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Article

\$=€=BITCOIN?

HILARY J. ALLEN*

Bitcoin (and other virtual currencies) have the potential to revolutionize the way that payments are processed, but only if they become ubiquitous. This Article argues that if virtual currencies are used at that scale, it would pose threats to the stability of the financial system—threats that have been largely unexplored to date. Such threats will arise because the ability of a virtual currency to function as money is very fragile—Bitcoin can remain money only for so long as people have confidence that bitcoins will be readily accepted by others as a means of payment. Unlike the U.S. dollar, which is backed by both a national government and a central bank, and the euro, which is at least backed by a central bank, there is no institution that can shore up confidence in Bitcoin (or any other virtual currency) in the event of a panic.

This Article explores some regulatory measures that could help address the systemic risks posed by virtual currencies, but argues that the best way to contain those risks is for regulated institutions to out-compete virtual currencies by offering better payment services, thus consigning virtual currencies to a niche role in the economy. This Article therefore concludes by exploring how the distributed ledger technology pioneered by Bitcoin could be adapted to allow regulated entities to provide vastly more efficient payment services for sovereign currency-denominated transactions, while at the same time seeking to avoid concentrating the provision of those payment services within “too big to fail” banks.

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* Associate Professor, Suffolk University Law School. This Article benefitted enormously from comments from the law faculties at Northeastern University and Suffolk University, as well as participants at the Law & Society Annual Meeting in Seattle, Washington, the Bay Area Corporate and Financial Scholars Workshop at UC Berkeley, and the conference on Rethinking the Public-Private Balance in Financial Markets and Regulation hosted by Cornell Law School’s Clarke Business Law Institute.

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INTRODUCTION

*I view Bitcoin as a potentially promising payment system, saddled with a less-than-ideal money and monetary policy.*¹

Two broad narratives have emerged from the heated debate about the virtual currency Bitcoin. The first, negative narrative focuses on Bitcoin’s potential to facilitate anonymous, nefarious, and fraudulent transactions in a realm beyond the power of law enforcement.² The other, overwhelmingly positive narrative posits that Bitcoin will revolutionize money in the same way that the internet revolutionized information.³ Proponents of this sec-

1. David Andolfatto, *Fedcoin: On the Desirability of a Government Cryptocurrency*, MACROMANIA (Feb. 3, 2015, 11:38 AM), <http://andolfatto.blogspot.com/2015/02/fedcoin-on-desirability-of-government.html>.

2. See *infra* Part IV.A.

3. *Beyond Silk Road: Potential Risks, Threats, and Promises of Virtual Currencies: Hearing Before the U.S. S. Comm. on Homeland Security and Governmental Affairs*, 113th Cong. 4 (2013)

ond narrative stress Bitcoin's ability to effect payments quickly and reduce transaction costs—and, to the extent that it limits the role of national governments and central banks in the money supply, Bitcoin is the stuff of libertarian dreams.⁴ Each of these narratives contains elements of truth and hyperbole, but there is one important element that is largely missing from both narratives: the externalities that can be created by virtual currencies. The negative narrative focuses only on the counterparties to Bitcoin transactions and misses the threat that a widely used virtual currency could pose to the stability of the financial system as a whole (and to the economy more broadly). The positive narrative misses the point that a virtual currency can only be transformative if it is widely adopted, and a widely adopted virtual currency can threaten the financial system.

This Article will therefore consider the risks that a widely used virtual currency might pose for financial stability. Perhaps because Bitcoin did not come into being until after the financial crisis of 2007–2008 (the “Financial Crisis”), it has rarely been mentioned in the large literature on financial stability that has been penned since the Crisis. And it is true that, at its current size, Bitcoin poses little risk to the financial system. Since its inception in 2009, there have been approximately 200 million Bitcoin transactions in total,⁵ whereas “[i]n 2012 [alone], there were approximately 122.4 billion noncash payments (excluding wire transfers) made in the United States with a value of \$174.4 trillion.”⁶ The usage of Bitcoin is steadily increasing, however,⁷ and one important lesson from the Financial Crisis is that risks to financial stability can come from unexpected places. If Bitcoin, or any other virtual currency, were to become widely used (and to become truly transformative, it would need to be widely used), it could pose a threat to financial stability in a way that transactions consummated in United States dollars (“USD”) do not.

(written testimony of Patrick Murck, General Counsel, The Bitcoin Foundation). Patrick Murck explained:

Bitcoin is a protocol. It is like TCP/IP, which enables all the different uses people around the globe invented for the Internet. And it is like HTML, which enables all the different uses people invented for the World Wide Web without having to ask anyone's permission. We envision Bitcoin as a driver of global change that rivals these other protocols in terms of the benefits it delivers to humankind across the globe.

Id.

4. Marc Andreessen, *Why Bitcoin Matters*, N.Y. TIMES: DEALBOOK (Jan. 21, 2014, 11:54 AM), http://dealbook.nytimes.com/2014/01/21/why-bitcoin-matters/?_r=0.

5. *Total Number of Transactions*, BLOCKCHAIN, <https://blockchain.info/charts/n-transactions-total> (last visited May 17, 2017).

6. U.S. FED. RES. SYS., STRATEGIES FOR IMPROVING THE U.S. PAYMENT SYSTEM 6 (2015) [hereinafter, PAYMENTS WHITE PAPER] (citing FEDERAL RES. SYS., THE 2013 FEDERAL RESERVE PAYMENTS STUDY (2013)).

7. *Total Number of Transactions*, *supra* note 5.

The USD is currently the preeminent world currency. Backed by the full faith and credit of the United States government, its supply is managed by members of the Federal Reserve System to meet worldwide demand.⁸ The support of the U.S. government and central bank inspires unparalleled confidence in the USD as a reliable store of value and a widely accepted means of exchange.⁹ There is, for the foreseeable future at least, no risk that the USD will cease to become accepted as a method of effecting payments, or that significant exposures to the USD will cripple financial institutions.

The euro is a much newer currency that could theoretically pose some risk to the financial system. This is because of the euro's unique status as a supranational currency with centralized monetary policy (administered by the European Central Bank or "ECB"), but decentralized fiscal policy (the national governments of the European countries that use the euro as their currency have retained much of their unilateral authority to make decisions about taxing and spending).¹⁰ When it was launched in 1999, the architects of the euro hoped that it would serve as a counterbalance to the dominance of the USD and, for much of the 2000s, the euro seemed to be fulfilling that promise.¹¹ However, the fallout from the Financial Crisis spurred a sovereign debt crisis in Europe that has damaged the fiscal health of some of the countries that use the euro—particularly Greece.¹² Greece's dire fiscal situation could ultimately force it to abandon the euro and redenominate its obligations in a new currency, a possibility that has, to some degree, compromised the status of the euro as readily accepted money.¹³ Should Greece *actually* redenominate its obligations, faith in the euro will be put to the test, cross-border payment systems in Europe may be affected, and financial

8. See *infra* note 38 and accompanying text.

9. Adam Davidson, *In Greenbacks We Trust*, N.Y. TIMES MAG. (Feb. 27, 2015), <http://www.nytimes.com/2015/03/01/magazine/in-greenbacks-we-trust.html>. Adam Davidson explained that, notwithstanding the Financial Crisis:

[T]he dollar itself never faltered. Confidence in currencies is measured in various ways—by inflation, by the interest rate governments have to pay to borrow, by the exchange rate with other currencies and so on. For years now, the dollar has performed better than at almost any point in history on all of these measures. Seven years after a U.S. financial crisis nearly brought down the world economy, confidence in the dollar has never been stronger.

Id.

10. See generally Alex Cukierman, *Monetary Policy and Institutions Before, During and After the Global Financial Crisis*, 9 J. FIN. STABILITY 373, 382 (2013).

11. See CHRIS BRUMMER, *MINILATERALISM: HOW TRADE ALLIANCES, SOFT LAW, AND FINANCIAL ENGINEERING ARE REDEFINING ECONOMIC STATECRAFT* (2014).

12. See *infra* text accompanying notes 107–109.

13. See *infra* text accompanying notes 107–109.

institutions with exposure to certain euro-denominated obligations may suffer.¹⁴

In the sense that the euro lacks the backing of a single sovereign government, we can think of it as a movement along the spectrum away from traditional sovereign currencies, like the USD, which have institutional backing from both the government and a central bank. At the other end of that spectrum is privately issued money, which is backed by neither a government nor a central bank. While privately issued money may be readily accepted for a period of time, historically, such privately issued money has been much more susceptible to panics than traditional sovereign currencies.¹⁵

Virtual currencies like Bitcoin are a type of privately issued money. Although there are many who argue that virtual currencies—like the internet before them—are an unprecedented game-changer that will succeed where other types of privately issued money have failed,¹⁶ virtual currencies are at least as susceptible to panics as previous iterations of privately issued money. Virtual currencies are inherently fragile because they are nothing more than a series of numbers recorded on a database, and have no worth as an asset class other than their ability to facilitate transactions.¹⁷ They are not backed by a sovereign, or a commodity, or any other type of payment stream that could be of value if the virtual currency ceased to be accepted as a means of exchange. Instead, virtual currencies have value only because people believe that others will be willing to accept the virtual currency in exchange for other goods and services.

If, however, something were to happen to damage that belief, a vicious cycle of panic would commence: past experience with exchange rate crises is illuminating here.¹⁸ If people fear that payments can no longer be reliably effected using a virtual currency, demand for it will decrease, and its value will plummet as holders try to exchange it for more reliable sovereign currencies. The fear of being left with worthless virtual currency will inspire people to try and exchange it as soon as possible, notwithstanding that this sub-optimally pushes down the value of the virtual currency for everyone. Such decrease in value will confirm fears about the unreliability of the virtual currency as a method of payment, causing it to have even less value

14. See *infra* text accompanying note 135.

15. Morgan Ricks, *Regulating Money Creation After the Crisis*, 1 HARV. BUS. L. REV. 75, 96 (2011) (“[F]inancial history illustrates the problems that can arise from entrusting [money’s] creation and destruction to private actors.”).

16. See, e.g., Murck, *supra* note 3, at 5.

17. Paul Krugman, Opinion, *Bits and Barbarism*, N.Y. TIMES (Dec. 22, 2013), <http://www.nytimes.com/2013/12/23/opinion/krugman-bits-and-barbarism.html>.

18. For a discussion of how the Mexican “Tequila Crisis” led to a financial crisis, see Frederic S. Mishkin, *Lessons from the Tequila Crisis*, 23 J. BANKING & FIN. 1521, 1522 (1999).

and causing even more people to attempt to dump their virtual currency holdings. If the virtual currency had been used widely as a payment system before such a panic, the failure of that virtual currency would dramatically impact the normal flow of funds, impeding everyday purchases and other transactions. Financial institutions that held significant amounts of the virtual currency would find themselves facing illiquidity or even insolvency, rendering them unable to provide the capital intermediation and risk management services necessary for economic growth.¹⁹

Such a downward spiral is simply not conceivable with respect to payments effected in USD, and it is this inferiority of privately issued money that has kept the USD from being supplanted—not, as some have argued, because laws give the USD an undeserved monopoly.²⁰ In fact, the law is very limited in its ability to stop people from using something other than a sovereign currency as money if they so desire²¹—and because the law is so limited in its ability to stop the usage of virtual currencies, it is also limited in its ability to regulate the risks that virtual currencies pose to the financial system.²² Although this Article will explore some strategies for regulating virtual currencies to address such systemic risks, the best way to contain such risks is for the traditional financial system to improve the ways in which it effects payments in sovereign currencies, relegating virtual currencies to a niche role by outcompeting them.

To this end, there is some truly innovative technology associated with virtual currencies that the traditional financial system could take advantage of and build upon.²³ The most innovative aspect of the Bitcoin system is its development of the “blockchain” or “distributed ledger,” which is a large decentralized database that has unique identifiers for each user and each bitcoin.²⁴ Every transaction that has ever been effected with a bitcoin has been recorded on the blockchain, after being verified to ensure that the user indeed owned the bitcoin and had not previously tried to spend it.²⁵ Because all transactions are recorded on the one distributed ledger, this avoids

19. See *infra* Part III.A.

20. See, e.g., Friedrich A. Hayek, *Toward Free Market Money*, WALL ST. J., Aug. 19, 1977, at 12.

21. See text accompanying *infra* notes 145–153.

22. See *infra* Part IV.B.

23. See, e.g., Joshua A.T. Fairfield, *BitProperty*, 88 S. CAL. L. REV. 805, 819–23 (2015). While there has been significant interest in using the distributed ledger to convey property (such as securities), this intriguing prospect is beyond the scope of this Article, which focuses squarely on more traditional notions of payment systems. *Id.* For a discussion of other potential applications of blockchain technology, see generally Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia* (Mar. 10, 2015) (unpublished manuscript), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664.

24. Wright & De Filippi, *supra* note 23, at 2.

25. *Id.* at 6–8.

replication errors and allows quicker verification than if all transactions were queued on separately administered ledgers that needed to be reconciled before the transaction could be finalized.²⁶ Because the use of a distributed ledger can make payments processing cheaper and more efficient, this Article will explore the possibilities for a distributed ledger to be used within the regulated financial industry (using entries denominated in sovereign currency rather than a virtual currency). Importantly, though, this distributed ledger needs to be accessible to *all* regulated financial institutions—it should not concentrate payments processing in the hands of those financial institutions that are “too big to fail.”

The remainder of this Article will proceed as follows. Part I will provide a brief introduction to the USD, the euro, and Bitcoin, which will facilitate the rest of this Article’s discussion. Part II will look at what “currency” and “money” are, and conclude that while the USD and the euro constitute both currency and money, Bitcoin and other virtual currencies are not “currency,” but may functionally achieve the status of money—at least for a while—if they are adopted widely enough. However, as with other privately issued money lacking governmental and central bank support, this “money” status is fragile, and this fragility opens up the systemic risks that are explored in Part III. Part III also explores the benefits of virtual currencies, particularly the payment system technology innovations associated with them. These technological innovations need not be tied to the virtual currencies themselves: by applying these innovations to sovereign currencies, the architecture of antiquated payment systems can be improved without making the financial system more vulnerable (that is, so long as such payments innovations are not monopolized by “too big to fail” banks). Part IV therefore considers policies to encourage payments innovation by regulated financial institutions (particularly smaller financial institutions), as a complement to regulation designed to mitigate any systemic risks posed by virtual currencies. Part V concludes.

Before proceeding any further, it is helpful to introduce some of the terminology that will be used in this Article. “Bitcoin” with a capital “B” is a reference to the entire Bitcoin network, rather than the individual units of currency, which are referred to as bitcoins (lower case “b”).²⁷ This Article will be very specific—references to “Bitcoin” or “bitcoins” refer only to that particular decentralized cryptocurrency, and the term will *not* be used as a catch-all for virtual currencies more generally. This Article will also

26. TIM SWANSON, CONSENSUS-AS-A-SERVICE: A BRIEF REPORT ON THE EMERGENCE OF PERMISSIONED, DISTRIBUTED LEDGER SYSTEMS 1, 24, 28 (2015), <http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf>.

