

THE BITCOIN REVOLUTION

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The likelihood of the Bitcoin system replacing the Federal Reserve as the main provider of money in the United States and the desirability of such a transformation are the topics of this article.¹ With respect to the first of these topics, one needs to consider how far the so-called Bitcoin Revolution has progressed by estimating the average volume of transactions conducted per time period by means of Bitcoin payments, and then compare recent values of that magnitude with the total volume per period of dollar payments in the United States.²

Francois Velde of the Federal Reserve Bank of Chicago has estimated that, as of late 2013, the average volume of bitcoin transactions per minute totaled less than four-tenths of 1 percent of average dollar transactions per minute—actually, not *total* dollar transactions but only the *subset* conducted by means of Visa credit card payments (Velde 2013). In the months since the publication of Velde’s article the volume of bitcoin payments has been growing rapidly, but their quantitative extent is still negligible from a macroeconomic perspective. In fact, this 0.004 magnitude is quite

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¹I have not attempted to explain the workings of the Bitcoin system in this article because it would require space and because I could not do this better than Velde (2013).

²In what follows, I will use “Bitcoin” as the name of the system, “bitcoin” as an adjective or a singular noun, and “bitcoins” to refer to specified quantities.

close to the ratio implied by magnitudes of Bitcoin and Visa daily transactions averaged over the most recent 12 months as reported on August 7, 2014, by the *coinometrics.com* web site. These magnitudes are \$57.3 million and \$16,518 million, so the implied ratio is 0.00345. Alternatively, in terms of *stocks*, rather than transactions, the M1 measure of the U.S. money supply (currency plus demand deposits) is currently about \$2,835 billion (as of August 7, 2014) with bitcoins worth \$7.7 billion, for a ratio of 0.00272—again, of the same order of magnitude.

Another way to express the point that Bitcoin is not at this time a quantitatively important money is to reflect on the economist's standard definition of money—namely, an entity that serves as a medium of exchange, store of value, and unit of account.³ Doing so, one recognizes that some clarification in this common description is necessary to make it analytically coherent. First, traditional money is typically a tangible object (e.g., metallic coins, government issued currency, or legal claims to such coins or currency) and thus is not itself a unit of account, which is intangible. Indeed, careful terminology would replace “unit of account” with “medium of account,” a specified amount of which serves as the unit of account.⁴

Also, it is necessary to recognize that in developed economies tangible money does not rank highly as a store of value. For example, in the United States, during the first quarter of 2014, aggregate assets of households and nonprofit organizations together totaled \$95,549 billion whereas checkable deposits and currency holdings by these units came to only \$1,096 billion (roughly 1/100 of their assets).⁵ Much larger components of household plus nonprofit-organization wealth include the reported monetary value of houses, furniture, automobiles, etc. Some major categories are real estate (\$22,820 billion), corporate equities (\$13,502 billion), corporate and foreign bonds (\$2,626 billion), and pension entitlements (\$19,766 billion).

Accordingly, it is the medium-of-exchange role that is the primary attribute that serves to define money.⁶ But an important qualifier

³See, for example, Jevons (1875: 13–18), Wicksell (1935: 6–7), and Clower (1967: 4–5)

⁴This semantic point has been made by Niehans (1978: 118), McCallum (1989: 17), and White (1999: 7)

⁵These figures came from: www.federalreserve.gov/releases/z1/current/z1r-5.pdf.

⁶That the medium-of-exchange property is the essential one is mentioned by Wicksell (1935: 7), Clower (1967: 4), and (implicitly) Jevons (1875: 13–18).

often made explicit is that money is a *generally acceptable* medium of exchange. By that standard bitcoins do not qualify as money. Indeed, for most members of the U.S. population there are very few, if any, of their basic payments that could be made using bitcoins.

None of the foregoing arguments rule out the possibility that Bitcoin will become a major—or even the main—medium of exchange in the future.⁷ But as of today it seems likely that for law-abiding U.S. citizens the practical attractions of Bitcoin are primarily as a financial investment with very high volatility and as a means of participating in an intellectually fascinating, avant-garde, and potentially revolutionary, social experiment.⁸ One would have to admit, however, that there are certain categories of transactions for which bitcoin payments are (or could be) quite important.

