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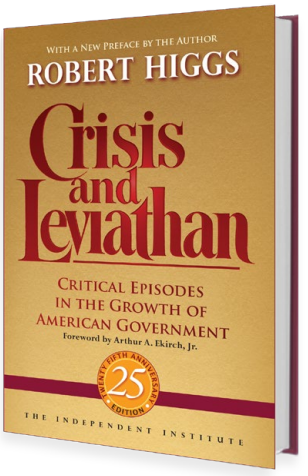

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Bitcoin and the Future of Digital Payments

WILLIAM J. LUTHER

Following the publication of a white paper by Satoshi Nakamoto in 2008, bitcoin was quietly introduced to the world in 2009 as not much more than an obscure piece of code. For more than a year after its introduction, each bitcoin in circulation traded for pennies as a community of coders made minor modifications and refinements to the open-source client at the system's core. Its value climbed to roughly $1.00 by February 2011 and then to nearly $30 four months later before settling down to an average of just $8.16 from July 2011 to February 2012. After that, demand began to increase. First gradually. Then suddenly.

In mid-2015, one bitcoin exchanged for roughly $290. It is accepted by a wide variety of businesses around the world, from major online retailers to food trucks. An entire cottage industry has emerged to help individuals buy, sell, store, transfer, and track the price of bitcoin. It is routinely the subject of major media coverage. And everyone with even a passing interest in bitcoin seems to have one question in mind: Will it survive?

Opinions regarding the future of bitcoin are mixed. Jennifer Shasky Calvery, the director of the Financial Crimes Enforcement Network, suggests bitcoin could become "a significant player in the financial system" (2013). Others express optimism regarding the underlying blockchain technology but reserve judgment on bitcoin in particular. Nassim Taleb, for example, believes "[b]itcoin is the beginning of something great: a currency without a government, something necessary and imperative." However, he remains unsure "whether [bitcoin] is the best potential setup" and recognizes that it takes "a long time to establish confidence" in a new payment

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system (2013). Still others see little hope for bitcoin. Although Paul Krugman acknowledges that bitcoin solves "an interesting information problem," he doubts "whether solving that problem has any economic value" (2014).

In this essay, I consider the factors affecting the likelihood that bitcoin will continue to facilitate exchange in the future. First, I discuss the obstacles to bitcoin from incumbent monies and alt-coins. Then I offer my view on the future of bitcoin and digital payments.

Bitcoin and the Incumbent-Monies Problem

The biggest obstacle to the widespread adoption of bitcoin is the incumbent-monies problem. Virtually everyone in the world is already using money. Therefore, the decision to use bitcoin is, at least on the margin, the decision to stop using an incumbent money. The problem: switching costs and network effects favor the status quo (Luther forthcoming).

Switching costs refer to any cost required to transition from the incumbent money to bitcoin. They include the need to retool vending and automatic teller machines; to update menus and transaction records; and even to learn to think and calculate in terms of a new unit of account. If bitcoin is to have any hope of replacing an incumbent money, it must be sufficiently better to warrant the cost of switching.[1]

Network effects result when the value of a good or service depends on the total number of those using it. Monies are characterized by network effects because a medium of exchange is useful only to the extent that one's trading partners are willing to accept it. Moreover, when one is choosing between multiple monies (or would-be monies), historical acceptance might act as a particularly salient focal point for coordinating on the incumbent money (Luther and White 2011; Luther forthcoming). Hence, even if bitcoin warrants the costs of switching, it must also be sufficiently better than an incumbent money (net of switching costs) to warrant the costs of coordination.[2]

The incumbent-monies problem is exacerbated by the fact that virtually all incumbent monies employed at present are government sponsored. These monies typically benefit from some form of legal-tender status and public receivability (i.e., the government accepts taxes in and makes payments with the incumbent money). By providing a lower bound on the network size of the incumbent money, legal-tender status and public receivability make it more difficult to overcome the network-effects problem.[3]

1. Luther and White 2014 considers recent attempts to reduce the costs of switching. Still, switching costs are positive. See also Luther 2014.

2. Nair and Cachanosky 2014 discusses entrepreneurial efforts to overcome these network effects.

3. On the role of government in determining the medium of exchange, see Salter and Luther 2014.

Government-sponsored incumbent monies also permit the issuer to conduct monetary policy, generate seigniorage revenue, and, at least with electronic balances, provide some scope for oversight and confiscation. To the extent that bitcoin conflicts with governmental objectives (e.g., conducting monetary policy, raising revenue, preventing private agents from engaging in illegal transactions, protecting private agents from fraud, etc.), it might be subject to regulatory efforts aimed at precluding or dissuading users from adopting it (Luther 2015). Indeed, some governments have already taken steps to ban or regulate bitcoin (Hendrickson, Hogan, and Luther forthcoming). And as Reuben Grinberg explains, even the absence of explicit regulation "may significantly hamper demand" because ambiguity leaves bitcoin "in a legal grey area" (2011, 182). Hence, the regulatory environment—be it explicit or implicit—might significantly raise the costs of switching to bitcoin for some users.