27. *Some Bitcoin Words You Might Hear*, BITCOIN, <https://bitcoin.org/en/vocabulary> (last visited May 17, 2017).

rely on several definitions formulated by the international Financial Action Task Force in June 2014. As defined by the Financial Action Task Force, a “virtual currency” is a “digital representation of value” that can be distinguished from sovereign currencies like the USD or the euro because “[i]t is not issued nor guaranteed by any jurisdiction, and fulfills [its] functions only by agreement within the community of users of the virtual currency.”²⁸ A specific subset of virtual currency is known as a “cryptocurrency”: “a math-based, decentralised convertible virtual currency that is protected by cryptography.”²⁹ In this context, the term “decentralized” describes virtual currencies that are “distributed, open-source, math-based peer-to-peer virtual currencies that have no central administrating authority, and no central monitoring or oversight”³⁰ and the term “convertible” means that the virtual currency is convertible into sovereign currency.³¹ The Bitcoin system is the most prominent of the decentralized cryptocurrencies and will be explained more fully in Part I.

I. THE CAST OF CHARACTERS

This Part will start with the USD, the oldest of three instruments that will be considered in this Article. The USD was first issued by the Continental Congress in 1775, and the first 150 years of its existence were tumultuous.³² However, since the end of the Second World War, the USD has been the world’s preeminent currency in the sense that it is the most widely held reserve currency,³³ and it is also frequently used to settle cross-border transactions.³⁴ This preeminence generates significant network externalities for the USD: its widespread acceptability ensures liquidity and low transaction costs, making the currency even more desirable as a way of effecting transactions, shoring up its preeminence in a virtuous cycle.³⁵ Since 1971,

28. FINANCIAL ACTION TASK FORCE, VIRTUAL CURRENCIES: KEY DEFINITIONS AND POTENTIAL AML/CFT RISKS 4 (2014) (footnote omitted).

29. *Id.* at 5.

30. *Id.* (footnote omitted). “Distributed” mean that transactions are verified by a network of participants. *Id.* at 14 n.13.

31. *Id.* at 4.

32. For background on the history of the dollar, see generally Arthur Nussbaum, *The Law of the Dollar*, 37 COLUM. L. REV. 1057 (1937).

33. Colleen Baker, *The Federal Reserve’s Use of International Swap Lines*, 55 ARIZ. L. REV. 603, 612 n.46 (2013) (“Reserve currencies are financial assets international central banks hold in reserve because they are considered to be safe and liquid holdings.”).

34. *Id.* at 612.

35. CRAIG K. ELWELL ET AL., CONG. RES. SERV., R43339, BITCOIN: QUESTIONS, ANSWERS AND ANALYSIS OF LEGAL ISSUES 5 (2015).

the USD has been a purely fiat currency,³⁶ meaning that it is backed only by the full faith and credit of the United States government and is not redeemable for any commodity,³⁷ and the supply of USD has been managed by the Federal Reserve System since that central banking system was created by the Federal Reserve Act of 1913.³⁸

The euro is a much newer currency. Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Spain, Portugal, and Greece all adopted euro-denominated banknotes and coins as their physical currency on January 1, 2002,³⁹ and a number of other European nations have joined the Eurozone since that time, including Cyprus, Estonia, Latvia, Malta, Slovakia, and Slovenia.⁴⁰ Conspicuously absent from this list are Denmark and the United Kingdom, which (notwithstanding their membership in the European Union) have opted to keep their existing currencies rather than converting to the euro.⁴¹ The truly novel thing about the euro is that it is the first sovereign currency to exist without “a single fiscal authority and political power at the center of a political union.”⁴² Monetary policy for the euro is managed by the supranational ECB (just as the Federal Reserve manages monetary policy in the United States), but fiscal policymaking largely remains with the national governments of the countries in the Eurozone.⁴³

Bitcoin is newer still. It first appeared in 2009, created by an elusive computer programmer who went by the name of Satoshi Nakamoto (the

36. See *Gold & Silver*, FED. RES. BANK OF RICHMOND, https://www.richmondfed.org/faqs/gold_silver (last visited May 17, 2017). Nixon terminated the gold standard in 1971, moving the USD to a purely fiat currency. *Id.*

37. EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES 1, 9–10 (2012) [hereinafter ECB 2012]. This report states:

Modern economies are typically based on “fiat” money, which is similar to commodity-backed money in its appearance, but radically different in concept, as it can no longer be redeemed for a commodity. Fiat money is any legal tender designated and issued by a central authority. People are willing to accept it in exchange for goods and services simply because they trust this central authority. Trust is therefore a crucial element of any fiat money system.

Id.

38. Federal Reserve Act, Pub L. No. 63-42, 38 Stat. 251 (codified as amended at 12 U.S.C. §§ 221–522 (2012)).

39. *The History of the Euro*, EUROPEAN COMM’N, http://ec.europa.eu/economy_finance/euro/index_en.htm (last visited May 17, 2017).

40. *What is the Euro Area?*, EUROPEAN COMM’N, https://ec.europa.eu/info/business-economy-euro/euro-area/what-euro-area_en (last visited May 17, 2017).

41. *Id.*

42. Kathleen McNamara, *Banking on Legitimacy: The ECB and the Eurozone Crisis*, 13 GEO. J. INT’L AFF. 143, 146 (2012).

43. Rosa M. Lastra, *Evolution of the European Central Bank*, 35 FORDHAM INT’L L. J. 1260, 1266–68 (2012).

true identity of Nakamoto has not yet been established).⁴⁴ It was by no means the first of the virtual currencies, but has become the most prominent.⁴⁵ More specifically, Bitcoin falls into a subgenre of virtual currencies known as “cryptocurrencies,” which operate peer-to-peer without any need for an intermediary institution to verify transactions (by design, sovereign governments, central banks and regulated banks are all superfluous to the operation of Bitcoin).⁴⁶ Instead, each bitcoin is given an identifier,⁴⁷ and each user has an electronic “wallet” in which they keep their bitcoins.⁴⁸ Wallets have both public and private identifiers: “A commonly used analogy is that of a letterbox. The public key is the address of the letterbox. Anyone can put a letter in. But only the owner of the letterbox has the key to open it and retrieve the contents.”⁴⁹ A sender of bitcoins therefore sends them to the recipient’s wallet using that wallet’s public identifier, but only by using the wallet’s private identifier can the recipient “unlock” and access them.⁵⁰ The location of the bitcoin in the wallet can therefore be seen by everyone, but the identity of the person able to access the bitcoin at that location remains hidden. These unique identifiers ensure that transactions using Bitcoin are pseudonymous rather than anonymous—they do not reveal

44. ELWELL ET AL., *supra* note 35, at 1. The latest theory is that Satoshi Nakamoto is actually an Australian man named Craig Steven Wright. See Andy Greenberg & Gwern Branwen, *Bitcoin’s Creator Satoshi Nakamoto Is Probably This Unknown Australian Genius*, WIRED (Dec. 8, 2015; 4:25 PM), <https://www.wired.com/2015/12/bitcoins-creator-satoshi-nakamoto-is-probably-this-unknown-australian-genius>.

45. EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES—A FURTHER ANALYSIS 15 (2015), <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemesen.pdf> [hereinafter ECB 2015]. It is very difficult to get accurate and up-to-date information about the number and volume of virtual currencies in circulation, but in early 2015, the ECB commented:

[T]here are a large number of decentralised [virtual currency schemes], namely around 500 [virtual currency schemes] with a total market capitalisation of about €3.3 billion. The majority of [virtual currency schemes] have insignificant market capitalisation, i.e. below €1 million. Only 21 [virtual currency schemes] exceed this figure, and only the top eight are above €10 million.

Id. (footnote omitted) (citing CRYPTO-CURRENCY MARKET CAPITALIZATIONS, <https://coinmarketcap.com/> (last visited May 17, 2017)). Bitcoin is clearly the largest and most well-established virtual currency, with a market capitalization of more than \$28 billion as of May 2017. *Market Capitalization*, BLOCKCHAIN, <https://blockchain.info/charts/market-cap?timespan=all&daysAverageString=1&scale=1&address=> (last visited May 17, 2017). There are also a number of post-Bitcoin virtual currencies (often referred to as “altcoins”) that claim to be superior to Bitcoin, including Litecoin, GeistGeld, SolidCoin, BBQcoin, and PPCoin. Stephen T. Middlebrook & Sarah Jane Hughes, *Regulating Cryptocurrencies in the United States: Current Issues and Future Directions*, 40 WM. MITCHELL L. REV. 813, 819–20 (2014).

46. ELWELL ET AL., *supra* note 35, at 1.

47. *Id.*

48. Murck, *supra* note 3, at 4.

49. Fairfield, *supra* note 23, at 820 (citing BRUCE SCHNEIER, APPLIED CRYPTOGRAPHY 31–32 (1996)).

50. *Id.*

personal information about either user, but there is a permanent and publicly available (albeit encrypted) record of the users' participation in the transaction.⁵¹

Each transaction involving an identified user and bitcoin is recorded on what is known as the “blockchain,” or the “distributed ledger” (a large, decentralized database that is maintained on a network of computers rather than a single server, and that is updated in real-time).⁵² The blockchain is the definitive word on who the owner of a bitcoin is, ensuring that bitcoins cannot be spent twice,⁵³ but Bitcoin does not rely on any central authority to verify the transactions that are added to the blockchain.⁵⁴ Instead, transactions are verified by members of the public known as “miners,” who use significant amounts of computer power to make repeated guesses of an arbitrary number (this is known as “hashing”).⁵⁵ Only when they succeed in guessing that arbitrary number are the miners given the authority to add a transaction to the blockchain.⁵⁶ To compensate the miners for the time and computer processing power expended in the verification process, the miners are rewarded (at least for now) with new bitcoins.⁵⁷

II. WHAT IS A CURRENCY (OR MONEY)?

The USD, euro, and Bitcoin introduced in the previous Part are all often referred to as “currency” or “money.” This Part will consider more precisely what “currency” and “money” mean, focusing on the institutions that

51. ELWELL ET AL., *supra* note 35, at 3. “[U]sing sophisticated computer analysis, transactions involving large quantities of Bitcoin can be tracked and claim that if paired with current law enforcement tools it would be possible to gain a lot of information on the persons moving the Bitcoins.” *Id.* (citing Sarah Meiklejohn et al., *A Fist Full of Bitcoins: Characterizing Payments Among Men with No Name*, ;LOGIN:, December 2013, at 10).

52. Wright & De Filippi, *supra* note 23, at 2; ELWELL ET AL., *supra* note 35, at 1.

53. Fairfield *supra* note 23, at 821. Professor Fairfield elaborates:

[T]ransactions during a ten-minute period of time are gathered by [miners] into a discrete “block” of transactions. Once the transactions in a given block of time are verifiably baked into the overall list of transactions, they become the latest block of transactions in a chain of such blocks, hence the term block chain. The block chain constitutes a complete transaction history of all transfers of the asset (and, indeed, all other assets recorded in the chain), going back to the creation or original allocation of the asset. All transactions must be registered with the chain and included in a block to transfer the interest.

Id. (footnotes omitted) (first citing J.P. & G.T., *Bits and Bob*, ECONOMIST: BABBAGE (June 13, 2011, 8:30 PM), <http://www.economist.com/blogs/babbage/2011/06/virtual-currency>; then citing ECB (2012); and then citing Nikolei M. Kaplanov, *Nerdy Money: Bitcoin, the Private Digital Currency, and the Case Against Its Regulation*, 25 LOY. CONSUMER L. REV. 111, 116 (2012)).

54. *Id.* at 808.

55. See ELWELL ET AL., *supra* note 35, at 1–2; Fairfield *supra* 23, at 821–22.

56. ELWELL ET AL., *supra* note 35, at 2. For a detailed discussion of the verification process, see Fairfield *supra* 23, at 821–23.

57. ELWELL ET AL., *supra* note 35, at 2.

are connected with such statuses, and the degree to which the USD, euro, and Bitcoin are substitutable.

A. *Legal Definitions of “Currency”*

The ECB has expressed its view that a virtual currency like Bitcoin is “not money or currency from a legal perspective.”⁵⁸ A number of Eurozone countries have also publicly announced that Bitcoin and its brethren do not constitute currencies under their national legislation. Sweden, for example, defines currencies as being, *inter alia*, “tied to a central bank or a geographic area.”⁵⁹ Bitcoin and other decentralized virtual currencies are designed to dispense with central bank imprimaturs and geographical localization, so they do not constitute “currencies” in Sweden.⁶⁰ As of 2015, authorities in Croatia, Denmark, Finland, Slovenia, and Spain had similarly concluded that Bitcoin is not a currency.⁶¹ Most other countries in the Eurozone have so far remained silent on the specific question of whether virtual currencies are “currencies,” although many of them have stated that virtual currencies do not constitute legal tender in their jurisdiction.⁶²

United States Treasury regulations currently define “currency” as:

The coin and paper money of the United States or of any other country that is designated as legal tender and that circulates and is customarily used and accepted as a medium of exchange in the country of issuance. Currency includes U.S. silver certificates, U.S. notes and Federal Reserve notes. Currency also includes official foreign bank notes that are customarily used and accepted as a medium of exchange in a foreign country.⁶³

This Treasury definition of “currency” does not seem to include Bitcoin, or any other virtual currency that lacks a government imprimatur, but in a 2013 Interpretive Guidance Note, the Financial Crimes Enforcement Network (“FinCEN”), a department of the U.S. Treasury Department, edged a little closer towards recognizing virtual currencies as legal “currencies.”⁶⁴ FinCEN stated that “‘virtual’ currency is a medium of exchange that operates like a currency in some environments, but does not have all

58. ECB 2015, *supra* note 45, at 4.

59. *Id.* at 31.

60. *See id.*

61. *Id.* at 34–37. For a regularly updated summary of regulatory approaches to Bitcoin in different jurisdictions around the world, see *Regulation of Bitcoin in Selected Jurisdictions*, LIBRARY OF CONGRESS, <http://www.loc.gov/law/help/bitcoin-survey/> (last visited May 17, 2017).

62. ECB 2015, *supra* note 45, at 34–37.

63. 31 C.F.R. § 1010.100(m) (2016).

64. U.S. DEP’T OF THE TREASURY, FINANCIAL CRIMES ENFORCEMENT NETWORK, GUIDANCE NOTE FIN-2013-G001 (Mar. 18, 2013), <https://www.fincen.gov/sites/default/files/shared/FIN-2013-G001.pdf>.

the attributes of real currency. In particular, virtual currency does not have legal tender status in any jurisdiction.”⁶⁵

If virtual currencies become increasingly accepted in our society, it is conceivable that more legislators, central banks, and regulatory bodies in the United States and the Eurozone could change their definitions of “currency” to encompass virtual currencies that are not issued by any particular country, or localized to any particular geographic area. Even in the absence of legislative or regulatory change, if virtual currencies achieve a high level of acceptance amongst businesses and consumers, definitions of “currency” might change by virtue of court decisions that recognize the practical importance of virtual currencies. For example, a recent decision from the Eastern District of Texas held:

It is clear that Bitcoin can be used as money. It can be used to purchase goods or services, and . . . used to pay for individual living expenses. The only limitation of Bitcoin is that it is limited to those places that accept it as currency. However, it can also be exchanged for conventional currencies, such as the U.S. dollar, Euro, Yen, and Yuan. Therefore, Bitcoin is a currency or form of money.⁶⁶

In the end, though, this formalistic definitional analysis of what constitutes a “currency” for legal purposes is likely to be unimportant to many users of virtual currencies. So long as there are no legal restrictions that prevent the use of virtual currencies,⁶⁷ many consumers will likely not care if instruments satisfy any legal definition of “currency” so long as the virtual currency can *function* as money.⁶⁸ The following Section will therefore explore the concept of “money” from a more functional perspective.

