term rewards.

There is nothing normal about all governments and the vast majority of individuals being in debt. Contrary to what the high-time-preference economics textbooks teach, this is not a normal state of affairs because "we owe it to ourselves," a linguistic sleight-of-hand that hides away the fact that "ourselves" is made up of different generations, the present of which consume at the expense of future generations. Societies and individuals that engage in this kind of short-sighted behavior will quickly be weeded out of the gene pool and its survival in

the current world is a historical aberration unlikely to continue for long. The widespread availability of a hard money makes the prospects for debt-based economies bleak, as individuals and families that accumulate savings end up continuously improving their quality of life while those who accumulate debt worsen it.

Whereas in the past everyone had no reliable low-volatility store of value, everyone had to store their value in other kinds of assets which offer return, but carry risk. The problem with these assets is that no matter how profitable they might be, it is relatively easy to make more of them, which brings the price down, making the search for a reliable store of value a never-ending guessing game reliant on outsmarting the guesses of others with regards to their choice of store of value, a speculative activity with no productive value for society, and distinct from speculating on the returns to various assets, since their prices become more of a reflection of store of value demand than their underlying financial fundamentals. With bitcoin available, everyone in the world has access to a store of value whose supply cannot be inflated in response to increasing demand, and given its very small scale of penetration into the global money market and its strictly scarce supply, the potential upside is almost unlimited, making it even more attractive as a store of value in its early phases.

While most people tend to think of Bitcoin's rise in terms of its impact on the demand for government money, I have never come across a discussion of its impact on the supply of money. I believe this causal channel runs through Bitcoin's impact on demand for loans. Here is how I can imagine this scenario unfolding: imagine a basic modern wage earner who is in debt for something in the range of a years' income. Imagine he decides to put 1% of his income in Bitcoin every month, and imagine, for the sake of this thought experiment, that bitcoin appreciates on average around 50% per year from now2. If this man holds on to his bitcoin and does not touch them, they would appreciate to match the value of all of his debt in less than ten years. If Bitcoin's value rises by 100% a year, it would only take him 7 years to have enough bitcoin to pay off his debt.

I would expect that this scenario will become more and more common, provided bitcoin continues to survive, as evidenced by my personal interactions with bitcoiners, who have used their gains over the years to get out of debt and buy the peace of mind you get from not having to be dragged out of bed every morning to work to pay off someone, rather than working for yourself. In such a world where the possibility of saving is available again, you would expect a growing portion of the population to be free of debt and to have enough savings to finance their expenses, as well as to finance their businesses. Fewer people will get into debt for buying cars, houses, or consumer goods, because they can save up for them in hard money. More interestingly, perhaps, will be the shift in business financing, as more people become wealthy enough to finance their own businesses with their

own savings rather than from bank credit.

The return to this form of mass capitalism, where capital is widely distributed, rather than centrally-controlled, is one of the themes I discussed in chapter 8 of The Bitcoin Standard. Under sound money regimes, a free market in capital emerges. Individuals who are productive are able to accumulate capital and watch it appreciate in value, and so can finance themselves and their businesses. Productivity is rewarded with compounding growth in value over time, allowing the holder more capital, and thus placing more and more capital in the hands of the productive. In large centrally-planned credit markets, such as those that exist under government money, capital is centrally allocated by government bureaucracies that determine who gets new capital, while also devaluing the capital accumulated by the productive members of society. In such a world, being productive is punished over time, and credit financing is more likely to go to those who can afford bracing the bureaucratic hoops of government credit boards. Capital is centrally allocated and the individual has less agency in deciding where to invest it. Capital and firms grow larger to afford lawyers and PR firms to communicate stability to bankers, and smaller businesses become less viable. This is why under the gold standard firms tended to be smaller, and there were far more smaller businesses thriving. It is said that when Britain was the prime industrial force of the world, its average factory had 20 workers. This is what a free market in capital would look like. The centralization of credit issuance rewards bureaucratic and sclerotic growth. It is no wonder that the golden era of innovation3 in the nineteenth century, la belle epoque, was a world running on a hard money, because that hard money is what allowed all these many inventors and tinkerers the capital and freedom to experiment with outlandish ideas.

Bitcoin allows everyone to erase their debts by moving to it.

The way this would work, functionally, is to understand that money in the current monetary system is made up of debt. This is taken as normal by most people, and after more than a century of Marx, Keynes, and other cranks spreading the gospel of government credit money as normal, many people believe this is normal. But it is not normal, and is only a consequence of the artificial government manipulaton of money causing it to depreciate. A market solution that provides people with the possibility of appreciating money, money whose supply is not responsive to increases in value brought about by high demand—would bring about a decline in the demand for debt. Individuals first, then businesses, and then large corporations would slowly climb their way out of debt and into holding wealth in the form of bitcoin, using that wealth to pay off their debt. You would expect municipal governments to get into these kind of arrangements particularly in more decentralized governmental structures where local authorities have more sovereignty. As more and more of the

money supply shrinks, the damage caused by the fiat economy shrinks, and the number of people under debt slavery is reduced. Eventually, the only part of the economy that remains wedded to government money would be government itself, and the parts of the economy dependent on government money.

As monetary central planning goes, it is possible to underestimate just how effective it can be at manufacturing its own justifications. Just like the Soviet Unions continued to produce very impressive numbers for economic growth into the late 1980s as Russians were going hungry thanks to shortages, the modern government-run central banks can also keep a macroeconomic charade going for a while. Paul Samuelson and William Nordhaus, two of the most important postwar economists in the US, both of whom have won the Bank of Sweden Prize (commonly misidentified as a Nobel Prize), the latter just two weeks ago, wrote in their 1989 Economics textbook, which is standard issue for most undergraduate students around the world: "The Soviet economy is proof that, contrary to what many skeptics had earlier believed, a socialist command economy can function and even thrive". Modern macroeconomics is no different than Soviet macroeconomics in its blind faith in the ability of high priests with PhDs to divine the working of the economy through models, metrics, and statistical analysis.

Here it is worth remembering that the best way in which inflation has been fought in the United States has been to massively centrally plan the food industry to direct people toward consuming cheaper foods, and to direct industrial processes toward increasing the volume of this food to appear more impressive. This is a topic which I plan on discussing in detail in a future edition of The Bitcoin Standard research bulletin, but for now, those interested in reading more might want to research a man named Earl Butz and read about his farm program, and how it relates the inflation of the 1970s to the devastating reduction of health widely witnessed in the United States since. Nixon hired Butz wanted to make food cheaper, and Butz did that by centrally-planning farming into a mega-industrial operation, telling small farmers to "go big or go home". He focused on promoting corn as a cheap food which would help bring down the cost of food. Dietary guidelines at the time also strongly discouraged consumption of expensive meat, and encouraged the heavy consumption of grains, which are very low on nutrients, very high on toxins, but very cheap. The shifting dietary intake from meat and a wide variety of plants to a heavy dependence on heavily processed and mass produced grains has been at the root of the obesity and diabetes crises. More can be read about this in The Big Fat Surprise by Nina Teicholz.