Competition from Alt-Coins

In addition to the challenge posed by incumbent monies, bitcoin also faces competition from other cryptocurrencies, otherwise known as alt-coins. Like bitcoin, alt-coins face the incumbent-monies problem. They also have to overcome bitcoin's first-mover advantage. However, alt-coins might make use of a second-mover advantage to outcompete bitcoin in the long run.

Alt-coins exploded onto the scene shortly after bitcoin's early (if limited) success.[4] There are more than five hundred cryptocurrencies trading today, with a combined market capitalization of roughly $4.89 billion as of July 15, 2015.[5] Bitcoin dominates the market by far: with a market capitalization of $4.17 billion, it holds 85.6 percent of the market. Notable alt-coins include ripple ($274 million; 5.6 percent), litecoin ($183 million; 3.7 percent), dash ($21 million; 0.42 percent), and dogecoin ($19 million; 0.39 percent). Lawrence White reports that the market caps of ripple and litecoin were 8.5 percent and 1.8 percent as large as bitcoin on March 9, 2015 (2015, 384). As of July 15, 2015, they are 6.6 percent and 4.4 percent, respectively.

The success of bitcoin relative to other cryptocurrencies suggests it enjoys a substantial first-mover advantage. If one is interested in switching to a cryptocurrency, bitcoin is the obvious choice. It is the most familiar, so it enjoys relatively lower switching costs, and it has the biggest network. In other words, the same forces that discourage users from switching from incumbent monies to bitcoin encourage those users that have already switched to stick with bitcoin and those users who are going to switch to choose bitcoin over one of its alt-coin rivals. This state of affairs bodes well for bitcoin.

4. For a more comprehensive overview of the market for cryptocurrencies, see White 2015.

5. At the time of this writing, the website Crypto-Currency Market Capitalizations (http://coinmarketcap.com/all/views/all/) tracked 680 cryptocurrencies, of which 580 had a positive value. All market capitalization data presented herein come from this source.

However, alt-coins might enjoy a second-mover advantage. Specifically, developers can identify common complaints about bitcoin and offer alt-coins that are modified to address the issues. For example, litecoin employs the same proof-of-work distribution as bitcoin, but it offers a maximum circulation of 84 million coins, whereas bitcoin is limited to 21 million. Similarly, a relatively new alt-coin aptly named NuBits ($0.55 million market capitalization; 0.01 percent of the market) overcomes purchasing-power volatility issues experienced by bitcoin by pegging its value to the dollar.[6] Whether and to what extent the second-mover advantage enjoyed by some alt-coins will be sufficient to overcome the incumbent-money problem and bitcoin's first-mover advantage remain to be seen.

The Future of Digital Payments

Predicting the future in the face of technological change is almost certainly a fool's errand. A decade and a half ago eBay was king, and Amazon sold books. The popular romantic comedy *You've Got Mail* (Nora Ephron, 1998) saw the owner of a small local bookstore match with the heir of a megabookstore chain likely to put her out of business. Barnes & Noble had sued Amazon in 1997 for claiming to be "the world's largest bookstore," and yet few questioned the plot. Looking back, it seems obvious that Amazon would push out not only the small local bookstore but also the megabookstore chains and many other brick-and-mortar shops that sell a wide range of products. But it was not so obvious at the time. The Internet was neat. It made it easier to chat with loved ones and find new friends. However, it was difficult to imagine in the late 1990s all the ways in which it would touch our day-to-day lives in the future—let alone which companies would come to dominate the landscape. Much the same might be said about the future of digital payments today. Nevertheless, and perhaps against my better judgment, I offer some modest predictions based at least in part on the forces discussed earlier.

The share of electronic transactions will continue to increase. The share of the currency component of M1 to the M1 money stock peaked in October 2007 at 56 percent. Today, it sits around 42 percent because people are somewhat less inclined to use currency to make transactions. Why? In part because of the rise in online shopping and in part because it has never been more convenient to make digital payments in face-to-face exchanges. With the widespread adoption of smartphones and the relatively recent rollout of small, low-fee card-reader devices by Square, PayPal, and others, even the smallest business can accept electronic payments. And, more recently, smartphone apps such as Venmo and Cash (by Square) enable users to make digital payments on the fly with virtually anyone else willing to download

6. Specifically, custodians maintain constant sell walls at U.S.$1.00, and shareholders offer interest on NuBits effectively held out of circulation to create synthetic demand when necessary. Since launching in September 2014, NuBits's price has ranged from a low of $0.94 in May 2015 to a high of $1.06 in February 15.

the app. As existing vending machines, parking meters, card readers, and the like are replaced with newer, tap-to-pay-enabled devices, it will become even easier to make digital payments. In the future, the rare occasion when one asks a stranger or shopkeeper if she has change for a dollar (or, given inflation, perhaps a five or a ten) will provide an amusing reminder of a time when cash was king and transacting was much less convenient.