Anonymity

Before proceeding, it should be mentioned that, as a novice to the Bitcoin world, I have found it confusing that some experts tout anonymity as a great advantage of Bitcoin over other payment systems while other, also qualified, experts—e.g., Spear (2014)—state that anonymity is not a feature at all. Apparently, however, both are correct but have in mind anonymity in two quite different respects. One is whether it is possible to follow the transactions of an individual Bitcoin user. Since all transactions are recorded and retained in the system’s “block chain,” which is a public ledger, there is no anonymity at all of this nature. The public ledger does not, however, associate a particular Bitcoin transactor with any specific person (or group of persons). It might be possible, therefore, for an individual to keep secret his ownership of his bitcoin account. A useful brief statement on this topic by Grinberg (2011: 179) is: “All Bitcoin transactions are public, but are considered anonymous because nothing ties individuals or organizations to the accounts that are identified in the transactions.” Velde (2013: 3) puts this in another way as follows: “The many ingenious features of bitcoin try to emulate . . . properties of cash, but do so at some costs. One prominent cost is the loss of anonymity. Possession of the virtual currency

⁷ For a reasonably optimistic outlook, and suggestions for improving it, see Luther and White (2014).

⁸ For an analytically impressive argument to the contrary, see Selgin (2013).

must be linked to the unique identifier of the wallet. Admittedly, there . . . are ways to make the wallet hard to trace back to its owner, but these require additional efforts.”

Will Bitcoin Become a Major Medium of Exchange?

Here the object is to consider the possibility that, while quantitatively unimportant at present, Bitcoin will in the foreseeable future become a major (and perhaps main) medium of exchange—provided it is not thwarted by legal actions of the U.S. government. A natural way to argue that Bitcoin will grow is to identify some of its major advantages. A useful (and highly positive/optimistic) viewpoint has been expressed by Andreessen (2014). Since that writing is intended to be persuasive, I will quote from it extensively in what follows.

First, Andreessen emphasizes the reduction in certain transaction costs that Bitcoin could bring about. A major example is the case of international remittance: “Every day, hundreds of millions of low-income people go to work in hard jobs in foreign countries to make money to send back to their families in their home countries—over \$400 billion annually Every day, banks and payment companies extract mind-boggling fees, up to 10 percent . . . to send this money Switching to Bitcoin, which charges no or very low fees, for these remittance payments will therefore raise the quality of life of migrant workers and their families significantly.” Moreover, he says, Bitcoin can be a powerful force “to bring a much larger number of people around the world into the modern economic system” and thereby “can be a powerful catalyst to extend the benefits of the modern economic system to virtually everyone on the planet.”

Also, Andreessen argues that another “fascinating use case for Bitcoin is micropayments, or ultras-small payments” that “have never been feasible, despite 20 years of attempts, because it is not cost effective to run small payments . . . through the existing credit/debit and banking systems” whose fee structure “makes that nonviable.” By contrast, “Bitcoins have the nifty property of infinite divisibility: currently down to eight decimal places. . . . So you can specify an arbitrarily small amount of money, like a thousandth of a penny, and send it to anyone in the world for free or near-free. . . . Think of content monetization, for example. One reason media businesses such as newspapers struggle to charge for content is because they need to charge either all (pay the entire subscription fee for all the content)

or nothing.” But “with Bitcoin, there is an economically viable way to charge arbitrarily small amounts of money per article, or per section, or per hour, or per video play, or per archive access, or per news alert.”

In this context, Andreessen states that “another potential use of Bitcoin micropayments is to fight spam. Future email systems and social networks could refuse to accept incoming messages unless they were accompanied with tiny amounts of Bitcoin—tiny enough to not matter to the sender, but large enough to deter spammers, who today can send uncounted billions of spam messages for free with impunity.” This is a type of use that seems likely to appeal to economists, many of whom are (I believe) appalled by the view (evidently held by many Internet developers and guardians) that use of the Internet should be *entirely* free with respect to the sending of e-mail messages.