The fiat credit money system disguises its inflation from its subjects by destroying the quality of the food they consume and telling them that prices are stable. Whereas $2 could have bought you a ribeye in 1968, they could buy you a hamburger in 1988, and half a soyburger in 2008. If you ignore

the differences between all these lunches, inflation hasn't been bad, the price of your lunch has gone up by 100% over 40 years, which is not a terrible fate. But this of course ignores that the lunch going from ribeye to a soyburger is not a like to like comparison. The ribeye is a heavily nutritious food, the soyburger is toxic industrial sludge. The real inflation, if measured in terms of nutrition, would be far higher.

The point from this digression is that you can expect the monetary system to persist for a while in creating an image of success by continuing to present to its subjects improved statistics and manipulating their experience of the world to better tolerate the reality. This become less and less tenable with time as governments are less able to finance themselves through inflation through the threat of bitcoin, and so you would expect these sclerotic economies surrounding governments to begin a slow terminal decline into irrelevance. Ultimately, the structures for these shambles of organizations can remain, but they will just become less attractive to people who see the migration to the new economy as more beneficial. While government connected firms may continue, they will lose relevance and value.

What we would likely see in this kind of scenario is a growing size of the bitcoin-based hard money economy, in which holders of money witness their value appreciate, while the government-based economy shrinks in size and in relative wealth as its lack of productivity becomes more punishing as more of the productive member of society flee to other sectors. The fiat economy will continue to provide people with lucrative careers with alluringly large numbers of monetary units being paid their way. But as the people who actually produce economically valuable goods move away to a harder monetary standard, these monetary units will buy less valuable fruits of others' labor, and will continue to maintain a semblance of value only when being used to purchase mass-produced large-scale economic goods whose production government can manipulate to appear cheap.

You can imagine two new global economies emerging across the world: the easy money centrally-planned economy of which government, media, and academia insist you must be part, with comfortable jobs secured from competition and controlled prices to ensure everyone gets their government-recommended soy and high fructose corn syrup rations. On the other hand, a growing, innovative, and apolitical economy which draws in the most ambitious, creative, and productive people in the world to work hard on providing goods of value to others.

It is true that in the long-run this is not sustainable, but the long-run might take a long time to arrive, because contrary to popular belief Bitcoin is unlikely to cause a collapse in the value of fiat money, by undermining the money creation process, and thus limiting the possibility of hyperinflationary collapse.

The only way to peacefully end credit money is to pay it all off, which looks like yet another nifty killer app for a digital apolitical harder form of money that appreciates and encourages saving, capital accumulation, and long-term orientation.

Third scenario: The Monetary Vigilante In The Shadows

A third alternative scenario in which Bitcoin grows is one in which it continues to survive without ever becoming a mainstream global monetary system, but remains as a fringe alternative which people only resort to in times of economic crisis. Its continued existence would provide citizens with a quick way to exit from their local currencies and still have a monetary system to use to trade with others, in case central banks mismanage the supply of their currency. This credible threat, in turn, would make central banks far more careful about managing their currencies and would force their hands into limited inflation and into reigning in the credit creation mechanism of their financial systems. Perhaps it will take another example of hyperinflation happening and the local population switching significantly to bitcoin to make other central banks aware of the threat. In this scenario, Bitcoin would lead to an improvement in monetary policy around the world as countries need to adhere to harder monetary policy to ensure their survival.

Bitcoin, for all the talk about its growth, still requires a significant amount of time and attention to understand and operate safely. It is something that a very large number of people will find very hard to navigate reliably. Technology will be built that will make dealing with bitcoin easier, but the logistics of dealing with a private key and public key are likely to remain, and these are challenging for most people. There is a significant advantage to the familiarity of what has worked for a while, and this could hamper bitcoin's growth. A good way of understanding the difference is that in the personal desktop market, even though Linux is a free alternative available for free, most people prefer the comfort of using a proprietary platform like Windows or iOS. Perhaps Bitcoin will remain in this state for many years, with not enough of a critical mass of users developing to create momentum for a comprehensive shift.

In this scenario, Bitcoin would increase the possibility for exit from the current financial system, but either through its own limitations, or through the many advantages that governments can bestow on their monopoly monetary systems, the current monetary system would continues surviving. Bitcoin would remain as a monetary vigilante in the shadows of every monetary system. As soon as credit creation increases in a way that brings down the currency value significantly, wealth begins to find its way to bitcoin. Seeing as bitcoin is hard money, it is not possible for anyone to increase bitcoin production as a response to this increase in demand, and so the value of bitcoin would likely appreciate, making this an increasingly attrac-

tive prospect for citizens. Some currencies may collapse, but perhaps the long-run effect is that current central banks will reform their monetary policies enough to ensure these kinds of periods happen less and less frequently, and that the familiarity and the legal and tax requirements for using the current monetary system maintain its advantage over bitcoin in the long-run. As I discuss in The Bitcoin Standard, the most effective policy governments could adopt in this regard would be the gold standard, which would seriously undermine demand for bitcoin by making hard money easily available for anyone with the current monetary system. With the monetary and fiscal discipline that a gold standard enforces on society, individuals would have little incentive to switch to the complicated world of bitcoin.

In such a scenario, bitcoin may have failed in becoming the global monetary standard, but it would have undoubtedly succeeded in its real mission of building a sound global monetary system. It would remain like a vigilante, in the shadows of every society, ready to heavily punish any diversion away from a gold standard by rewarding heavily those who defect from it. That threat in turn could deter governments from trying it enough times to force everyone to adopt bitcoin.

II- The short and long term consequences of financial crises on Bitcoin:

Many readers ask regularly about what to expect from Bitcoin in the case of a coming financial crisis. This, I believe, is one of the most interesting questions surrounding Bitcoin, and one of the most important indicators of what its future will look like. To answer this question, I must first begin with an explanation of how I understand financial crises, before explaining how Bitcoin relates.

To begin with, we need to make one thing clear: The Austrian Business Cycle Theory is the only theory of business cycles worth even reading about. It clearly explains recessions in a way that is unmatched by any other theory. For a good, brief, and intuitive introduction to them, you cannot beat Murray Rothbard's Economic Depressions: Their Cause and Cure. While not being a book focused on recessions, I have always found the introduction and first few chapters of Rothbard's **America's Great Depression** a wonderful beginner's guide to the topic. **Rothbard's Man, Economy, and State** contains a good thorough explanation of this topic, as does **Jesus Huerta de Soto's Money, Bank Credit and Economic Cycles**. Hayek's **Monetary Theory and the Trade Cycle** is a foundational book on this and contains a wonderfully lucid discussion of it, in Hayek's inimitable style. An excellent modern explanation of the theory, and a comparison of it to Keynesian theory, can be found in an excellent collection of presentation slides by Roger Garrisson (**1** and **2**). Garrison uses simple diagrams that illustrate the capital structure in a very effective way to convey the essence of the theory, and I highly recommend taking the time to go through them.