B. Functional Definitions of “Money”

The law can delineate what serves as “money” for a particular purpose (for example, in a bankruptcy, for accounting purposes, or for government surveys of the money supply),⁶⁹ but it cannot prevent an instrument from

65. *Id.* at 1.

66. SEC v. Shavers, No. 4:13-CV-416, 2013 WL 4028182, at *2 (E.D. Tex. Aug. 6, 2013).

67. The few existing regulations that pertain to the use of virtual currencies are discussed *infra* Part IV.A.

68. See ROSA MARÍA LASTRA, LEGAL FOUNDATIONS OF INTERNATIONAL MONETARY STABILITY 15 (2006). Lastra notes that the law in general “tends to reflect a restrictive notion of money as ‘currency’ (physical notes and coins), leaving aside other ‘monetary assets’ such as bank deposits.” *Id.* At present, definitional matters seem much more important to regulators (who are trying to figure out if they have jurisdiction over the evolving technologies) than to users of the virtual currencies. For a discussion of legal restrictions on virtual currencies, see *infra* Part IV.A.

69. Ricks, *supra* note 15, at 80, 89–90.

functioning as money from an economic perspective. Money is usually described as performing three main functions: it acts as a unit of account, a store of value, and a medium of exchange.⁷⁰ Money serves as a unit of account when it “acts as a standard numerical unit for the measurement of value and costs of goods, services, assets and liabilities”⁷¹—although this has traditionally been a characteristic of money, an instrument can function as “money” even if it does not serve as a unit of account, so long as its value can otherwise be reliably assessed.⁷² The more important attributes of money are its ability to function as a store of value (meaning that it “can be saved and retrieved in the future”),⁷³ and that it is widely accepted as a means of exchange.⁷⁴ To function as a means of exchange, the instrument must facilitate “decentralised transfer, whereby . . . value can be transferred from one person to another.”⁷⁵ In other words, both parties to a transaction must repose sufficient trust in either the instrument itself, or the issuer of that instrument, that they believe that others will also honor the instrument in future transactions at a (relatively) stable value.⁷⁶ We typically think of sovereign currencies like the USD performing these functions, but in fact—given the right circumstances—instruments issued or controlled by private entities can also operate as “money.” As Mankiw has noted, “in the end, the use of money in exchange is largely a social convention.”⁷⁷

The ECB recently concluded that because Bitcoin’s value is currently very volatile, and because bitcoins are only accepted by a limited number of users, Bitcoin cannot presently act as a store of value or means of exchange and should not be thought of as “money.”⁷⁸ However, the ECB did concede that as virtual currencies evolve, it is possible that they could come to function as money if their value stabilizes.⁷⁹ After all, stranger things (including animal pelts and tobacco) have served as money in the past.⁸⁰ In the Pacific island of Yap, for example, different sized limestone discs (sometimes so

70. ECB 2012, *supra* note 37, at 10.

71. *Id.*

72. Robert J. Shiller, *In Search of a Stable Electronic Currency*, N.Y. TIMES (Mar. 1, 2014), <http://www.nytimes.com/2014/03/02/business/in-search-of-a-stable-electronic-currency.html>. Shiller has argued, “[h]istory shows that this unit-of-account function of money has been separated from the other two, and to good purpose.” *Id.*

73. ECB 2012, *supra* note 37, at 10.

74. LASTRA, *supra* note 68, at 14.

75. FELIX MARTIN, MONEY: THE UNAUTHORISED BIOGRAPHY 257 (2014).

76. *Id.* at 258.

77. N. GREGORY MANKIW, MACROECONOMICS 158 (4th ed. 2000).

78. ECB 2015, *supra* note 45, at 23–24.

79. *Id.* at 25.

80. David Wolman, *A Short History of American Money, From Fur to Fiat*, ATLANTIC (Feb. 6, 2012), <http://www.theatlantic.com/business/archive/2012/02/a-short-history-of-american-money-from-fur-to-fiat/252620/>.

large that they were almost impossible to move) known as “rai” functioned as money for generations.⁸¹ The durability of rai made them an excellent store of value. Smaller rai could physically change hands to effect exchanges,⁸² but it was very difficult for the large and heavy rai to be physically moved, and so a local custom developed of “transferring title of money without moving it”⁸³—a very modern notion that recognized that it is the system of credit associated with the monetary unit, rather than physical possession of the monetary unit itself, that underpins an effective payment system. Even the heaviest rai were therefore able to serve as a means of exchange, as well as a store of value. Rai functioned as money even though they did not provide a consistent numerical unit for denominating obligations and therefore could not serve as a unit of account: no individual disc “had a definite, unalterable value. Buying power was always dependent upon the social position of the buyer and the receiver, as well as the occasion for use.”⁸⁴ However, while “[v]alue was somewhat relative in such dealings, . . . it was never arbitrary. Custom and tradition established a firm criteria of exchange”⁸⁵—these rai could therefore be used as a reliable store of value and means of exchange even though they did not represent a standardized unit of account.

Skipping ahead to a more recent example, in the mid-2000s, AAA-rated mortgage-backed securities (“MBS”) achieved money status. Like the rai, these were not really used as a unit of account, but they did function both as a store of value and as a means of exchange in the lead-up to the Financial Crisis because they had both a relatively stable value and were readily accepted as collateral for transactions like repo agreements between banks.⁸⁶ Repo agreements are agreements to sell securities bundled with a

81. See generally CORA LEE C. GILLILLAND, *THE STONE MONEY OF YAP: A NUMISMATIC SURVEY* 1, 9, 10–11 (1975), http://www.sil.si.edu/smithsoniancontributions/HistoryTechnology/pdf_hi/SSHT-0023.pdf.

82. *Id.* at 11 (“[M]ore portable ‘coins’ were used for the purchase of fish.”).

83. See *id.* at 10–11, 18.

84. *Id.* at 12.

85. *Id.*

86. Adam J. Levitin, *The Politics of Financial Regulation and the Regulation of Financial Politics: A Review Essay*, 127 HARV. L. REV. 991, 2009 (2014) (reviewing ANAT ADMATI & MARTIN HELLWIG, *THE BANKERS’ NEW CLOTHES: WHAT’S WRONG WITH BANKING AND WHAT TO DO ABOUT IT* (2013); SHEILA BAIR, *BULL BY THE HORNS: FIGHTING TO SAVE MAIN STREET FROM WALL STREET AND WALL STREET FROM ITSELF* (2012); NEIL BAROFSKY, *BAILOUT: HOW WASHINGTON ABANDONED MAIN STREET WHILE RESCUING WALL STREET* (2012); BEN S. BERNANKE, *THE FEDERAL RESERVE AND THE FINANCIAL CRISIS* (2013); ALAN S. BLINDER, *AFTER THE MUSIC STOPPED: THE FINANCIAL CRISIS, THE RESPONSE AND THE WORK AHEAD* (2013); JEFF CONNAUGHTON, *THE PAYOFF: WHY WALL STREET ALWAYS WINS* (2012)). Levitin explained:

These [AAA-rate MBS] were used as one of the predominant forms of collateral throughout the financial system, particularly for short-term lending in repo markets,

promise to buy back those securities in the future, and they function as a type of short-term secured loan.⁸⁷ Because repo agreements are so short-term (they often have overnight maturities), the likelihood of default is negligible—at least in normal times.⁸⁸ Banks rely heavily on repo agreements from other banks to fund their investments, and the MBSs that functioned as collateral for such repo agreements facilitated the transfer of funds from one bank to another.⁸⁹ However, once the Financial Crisis hit, banks distrusted valuations of MBSs and would no longer accept them as collateral for repo transactions. Once MBSs were no longer a reliable store of value, they (and the repos that relied on them for collateral) lost their status as money.⁹⁰ As Levitin described it, “[o]nce the value of the [MBS] became questionable, the whole system started to collapse, much as if the value of a currency became in doubt.”⁹¹

Gorton has conceptualized this loss of money status as an issue of “information insensitivity”: instruments can attain money status if they are believed to be sufficiently reliable that there is no need to expend time or effort in assessing the likelihood that the instrument will be honored at the expected value.⁹² However, once the trust in such instrument and its issuer starts to erode, the terms of the instrument do become important and require time-consuming and diligent investigation, which raises questions about valuation and prevents the instrument from being accepted automatically as a means of exchange—thus eroding its liquidity and its money status.⁹³ Investors then fly to “an asset which is surely informationally-insensitive—cash.”⁹⁴ The next two Sections will explore why cash (i.e. central bank liabilities, particularly the USD) is considered so reliable as a form of money. First, the much-studied relationship between central banks and monetary policy is explained, and then the less well-defined relationship between governments and their currencies is considered.

where they were accepted as collateral at par value. . . . AAA-rated bonds were used as a medium of exchange among financial institutions. For this to work, however, the medium of exchange had to maintain a steady value.

Id. (footnote omitted) (citing GARY B. GORTON, *SLAPPED BY THE INVISIBLE HAND: THE PANIC OF 2007*, at 6–7 (2010)).

87. Hilary J. Allen, *Cocos Can Drive Markets Cuckoo*, 16 *LEWIS & CLARK L. REV.* 125, 145 (2012).

88. Ricks, *supra* note 15, at 79, 85.

89. Gary Gorton, *Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007* (May 9, 2009) (unpublished manuscript), https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=1401882 (“If securitization debt is informationally-insensitive, it can be an input into the repo system of creating a kind of transaction medium, i.e., collateral that can be rehypothecated.”).

90. Ricks, *supra* note 15, at 84.

91. Levitin, *supra* note 86, at 2009.

92. Gorton, *supra* note 89, at 6–7.

93. *Id.* at 18.

94. *Id.*

C. Central Banks and Monetary Policy

The purpose of central banking has evolved over time,⁹⁵ and even today, different central banks around the world have been given different mandates by their legislatures. However, the one mandate that the Federal Reserve and the ECB share (and for which they generally have political support) is to protect their currencies by seeking to match the supply of money to the needs of the economy and thus maintain price stability.⁹⁶ Price stability mandates dictate that central banks avoid high inflation, which creates uncertainty about the future and erodes the store of value that the sovereign currency is intended to provide.⁹⁷ If the prices of consumer goods and services increase only in a slow and reliable way over time, the sovereign currency should continue to be honored at a value that matches public expectations about what the currency can buy—only then will the sovereign currency be trusted as a reliable store of value.⁹⁸ A central bank that commits, in advance, to a credible inflation target promotes continuing confidence in a currency.

To effect their price stability mandates, central banks regularly monitor prices and use a variety of tools to move inflation towards their target rates: chief amongst them is the setting of interest rates.⁹⁹ Central banks also manage their currencies indirectly through their public communications, which “are prepared for the purpose of shaping economic and monetary

95. For example, the first central banks were created for the purpose of government finance. Lastra, *supra* note 43, at 1262.

96. *Compare Why Does the Federal Reserve Aim for 2 Percent Inflation Over Time?*, BD. OF GOVERNORS OF THE FED. RES. SYS., http://www.federalreserve.gov/faqs/economy_14400.htm (last updated Jan. 26, 2015) (noting one of the Federal Reserve’s mandates as price stability), *with Monetary Policy*, EUROPEAN CENT. BANK, <https://www.ecb.europa.eu/mopo/html/index.en.html> (last visited May 17, 2017) (“The primary objective of the ECB’s monetary policy is to maintain price stability.”). Monetary policy seeks to promote price stability by targeting a rate of inflation close to defined benchmarks. In the United States, the Federal Open Markets Committee of the Federal Reserve System targets an inflation rate of two percent. *Why Does the Federal Reserve Aim for 2 Percent Inflation Over Time?*, *supra*. Similarly, the ECB has a targeted inflation rate below, but close to, two percent. *Monetary Policy*, *supra*.

97. *Why Does the Federal Reserve Aim for 2 Percent Inflation over Time?*, *supra* note 96. Inflation “erodes savings, discourages investment, stimulates capital flight (as domestic investors put their funds into foreign assets, precious metals, or unproductive real estate), inhibits growth, makes economic planning a nightmare, and, in its extreme form, provokes social and political unrest.” Sarwat Jahan, *Inflation Targeting: Holding the Line*, INT’L MONETARY FUND, <http://www.imf.org/external/pubs/ft/fandd/basics/target.htm> (last updated Mar. 28, 2012).

98. *Id.*

99. Ricks, *supra* note 15, at 77. When interest rates are low, the availability of credit theoretically should increase, allowing consumers and businesses to borrow more (thus giving them more purchasing power). *See id.* When more people want to buy more goods, that drives prices up—increasing inflation. An increase in rates conversely results in a reduction in the amount of the money in the economy, which slows the economy in general and the rising prices—reducing the likelihood of inflation and inspiring confidence that currency will hold its purchasing power. *See id.*

conditions prospectively, as instruments of persuasion.”¹⁰⁰ These communications “are not merely expressing an interpretative account or commentary; they are *making* the economy itself.”¹⁰¹ In other words, central banks create expectations through the way they portray the future, and when market actors act on the basis of these communications, they allow such expectations to be achieved—as Federal Reserve Chairwoman Janet Yellen has noted, “the explanation *is* the policy.”¹⁰² When confidence is damaged, then central banks adjust their communications “to address the spectrum of sentiments and expectations that can underwrite or undercut public confidence.”¹⁰³

Of course, central bank action is not the only thing that impacts the credibility of a currency—as will be explored in the next Section, the issuing government’s fiscal policy is also relevant. This is why the euro is such a fascinating innovation: in supporting the euro, the supranational ECB is required to work with disparate national governments with different fiscal conditions and policies.¹⁰⁴ This system seemed to work well through most of the 2000s, but serious problems with the euro became evident in the wake of the Financial Crisis. Many European countries had been relying on cheap borrowed money to fund their fiscs, but as credit dried up in the wake of the Crisis, it became increasingly expensive for countries with less prosperous economies to borrow money.¹⁰⁵ The situation was particularly dire in Portugal and Greece (which eventually required bailouts from the European Commission, the ECB and the IMF—the so-called “troika”), but concerns were also raised about the sustainability of sovereign debt in many other Eurozone nations.¹⁰⁶ Investors became concerned not only about

100. Douglas R. Holmes, *Communicative Imperatives in Central Banks*, 47 CORNELL INT’L L.J. 15, 17 (2014).

101. *Id.* at 18.

102. Janet L. Yellen, Vice Chair, Bd. of Governors of the Fed. Reserve Sys., Remarks at the Society of American Business Editors and Writers 50th Anniversary Conference: Communication in Monetary Policy 9 (Apr. 4, 2013), <http://www.federalreserve.gov/newsevents/speech/yellen20130404a.pdf>.

103. Holmes, *supra* note 100, at 33.

104. Cukierman, *supra* note 10, at 382.

105. Christopher Alessi & James McBride, *CFR Backgrounders: The Eurozone in Crisis*, COUNCIL ON FOREIGN RELATIONS (Feb. 11, 2015), <http://www.cfr.org/eurozone-crisis/p22055>.