Bitcoin Growth Rate

As most descriptions of the Bitcoin system explain, the total stock of bitcoins outstanding is programmed to grow automatically at a rate that is currently 25 bitcoins every ten minutes but which will be halved every four years, implying that the stock will asymptotically approach 21 million bitcoins. Thus, if real economic growth continues and Bitcoin becomes a dominant currency, the bitcoin price of goods will at some point have to begin a continuous fall. This plan could be modified, if I understand correctly, by Bitcoin’s five-man “development team” that could in principle alter the schedule of growth rates.⁹ It is of some interest from the perspective of monetary economics, then, to consider what a desirable rate of growth would be for the stock of bitcoins. Suppose that Bitcoin became the dominant medium of exchange; what then

⁹See, e.g., Selgin (2013: 21) and Grinberg (2011: 175–76).⁹ A member of the Bitcoin development team has indicated to me that the process for changing the code is more difficult than the foregoing discussion implies. What a member (or, in fact, anyone) actually can do is to submit a proposal for changing the code. Any such proposal is then reviewed by all interested members of the Bitcoin community. If a proposed change would have the effect of changing the path of the Bitcoin supply, it would amount to a “hard fork” that would entail the existence of two different versions of the Bitcoin code. Then if all users adopted the proposal, the change would be incorporated. If they did not, then the result would be two competing versions of Bitcoin—in which case its market value might be endangered. Accordingly, all Bitcoin holders would have, he suggests, a strong incentive not to adopt the proposal.

would be the socially optimal rate of growth of the bitcoin stock? Well, if there is only a negligible resource-cost difference for different rates of growth of the bitcoin stock, one could use Milton Friedman's famous argument regarding the "optimal inflation rate" in the bitcoin context.¹⁰

That is, one could argue that the optimal money-creation rate should be that which drives the nominal (money) rate of interest to zero, since lower rates of interest lead economic agents to hold larger money stocks in real terms thereby providing more real transaction-facilitating *services* for their holders. Since there are no tangible costs of producing these additional services, it is socially optimal to increase their magnitude to a satiation level. So, applying this line of argument to an economy with a Bitcoin medium of exchange, we get the Friedman result again: the optimal inflation rate is the negative of the real rate of interest, which makes the nominal interest rate equal to zero.

The foregoing line of argument suggests, however, that if the Bitcoin development team or others can propose altered rules for the creation of bitcoins and have them adopted by the Bitcoin community, then it is possible that the development team could lead the way into adoption of an *activist* rule or to one that would generate some inflation. So it seems that the ultimate fundamental difference between a highly developed Bitcoin system and our current Fed-based, paper-money arrangement is *political*—the tangible resource costs of creating the medium of exchange are extremely low in both cases. In this regard one might be able to argue—as in footnote 9—that a Bitcoin-type system would be less subject to political forces inimical to price level stability. But, on the other hand, one might be impressed by Velde's statement that "it is hard to imagine a world where the main currency is based on an extremely complex code understood by only a few and controlled by even fewer, without accountability, arbitration, or recourse" (Velde 2013: 3).

In this context it is pertinent to remember that the U.S. Constitution clearly intends, as specified in Article I, Sections 8 and

¹⁰The usual reference is Friedman (1969) but that article's basic argument was developed much earlier, in Friedman (1960: 73). Selgin (1995) has suggested that that Friedman's analysis "superficially resembles arguments for the productivity norm" which Selgin has championed.

10, for the nation's monetary system to be based on gold and/or silver.¹¹ Since there is nothing in the existing Amendments that suggests any change in this arrangement, it is clear that the inconsistency of today's reality with the Constitution's specification is severe—and that it can be traced to Supreme Court rulings in the 1871 cases of *Knox v. Lee* and *Parker v. Davis*. I have written a short paper (McCallum 2010) discussing this astonishing episode, drawing heavily on several earlier writings by Richard Timberlake that are beautifully and extensively developed in *Constitutional Money: A Review of The Supreme Court's Monetary Decisions*.¹²

Will Bitcoin Prosper?