In The Bitcoin Standard I have written a short explanation of Austrian business cycle theory as I understand it. I will reproduce it here for those unfamiliar with it, or looking for a refresher, but readers who are familiar with the theory, or with my book, may want to skip until the end of this excerpted section.

How do financial crises happen?
Excerpted from The Bitcoin Standard*

Whereas in a free market for capital the supply of loanable funds is determined by the market participants who decide to lend based on the interest rate, in an economy with a central bank and fractional reserve banking, the supply of loanable funds is directed by a committee of economists under the influence of politicians, bankers, TV pundits, and sometimes, most spectacularly, military generals.

Any passing familiarity with economics will make the dangers of price controls clear and discernable. Should a government decide to set the price of apples and prevent it from moving, the outcome will be either a shortage or a surplus; and large losses to society overall from overproduction or underproduction. In the capital markets, something similar happens, but the effects are far more devastating as they affect every sector of the economy, since capital is involved in the production of every economic good.

It is first important to understand the distinction between loanable funds and actual capital goods. In a free market economy with sound money, savers

have to defer consumption in order to save. Money that is deposited in a bank as savings is money taken away from consumption by people who are delaying the gratification that consumption could give them, in order to gain more gratification in the future. The exact amount of savings becomes the exact amount of loanable funds available for producers to borrow. The availability of capital goods is inextricably linked to the reduction of consumption: Actual physical resources, labor, land and capital goods, will move from being employed in the provision of final consumption goods to the production of capital goods. The marginal worker is directed away from car sales and towards a job in the car factory; the proverbial corn seed will go into the ground instead of being eaten.

Scarcity is the fundamental starting point of all economics, and its most important implication is the notion that everything has an opportunity cost. In the capital market, the opportunity cost of capital is forgone consumption, and the opportunity cost of consumption is forgone capital investment. The interest rate is the price that regulates this relationship: as people demand more investments, the interest rate rises, incentivizing more savers to set aside more of their money for savings. As the interest rate drops, it incentivizes investors to engage in more investments, and to invest in more technologically advanced methods of production with a longer time horizon. A lower interest rate, then, allows for the engagement of methods of production that are longer and more productive: society moves from fishing with rods to fishing with oil-powered large boats.

As an economy advances and becomes increasingly sophisticated, the connection between physical capital and the loanable funds market does not change in reality, but it does get obfuscated in the minds of people. A modern economy with a central bank is built on ignoring this fundamental trade-off and assuming that banks can finance investment with new money without consumers having to forego consumption. The link between savings and loanable funds is severed, to the point where it is not even taught in the economics textbooks any more1, let alone the disastrous consequences of ignoring it.

As the central bank manages the money supply and interest rate, there will inevitably be a discrepancy between savings and loanable funds. Central banks are generally trying to spur economic growth and investment, and to increase consumption, so they tend to increase the money supply and lower interest rate, resulting in a larger quantity of loanable funds than savings. At these artificially low interest rates, businesses take on more debt to start projects than savers put aside to finance these investments. In other words, the value of consumption deferred is less than the value of the capital borrowed. Without enough consumption deferred, there will not be enough capital, land, and labor resources diverted away from consumption goods towards higher-order capital goods at the earliest stages of production. There is no free lunch, after all, and if consumers save less, there will have to be less capital available for investors. Creating new pieces of paper and digital entries to paper over the deficiency in savings does not magically increase

society's physical capital stock, it only devalues the existing money supply and distorts prices.

This shortage of capital is not apparent immediately, since banks and the central bank can issue enough money for the borrowers—that is, after all, the main perk of using unsound money. In an economy with sound money, such manipulation of the price of capital would be impossible: as soon as the interest rate is set artificially low, the shortage in savings at banks reflects into reduced capital available for borrowers, leading to a rise in the interest rate, which reduces demand for loans, and raises the supply of savings, until the two match.

Unsound money makes such manipulation possible, but only for a short while, of course, as reality cannot be deceived forever. The artificially low interest rates, and the excess printed money, deceive the producers into engaging in production process requiring more capital resources than is actually available. The excess money, backed by no actual deferred consumption, initially makes more producers borrow, operating under the delusion that the money will allow them to buy all the capital goods necessary for their production process. As more and more producers are bidding for fewer capital goods and resources than they expect there to be, the natural outcome is a rise in the price of the capital goods during the production process. This is the point at which the manipulation is exposed, leading to the simultaneous collapse of several capital investments which suddenly become unprofitable at the new capital good prices, these projects are what Mises termed malinvestments—investments that would not have been undertaken without the distortions in the capital market, and whose completion is not possible once the misallocations are exposed. The central bank's intervention in the capital market allows for more projects to be undertaken because of the distortion of prices that causes investors to miscalculate, but the central bank's intervention cannot increase the amount of actual capital available. So these extra projects are not completed and become an unnecessary waste of capital. The suspension of these projects at the same time causes a rise in unemployment across the economy. This economy-wide simultaneous failure of overextended businesses is what is referred to as a recession.

Only with an understanding of the capital structure and how interest rate manipulation destroys the incentive for capital accumulation can one understand the causes of recessions and the swings of the business cycle. The business cycle is the natural result of the manipulation of the interest rate distorting the market for capital by making investors imagine they can attain more capital than is available with the unsound money they have been given by the banks. Contrary to Keynesian animist mythology, business cycles are not mystic phenomena caused by flagging "animal spirits" whose cause is to be ignored as central bankers seek to try to engineer recovery. Economic logic clearly shows how recessions are the inevitable outcome of interest rate manipulation in the same way shortages are the inevitable outcome of price ceilings.