106. *Id.* Concerns were raised about Belgium, Spain, Italy, and even France and Austria. *Id.*; see also Stratfor, *Belgium and Austria Are Now Targets as Europe’s Sovereign Debt Crisis Spreads*, BUSINESS INSIDER (Dec. 14, 2010, 10:30 PM), <http://www.businessinsider.com/europe-sovereign-debt-austria-belgium-2010-12>. Ireland, Spain, and Cyprus were also bailed out, although the immediate motivation for these bailouts was in response to housing-related banking crises, rather than unsustainable sovereign debt. Alessi & McBride, *supra* note 105. Banking and sovereign debt crises can be interlinked: questions about Ireland’s ability to honor its sovereign debt arose because of the size of the bailouts the Irish government gave to its banks. For a detailed discussion of the Irish situation, see INT’L MONETARY FUND, IRELAND: LESSONS FROM ITS

these countries' ability to repay, but also about redenomination risk. There was a fear that Greece would be forced to exit the Eurozone and in doing so would redenominate its obligations in a new currency.¹⁰⁷ As a result, all euros were no longer viewed as equal: a German bank might trust euro-denominated obligations issued in Germany, but not euro-denominated obligations issued in Greece.¹⁰⁸ The euro was increasingly undermined as a means of inter-country exchange, and lending across Eurozone borders dried up.¹⁰⁹

In light of this state of affairs, the ECB metamorphosed into a more interventionist central bank in an attempt to bolster confidence in *all* euro-denominated obligations.¹¹⁰ In many ways, Mario Draghi, who became the President of the ECB on November 1, 2011,¹¹¹ was the architect of this new ECB. Under Draghi, the ECB launched a number of programs designed to provide liquidity to Eurozone financial institutions,¹¹² in the hope that such

RECOVERY FROM THE BANK-SOVEREIGN LOOP (2015), <https://www.imf.org/external/pubs/ft/dp/2015/eur1501.pdf>.

107. Lorenzo Codogno & Paul De Grauwe, *Both Greece and Its Creditors Must Compromise to Prevent the Risk of a Grexit*, LONDON SCH. OF ECON.: EUROPEAN POL. & POL'Y BLOG (Mar. 26, 2015), <http://bit.ly/1EVAX54> (“[R]edenomination risk . . . [means] that banks and corporations would view across border exposures as risky despite the fact that they are denominated in the same euros.”).

108. Mario Draghi, President, European Cent. Bank, Speech at the Global Investment Conference (July 26, 2012), <http://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html>.

109. *Id.* (“The interbank market is not functioning. It is only functioning very little within each country by the way, but it is certainly not functioning across countries.”); *see also* A.P., *Breaking Up Is Slow to Do*, ECONOMIST: FREE EXCHANGE BLOG (May 1, 2012), <http://www.economist.com/blogs/freeexchange/2012/05/euro-zone-crisis>.

110. McNamara, *supra* note 42, at 147, 149. The ECB’s mandate, as established by treaty, focuses narrowly on price stability. *See* Consolidated Version of the Treaty on the Functioning of the European Union art. 127 & 282, 2012 O.J. (C 326) 47 (“The primary objective of the [European Central Bank, together with the national central banks] shall be to maintain price stability. Without prejudice to [that objective], [it] shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union.”).

111. Press Release, European Cent. Bank, Change of Presidency of the European Central Bank (Nov. 1, 2011), <https://www.ecb.europa.eu/press/pr/date/2011/html/pr111101.en.html>.

112. MARCEL FRATZSCHER ET AL., ECB UNCONVENTIONAL MONETARY POLICY ACTIONS: MARKET IMPACT, INTERNATIONAL SPILLOVERS AND TRANSMISSION CHANNELS 6–7 (2014), https://www.imf.org/external/np/res/seminars/2014/arc/pdf/fratzscher_loluca_straub.pdf. For a discussion of the measures taken prior to October 2014, *see id.* In January of 2015, the ECB announced an expanded asset purchase programme, which commenced on March 9, 2015. This programme involves:

[C]ombined monthly purchases of EUR 60 bn in public and private sector securities, purchases under the public sector purchase programme (PSPP) of marketable debt instruments issued by euro area central governments, certain agencies located in the euro area or certain international or supranational institutions (referred to in legal texts as “international organisations and multilateral development banks”) . . .

Text: ECB Statement Regarding Public Sector Purchase Program, MNI (Mar. 5, 2015; 9:45 AM), <https://www.marketnews.com/content/text-ecb-statement-regarding-public-sector-purchase-program>.

programs would provide sufficient comfort and funds to restart the cross-border lending market (and that all euros would once again be viewed as equal).¹¹³ Despite questions regarding the legality of some of these programs, Draghi asserts “there was a paramount authority—the ECB’s constitutional mandate to manage monetary policy across the Eurozone—that overruled restrictions on bond purchases as well as other unorthodox interventions.”¹¹⁴ These interventions, coupled with Draghi’s bold commitment to do “whatever it takes” to preserve the euro,¹¹⁵ resulted in a period of relative calm commencing in July of 2012.¹¹⁶

Draghi’s actions illustrate that in times of panic, central bank actions can compensate, at least to some degree, for a lack of centralized fiscal backing of a currency. But there are limits on what central banks can achieve.¹¹⁷ In extreme circumstances, central banks acting alone may be unable to maintain confidence in their currency as a store of value and readily accepted means of exchange. Governments and their fiscal policies will also be essential to this effort.

D. Governments and Currencies

Surprisingly, while there is a wealth of scholarship on how central bank policies affect the credibility of the currencies they administer, there are few sources discussing how the fiscal policies pursued by national governments affect their sovereign currencies. It is self-evident, however, that a government’s fiscal policies will have an impact on the credibility, and thus the stability, of a national currency.¹¹⁸ Some have argued that a government’s commitment to small deficits and avoiding inflation is likely to create confidence in its currency, as this suggests that the currency will remain a safe store of value.¹¹⁹ Indeed, this was one of the justifications ad-

113. Draghi, *supra* note 108 (“I think the key strategy point here is that if we want to get out of this crisis, we have to repair this financial fragmentation.”).

114. Holmes, *supra* note 100, at 53 (citing Mario Draghi, President, European Cent. Bank, Introductory Statement to the Hearing at the Committee on Economic and Monetary Affairs of the European Parliament (July 9, 2012), <https://www.ecb.europa.eu/press/key/date/2012/html/sp120709.en.html>).

115. Draghi, *supra* note 108.

116. Holmes, *supra* note 100, at 47.

117. McNamara, *supra* note 42, at 146.

118. Christine Desan, *The Market as a Matter of Money: Denaturalizing Economic Currency in American Constitutional History*, 30 L. & SOC. INQUIRY 1, 19 (2005) (“In the case of public bills, holders estimate the security of their claims, and therefore their value, by considering the government’s fiscal policy and the credibility of claims that it will stay that course.”).

119. BRUMMER, *supra* note 11, at 125; *see also* Jack Ewing, *Weighing the Fallout of a Greek Exit from the Euro*, N.Y. TIMES (July 9, 2015), http://www.nytimes.com/2015/07/10/business/international/drachma-grexit-eurozone.html?_r=0. Ewing elaborated:

And ironically, some economists say, the best way to bolster a currency’s value is for the government to impose exactly the kind of austerity budgets that Prime Minister

vanced for abandoning the Bretton Woods system of fixed exchange rates for a floating rate system in the 1970s: “Optimists hoped that leaders would be forced to make prudent macroeconomic decisions and adjust domestic economic policies in the face of headwinds in order to maintain the confidence of foreign creditors.”¹²⁰ Conversely, profligate spending may indicate impending inflation and weaken expectations that the currency will remain a safe store of value.¹²¹ However, there is no precise mathematical formula for engendering confidence in a currency through fiscal policy. Confidence is a complex narrative construct that Akerlof and Shiller describe as “a view of the world—a popular model of current events, a public understanding of the mechanism of economic change as informed by the news media and by popular discussions.”¹²² As such, one cannot state with any certainty that a certain level of debt, or deficit, or debt-to-GDP ratio, will maintain or undermine confidence in a particular currency. Indeed, markets are much more tolerant of high debt-to-GDP ratios in the United States and Japan than they are of lower ratios in Europe.¹²³

Nonetheless, the architects of the euro identified inflation, deficit, and debt-to-GDP ratio thresholds that countries had to meet to join, and remain in, the Eurozone.¹²⁴ Prior to the Financial Crisis, however, these criteria were not applied with any stringency: “There was shockingly weak due diligence in assessing suitability for entry into the euro, and an equally weak application of the few rules that were supposed to police its operation.”¹²⁵ Once sovereign debt became harder to come by in the wake of the Financial Crisis, it became clear that Greece in particular was in deplorable fiscal condition.¹²⁶ A fiscally unified entity like the United States could pool resources and allocate them where needed, but this was impossible in the Eurozone where there is no joint fiscal policy amongst its member states.¹²⁷ A bailout from the troika was therefore required for Greece (and also Portugal,

Alexis Tsipras of Greece has promised to abolish. “You need restrictive fiscal and monetary policy, which is something the Greek government does not want to do,” said Adalbert Winkler, a professor at the Frankfurt School of Finance and Management.

Ewing, *supra*.

120. BRUMMER, *supra* note 11, at 129.

121. *Id.* at 125–26.

122. GEORGE A. AKERLOF & ROBERT J. SHILLER, ANIMAL SPIRITS: HOW HUMAN PSYCHOLOGY DRIVES THE ECONOMY, AND WHY IT MATTERS FOR GLOBAL CAPITALISM 55 (2009).

123. McNamara, *supra* note 42, at 145.

124. Alessi & McBride, *supra* note 105 (“[S]tates joining the euro . . . must ensure inflation below 1.5 percent, budget deficits below 3 percent of GDP, and a debt-to-GDP ratio of less than 60 percent.”).

125. JASON MANOLOPOULOS, GREECE’S ‘ODIOUS’ DEBT: THE LOOTING OF THE HELLENIC REPUBLIC BY THE EURO, THE POLITICAL ELITE AND THE INVESTMENT COMMUNITY 163 (2011).

126. Alessi & McBride, *supra* note 105.

127. BRUMMER, *supra* note 11, at 136.

Ireland, Cyprus and Spain),¹²⁸ instead of a reallocation of funds from more prosperous Eurozone nations like Germany, which could have occurred in a fictionalized federalized Europe with truly integrated fiscal policy. The bailouts granted were conditioned on strict requirements of austerity (including increased taxes and cuts on wages and pensions), which have proved punishing for the nations involved.¹²⁹ By May of 2014, Ireland, Spain and Portugal had exited their bailout programs, but Greece continues to struggle.¹³⁰

In January of 2015, the Greek people elected the Syriza party to power, which had campaigned on an anti-austerity platform.¹³¹ Negotiations over the terms of Greece's bailout deteriorated in the first half of 2015, as the new Greek government sought to renegotiate the austerity-related conditions attached to its bailout funds.¹³² In early July of 2015, it seemed distinctly possible that no agreement would be reached between Greece and the troika, with the result that Greece would default on its debt and leave the Eurozone (and perhaps even the European Union).¹³³ Although there was no clear plan for how a so-called "Grexit" might occur, many took the view that Greek obligations that were denominated in euros pre-Grexit would have to be redenominated in some new currency, which would swiftly depreciate against the euro.¹³⁴ A Grexit would certainly have a dramatic impact on the Greeks, but from this Article's perspective, the most relevant concern is that a Grexit could permanently undermine confidence in the euro, as users would fear that other countries would follow suit and redenominate into another currency.¹³⁵ In other words, the euro would become less reliable as a store of value simply because of its potential to change into some other type of obligation by virtue of the unilateral action of any of the Eurozone governments—and as a less reliable store of value, it would be less readily accepted as a means of exchange.

This eventuality was avoided—at least for a time—after an all-night meeting resulted in an agreement on July 13, 2015, which "would give

128. Alessi & McBride, *supra* note 105.

129. *Id.*

130. *Id.*

131. *Id.*

132. *Id.*

133. Ewing, *supra* note 119.

134. See, e.g., Douglas J. Elliott, *How Might Greece Fall Out of the Eurozone?*, BROOKINGS (Feb. 20, 2015), <http://www.brookings.edu/blogs/order-from-chaos/posts/2015/02/20-how-might-greece-fall-out-of-eurozone-elliott>; *Zoning Out: Why Leaving the Euro Would Still Be Bad for Both Greece and the Currency Area*, ECONOMIST: FREE EXCHANGE BLOG (Jan. 17, 2015), <http://www.economist.com/news/finance-and-economics/21639591-why-leaving-euro-would-still-be-bad-both-greece-and-currency>.

135. *Zoning Out: Why Leaving the Euro Would Still Be Bad for Both Greece and the Currency Area*, *supra* note 134.

Greece the chance to receive its third international bailout in five years, a package of as much as 86 billion euros, or \$96 billion, as well as easier repayment terms on some of its existing debt of more than €300 billion and a short-term economic stimulus plan.”¹³⁶ None of Greece’s existing debt was forgiven under this plan, though, and as the IMF has stated publicly, Greece’s existing debt burden is unsustainable.¹³⁷ As such, the July 2015 deal seemed very much to be just kicking the can down the road, and unless some debt relief is given, Greece may be forced to abandon the euro after all.

E. Arguments for Privately Issued Money

If Greece is forced to leave the Eurozone, it will likely take some time for Greek citizens, and others, to trust in any new Greek currency as a reliable store of value and means of exchange.¹³⁸ Many have drawn parallels between the Greek situation and that of Argentina, which has a history of sovereign debt crisis, financial instability, government currency controls, and high inflation.¹³⁹ As a result, there is a longstanding distrust of the Argentinian peso, and Bitcoin has become popular in Argentina as a medium for everyday transactions.¹⁴⁰ In countries without reliable government and central banking institutions, privately issued money may be a more appealing alternative than sovereign-issued fiat currencies.¹⁴¹ However, as this

136. Suzanne Daley & Liz Alderman, *Premier of Greece, Alex Tsipras, Accepts Creditors’ Austerity Deal*, N.Y. TIMES (July 13, 2015), <http://www.nytimes.com/2015/07/14/world/europe/greece-debt-plan.html>.

137. Alison Smale, *Germany Votes to Move Ahead with Greek Bailout, but Opposition Grows*, N.Y. TIMES (July 17, 2015), <http://www.nytimes.com/2015/07/18/world/europe/germany-greece-bailout-talks.html> (“Christine Lagarde, managing director of the fund, said in an interview with Europe 1 radio on Friday that the Greek bailout plan was ‘categorically not’ viable without debt relief.”).

138. Ewing, *supra* note 119.

139. See, e.g., Mario Blejer & Guillermo Ortiz, *Latin Lessons*, ECONOMIST: FREE EXCHANGE BLOG (Feb. 18, 2012), <http://www.economist.com/node/21547750>; Larry Elliot, *Could Greece Emulate Argentina’s Success After It Defaulted in 2001?*, GUARDIAN (July 8, 2015), <https://www.theguardian.com/world/2015/jul/08/greek-crisis-emulate-argentina-default-success>; Paul Krugman, Opinion, *Argentine Lessons for Greece*, N.Y. TIMES (July 9, 2015, 10:24 AM), <http://krugman.blogs.nytimes.com/2015/07/09/argentine-lessons-for-greece/>.

140. Nathaniel Popper, *Can Bitcoin Conquer Argentina?*, N.Y. TIMES MAG. (Apr. 29, 2015), <http://www.nytimes.com/2015/05/03/magazine/how-bitcoin-is-disrupting-argentinas-economy.html>. Friedman and Schwartz have argued that privately issued money will only become an attractive alternative to a sovereign currency if there is hyperinflation, or some other major collapse of the sovereign currency (and even then, they argue that the privately issued money would need to be backed by some type of commodity). Milton Friedman & Anna J. Schwartz, *Has Government Any Role in Money?*, in MONEY IN HISTORICAL PERSPECTIVE 289, 301 (Anna J. Schwartz ed., 1987).