In thinking about the future of Bitcoin, a major question is whether the U.S. government will, or will not, take legal steps to prevent its growth and possible dominance. A substantial discussion of this matter has been provided by Grinberg (2011: 181–206). He observes that the U.S. Constitution “has nothing to say about private parties creating money,” and that the relevant existing federal statutes are the Stamp Payments Act of 1862 and an assortment of federal statutes concerning counterfeiting. Regarding the first of these, he concludes that it is unlikely that this act would form the basis for a federal attack on Bitcoin: “It is a 150-year-old statute that has outlived its usefulness.” Specifically, “there has been no published court opinion interpreting the Act since 1899.” In addition, “the availability of more fitting statutes under which to attack Bitcoin” is “likely to dissuade prosecutors from trying to breathe new life into the Stamp Payments Act” (Grinberg 2011: 190–91).

What, then, about the statutes regarding counterfeiting? Grinberg's discussion is highly informative, but does not leave one with much confidence regarding the major issue at hand—namely, whether the U.S. government would permit control of monetary

¹¹More precisely, it put constraints on monetary arrangements made by Congress and the states, evidently presuming that the main monetary institutions would be provided by Congress.

¹²Timberlake (2013) argues that not only was the majority Supreme Court reasoning in these cases faulty, but also that there exists a possibility of reversing the *Knox v. Lee*, *Parker v. Davis*, and *Juilliard v. Greenman* decisions, these themselves being startling and fascinating reversals of the *Hepburn v. Griswold* decision of 1870.

management to pass from the Federal Reserve to a system not under its dominance. In this regard, Selgin (2013: 23–24) states:

Although I have suggested that a synthetic commodity monetary regime might perform better than either existing fiat money regimes or than potential commodity money alternatives, I have deliberately avoided suggesting that any government is likely to take steps to establish such a regime. Indeed, rather than make that suggestion, I'm inclined to argue that, while it is possible to conceive of a government-sponsored synthetic commodity monetary regime, it is difficult to imagine a government actually embracing the idea, and more difficult still to imagine one that would not be tempted to interfere with, and ultimately to undermine, an established synthetic commodity standard by means of its ability to introduce and to confer legal tender status upon some new fiat currency.

I find it difficult to argue with Selgin's conclusion. Yet, I would like to believe that it might be possible for Bitcoin to survive and succeed in providing the useful services identified by Andreessen.¹³ In this context, it is interesting that an outcome of this type could be possible, should be welcomed, and seems reasonably likely, as St. Louis Fed economist David Andolfatto (2014) has recently argued.

An Intriguing Possibility

In conclusion, I would like to mention an unlikely but intriguing possibility that could arise from the existing situation. It is, that there exists a rather prominent possibility that the U.S. government will take legal steps to constrain or banish the Bitcoin system. In that case, it would seem that any legal attack by the federal branch of government on Bitcoin would have to begin by establishing the government's responsibility for management of the U.S. monetary system.¹⁴

¹³It might be asked what one could reasonably believe would be the case if it were not for the likelihood of government resistance to Bitcoin. To me it would nevertheless seem unlikely that Bitcoin would replace government currencies to a large extent. If, however, I think back to the early 1990s, I would have myself never believed that e-mail and the Internet would have taken over as large a part of my daily activities as, in fact, they have.

¹⁴There will be regulations at the state level—New York, for example, has been holding hearings in preparation for the design of its version—but these will be of a different nature than ones that would entail a challenge to the Federal Reserve as the nation's monetary authority.

But, given the explicit provisions of the Constitution, doing so would apparently need to rely on the Supreme Court decisions in the “Legal Tender Cases” of *Knox v. Lee* (1871) and *Parker v. Davis* (1871), plus *Juilliard v. Greenman* (1884), which served to overturn the post–Civil War decision in *Hepburn v. Griswold* (1870). But, given the illogical nature of the decisions in these three cases, as richly detailed by Timberlake (2013), a competently developed counter-argument should be able to yield a reversal of their rulings, which permitted the development of today’s arrangements—ones that appear to be (whether one likes them or not) fundamentally inconsistent with the Constitution.

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