An analogy can be borrowed from Mises's work (and embellished) to illustrate the point: imagine the capital stock of a society as building bricks, and the central bank as a contractor responsible for constructing them into houses. Each house requires 10,000 bricks to construct, and the developer is looking for a contractor who will be able to build 100 houses, requiring a total of 1 million. But a Keynesian contractor, eager to win the contract, realizes his chances of winning the contract will be enhanced if he can submit a tender promising to build 120 of the same house while only requiring 800,000 bricks. This is the equivalent of the interest rate manipulation: it reduces the supply of capital, while increasing the demand for it. In reality, the 120 houses will require 1.2 million bricks, but there are only 800,000 available. The 800,000 bricks are sufficient to begin the construction of the 120 houses, but they are not sufficient to complete them. As the construction begins, the developer is very happy to see 20% more houses for 80% of the cost, thanks to the wonders of Keynesian engineering, which leads him to spend the 20% of the cost he saved on buying himself a new yacht. But the ruse cannot last, as it will eventually become apparent that the houses cannot be completed, and the construction must come to a halt. Not only has the contractor failed to deliver 120 houses, he will have failed to deliver any houses whatsoever, and instead, he's left the developer with 120 half-houses, effectively useless piles of bricks with no roofs. The contractor's ruse reduced the capital spent by the developer, and resulted in the construction of fewer houses than would have been possible with accurate price signals. The developer would have had 100 houses if he went with an honest contractor. By going with a Keynesian contractor who distorts the numbers, the developer continues to waste his capital for as long as the capital is being allocated on a plan with no basis in reality. If the contractor realizes the mistake early on, the capital wasted on starting 120 houses might be very little, and a new contractor is able to take the remaining bricks and use them to produce 90 houses. If the developer remains ignorant of the reality until the capital runs out, he will only have 120 unfinished homes that are worthless, as nobody will pay to live in a roofless house.

When the central bank manipulates the interest rate lower than the market clearing price by directing banks to create more money by lending, they are at once reducing the amount of savings available in society, and increasing the quantity demanded by borrowers, while also directing the borrowed capital towards projects which cannot be completed. Hence, the more unsound the form of money, and the easier it is for central banks to manipulate interest rates, the more severe the business cycles are. Monetary history testifies to how much more severe business cycles and recessions are when the money supply is manipulated than when it isn't.

** *End of Excerpt***

Exter's Pyramid

The above represents the classical Austrian school theory on business cycles, developed by Mises and Hayek based on the principles laid out by Carl Menger. Beyond this theory and based on it, I have found a mental model that is useful for understanding how financial crises occur. Exter's pyramid, developed by the late New York Federal Reserve Bank vice chairman John Exter, provides a visually intuitive way of understanding the mechanics of how the boom-and-bust cycle occurs in manipulated market economies. This is a good **interview with Exter** in which he explains the main ideas behind it.

The starting point of this model is an environment where individuals and investors attempt to maximize their wealth in the future, but naturally, the higher the reward of an asset, the higher the risk associated with it. The more the risk and reward of an asset, the less likely it is to be liquid. Exter's pyramid organizes financial assets in terms of their potential returns and risk on the one hand, and their liquidity on the other. At the narrow bottom of the pyramid is gold, which offers no returns, but is the safest asset because it is nobody's liability. It also has the highest liquidity, because it is a financial asset that has been accepted in the vast majority of times and places in history, and is an asset whose value is not dependent on anybody fulfilling any obligations. History shows that no matter how many newfangled new monetary inventions are made, once the going gets tough people flock back to the familiar, alluring, liquid, impersonal, and trustless safety of gold.

As we move up Exter's pyramid, assets' riskiness increases, as do their potential rewards, while the liquidity of the asset declines. Right above gold is the USD, which offers no return and is highly liquid, but is riskier than gold because its value is dependent on the behavior of the US Federal Reserve. Above it are government bonds, which are less liquid than paper money, but offer returns. Above them come various financial assets with increasing riskiness and decreasing liquidity, since the riskiness of strongly compromises the suitability as a medium of exchange. The pyramid grows wider as the size of the assets increases along with their risk, with each asset's section of the pyramid representing its relative size. The size of the global gold market is in the range of $8 trillion dollars, but the notional value of derivatives is in the quadrillions. A pyramid is the most stable geometric structure, but an inverted pyramid, like Exter's, is only stable with a heavy gold base. If it became too top-heavy, it begins to collapse in on itself. The more the growth in the pyramid the more the forces accumulate to bring it crashing back down.

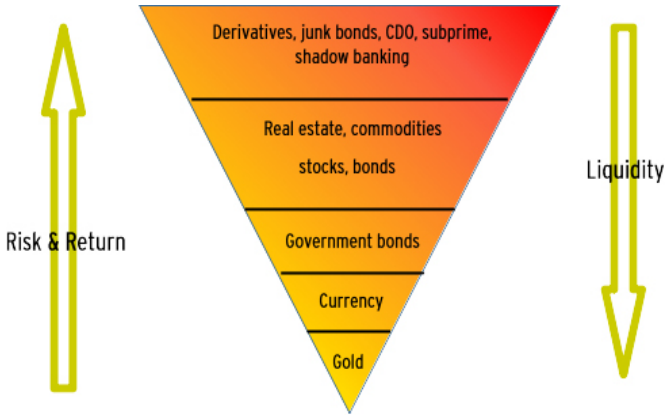

Figure 1: Exter's Pyramid

Exter's analysis of the business cycle is firmly in the Austrian tradition: When the central bank engages in monetary expansion, investors seek higher returns to avoid wealth erosion from currency depreciation. Lower interest rates lead to the creation of more financial assets, increasing the size of the pyramid into riskier and less liquid assets and instruments, employing ever-greater maturity mismatching. A quickly expanding pyramid would look like modern day Venezuela: a currency quickly depreciating as citizens desperately search for any asset that would hold value. A more responsible central bank will want to limit the growth of the pyramid to keep faith in its currency. The problem, however, is that starting the inflation process is far easier than arresting it. Raising interest rates and reducing inflation will make refinancing difficult for the riskier assets near the top of the pyramid and liquidity crises would squeeze all asset classes dependent on low interest rates (Mises' malinvestments).

Exter's pyramid can grow in a healthy manner through economic growth producing more goods and creating more value for people to purchase. The value of all goods and services increasing causes the pyramid to grow, and gives the money at the base more purchasing power by offering more assets available for it. But credit expansion, fractional reserve banking, rehypothecation, maturity mismatching, and other forms of financial wizardry cause the triangle to grow in an unsustainable way, essentially by creating more than one claim for each asset in the pyramid, thus decreasing the purchasing power of the base money on the real assets in the pyramid, in other words, causing a rise in asset prices. Thus manipulation of interest rates may initially seem to produce economic growth by growing the pyramid, but since the new assets being created are just the same old assets being given additional owners through credit expansion, rehypotheciation, fractional reserve banking, or maturity mismatching. This is then followed by a contraction that can only happen with a messy deflationary crash and liquidity crunch that drives holders of assets at the top of the pyramid to scramble down to its bottom in search for safety. This explains why the US Dollar, US Government bonds, and gold were safe havens during the 2008 financial crisis. US government policy of bail-outs, slashed interest rates, and fiscal stimulus were the desperate attempt to re-inflate the pyramid back into its previous shape and to drive investors to hold risky assets instead of treasuries, dollars, and gold. The dollar did not depreciate in spite of the

enormous quantities of it that the Frederal Reserve injected into the banking system, and the reason is that an even bigger force was the scramble for dollars from holders of collapsing illiquid assets at the top of the pyramid. In a fiat monetary system, money is created not when the central bank bails out the holders of assets, but when the central bank allows them license for the creation of these assets in the first place.