141. Friedman & Schwartz, *supra* note 140, at 307. Part of the appeal of the U.S. dollar as reserve currency is due to the perceived stability of its political institutions. BRUMMER, *supra* note 11, at 130. It is possible that, as some have predicted, “[t]he power of friction-free transac-

Part will explore, sovereign currencies with solid central bank and government backing are much more stable than any privately issued money: the legal and institutional environment in which such currencies exist provides an assurance of continuing liquidity that cannot be matched by the private sector. As such, efforts to displace sovereign currencies are misguided.

Perhaps the most prominent argument for privately issued money (also referred to as market-based money) was made by Friedrich Hayek in a 1977 Wall Street Journal article advocating for allowing “free enterprise the right to supply the good money it needs, money which competition would undoubtedly long ago have provided if it had not been prohibited by government.”¹⁴² Citing concerns about the state intervention associated with sovereign currencies (particularly the ability of central banks to flood the economy with credit by manipulating the money supply), Hayek advocated for privately issued money to supplant sovereign-issued fiat currencies.¹⁴³ In Hayek’s view, the major impediments to the development of market-based forms of money were the laws that national governments enacted restricting privately issued money.¹⁴⁴ In fact, though, the law is circumscribed in its ability to limit the types of money that can be used in a sovereign territory.

Although it is true that the U.S. Constitution reserves to the government the right to coin money and regulate the value thereof,¹⁴⁵ and there are prohibitions on the use of instruments “intended to circulate as money or to be received or used in lieu of lawful money of the United States,”¹⁴⁶ such laws have been understood to prohibit counterfeit bills and coins that purport to be USD—not to prohibit other types of money that are unlikely to be confused with USD.¹⁴⁷ Furthermore, although governments can and do rule on what constitutes “legal tender” in their jurisdictions,¹⁴⁸ the importance of legal tender status is perhaps overstated. In the United States, federal legislation provides that “United States coins and currency . . . are legal tender

tions over the Internet will unleash the typical forces of consolidation and globalization, and we will end up with six digital currencies: US Dollar, euro, Yen, Pound, Renminbi and Bitcoin.” Popper, *supra* note 140 (quoting a privately distributed paper by Charlie Songhurst, Microsoft’s head of corporate strategy).

142. Hayek, *supra* note 20.

143. ECB 2012, *supra* note 37, at 22 (citing FRIEDRICH A. HAYEK, *THE DENATIONALISATION OF MONEY* (1976)).

144. Hayek, *supra* note 20.

145. U.S. CONST. art. I, § 8, cl. 5.

146. 18 U.S.C. § 336 (2012).

147. Julie Andersen Hill, *Virtual Currencies & Federal Law*, 18 J. CONSUMER & COM. L. 49, 49 (2015).

148. Lawrence H. White, *The Troubling Suppression of Competition from Alternative Monies: The Cases of the Liberty Dollar and E-Gold*, 34 CATO J. 281, 282–84 (2014).

for all debts, public charges, taxes, and dues,”¹⁴⁹ but as the Treasury Department has pointed out, this only means that such coins and currency are a legal *offer* of payment.¹⁵⁰ There is no federal legislation requiring that such coins and currency be *accepted* as payment.¹⁵¹ In Europe, legal tender status is somewhat more meaningful: “only euro banknotes and coins are legal tender in the countries of the euro area and therefore, *by law*, must be accepted as payment for a debt within those countries.”¹⁵² Nonetheless, in both Europe and the United States, the parties to a transaction are free to contract for payments in instruments that do not constitute legal tender.¹⁵³

The very existence of Bitcoin—the creation of which was in part inspired by Hayekian-libertarian sentiments¹⁵⁴—demonstrates that privately issued means of payment can exist alongside sovereign currencies. Although the ECB has concluded that, at present, Bitcoin is not sufficiently widely used to constitute “money,” this conclusion is based on Bitcoin’s current functionality, rather than any legal impediment.¹⁵⁵ While many countries have ruled that Bitcoin cannot serve as legal tender within their borders,¹⁵⁶ this only means that agreements to pay in Bitcoin must be established upfront by contract, not that it cannot be used as money at all. Instead, the most important impediment to Bitcoin being more widely accepted as “money” is the volatility of the price of a bitcoin,¹⁵⁷ which undermines its ability to function as a reliable store of value. Because of

149. 31 U.S.C. § 5103 (2012).

150. *Legal Tender Status*, U.S. DEP’T OF TREASURY, <http://www.treasury.gov/resource-center/faqs/Currency/Pages/legal-tender.aspx> (last updated Jan. 4, 2011).

151. *Id.*

152. ECB 2015, *supra* note 45, at 24 (footnotes omitted) (citing *Use of the Euro*, EUROPEAN CENT. BANK, <http://www.ecb.europa.eu/euro/intro/html/index.en.html> (last visited May 17, 2017); Council Regulation art. 11, 1998 O.J. (L974) 98 (EC)).

153. *See, e.g., id.* at 24 (“[V]irtual currencies can be used only as contractual money, when there is an agreement between buyer and seller in order to accept a given virtual currency as a means of payment.”).

154. ECB 2012, *supra* note 37, at 22. The Bitcoin website trumpets that: “Bitcoin has the characteristics of money . . . based on the properties of mathematics rather than relying on physical properties (like gold and silver) or trust in central authorities (like fiat currencies).” *Frequently Asked Questions*, BITCOIN, <https://bitcoin.org/en/faq> (last visited May 17, 2017).

155. ECB 2015, *supra* note 45, at 24. According to the ECB, at present:

[V]irtual currencies have a limited function as a medium of exchange because they have a very low level of acceptance among the general public. In addition, the high volatility of their exchange rates to currencies—and therefore in terms of most goods and services—renders virtual currency useless as a store of value even for short-time purposes, let alone for the purpose of being a longer-term savings instrument. Finally, both the low level of acceptance and the high volatility of their exchange rates and thus purchasing power make them unsuitable as a unit of account.

Id. at 23–24.

156. *Id.* at 34–37.

157. ELWELL ET AL., *supra* note 35, at 7 (noting that between 2013 and 2015, Bitcoin’s dollar exchange rate fluctuated between \$50 and over \$1,000).

this volatility, Bitcoin has found wider popularity among speculators seeking to profit from that volatility than it has among those wishing to use it for everyday transactions.¹⁵⁸ However, this state of affairs is not immutable.

As Bitcoin becomes more established and more widely traded, its volatility could moderate to the point where Bitcoin becomes more widely accepted as a means of exchange.¹⁵⁹ Even now, it is already accepted by a number of online retailers and other merchants, including Amazon, Dell, Expedia, and Overstock.com.¹⁶⁰ Importantly, such acceptance does not depend on an entirely rational calculation of a bitcoin's value. As the mortgage-backed securities bubble that developed prior to the Financial Crisis handily illustrates, market participants do not always rationally value financial instruments.¹⁶¹ Bitcoin may be the subject of another bout of irrational exuberance:

The Bitcoin phenomenon seems to fit the basic definition of a speculative bubble—that is, a special kind of fad, a mania for holding an asset in expectation of its appreciation. Further, a bubble is publicized and amplified by news of price increases, often justified by some kind of inspiring “new era” story that attracts more attention as the price rises. In this case, the narrative was that a computer whiz invented a new kind of money in the form of electronic currency units, as part of a decentralized computer-driven system for a world economy that extends beyond the reach of any single government.¹⁶²

This same “new era” thinking could also drive interest in other virtual currencies beyond rational levels, notwithstanding that others have called out this narrative as overstating the transformative power of virtual currencies (unlike the internet, which was a truly transformative protocol in the

158. *Id.*

159. Tom Polansek, *CME, ICE Prepare Pricing Data That Could Boost Bitcoin*, REUTERS, May 2, 2016, <http://www.reuters.com/article/us-cme-group-bitcoin-idUSKCN0XT1G1>. Both the Chicago Mercantile Exchange and the New York Stock Exchange plan to start publishing pricing data relating to Bitcoin which is expected to “lower uncertainty among market participants and would very likely reduce bitcoin’s traditionally high volatility.” *Id.* (quoting Paul Chao, founder and chief executive officer of Ledger X, an “institutional trading and clearing platform for bitcoin options”); see also Jerry Brito et al., *Bitcoin Financial Regulation: Securities, Derivatives, Prediction Markets, and Gambling*, 16 COLUM. SCI. & TECH. L. REV. 144, 156 (2014); Murck, *supra* note 3, at 10 (“The Bitcoin market is infinitesimal compared to its potential size, so it is subject to relatively high volatility. That volatility will drop over time, as the worldwide use of the Bitcoin protocol grows. Psychology around this new asset probably also drives wider price swings than will occur in the future.”). For further discussion of how Bitcoin, or another virtual currency, might become more widely accepted, see *infra* Part III.B.

160. Kevin V. Tu & Michael W. Meredith, *Rethinking Virtual Currency Regulation in the Bitcoin Age*, 90 WASH. L. REV. 271, 273 (2015).

161. See generally David Min, *Understanding the Failures of Market Discipline*, 92 WASH. U. L. REV. 1421 (2015).

162. Shiller, *supra* note 72.

sense that it is free to use and not owned by anyone, access to a virtual currency network requires prepayment for the virtual currency).¹⁶³

It is thus possible that Bitcoin, or another virtual currency, may come to be accepted widely enough that it achieves money status, but just as with mortgage-backed securities, that status would be fragile and could easily be lost.¹⁶⁴ Historically, only instruments that are backed (even if just implicitly) by the full faith and credit of a sovereign government have functioned successfully as a currency over a long period of time,¹⁶⁵ because non-sovereign issuers of money are limited in their ability to muster resources to back their obligations in the event of a panic.¹⁶⁶ There is also no baseline natural demand for virtual currencies in the way that there is for sovereign currencies.¹⁶⁷ At the most basic level, the fact that a country imposes and accepts payment of taxes in a currency generates demand for that currency and thus gives it value.¹⁶⁸ Furthermore, because a government that demands taxation is the most common creditor within a country, “[t]he tokens

163. SWANSON, *supra* note 26, at 18. Also, in the case of Bitcoin (if not other virtual currencies), the miners of bitcoins control how the network develops. *Id.* at 19.

164. *See supra* text accompanying notes 89–94.

165. MARTIN, *supra* note 75, at 74–75. Martin elaborates: “No private issuer enjoys the same extent for its markets, the same capacity to coerce demand for its liabilities, or the same psychological association with confidence in society.” *Id.* at 114. Proponents of privately issued money, seeking to rebut this claim, often advance the example of the largely successful free banking system that operated in Scotland prior to 1845. Friedman & Schwartz, *supra* note 140, at 301–02. However, as Friedman and Schwartz note, there are several factors that distinguish the Scottish experience from modern attempts to establish privately issued money. *Id.* at 302. Notably, the claims on Scottish banks that functioned as money were supported by the unlimited personal liability of shareholders in those banks—those shareholders “were well known, had considerable private wealth and valued their own reputations for probity highly enough to honor their obligations.” *Id.* Virtual currencies, with their anonymous participants and lack of institutional backing, have no equivalent way of developing confidence.

166. Katharina Pistor, *A Legal Theory of Finance*, 41 J. COMP. ECON. 315, 322 (2013). Pistor is careful to point out, however:

This is not to say that currencies not backed by state money cannot exist. However, they tend to be instable and prone to collapse whenever commitments made in the past require substantial readjustment in light of new events. Consider the fate of bank-issued money in the US prior to the establishment of the US dollar as the common currency. Many state banks issued their own IOUs with nothing but their own assets to back them. Predictably, they failed whenever too many claimants sought to make good on their claims at the same time This follows from the hierarchy of finance and the fact that non-state entities by definition have limited resources. Critically, their ability to mobilize fresh resources may falter precisely when it is most needed, namely in times of crisis.

Id. (citation omitted) (citing Gerald P. Dwyer, *Wildcat Banking, Banking Panics, and Free Banking in the United States*, ECON. REV., Dec. 1996, at 3–6).

167. ECB 2015, *supra* note 45, at 24 (“[N]o creditor is obliged to accept payment with [a virtual currency] to discharge a debtor of its debt.”).

168. ELWELL ET AL., *supra* note 35, at 6; Charles A.E. Goodhart, *The Two Concepts of Money: Implications for the Analysis of Optimal Currency Areas*, 14 EURO. J. POL. ECON. 407, 417 (1998).

it [takes], unlike those preferred by any other actor, . . . matter[] to everybody.”¹⁶⁹ Finally, sovereign governments also have access to funding from the IMF in times of crisis, which is not available with respect to privately issued money.¹⁷⁰ As a result, privately issued money is less likely than a sovereign currency to be consistently liquid (and just as importantly, market participants are less likely to expect liquidity from privately issued money when things go awry).¹⁷¹ It is not surprising, then, that we often see a flight from privately issued money to cash in times of panic.¹⁷² At those times, even without according special legal privilege to it, sovereign-issued money is considered superior to other types of money.¹⁷³ Even as prominent a free-marketeer as Milton Friedman concluded, “[i]t is dubious that the market can by itself provide [a moderately stable monetary] framework. Hence, the function of providing one is an essential governmental function.”¹⁷⁴

Privately issued money that consists of some commodity (like gold) or represents a claim on other assets (like a mortgage-backed security) may have some underlying value even if it ceases to function as a means of exchange.¹⁷⁵ A virtual currency, however, is nothing more than a series of numbers recorded on a database.¹⁷⁶ According to the Bitcoin website, bitcoins have value because “they are useful as a form of money.”¹⁷⁷ This is obviously somewhat circular: as Krugman puts it, bitcoins have value because “for the time being at least people are willing to buy [them] because they believe other people will be willing to buy [them].”¹⁷⁸ However, if this belief evaporates for any reason and there is no government or central bank

169. Christine Desan, *Coin Reconsidered: The Political Alchemy of Commodity Money*, 11 THEORETICAL INQ. L. 361, 372 (2010).

170. Nicholas A. Plassaras, *Regulating Digital Currencies: Bringing Bitcoin Within the Reach of the IMF*, 14 CHI. J. INT’L L. 377, 399 (2013).

171. Desan, *supra* note 169, at 372 (“[L]iquidity—was the centripetal force that brought government and people together to produce money.”).

172. Gorton, *supra* note 89, at 18.

173. MARTIN, *supra* note 75, at 114.

174. MILTON FRIEDMAN, A PROGRAM FOR MONETARY STABILITY 8 (1959).

175. Friedman & Schwartz, *supra* note 140, at 297 (footnote omitted) (“Many examples can be cited of fairly long-continued and successful producers of private moneys convertible into specie. We do not know, however, of any example of the private production of purely inconvertible fiduciary moneys . . .”).

176. ECB 2015, *supra* note 45, at 23, 33. As the Danish Central Bank put it, “Bitcoin does not have any real trading value compared to gold and silver, and thus is more similar to glass beads.” *Id.* at 34 (footnote omitted) (citing *Bitcoin Er Ikke Penge*, http://www.nationalbanken.dk/da/presse/Documents/2014/03/PH_bitcoin.pdf#search=Bitcoin (last visited May 17, 2017)). Even some of those who support a return to the gold standard are wary of the Bitcoin system because bitcoins are not linked to any commodity that is purported to have intrinsic value. *Id.* at 23.