The blockchain technology will be widely adopted to process digital payments. The technological advance of bitcoin is its ability to process transactions over a distributed network without a central node functioning as a bank or clearinghouse.[7] At the moment, processing transactions using the blockchain seems to be less costly than the traditional approach. Moreover, the business of processing transactions tends to be highly concentrated. As such, the volume of transactions handled by each payment processor means that the benefit of switching might be quite large, and the small number of participants means that the cost of coordinating to overcome network effects are probably small. Hence, to the extent that the blockchain technology lowers transaction costs, it will likely be adopted to process digital payments.

Some businesses have already taken steps toward adopting the blockchain technology. NASDAQ announced it will launch a blockchain-style digital-ledger technology to manage equities with its NASDAQ Private Market platform (Orcutt 2015). The consulting firm Deloitte has established the Deloitte Cryptocurrency Community to advise its customers on the benefits of the blockchain for exchanging funds and managing staff payments, among other things (Rizzo 2015). Even the U.S. Federal Reserve System (2015) has looked into the blockchain—or what it calls a "digital value transfer vehicle"—to process interbank payments. More firms will likely adopt the technology as it becomes more familiar.

Bitcoin and other cryptocurrencies, to the extent that they survive at all, will likely function exclusively as niche monies. Most users seem relatively content with the existing payment system. They perceive the benefits of switching to be small. And, with so many potential trading partners, the costs of coordination are quite large. So although the blockchain technology will likely be adopted to process transactions on the back end, the average consumer will not switch from incumbent money to cryptocurrency.

Some users might experience large gains from switching to a cryptocurrency if it enables them to complete transactions they would otherwise be unable to complete. For example, the extent to which bitcoin permits pseudonymous transactions seems to make it especially useful in illicit transactions. It was the only currency accepted on the Silk Road, an online marketplace where users could buy illegal goods and services from 2011 to 2013 (Christin 2013). Most online illicit markets in operation today also rely on cryptocurrencies.

7. Luther and Olson 2015 compares the blockchain to memory.

Others have suggested that cryptocurrencies might provide a convenient mechanism for monetizing contributions that are currently zero priced. Because cryptocurrencies are usually divisible to many decimal places—eight in the case of bitcoin—users might offer very small tips when viewing online content. Facebook permits apps enabling users to offer others tips in cryptocurrency (Hajdarbegovic 2014). As in the case of illegal transactions, however, these benefits are limited to a subset of one's transactions. Hence, bitcoin or some other alt-coin might find some limited success functioning as a niche money even if it is not adopted more widely.

Bitcoin or some other cryptocurrency might function as more than a niche money in countries with especially weak currencies, even though these countries would seem to pose the greatest regulatory risk to bitcoin. The most likely place for a cryptocurrency to accomplish widespread acceptance would seem to be where the incumbent money is managed poorly because in these cases the benefits might be sufficiently high to warrant the costs of switching and coordination. Individuals have historically been reluctant to switch currencies to such an extent—even in the absence of legal restrictions—except in cases of hyperinflation or government support (Luther 2013, forthcoming). And, when they have switched, they tend to prefer the currency of their largest trading partners and/or a widely accepted, fairly stable currency such as the dollar or the euro. In the future, however, cryptocurrencies might thrive in such an environment because, unlike the paper-money alternatives, they allow users to make digital payments. In Kenya, where many people are unbanked but have cell phones, Vodafone's m-pesa system has taken off (Burns 2015). If the incumbent money were especially unstable, such users might opt to use their phones to transfer cryptocurrencies instead.

One countervailing force in such environments is the prospect for outright bans or excessive regulation. Governments that mismanage currencies tend to institute other draconian measures when things go awry. Nonetheless, the few cases of unofficial currency substitution in the face of troubled currencies provide some reason to believe those wishing to use cryptocurrencies might successfully circumvent the law. Similarly, the few cases of official currency substitution and currency boards suggest that some governments are willing to take drastic actions—and sacrifice seigniorage—when few options remain. As such, there is some hope for the widespread adoption of cryptocurrencies in countries with especially weak currencies.

Conclusion

Bitcoin represents a technological advance in the processing of payments. It is always difficult to predict the future, but technological advancements tend to be put to good use—at least until something better comes along. In my opinion, the long-run odds do not seem to favor bitcoin—or any other existing cryptocurrency, for that matter. One can, however, be reasonably certain regarding the growth of electronic transactions. And if the blockchain technology significantly reduces the costs of processing

transactions, it will be adopted. As for bitcoin and the alt-coins it has inspired, they are unlikely to function as more than a niche money except in the unlikely event of hyperinflation or government support or both.

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