Exter's pyramid is another way of understanding the issue of rehypothecation discussed in September's Bulletin. Rehypothecation is how one $1 in cash deposited at a bank can lead to the creation of several dollars in checking account balances in banks, or how financial institutions manage maturities in order to monetize their assets. The number of assets produced is larger than the underlying asset, thus the move up Exter's pyramid, with more reward possible, along with more risk.

Whereas the 2008 financial crisis witnessed the most spectacular collapse in Exter's pyramid ever, the policy response after it has been even more spectacular in its attempt to prop up the pyramid back in place. Governments worldwide made illiquidity their biggest enemy, and effectively showered every large firm with liquidity, even those whose problems were solvency rather than liquidity, and even those who did not need the liquidity. You can understand that process as the central bank giving institutions that hold the assets at the top of Exter's pyramid cash reserves at the central bank to ensure that their liquidity and solvency is not compromised. To the extent that it averted a collapse in Exter's pyramid, that scheme largely worked. Whether returning to the shape of the pyramid that brought about the collapse is desirable in the long-run, however, is a completely separate question which the modern high time preference bureaucrat and economist has been trained to doggedly and skillfully avoid confronting.

The problem here is that the success and stability of this system is in itself destabilizing to it. The more stable the pyramid appears, the less likely it is to collapse, the more that central banks are lenient in their monetary policy and regulations around capital creation, the higher and wider the pyramid grows, the more risky the top of the pyramid becomes, and the more likely it is to collapse. But on an even more basic level, the problem with this scheme is that if the rehypotheticated creation of any asset in the pyramid is profitable, there are no effective defenses against the inflation of the supply of that asset. So, if Wall Street banks succeed in marketing mortgage-backed-securities, not only will this create enormous demand for mortgage-backed-securities, it will even create enough demand for the creation of more houses, as banks search for any person, regardless of their creditworthiness to buy a house. If people make good returns on stocks, there will be increasing demand for stocks beyond their profitability, incentivizing the creation of many more new companies and listing them on the stock market, as was the case with penny stocks and countless stock market scams.

This brings us back to the familiar story of monetization of assets which forms the beginning of the Bitcoin Standard. Exter's pyramid helps us understand why certain things can get chosen as money throughout history and not others. As people select various things as stores of value, gold remains firmly at the bottom of the pyramid due to the uncompromising hardness of its supply. When people choose anything else as a store of value, its producers make more of it, bringing it further up in the pyramid as its size increases, bringing down its value, and making it less desirable as an acceptable means of payment, bringing down its liquidity. Gold, offering no returns, while maintaining superior salability across time and space with a longer track record than any competitor, continues to remain the hardest to produce, and so remains firmly entrenched at the bottom of the pyramid.

Bitcoin and Exter's Pyramid

Like it has done to many things in this world, the emergence of Bitcoin shakes up foundations of Exter's pyramid, both the credit structure and the pedagogical concept. After the massive reflation of Exter's pyramid in 2008, governments have gone on with their eternal song and dance of creating credit and debasing money, while individuals try to maximize their wealth by searching for the best combination of liquidity and risk to achieve their ends. The easier the credit conditions, the easier money is, the more risk people will be willing to take, and the more reckless investments they finance. Whereas in the 1970's the top of the pyramid contained third world debt, in the 1980's it had penny stocks and junk bonds, while the 1990's and 2000's saw stocks, real estate, and collateralized debt obligations take the dubious crown of silliest money at top of the pyramid.

It is not easy to estimate with any certainty what assets are at the top of Exter's pyramid today, particularly as there are many, many competitors for the crown. Stock markets' unstoppable rise looks like a prime candidate, but when one looks at the ridiculous amounts flowing into the bonds of incompetent governments, that appears like another worthy candidate. Various industries surviving thanks to government subsidies and access to cheap credit are other prime candidates for this. The number of industries reliant on low interest rates and continued credit expansion is so overwhelming that it is not even clear what would be the first major sector of the economy that would collapse.

Suffice it to say that this entire charade would never be possible without the insane amounts of easy money creation taking place in the major central banks. As individuals can borrow to finance the most hare-brained business idea or even personal consumption, and failed and unproductive businesses are provided the lifeline of low interest rate lending, they can continue to pay salaries to people who are not productive, and dividends to investors who are not good at picking investments. This means a lot of unearned easy money in the hands of people who overestimate their own compe-

tence. As these people start putting their money in various new fields, one particular sector is likely to offer particularly high returns, due to technological, political, or regulatory reasons. For instance, in the 1990's this was mainly internet-related stocks as the internet's explosion created large profits. In the 2000's it was housing because various US government regulations made investment in housing more profitable, such as the removal of capital gains tax on housing.

I would propose that a strong candidate for being the top of the pyramid is the massive bubble that is "the cryptocurrency industry"—an entire industry of cargo cult investors throwing money at cargo cult engineers in the vain attempt that one of them will one day produce anything worthy of being compared to bitcoin. The Bitcoin Standard, and my twitter feed, contain enough material on why exactly I find this entire industry pointless, and I will not rehash these points here, but explain how I see the rise of the Shitcoin Industrial Complex through the lens of Exter's pyramid. Bitcoin was created in 2008, and began trading in 2009, right at the beginning of this current episode of credit expansion. As it rose in value through its early years, it attracted a lot of the easy money people have floating around and ready to invest in mostly-stupid high risk ideas. The rise in value continued to attract more people to invest in Bitcoin, and like with anything in Exter's triangle, the rise in value will cause a rising demand for creation of more.

But as readers of The Bitcoin Standard will note, Bitcoin is unique among all monetary assets to have ever existed in being absolutely scarce. No matter how much time and money goes into producing more bitcoin, there seem to be no way to produce any more than the 21 millions Satoshi gave us. But it is very easy to produce knock-offs! As these altcoins were being produced during the credit expansion phase, they were also there ready to benefit from the large amounts of stupid money looking for something with a return. The musical chairs dance could continue for as long as the music of credit expansion went on.

So what happens next assuming the preceding analysis on Bitcoin and altcoins is applicable? Two very important questions emerge with respect to a potential financial crisis: first, how will bitcoin behave in a financial crisis? Will it witness a collapse like a top-of-the-pyramid high risk asset, or will it witness a rise in value as a bottom-of-the-pyramid safe haven asset? Second, will Bitcoin differentiate itself from shitcoins during the next financial crisis, or will they behave similarly?