177. *Why Do Bitcoins Have Value?*, BITCOIN, <https://bitcoin.org/en/faq#why-do-bitcoins-have-value> (last visited May 17, 2017).

178. Krugman, *supra* note 17.

to provide support,¹⁷⁹ Bitcoin (or any other virtual currency) will no longer be accepted as a means of exchange, its store of value will erode, and it will lose its status as money. Virtual currencies also lack any central bank to manage their supply to match demand,¹⁸⁰ which may also jeopardize the virtual currency's ability to function as a reliable store of value.

Despite the fact that it is not linked to any commodity, Bitcoin is in some ways a high-tech attempt to replicate the gold standard.¹⁸¹ Proponents of a return to the gold standard are wary of central bank management, which they fear will debase fiat sovereign currencies,¹⁸² and so they wish to prevent such intervention by tying the value of money to the value of a commodity.¹⁸³ By capping the maximum number of bitcoins to be released at 21,000,000,¹⁸⁴ the creators of Bitcoin have similarly ensured that it is not susceptible to the type of monetary policy intervention that central banks deploy to maintain price stability.¹⁸⁵ However, when the supply of money does not match the demand for it, either inflation or deflation is likely; a key reason for abandoning the gold standard as a basis for monetary policy in the 1920s and 1930s was the recognition that the demand for gold did not predict the demand for other goods and services.¹⁸⁶ Nonetheless, the crea-

179. Possible triggers for a panic are explored *infra* Part III.B.

180. For example, before the creation of the Federal Reserve, the USD was not always able to “accommodate changes in demand that arose from seasonal and cyclical factors and from periods of financial crisis.” Michael J. Lambert & Kristin D. Stanton, *Opportunities and Challenges of the U.S. Dollar as an Increasingly Global Currency: A Federal Reserve Perspective*, 87 FED. RES. BULL. 567, 569 (2001).

181. ECB 2012, *supra* note 37, at 22–23 (“The scheme is inspired by the former gold standard.”); see also Lawrence H. White, *Making the Transition to a New Gold Standard*, 32 CATO J. 411, 411 (2012). White defines the gold standard as:

[A] monetary system in which a standard mass (so many grams or ounces) of pure gold defines the unit of account, and standardized pieces of gold serve as the ultimate media of redemption. Currency notes, checks, and electronic funds transfers are all denominated in gold and are redeemable claims to gold.

Id.

182. Lawrence H. White, *Gold Standard with Free Banking Would Have Restrained the Boom and Bust*, 31 CATO J. 497, 498 (2011) (“A poorly constrained central bank . . . can cheapen credit when it thinks it expedient, or when it concedes to political pressure, to try to stimulate the economy.”).

183. *Id.* at 502 (“A commodity standard would regulate the quantity of money without the need for the wisdom of [the Federal Reserve].”).

184. *How Are Bitcoins Created?*, BITCOIN, <http://bitcoin.org/en/faq#how-are-bitcoins-created> (last visited May 17, 2017). Once there are 21 million bitcoins in existence, bitcoin issuance will stop. *Id.*

185. ECB 2012, *supra* note 37, at 22.

186. JOHN MAYNARD KEYNES, *ESSAYS IN PERSUASION* 208 (1931). Keynes is critical of the gold standard, arguing:

In truth, the gold standard is already a barbarous relic. All of us, from the Governor of the Bank of England downwards, are now primarily interested in preserving the stability of business, prices, and employment, and are not likely, when the choice is forced

tors of Bitcoin have constrained the supply of bitcoins without regard to fluctuating demand in terms of the prices of goods and services the bitcoins are used to buy.¹⁸⁷

As the former head of the Bank of England Mervyn King has noted, it is undesirable to precommit to any particular permanent monetary policy strategy because “we cannot articulate all possible future states of the world.”¹⁸⁸ Today, the general consensus is that some form of discretionary intervention by central banks is needed to ensure price stability.¹⁸⁹ Certainly there is a downside to this discretion—there is always the possibility that central bank policy will have negative consequences. However, the potential for the unexpected to occur ensures that a “set and forget” monetary policy is not a viable alternative.¹⁹⁰ One virtual currency known as Peercoin, for example, has an algorithm that allows for the release and retirement of its units depending on demand, as determined by a simple preset formula.¹⁹¹ While the Peercoin algorithm is superior to the Bitcoin code because it makes some attempt to match supply and demand,¹⁹² its rigid formula will likely not achieve the desired slight level of inflation in “all

on us, deliberately to sacrifice these to the outworn dogma, which had its value once, of £3:17:10½ per ounce. Advocates of the ancient standard do not observe how remote it now is from the spirit and the requirements of the age.

Id.

187. By limiting the supply of bitcoins, its architects have ensured that the value of a bitcoin will increase vis-à-vis other assets—which means that it is inherently deflationary in the sense that things will “cost less in terms of Bitcoin” in the future. Matthew O’Brien, *Why Bitcoin Will Never Be a Currency—In 2 Charts*, ATLANTIC (Dec. 15, 2013), <http://www.theatlantic.com/business/archive/2013/12/why-bitcoin-will-never-be-a-currency-in-2-charts/282364/> (emphasis omitted).

188. Mervyn King, *The Institutions of Monetary Policy*, at i (Nat’l Bureau of Economic Res. Working Paper No. 10400, 2004).

189. See *supra* text accompanying notes 96–98. That is not to say that everyone agrees with this general consensus. One well-known critic is economist John Taylor, who argues that monetary policy should be based on “a predictable rule-like strategy for the instruments of policy.” John B. Taylor, *A Monetary Policy for the Future 2* (Apr. 15, 2015) (unpublished manuscript), http://web.stanford.edu/~johntayl/2015_pdfs/A_Monetary_Policy_For_the_Future-4-15-15.pdf. However, the rule that Taylor has developed “provides no guidance about what to do when the predicted rate is negative, as has been the case for almost the entire period since the crisis.” Ben S. Bernanke, *The Taylor Rule: A Benchmark for Monetary Policy?*, BROOKINGS (Apr. 28, 2005), <http://www.brookings.edu/blogs/ben-bernanke/posts/2015/04/28-taylor-rule-monetary-policy>. Instead, monetary policy requires some level of discretion and flexibility to deal with unanticipated events.

190. King, *supra* note 188, at i.

191. *Frequently Asked Questions*, PEERCOIN, <http://peercoin.net/faq> (last visited May 17, 2017). The Peercoin website explains that its money supply is calculated based on: “Proof of Work mining (increases supply); Number of transactions (decreases supply by 0.01 PPC per transaction); [and] Proof of Stake minting (increases supply at a rate up to 1% per year).” *Id.*

192. *Id.* (“Peercoin inflation rate has consistently remained below 5% for the first half of 2014. At the current adoption rate, this rate will decline further over time, making Peercoin less inflationary and more sustainable than most other cryptocurrencies.”).

possible future states of the world.”¹⁹³ Because there is no central bank to intervene to correct the supply of Peercoins, in the event that its formula mismatches supply and demand and the virtual currency becomes highly inflationary or deflationary, people are likely to abandon Peercoin in favor of a more reliable form of money.

III. BENEFITS AND RISKS OF VIRTUAL CURRENCIES

Virtual currencies are not an ideal form of money, but they do have other positive attributes: much of the enthusiastic discussion of virtual currencies has focused on their superiority to existing payment systems (particularly in terms of reducing transaction costs). This Part will explore these benefits of virtual currencies, but will not neglect the systemic risks that widely used virtual currencies could pose. The next Part will then consider how these benefits might best be preserved, while mitigating the risks.

A. *Benefits of Virtual Currencies*

The Federal Reserve has noted, “[a] safe, efficient, secure and accessible payment system contributes to a nation’s financial stability and economic growth. Payments play a vital role in supporting financial transactions, facilitating commerce and enabling the transfer of value between businesses, consumers and financial institutions.”¹⁹⁴ However, the more established consumer payment systems that we have, including cash, checks, credit cards, and electronic funds transfers,¹⁹⁵ leave much to be desired. This Section will explore some of the drawbacks associated with these payment methods, and consider how virtual currencies can address some of these drawbacks.

Cash is prized because there is no settlement risk associated with cash payments: these payments “involve the simultaneous exchange of a commodity and good funds” (sometimes referred to as a “delivery versus payment” procedure).¹⁹⁶ Cash is also prized because it allows for anonymous transactions that leave no paper trail.¹⁹⁷ However, cash is impractical for

193. King, *supra* note 188, at i.

194. PAYMENTS WHITE PAPER, *supra* note 6, at 6.

195. Mark J. Flannery, *Financial Crises, Payment System Problems, and Discount Window Lending*, 28 J. MONEY, CREDIT & BANKING 804, 812 (1996). This does not purport to be an exhaustive list of types of consumer payment systems, only a discussion of a few common types. This Part also does not consider real time gross settlement systems for large payments such as FedWire (in the United States) and the TARGET2 System (in Europe), as these typically serve only institutional clients.

196. *Id.* at 808.

197. Andolfatto, *supra* note 1.

making large payments, or for making payments over a distance.¹⁹⁸ Checks solve these latter problems, but they involve settlement risk—the recipient of the check provides the good or service in exchange for the check rather than good funds, and so the recipient is effectively extending interim credit to the payer until the check clears and the good funds are provided to the recipient.¹⁹⁹ There is always a risk that the payer will not have sufficient funds to honor the check. Furthermore, depending on how the check is cleared, the financial institutions involved in the clearing process may end up being exposed to each other's credit.²⁰⁰ While it is often more efficient for such financial institutions to use credit to settle payments (rather than requiring ready funds or collateral before settlement can take place),²⁰¹ reliance on interbank credit during settlement makes a payment system more susceptible to shocks and crises.²⁰² If for any reason that credit ceases to become available, the entire payment system will seize up. Similar concerns pertain to the interbank settlement of electronic funds transfers, like payroll and bill payments.²⁰³

Credit cards also involve credit risk, but it is the bank that issued the card that takes on the risk that the payer has insufficient funds, rather than the recipient of funds (the recipient is usually referred to as the “merchant” in the credit card context).²⁰⁴ From the merchant's perspective, credit cards reduce settlement risk, but the merchant is required to pay an often opaque array of fees to a number of different entities for card processing services.²⁰⁵ The merchant also bears the risk of chargebacks: if a payer successfully disputes a charge, then the merchant's bank will pull the funds from the

198. Flannery, *supra* note 195, at 812; *see also* Julie Andersen Hill, *Banks, Marijuana, and Federalism*, 65 CASE W. RES. L. REV. 597, 600–01 (2015).

199. Flannery, *supra* note 195, at 812.

200. MORGAN RICKS, *THE MONEY PROBLEM: RETHINKING FINANCIAL REGULATION* 23 (2016). Ricks explains:

The payer's bank debits the payer's account, and the payee's bank credits the payee's account. . . . To offset these effects, the payer's bank delivers [money] to the payee's bank. . . . It is generally done through electronic systems managed by the Federal Reserve, and it is coupled with a system of intraday credit whereby the Fed advances base money to deposit banks to enable them to settle payments with other deposit banks throughout the day.

Id.

201. Flannery, *supra* note 195, at 808.

202. *Id.* at 804 (“The payment system's credit component constitutes its (potential) Achilles' heel.”).

203. *Id.* at 817.

204. *Id.* at 812; Paul Downs, *What You Need to Know About Credit Card Processing*, N.Y. TIMES: YOU'RE THE BOSS (Mar. 25, 2013, 11:00 AM), http://boss.blogs.nytimes.com/2013/03/25/what-you-need-to-know-about-credit-card-processing/?_r=0.

205. Downs, *supra* note 204.

merchant's account to return to the payer.²⁰⁶ Merchants tend to be charged more for processing transactions that are more likely to be the subject of a chargeback—particularly transactions done over the phone or internet.²⁰⁷ These types of transactions are sometimes referred to as “pull” payments,²⁰⁸ where “the payer supplies his/her account information to the [merchant]. The [merchant]’s financial institution then pulls the money out of the payer’s account.”²⁰⁹ Merchants often store this information for later use, and this stored information is vulnerable to theft.²¹⁰ “Push” payments are much safer, since they require the holder of the funds to take an active step to make a payment, and no information is left with the merchant.²¹¹

Virtual currency technologies have the ability to address many of these shortcomings. Unlike cash, virtual currency can be sent securely in large amounts and over great distances. Virtual currency transactions are also cheaper than credit card transactions: “[w]hile credit card networks charge merchants fees in the range of 3 to 4 percent of the total amount of a transaction . . . a Bitcoin transaction can cost less than 1 percent.”²¹² Payments can also be settled quickly using virtual currencies: transactions using bitcoins, for example, usually take around ten minutes to process.²¹³ This increased speed and efficiency is a result of the most innovative aspect of the Bitcoin system: its development of the “blockchain” or “distributed ledger.”²¹⁴ To initiate a transaction, the payer “pushes” the bitcoin to the recipient, avoiding the security issues associated with pull payments.²¹⁵ The transaction is then processed by miners who look to the distributed ledger (which shows all the transactions that have ever been conducted with the bitcoin in question) to determine whether the payer is indeed the owner of the bitcoin.²¹⁶ The miners need only look to the one distributed ledger to determine this, which allows for quicker verification than if the transaction were queued on multiple separately administered ledgers that needed to be

206. *Id.*

207. *Id.*

208. PAYMENTS WHITE PAPER, *supra* note 6, at 17.

209. *Id.*

210. *Id.*

211. *Id.*; Andreessen, *supra* note 4.

212. Brito et al., *supra* note 159, at 151.

213. *Id.*

214. Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 837, 843–44 (2015).

215. Andreessen, *supra* note 4. Because the payer takes an active step to send funds to the recipient, “the receiver of a payment does not get any information from the sender that can be used to steal money from the sender in the future, either by that merchant or by a criminal who steals that information from the merchant.” *Id.*

216. SWANSON, *supra* note 26, at 24, 28.

reconciled before the transaction could be finalized.²¹⁷ Avoiding the reconciliation of ledgers administered by different banks also avoids replication errors, and the need for any interbank credit to speed up settlement.²¹⁸ Once the transaction is approved, the ledger is updated real-time to reflect the transaction and is the definitive word on who now owns the bitcoin.²¹⁹

Even a cross-border payment simply involves passing a bitcoin from person to person: although a hypothetical French payer would admittedly have to convert their euros into bitcoins, and the hypothetical American recipient would have to convert such bitcoins into USD, using Bitcoin is much more efficient than a comparable international wire transfer, which would have to go through layers of “correspondent banks, exchanges and clearing houses.”²²⁰ When there are fewer institutions involved in the settlement of the payment, there are fewer links between institutions for systemic shocks to travel along (and when interbank settlement is avoided, no credit is extended between banks as part of that settlement process). No credit needs to be extended to the payer either, removing significant risk from the payments process. For all of these reasons, it is easy to understand venture capitalist Marc Andreessen’s enthusiasm for Bitcoin:

Bitcoin is a digital bearer instrument. It is a way to exchange money or assets between parties with no pre-existing trust: A string of numbers is sent over email or text message in the simplest case. The sender doesn’t need to know or trust the receiver or vice versa. Related, there are no chargebacks—this is the part that is literally like cash—if you have the money or the asset, you can pay with it; if you don’t, you can’t. This is brand new. This has never existed in digital form before.²²¹

But the benefits of using virtual currencies to effect payments on a large scale will not come without risk to the financial system. The next Section will explore these risks.