How bitcoin behaves in a financial crisis:

On the first question, if a majority of holders had been speculating on buying bitcoin as a highly-speculative high-risk instrument for a quick return, you would expect its price to crash, as these people face financial pressure of recession. Bitcoin holders who witness their stock market portfolio suffer, job getting terminated, or salary being reduced will almost certainly react by reducing their

bitcoin holdings in order to have more liquid and safe assets like cash and gold tide them through these tough periods. If this effect dominates, expect Bitcoin to crash considerably during the next financial crisis.

If, on the other hand, the majority of Bitcoin holders hold it as a long-term store of value, for the sake of its global liquidity and ability to settle payments quickly, as these people begin to suffer from financial pressures, they are likely to dump riskier assets and increase their holdings of bitcoin. This would also likely be the effect if the recession is combined with increased risk to commercial banks and threats to national currencies around the world, which would force people to look for alternatives to checking accounts and cash as a safe haven, bitcoin being an obvious one due to the difficulty of confiscating it and its global liquidity.

Should the financial crisis be triggered with shortages of liquidity that affect the lower levels of the current Exter pyramid, in other words, with collapses in the value of government money, government bonds, and other low risk bonds, or through restrictions in the operation of bank accounts for liquid money, this would induce large increases in demand for bitcoin. Should the next major collapses come in economic sectors like real estate, stock markets, and the more speculative sectors of tech, it would likely hit people who use bitcoin more as a speculative asset and who would be likely to sell bitcoin, bringing the price down.

In other words, we are yet to see where Bitcoin currently lies in Exter's pyramid, and whether a financial crisis would cause it to fall like a high-risk asset, or rise like a safe haven asset. I do not suppose I could know the motivation of the millions of bitcoin holders, and billions of potential holders, and so would not hazard a guess as to which effect would dominate in the next financial crisis. But I would be far more comfortable about predicting what would happen on predicting the outcome after a few financial crisis have exposed the nature of Bitcoin to many more people worldwide.

would not dare hazard a guess as to how bitcoin will behave in the case of the next financial crisis, as it is not possible to guess the financial motivations of every bitcoin holder out there, and what they will want to do with their bitcoins. Given how new bitcoin is, it is hard to estimate what kind of demand dominates. I would not be surprised to see bitcoin behave in either way in its first financial crisis. I would expect that after one or two financial crises, more and more people will appreciate the scarcity element of bitcoin, and bitcoin would likely drop lower in Exter's pyramid.

For its first financial crisis, the judgment and action of most bitcoin holders is going to be hard to guess, but the most important thing to understand here is that as time goes on, and more financial crises happen, bitcoin distinguishes itself from every other asset in Exter's pyramid in one distinct way: its supply cannot increase. Whereas in these early days as Bitcoin goes into its first crisis, the

subjective opinions of various bitcoin holders are likely to determine the course of action, with each extra recessions bitcoin's fundamental economic quality, its strict scarcity, ensures its supply increases the least4. This quality also shines through more as time goes on because bitcoin's stock-to-flow ratio, discussed extensively in the early chapters of The Bitcoin Standard, continues to drop significantly, making mining output a progressively smaller part of the new supply, and thus making bitcoin more an and more of a pure monetary good.

It is worth remembering that for its first ten years so far, bitcoin has been quite inflationary. Its supply has grown at very high rates initially, and is still close to 4% annual supply growth, still more than double that of gold. When one considers that around 2-4 million bitcoins are likely lost, the actual supply growth rate is likely to be higher, possibly exceeding 5 % this year. Taking into account these lost coins would lead us to revise the following growth rates numbers which were produced in the analysis of The Bitcoin Standard.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total BTC Supply, millions	1,623	5,018	8	10,613	12,199	13,671	15.029	16.075	16,775
Annual growth rate, %		209,13	59,42	32,66	14,94	12,06	9,93	6,8	4,35

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026
Total BTC Supply, millions	17,415	18,055	18,055	18,855	19,184	19,512	19,758	19,923	20,087
Annual growth rate, %	3,82	3,68	2,61	1,77	1,74	1,71	1,26	0,83	0,82

This means that a larger new amount of bitcoins is being produced every day and added onto the market supply than these numbers indicate. There is no accurate way of assessing the number of lost coins, and when writing The Bitcoin Standard I preferred to not speculate too much in the data so assumed all coins that were mined were still available for their holders to sell.

But if I were to revise estimates of these growth rates in order to account for bitcoin's lost coins, this is likely a high estimate of the growth rate that we have experienced in the last five years, and the coming years.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Annual growth rate, %	1,623	400	100	60	20	15	12	9	6

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026
Annual growth rate, %	5	4,7	2,6	2,3	2,2	2,2	1,6	1	1

I do not pretend these are in any way an accurate estimate, but I think they give a better idea of the real bitcoin supply growth rate considering only the coins whose owners can sell. A Satoshi Nakamoto himself **said**:

"Those coins can never be recovered, and the total circulation is less. Since the effective circulation is reduced, all the remaining coins are worth slightly more. It's the opposite of when a government prints money and the value of existing money goes down."

As bitcoin had an effective supply growth rate around 9% in 2016, 6% in 2017, and 5% in 2018, it is still a relatively fast-growing monetary asset. It is growing at multiples of gold's supply, closer to the numbers of national currencies with the better monetary policy. The way to understand this supply is that every day, bitcoin mining is produc-

ing new coins to the market which are depressing prices. Only with increasing demand can the price rise. At current daily mining output (1,800 new coins per day) and price ($6,500), daily new bitcoin supply is worth around $11.7 million. This is not an inconsiderable sum, and as long as new demand is not found to match it, the price will drop. Bitcoin's supply is still so small that the growth in adoption has more than compensated for mining output throughout most of its life, leading to long-term value rise.

If a new financial crisis is around the corner, bitcoin will distinguish itself from other assets with the fact that its supply is likely to not increase a lot. Former JP Morgan head of global macro explained this eloquently in a **blogpost last year**:

> "When bitcoin first started trading, I was mostly unaware and fairly agnostic of its value. As a trader, I became interested in its vertical rise in 2013 which was followed by a bear market in 2014. Notably, its drop found support; it didn't continue to fall to permanent obscurity below the event horizon. Instead, it stabilized, put a solid double-bottom in 2015, and started to creep up.
>
> "This trading pattern is consistent with precious metal behavior, only compressed to a shorter horizon. For example, [...]the slow consolidation in gold after the spike of 1980."

This trading pattern has so far been only exhibited during Bitcoin's own bubbles, but we have yet to see it during the context of a global financial crisis. It may not happen with the first crisis, because the supply growth rate is still not very low, the number of holders is still very little and so they are quite price sensitive. For its first crisis, bitcoin may drop significantly, but no matter how much it drops, it is likely to eventually stabilize around some level due to the scarcity of its new supply. This is the key differnece between bitcoin and all other assets, except arguably gold. Whenever money flows to an asset in Exter's pyramid, there is a large supply response. When people flow to the US dollar, the Federal Reserve is likely to resort to more inflation of the supply. When people resort to homes as a store of value, their supply increases as builders build more, eventually depressing the price. When people resort to mortgage-backed securities, these securities themselves proliferate quickly, as do the houses backing them, bringing the price down. But as more and more money flows to Bitcoin, there can be no supply response, and therefore it behaves similar to precious metals, as Gurevich observes.

An expected stability, especially in light of the extraordinary rise of the previous few years is likely to give bitcoin some credibility as a hedge and store of value. Given that bitcoin will continue to operate, and will maintain some value, even a significant drop would likely only set it back temporarily before new users begin to recognize its value proposition.

It might not happen with the first or second recession, but over time, as the supply growth rate continues, and perhaps after several financial crises had raised bitcoin's profile as an alternative asset one would expect that bitcoin as an asset will find its way down Exter's pyramid in a similar way to gold. Its wide salability across the world, and its scarcity and volatility, will ultimately make people more interested in holding it as a long-term store of value, rather than as a short-term speculative bet. This would in effect be the transition described in the second scenario for bitcoin monetization discussed above.

The longer that bitcoin continues surviving, and if it eventually gains the status of a safe haven in financial crises, it would start rivaling gold for being the base of the pyramid. Hypothetically, a bitcoin-based Exter triangle would be likely to be more stable than a gold-based one for all the reasons discussed in last month's bulletin on the difficulty of performing fractional reserve banking on top of bitcoin. A bitcoin Exter pyramid would grow very little beyond the creation of productive assets, and contain very few unsustainable expansions through fractional reserve banking, rehypothecation, and maturity mismatching.

Altcoins in a financial crisis:

While the speculative bubble in bitcoin and altcoins in general can only be understood as a consequence of easy money allowing people to engage in unsustainble speculative bubbles across the economy, the outcome of financial crises is likely to be different between bitcoin and altcoins.

Bitcoin is the only digital currency that is strictly scarce, because it is the only one whose supply can only be increased through expending resources roughly equal to the value of the coins produced—i.e. bitcoin is the only hard money among digital currencies. Thanks to Bitcoin's difficulty adjustment, nobody has ever been able to produce a single bitcoin without expending resources roughly equal to its market value. Bitcoin is pure hard money, and it does not make any promises for being anything else. It offers no returns, promises no "killer apps" for which it can be exclusively used. Anybody who bought Bitcoin has bought it for no purpose other than to sell it later on, in other words, bitcoin's demand is purely demand for liquidity.

While other currencies may theoretically have a fixed supply, it must be understood as a monetary policy with nowhere near the credibility that bitcoin's monetary policy has. As I've discussed frequently, bitcoin was the only network that grew organically as a neutral protocol, available to anyone to use, with a scarce resource whose production cost was always around the range of its market value. Had any altcoin begun with this format, it would be highly unlikely to survive or attract any market share from bitcoin, as bitcoin would have more liquidity and hashrate. It would also be quite easy to attack and destroy it when at its infancy, turning away all real value. That any currency has managed to survive, and attract attention and capital is purely down to having a dedicated team or foundation of individuals investing time and re-

sources into coding, mining, and maintaining the network. It is trivial to pinpoint a few individuals that are extremely decisive in the running of the network. This carries several implications. No altcoin has any contentiousness in its operation, they are run like businesses, controlled by a group of people working toward a set goal. With such a structure, no coin can credibly claim to have an immutable monetary policy. It would be trivial for any altcoin to carry out a hard fork to change its monetary policy, as has happened repeatedly with many of these coins. Perhaps more pertinently, the people controlling any altcoin are a single-point-of-failure which can be attacked to cripple, coopt, or derail the project.

This, of course, is in stark contrast to bitcoin, which has thoroughly earned the right to make a very credible claim to have an immutable monetary policy after the events of the Segwit2x hardfork, summarized here by **Kyle Torpey**. When a majority of the owners of the bitcoin hashrate, a majority of the mining processing power, a majority of businesses dealing with bitcoin, and a large number of influential and early bitcoin developers and holders agreed to hard fork bitcoin to change the blocksize, a technical parameter nowhere near as contentious as the monetary policy, they failed miserably, and had to submit to the consensus of the network. For more on this episode, I highly recommend this piece by the ever-excellent **Pierre Rochard on Bitcoin governance**.

To summarize, I will quote what I said in The Bitcoin Standard:

> In conclusion, the Bitcoin coders face a strong incentive to abide by consensus rules if they are to have their code adopted. The miners have to abide by the network consensus rules to receive compensation for the resources they spend on proof-of-work. The network members face a strong incentive to remain on the consensus rules to ensure they can clear their transactions on the network. Any individual coder, miner, or node operator is dispensable to the network. If they stray away from consensus rules, the most likely outcome is that they will individually waste resources. As long as the network provides positive rewards to its participants, it's likely that replacement participants will come up. The consensus parameters of Bitcoin can thus be understood as being sovereign. To the extent that Bitcoin will exist, it will exist according to these parameters and specifications. This very strong status-quo bias in Bitcoin's operation makes alterations to its money supply schedule, or important economic parameters, extremely difficult. It is only because of this stable equilibrium that Bitcoin can be considered hard money. Should Bitcoin deviate from these consensus rules its value proposition as hard money would be seriously compromised.

Altcoins do not even come close to demonstrating this. It is simply inconceivable to imagine an altcoin resisting a coordinated campaign to change their parameters from their major stakeholders,

as was the case with bitcoin with the Segwit2x hardfork. The second largest network after bitcoin, ethereum, has in its short history already had several hard forks, and it has no clear plan of what exactly its monetary policy will be in the future, currently holding meetings to decide on a future course of action. Other altcoins, with smaller communities would likely find such changes even less contentious.

No altcoin even attempts to compete with bitcoin on its one value proposition: immutability. They focus on speed of transactions, adding fancy buzzword features that have no hope of ever functioning, and even if they did, they would never have a millionth of the importance of a digital sound money. Even if these supposed apps work, none of them will create significant enough demand for people to hold the token, rather than just buy it when needed, for the very same reason that people don't hold any serious wealth in the tokens of any real world business that issues tokens. There is no comparison for demand for the US dollar to demand for casino chips or Chuck E. Cheese tokens, and that is precisely why grouping bitcoin with altcoins makes little sense.

Whereas ultimately demand for bitcoin is demand for a hard money, demand for altcoins is a wide variety of usecases and buzzwords that attract speculators. Even if these usecases and buzzwords work, there is nothing scarce about them, and there is nothing to stop the inflation of their supply, both on an individual and aggregate level.