B. Systemic Risks Posed by Virtual Currencies

The type of systemic risks posed by virtual currencies and distributed ledger technology will depend on the way, and the extent to which, the currencies and technology become integrated into our society. This Section will therefore engage in a thought experiment and consider two possible

217. *Id.*

218. For a discussion of credit and settlement, see *supra* text accompanying notes 205–206.

219. Walch, *supra* note 214, at 846.

220. John Gapper, *Bitcoin Is Far More Than a Currency for Speculators*, FIN. TIMES (Feb. 5, 2014), <http://www.ft.com/cms/s/0/612ed094-8aaf-11e3-9465-00144feab7de.html#axzz4JoYC9MK7>.

221. Andreessen, *supra* note 4, at 3.

scenarios and their attendant systemic risks. First, this Section will consider the systemic risks that might be posed by a decentralized virtual currency (be it Bitcoin or otherwise) that is widely adopted by members of the public, and thus operates as a type of shadow currency (“Scenario 1”). Then, the second scenario will consider the risks that could arise if systemically important financial institutions become significantly exposed to a virtual currency (“Scenario 2”). Importantly, these scenarios are not mutually exclusive—indeed, the proliferation of any virtual currency is most likely if the financial industry starts to invest in it (without such demand, it would be surprising if virtual currencies were to be sufficiently widely adopted that they could cause the macroeconomic problems discussed in Scenario 1).²²² Of course, it is possible that neither of these scenarios will come to pass, and that virtual currencies and their associated distributed ledger technologies will continue to serve only a niche market. If that is the case, no systemic risk will be posed, but none of the benefits discussed in the previous Part will come to fruition either. Part IV will therefore follow this Section’s thought experiments by considering ways of preserving those benefits, while minimizing systemic risks.

1. Scenario 1: Virtual Currencies as Widely Used Shadow Currencies

In the wake of the Financial Crisis, much attention has been focused on “shadow banking”—that is, the part of the financial industry that “performs the same functions as traditional banking, but . . . the regulatory structure is light or nonexistent.”²²³ If a decentralized virtual currency starts to become used so widely that it begins to operate as an alternative money, it could be considered a new type of shadow banking—as such, the post-Crisis scholarship on the systemic risks posed by shadow banking will be used here as a framework for considering the risks posed by widely adopted decentralized virtual currencies. First, however, it is worth addressing a potential quibble: some might consider the “shadow banking” literature to be inappropriate in this context. Typical discussions of shadow banking focus on whether we should regulate non-bank institutions that are providing banking-like services²²⁴—but a decentralized virtual currency transaction

222. See Robert C. Hockett & Saule T. Omarova, *The Finance Franchise*, 102 CORNELL L. REV. (forthcoming 2017) (manuscript at 57), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2820176.

223. Gary Gorton & Andrew Metrick, *Regulating the Shadow Banking System*, BROOKINGS PAPERS ON ECONOMIC ACTIVITY, Fall 2010, at 261, 261.

224. See, e.g., AKERLOF & SCHILLER, *supra* note 122, at 82. See generally Ricks, *supra* note 15.

can be processed without going through any institutional intermediary.²²⁵ This does not mean, however, that the shadow banking literature is inapposite. An unregulated virtual currency that usurps the role of payment systems traditionally provided by banks warrants attention as a type of shadow banking, even if there are no intermediary institutions involved.

Payment services have traditionally been provided by banks, and because these payment services (together with the other traditional banking functions of capital intermediation and risk management) are indispensable to broader economic growth, banks have always been highly regulated.²²⁶ However, since the 1970s, a significant proportion of banking services has migrated outside of the regulated banking sector.²²⁷ There were enormous disruptions of shadow banking services during the Financial Crisis, and such services have since faced heightened scrutiny.²²⁸ But Bitcoin did not exist when the financial system collapsed in 2008, and thus it is not surprising that it and other virtual currencies have not formed part of the debate on shadow banking that followed the Crisis. However, if virtual currencies start to usurp more and more of traditional banks' payments functions, then a problem with virtual currencies could certainly cause harm to the broader financial system and economy—former CFTC commissioner Bart Chilton's reference to Bitcoin as a "shadow currency"²²⁹ is therefore very apt.

Notwithstanding that it is not an ideal store of value and lacks explicit government backing, it is possible that the enthusiasm buoying Bitcoin may generate sufficient momentum for it to become a widely adopted means of exchange, and thus for it to achieve money status. After all, money is ultimately a social technology, and bitcoins can function as such for as long as people believe that others will accept bitcoins as payment.²³⁰ Alternatively, future iterations of privately issued virtual currencies might be better (although by no means perfect)²³¹ stores of value, and might therefore become more widely accepted as "money"—at least for a time. Any "money" status achieved by virtual currencies would be particularly vulnerable, though. If a virtual currency were to suddenly lose value as against a sovereign cur-

225. SWANSON, *supra* note 26, at 5. However, it is worth noting that the "intermediarylessness" of Bitcoin transactions is perhaps overstated. For a discussion of the intermediaries that now assist with Bitcoin transactions, see *infra* text accompanying note 337.

226. Hilary J. Allen, *A New Philosophy for Financial Stability Regulation*, 45 LOY. U. CHI. L.J. 173, 183–85 (2013).

227. Gorton & Metrick, *supra* note 223, at 269.

228. See, e.g., *id.* See generally Ricks, *supra* note 15.

229. Tracy Alloway, Gregory Meyer & Stephen Foley, *US Regulators Eye Bitcoin Supervision*, FIN. TIMES (May 6, 2013), <http://www.ft.com/cms/s/0/b810157c-b651-11e2-93ba-00144feabdc0.html#axzz4JoYC9MK7>.

230. See *supra* text accompanying notes 69–77.

231. As discussed *supra* in the text accompanying notes 191–192, there is therefore no precise formula for demand to which supply of a virtual currency can be tied.

rency, it would also lose its utility as a means of exchange²³²: once payments could no longer be reliably effected using a virtual currency at a rate that matches public expectations, demand for that virtual currency would decrease further as people retreated to readily accepted sovereign currencies, further driving down the value of the virtual currency and causing more holders to try and get rid of their virtual currency holdings.²³³ This vicious cycle is similar to a bank run,²³⁴ and any number of triggers might set such a cycle off.²³⁵

For example, a virtual currency might fall prey to the type of speculative attack that sometimes occurs with respect to emerging market currencies.²³⁶ Essentially, this would involve speculators taking short positions in the virtual currency, hoping to profit by selling borrowed amounts of the virtual currency in the expectation that, by the time such loan must be repaid, the value of the virtual currency needed to discharge the loan will have fallen. Speculative attacks can drive the value of a currency down, but when the subject of a speculative attack is a sovereign currency, the relevant central bank can shore up the value of that sovereign currency by raising interest rates.²³⁷ However, there is no central bank able to perform such intervention for a virtual currency, making it more likely that the speculators will profit from driving down its value, which, in turn, provides greater incentive to engage in such speculative attacks in the first place.

232. Ricks, *supra* note 15, at 83.

233. ECB 2012, *supra* note 37, at 39. For a discussion of the loss of money status, see text accompanying *supra* notes 164–180. See also Ricks, *supra* note 15, at 105.

234. Gorton & Metrick, *supra* note 223, at 279–80. Gorton and Metrick explain the failure of different parts of the shadow banking system as resulting from bank runs. *Id.* Indeed, the failure of Mt. Gox, which used to be the largest Bitcoin exchange, following a heist of bitcoins from it has indeed been analogized to a bank run:

Mt. Gox froze the accounts of its customers and “refus[ed] to give customers their . . . [bitcoins] back.” Customers were, however, still permitted to “trade the Bitcoins in their accounts for other currencies” and in their fear that they might only receive partial repayment of their initial investment “panicked customers carried out \$32M USD of transactions on the site, nearly five times the normal daily volume.”

Tu & Meredith, *supra* note 160, at 343 (footnotes omitted) (citing Jason Mick, *Mt. Gox Bitcoin Bank Run Intensifies, 1 Million Customers at Risk*, DAILYTECH (Feb. 7, 2014, 1:04 PM), <http://www.dailytech.com/Mt+Gox+Bitcoin+Bank+Run+Intensifies+1+Million+Customers+at+Risk/article34293.htm>); see also Hiroko Tabuchi, *In Disarray, Mt. Gox Signals a Move Toward Liquidation*, N.Y. TIMES: DEALBOOK (Apr. 16, 2014, 10:22 AM), <http://dealbook.nytimes.com/2014/04/16/former-bitcoin-exchange-mt-gox-set-to-liquidate-in-absence-of-revival-plan/> (explaining that Mt. Gox ultimately filed for bankruptcy, reporting that it had lost almost \$500 million in Bitcoins).

235. See Lawrence Trautman, *Virtual Currencies; Bitcoin & What Now After Liberty Reserve, Silk Road, and Mt. Gox?*, 20 RICH. J.L. & TECH. 1, 54 (2014) (discussing possible triggers).

236. Plassaras, *supra* note 170, at 397.

237. Mishkin, *supra* note 18, at 1528.

Alternatively, if a bubble were to develop in a particular virtual currency as an asset class, then the value of that currency would drop precipitously once the bubble popped.²³⁸ Or a particularly brazen theft of virtual currency might convince holders that the virtual currency (or the infrastructure built around it) is too vulnerable, and cause them to rapidly dump their virtual currency holdings.²³⁹ Or civil warfare over the virtual currency's code could undermine confidence in the virtual currency.²⁴⁰ Confidence could also be damaged by ponzi schemers or other fraudsters—who already seem to be taking advantage of Bitcoin to advance their schemes²⁴¹—as “overoptimistic media coverage of Bitcoin prompts waves of novice investors to pump up Bitcoin prices.”²⁴² There is no equivalent of deposit insurance in place for virtual currencies to assure users that their funds are protected, and so it would be entirely rational for holders of the virtual currency to make a “prisoner’s dilemma”-type calculation upon hearing news of any of these (or other, as yet unimagined) triggering events, and try to convert their virtual currency to sovereign currency before everyone else does—even though this would result in suboptimal outcomes for all.

If a failed virtual currency had previously been widely used to effect everyday purchases, the resulting payment system failure could impact the normal flow of funds in a way that could retard broader economic growth.²⁴³ Furthermore, the failure of a widely used virtual currency would effectively contract the supply of money available in the economy, which would also hamper economic growth.²⁴⁴ The usual response of a central bank in the face of a contracting money supply is to lower interest rates, but

238. See *supra* text accompanying notes 161–163 (discussing bubbles in virtual currencies). Bubbles are, by nature, unsustainable: eventually “investors no longer think prices will continue to rise and therefore no longer see a good reason to hold” the asset, and both demand and prices fall. ROBERT J. SHILLER, *IRRATIONAL EXUBERANCE* 61 (2000).

239. See ELWELL ET AL., *supra* note 35, at 8, for a list of sizable thefts of Bitcoin.

240. See, e.g., Nathaniel Popper, *A Bitcoin Believer’s Crisis of Faith*, N.Y. TIMES: DEALBOOK (Jan. 14, 2016), <http://www.nytimes.com/2016/01/17/business/dealbook/the-bitcoin-believer-who-gave-up.html>. The possibility of factional warfare is not just theoretical—there is currently something of a civil war unfolding amongst prominent Bitcoin developers over the direction that the Bitcoin algorithm should take, which may ultimately undermine Bitcoin. *Id.*

241. Trautman, *supra* note 235, at 14.

242. Tu & Meredith, *supra* note 160, at 338.

243. Even in the absence of any panic, should a significant percentage of the population come to use Bitcoin on a regular basis, the inherently deflationary nature of Bitcoin could be problematic for broader economic growth. Paul Krugman, Editorial, *Golden Cyberfettlers*, N.Y. TIMES (Sept. 7, 2011, 12:20 AM), <http://krugman.blogs.nytimes.com/2011/09/07/golden-cyberfettlers/>. Businesses and individuals are often reluctant to spend their money when it is likely to have greater purchasing power later on. *Id.* Without a reliable currency to facilitate transactions and payments, the scope of transacting would be limited to other, potentially geographically constrained strategies of exchange. For a discussion of the consequences of limited amounts of currency in the Middle Ages, see Desan, *supra* note 169, at 377, 396.

244. Ricks, *supra* note 15, at 106.

“a widespread substitution of central bank money by privately issued virtual currency could significantly reduce the size of central banks’ balance sheets, and thus also their ability to influence the short-term interest rates.”²⁴⁵ Central banks would therefore be limited in their ability to respond to a panic regarding a widely used decentralized virtual currency.²⁴⁶

2. Scenario 2: Financial Institutions and Virtual Currencies

The world’s largest financial institutions are often described as “too big to fail”: there is an expectation that governments will not permit the failure of these large and interconnected entities because such failure would cripple the financial system—with macroeconomic consequences.²⁴⁷ Despite legislative reforms enacted in the wake of the Financial Crisis, there is a general consensus that this “too big to fail” problem persists, which is highly problematic from a financial stability perspective.²⁴⁸ Such institutions are incentivized to engage in riskier behavior, knowing that they will reap any profits from the risks they take, and benefit from government intervention that will protect them and absorb their losses should those risks turn out badly.²⁴⁹ Any development, then, that increases the systemic importance of these large institutions, and confers a competitive advantage that will allow them to grow even larger, is unwelcome from a financial stability perspective. The risks associated with widespread use of a virtual currency discussed in Scenario 1 will be an order of magnitude more troubling if, as explored in this Scenario 2, large financial institutions were to

245. ECB 2012, *supra* note 37, at 35.

246. Because decentralized virtual currencies are not administered by any institution, there would also be no locus for other types of central bank assistance (such as the provision of funds through a “lender of last resort” program). *See id.* at 38–40.

247. BASEL COMM. ON BANKING SUPERVISION, BANK FOR INT’L SETTLEMENTS, BASEL III: A GLOBAL REGULATORY FRAMEWORK FOR MORE RESILIENT BANKS AND BANKING SYSTEMS 7 (2010, rev. 2011), <http://www.bis.org/publ/bcbs189.pdf> (“[E]xcessive interconnectedness among systemically important banks also [transmits] shocks across the financial system and economy.”); *see also* SIMON JOHNSON & JAMES KWAK, 13 BANKERS: THE WALL STREET TAKEOVER AND THE NEXT FINANCIAL MELTDOWN 184 (2010).

248. Simon Johnson, *The Myth of The Resolution Authority*, N.Y. TIMES (Mar. 31, 2011, 5:00 AM), <http://economix.blogs.nytimes.com/2011/03/31/the-myth-of-resolution-authority/>. Despite reforms, there is no real credible alternative to a bail-out or an unwieldy bankruptcy of large financial institutions with international operations. *Id.* The continuing lower cost of funding for systemically important institutions reflects market support for the view that some institutions remain “too big to fail.” *See* Viral V. Acharya et al., *The End of Market Discipline? Investor Expectations of Implicit State Guarantees* 20 (May 1, 2016) (unpublished manuscript), <http://ssrn.com/abstract=1961656>.