On an individual level: If one altcoin becomes increasingly valued, it would not be very difficult for its makers to change the rules of the supply, either to benefit themselves, or under pressure from political authorities. To imagine that governments will abdicate monetary policy responsibilities to currencies which are run by private citizens is naive to the extreme. It would be trivial for authorities to take any altcoin and force its founders to change the monetary supply if the need arises. Bitcoin's track record in segwit2x shows it has a chance of resisting such an attack. Altcoins' collaborative communities with clearly identifiable figureheads stand no chance.

On an aggregate level, the problem altcoins face is that none of them can ever build scarcity for its token around any particular usecase, even if they succeed in demonstrating successful market-adopted usecases. For every supposed usecase for cryptocurrencies, there are already several projects vying for the attention of the investor. For every person who wants to invest in smart contracts, for instance, there is a growing number of projects regurgitating the buzzwords that ethereum first popularized, but with new qualifiers. So as every novel idea gets an ever-increasing number of currencies, they are not only easy money individually because their creators can make more of them, they are also easy money in the aggregate because nothing stops other projects from creating similar coins.

If any novelty can have its own coin, and minting

coins can make someone rick quick, then every novelty imaginable will be used to make coins. As **Tuur Demeester explained**:

> A problem with coins that trade on novelty (rather than utility) is that the market creates novelty faster than they can.

An ever-growing number of novelty usecases, an ever-growing number of coins for each use case, the possibility that the creators of a coin could alter its schedule to increase the supply, and with liquidity and security significantly inferior to bitcoin, altcoins are firmly perched at the highest reaches of Exter's inverted pyramid. They have low liquidity, carry a lot of risk, but offer potentially high returns through quick appreciation. Most significantly, their supply can be increased quickly. They are clearly different from Bitcoin whose value proposition as hard money is uncontested by any altcoin. The only truly scarce digital tokens are bitcoins. This is why, over the years, one would expect bitcoin to drop down Exter's pyramid.

3- The Problem Bitcoin Solves

The Spectator magazine in London asked me to write a response to a recent op-ed by Paul Krugman on Bitcoin. I include the full text of the response here:

Blogger, fiat-currency enthusiast, and Nobel laureate economist Professor Paul Krugman recently justified his scepticism about crypto-currencies in the New York Times. He asked readers to give him a clear answer to the question: what is the problem cryptocurrency solves? He wrote: "governments have occasionally abused the privilege of creating fiat money, but for the most part governments and central banks exercise restraint." He added that, unlike Bitcoin, "fiat currencies have underlying value because men with guns say they do. And this means that their value isn't a bubble that can collapse if people lose faith."

Case closed, apparently. What he omitted to mention was that Bitcoin has been operating successfully for almost ten years now, not once confirming a fraudulent transaction. Every day, its traded volumes run to billions of dollars. In fact, Bitcoin's increasing reputation for security and the supercharged growth it is still undergoing suggests it's not about to go away. Could it be the market knows something about Bitcoin and central banks that Mr. Krugman does not?

A closer look at the track record of government money offers a perspective somewhat different to that seen through Krugman's rose-tinted spectacles. As I write, Zimbabwe and Venezuela are undergoing the ravages of a collapse of government money, while Argentina, Iran, and Turkey teeter on its brink. A quarter of a billion humans live in these failing economies – but not enough, evidently, to dissuade Krugman from endorsing government control of money so wholeheartedly.

It's not even as if what is happening in these countries is a new phenomenon. Hyperinflation has occurred 57 times since the end of World War I, afflicting several billions of people. In every instance it's been precisely the type of money whose worth is supposedly protected by men with guns that has become, well, worthless.

Indeed, hyperinflation is a form of economic disaster unique to government-created money. There was never an example of hyperinflation when economies operated a gold or silver standard. Government money is relatively cheap to produce, meaning governments in crisis are all too happy to produce it. In this way - as we have seen all too often - it is possible for a society to lose all of its savings in the space of a few months, or even weeks. This is what happens when the wrong people gain control of the financial levers. Whatever alleged benefits government-managed money may have, a single episode of hyper-inflation far outweighs them.

While most countries have not experienced hyperinflation, they have almost all experienced significant currency devaluation for sustained periods. Between 1960 and 2015, the average country's

money supply grew at around 32% per year. Even among the hard global reserve currencies, none today holds more than three percent of the value it was last redeemable for in gold in 1971.
Krugman doesn't seem to believe the value of government money needs to be justified intellectually. Instead, he believes "men with guns" will suffice as an argument. The good news for him is that intellectual justifications do not ultimately matter, not when set against the realities of the market. The power of the state is usually sufficient to protect the economic monopolies he defends. However, the bad news is that the flow of Bitcoin - which is decentralised, digital and cryptographically-secured - is far harder to stop with guns.

Krugman cites the relatively high cost of Bitcoin transactions as a reason the crypto-currency cannot compete long-term with fiat currencies. He seems, mistakenly, to assume Bitcoin is competing with consumer payments networks like Visa or Paypal. But as I argue in my book The Bitcoin Standard, that is not what Bitcoin is best suited for. Rather, Bitcoin is an international settlement network, one that competes with the central bank settlement systems that are the foundation upon which consumer payment networks like Visa or Paypal depend.

It must also be said that Bitcoin transaction costs are relatively cheap compared to those of traditional settlement systems. And that's not even to mention that Bitcoin offers international clearance within an hour, while the current banking system usually needs days, and sometimes weeks.

Certainly, there is appetite for a credible alternative to government-controlled fiat currencies. In the nine years it has been trading, Bitcoin has appreciated 700,000,000 percent against the dollar, despite the naysayers and warnings of its impending collapse.

Perhaps the most compelling argument for Bitcoin is the completely apolitical and predictable monetary policy it operates within. Bitcoin cannot be used for quantitative easing, for example. You can't just print more of it when the whim takes you. If Bitcoin's continued growth deprives central banks of the ability to finance catastrophic wars by printing money, or if it prevents even one more tragic incidence of hyperinflation, the energy consumption required to mine it will be the best bargain humanity ever got.

Could Bitcoin collapse? Of course it could. Any investor who puts a large amount of money into Bitcoin must know they are taking a significant risk - or they'll likely learn the hard way. But Bitcoin's price falls these days bottom out at prices many times higher than they did only a few years ago.

Can government currencies and bonds collapse, or drop significantly in value, despite the "men with guns" that protect them? The answer - after a hundred years and more of hyperinflations, financial repression and sovereign defaults, which together have affected billions of people - is a resounding yes.

It's no wonder so many people do not share Professor Krugman's brazen enthusiasm for the last century's experiment with government-controlled money, and herein lies the problem Bitcoin solves. Bitcoin offers anyone in the world an escape from being controlled by economists who believe they are immune to the lessons of history.

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