249. *See* William A. Lovett, *Moral Hazard, Bank Supervision and Risk-Based Capital Requirements*, 49 OHIO ST. L.J. 1365, 1365 (1989) (“If governments and modern nations do not allow most banks to [fail], how can the leaders and managements of banking institutions be disciplined and avoid unduly risky, negligent, or adventurous lending policies (or simply poor asset-liability management)?”).

become significantly exposed to a virtual currency. To be clear, the virtual currency in question need not be Bitcoin—for the purposes of this thought experiment, there are risks if the financial industry starts to develop, or invest heavily in, any virtual currency that is not also a sovereign currency.²⁵⁰

Financial institutions may wish to invest in virtual currencies purely to speculate on their rate of exchange as against sovereign currencies. Or they may wish to invest in them as assets that are expected to appreciate in value in the long-term. In either instance, a dramatic reduction in the value of a virtual currency (as outlined in Scenario 1) is likely to have a pernicious impact on any financial institution that is heavily exposed to that virtual currency. Presumably there would not be an exact match between the financial institution's virtual currency-denominated holdings and its virtual currency-denominated obligations.²⁵¹ In a panic, the financial institution would no longer be able to exchange the virtual currency for sovereign currencies (at least not at the expected rates)—and widespread attempts to exchange the virtual currency would put further downward pressure on its value. Instead, the financial institution would either have to sell other assets to raise the necessary sovereign currencies to discharge its obligations. This dynamic mirrors Mishkin's explanation of how a foreign exchange crisis can precipitate a banking crisis²⁵²: if multiple financial institutions are similarly situated (which is not unlikely, given that financial institutions tend to herd into the same investments),²⁵³ then they will all be forced to raise sovereign currency at the same time. If multiple financial institutions start to sell their other, non-virtual currency assets to raise sovereign currency, this will depress the value of those other assets market-wide—a concept Brunnermeier calls a “fire sale externality.”²⁵⁴ Of course, financial institutions could also try to borrow sovereign currencies to satisfy their obligations, but borrowing would likely be difficult given that a financial institution with exposure to large amounts of virtual currency would have a shrinking balance sheet and would therefore be seen as a high default risk.²⁵⁵ Furthermore, the assets that financial institutions might propose to

250. For example, Goldman Sachs recently filed a patent for a new virtual currency called SETLCoin. Ian Kar, *Goldman Sachs Wants to Create Its Own Version of Bitcoin*, QUARTZ (Dec. 2, 2015), <http://qz.com/563967/goldman-sachs-wants-to-create-its-own-version-of-bitcoin/>.

251. If the virtual currency is being held by the financial institution as an asset in expectation of appreciation, the institution would be holding more of the virtual currency than it needs to satisfy its obligations denominated in that virtual currency.

252. Mishkin, *supra* note 18, at 1523–24.

253. Charles K. Whitehead, *Destructive Coordination*, 96 CORNELL L. REV. 323, 327 (2011).

254. Markus K. Brunnermeier, *Deciphering the Liquidity and Credit Crunch 2007–2008*, 23 J. ECON. PERSP. 77, 94 (2009).

255. Mishkin, *supra* note 18, at 1523–24.

use as collateral for the loans will be less valuable in a fire sale environment, further limiting their ability to borrow.²⁵⁶

Additional concerns arise if financial institutions, rather than purchasing virtual currencies directly, devise new and indirect ways of gaining exposure to those assets—the number and complexity of transmission mechanisms between those virtual currencies and the rest of the financial system could increase as a result. For example, SecondMarket has already developed a mutual fund known as the Bitcoin Investment Trust, which is “an open-ended trust that is invested exclusively in bitcoin.”²⁵⁷ TeraExchange has developed (and the CFTC has approved) swap contracts that reference bitcoins.²⁵⁸ Because an institution is not required to own a unit of virtual currency in order to enter into a swap contract that references that virtual currency,²⁵⁹ financial institutions that are not comfortable investing in virtual currencies directly will be able to use this more familiar derivative format to gain exposure to them. Swaps therefore allow for broader, synthetic exposure to virtual currencies, potentially magnifying the impact of a change in the value of a unit of such virtual currency.²⁶⁰

A worst-case scenario, from a financial stability perspective, would involve financial institutions using virtual currencies as collateral for interbank repo agreements, which would make such virtual currencies integral to the interbank funding process.²⁶¹ If the virtual currency were, for any reason, to cease to constitute acceptable collateral for repo agreements (perhaps as a result of one of the possible trigger events discussed in Scenario 1), this could quickly damage financial stability. There is already a maturity mismatch between a financial institution’s long-term assets and short-term repo funding—and if the institution becomes unable to renew its short-term funding for some reason, this can result in a liquidity crunch.²⁶² This vulnerability to liquidity crunches becomes heightened when there is also a

256. Gorton & Metrick, *supra* note 223, at 279.

257. *Frequently Asked Questions*, GRAYSCALE, <https://grayscale.co/faq/> (last visited May 17, 2017).

258. Douwe Miedema, *Bitcoin Gets Boost as Watchdog Approves First Swap*, REUTERS, Sept. 12, 2014, <http://www.reuters.com/article/us-usa-bitcoin-cftc-idUSKBN0H71FU20140912> (“The swap locks in the dollar value of a given bitcoin amount, and the difference is settled in dollars when the contract expires.”).

259. See John Geanakoplos, *Solving the Present Crisis and Managing the Leverage Cycle* (Dec. 22, 2009) (unpublished manuscript), http://fcic-static.law.stanford.edu/cdn_media/fcic-testimony/2010-0226-Geanakoplos.pdf. The Financial Crisis Inquiry Commission was an independent commission created by statute to examine the causes of the Financial Crisis. See *History of the Commission*, FIN. CRISIS INQUIRY COMM’N, <https://fcic.law.stanford.edu/about/history> (last visited May 17, 2017).

260. Geanakoplos, *supra* note 259.

261. See *supra* text accompanying notes 86–91 (discussing the repo markets and their failure during the Financial Crisis).

262. Allen, *supra* note 87, at 145–46.

currency mismatch, and no working market mechanism to convert that currency.²⁶³ As a result, institutions that rely heavily on virtual currency-backed repo agreements could quickly find themselves starved of short-term funding, imperiling their liquidity, and then their solvency, in short order.²⁶⁴ If this were to happen on a systemic scale, then interbank lending would seize up entirely because of a general lack of confidence in financial institutions and their collateral—and if interbank lending seizes up, then the flow of credit to the economy at large will also seize.²⁶⁵

If such an eventuality were threatened, government intervention might be required in the form of bailouts or liquidity assistance for institutions with significant exposure to the virtual currency (ironically, then, the virtual currency will have invited the very state intervention that the developers of those currencies were so pointedly trying to avoid).²⁶⁶ If the experience of 2008 is anything to go by, such intervention would most likely take the form of emergency swap lines between central banks and the largest financial institutions, pursuant to which the central bank would provide the more liquid, sovereign-backed currency in exchange for the troubled virtual currency²⁶⁷ (smaller institutions are more likely to be permitted to fail²⁶⁸). Such swap agreements would address the liquidity crunches experienced by financial institutions, but they would also expose the central bank to the risk that such institutions might be unable to return sovereign currency to the central bank at the conclusion of the swap agreement, thus permanently saddling the central bank with worthless virtual currency.

Admittedly, at present, the thought of virtual currencies serving as collateral for repo transactions seems farfetched. Typically, “safe” assets like government obligations serve as collateral for these types of transactions.²⁶⁹ Virtual currencies would certainly not be “safe” in this sense. After all, a unit of virtual currency, as an asset, does not represent a direct claim on any

263. Baker, *supra* note 33, at 615–16.

264. Ricks, *supra* note 15, at 77, 91.

265. Allen, *supra* note 87, at 146–47.

266. *See supra* note 154 and accompanying text.

267. Baker, *supra* note 33, at 621–22. In 2008, the Federal Reserve made USD available to other central banks around the world, and those other central banks then lent those U.S. dollars to the financial institutions located in their jurisdictions that had significant USD-denominated obligations. *Id.* Those institutions faced severe liquidity crunches once their usual ways of borrowing or buying USD had been disrupted, just as an institution that could not convert its virtual currency holdings in order to discharge its USD-denominated obligations would. *Id.* at 613.

268. *Bank Failures in Brief: 2009*, FDIC, <https://www.fdic.gov/bank/historical/bank/2009/index.html> (last visited May 17, 2017). In 2009, for example, there were 140 small bank failures. *Id.*

269. Viral V. Acharya & T. Sabri Öncü, *The Dodd-Frank Wall Street Reform and Consumer Protection Act and a Little Known Corner of Wall Street: The Repo Market*, NYU STERN (July 16, 2010, 6:22 PM), <http://w4.stern.nyu.edu/blogs/regulatingwallstreet/2010/07/the-doddfrank-wall-street-refo.html#more>.

other person (government or otherwise). A virtual currency gains value purely from the expectation that others will also value it.²⁷⁰ However, institutional demand for reliably priced assets that can serve as collateral for cheap short-term funding has spurred the growth of other less-than-reliable asset classes (such as mortgage-backed securities) in the past,²⁷¹ and may do so again in the future. It is possible that through ubiquity and standardization, the volatility of a virtual currency might be sufficiently moderated such that it comes to be seen as a sufficiently reliable store of value that can serve as collateral for repo transactions—the same unit of virtual currency can then be re-pledged (potentially *ad infinitum*), and in this way, become a systemically important means of exchange amongst financial institutions.²⁷²

One way to reduce the volatility of the price of a virtual currency would be for it to achieve a high level of acceptance for retail transactions—there would then be a deep market for it, and liquidity is generally considered a characteristic of “safe” assets.²⁷³ Large financial institutions might therefore develop, and lend their reputations to, a virtual currency, in order to encourage others to use that virtual currency as a transaction mechanism (and in doing so, make Scenario 1 more likely).²⁷⁴ They might also use their considerable lobbying power to seek to align the U.S. tax treatment of virtual currencies with the position in the European Union in order to improve the ability of virtual currencies to act as a transaction mechanism.²⁷⁵ Financial institutions seeking to promote their virtual currency might even go a step further and fix the exchange rate of the virtual currency to that of a sovereign currency, like the USD (a practice often referred to as “pegging”²⁷⁶). This would certainly ensure a more stable value for the

270. Krugman, *supra* note 17.

271. Gorton & Metrick, *supra* note 223, at 275.

272. See Gorton, *supra* note 89 and accompanying text.

273. Anna Gelpern & Erik F. Gerding, *Inside Safe Assets*, 33 YALE J. ON REG. 363, 374 (2016).

274. See *supra* Part III.B.1.

275. At least at present, transactions consummated with bitcoins in the United States are problematic from a tax perspective, as the IRS has indicated that it will treat Bitcoin as property, rather than currency for taxation purposes. I.R.S. Notice 2014-21, 2014-16 I.R.B. 938 (Apr. 14, 2014). This means that “[w]ith each exchange of currency, the user must calculate gain or loss based on the rise and fall of the cryptocurrency against the dollar” and any such gains will be taxable. Fairfield, *supra* note 23, at 837. This makes dealings in bitcoins cumbersome. Conversely, the European Union has ruled that transactions effected with bitcoins “would not be taxed, but would instead be treated like currency transactions.” Nathaniel Popper, *Bitcoin Surges, Emerging From a Lull in Interest*, N.Y. TIMES: DEALBOOK (Nov. 4, 2015), http://www.nytimes.com/2015/11/05/business/dealbook/value-of-bitcoin-surges-emerging-from-a-lull-in-interest.html?_r=0.

276. “Pegging” describes a wide variety of practices related to the setting of exchange rates: “There is considerable diversity in the exchange rate regimes of developing and transition countries, from very hard currency pegs to relatively free floats and with many variations in between.” *Exchange Rate Regimes in an Increasingly Integrated World Economy*, INT’L MONETARY FUND (June 2000), <https://www.imf.org/external/np/exr/ib/2000/062600.htm#1>.

virtual currency, making it look more like an attractive “safe” asset—at least until the financial institutions administering the virtual currency became unable to maintain sufficient reserves of the sovereign currency to sustain the peg.²⁷⁷ Depegging the exchange rate of the virtual currency from that of a sovereign currency would inevitably invite panic about the value of the virtual currency, causing it to lose any status as a “safe” asset.

Even putting aside the fragility that would result from using virtual currencies as collateral for interbank repo transactions, it would be an unwelcome development if virtual currencies created and administered by “too big to fail” institutions came to dominate everyday transactions. By controlling access to such virtual currencies, these financial institutions could crowd out smaller institutions from the payments sphere.²⁷⁸ Furthermore, being the primary suppliers of an instrument regularly used by the broader populace to carry out transactions would only increase the already considerable political clout of the largest financial institutions. For example, when persons who regularly transact in the virtual currency are ready to pay their taxes, they would need to convert their funds into a sovereign currency. To the extent that financial institutions control the rate at which the virtual currency could be converted into the sovereign currency and vice versa, this would allow financial institutions to dictate the amount of money allowed to circulate, and circumscribe the ability of the central bank to conduct monetary policy.²⁷⁹ National governments would become increasingly beholden to these financial institutions as a result; notwithstanding any desire to improve payment systems using virtual currency technologies, such eventualities should be avoided.

IV. A FINANCIAL STABILITY-ORIENTED APPROACH TO VIRTUAL CURRENCIES AND PAYMENTS INNOVATION

A. *Current Approaches to Regulation of Virtual Currencies*

The previous Part discussed the improvements that virtual currencies could make to the processing of payments. However, for those improvements to have a significant impact, virtual currencies would need to be widely used. On that scale, virtual currencies could become a shadow currency that could threaten financial stability. The systemic risks posed by virtual currencies have not been the focus of regulatory efforts to date,

277. In discussing countries that seek to fix their exchange rate by pegging the value of their currency to that of a foreign country, the IMF has noted that those “committed to supplying or redeeming its monetary liabilities at a fixed exchange rate . . . implies that it must hold foreign reserves at least equal to its total monetary liabilities.” *Id.*

278. *See infra* Part IV.

279. *See supra* note 245 and accompanying text.

though. Instead, most of the regulatory focus on virtual currencies has been concerned with their ability to facilitate money laundering and criminal activities, and to defraud or otherwise harm consumers.

Money laundering and the facilitation of criminal activity are perhaps foremost amongst these concerns. The Financial Action Task Force (“FATF”), an international body that promulgates standards for avoiding money-laundering and terrorist financing, has raised a number of concerns about virtual currencies, including that many virtual currency protocols do not require or provide any identification of their participants and thus can be used to facilitate anonymous transactions for criminals and terrorists.²⁸⁰ The FATF is also concerned about the decentralized nature of many virtual currencies, which ensures that there is no central administrator who can be targeted for investigation.²⁸¹ In addition to concerns about criminal activity, consumer protection issues loom large in debates over virtual currencies: fraudsters seem to be taking advantage of the buzz over Bitcoin to swindle novice investors.²⁸² Even in the absence of fraud, consumers using Bitcoin need to be aware of its high volatility and susceptibility to theft.²⁸³

Because the decentralized nature of virtual currencies ensures that such currencies have no operators to regulate, much of the regulatory action to date has taken the form of warnings to users. In Europe, warnings have been issued by German, French, Dutch, and Belgian authorities about the volatility of unregulated virtual currencies, and possible cybersecurity issues that may affect users of such virtual currencies.²⁸⁴ In the United States, the Securities and Exchange Commission (“SEC”), the Financial Industries Regulatory Authority (“FINRA”), and the Consumer Financial Protection Bureau (“CFPB”) have all issued warnings to investors about the risks inherent in virtual currency investments.²⁸⁵ In addition to these warnings, the SEC and the Commodity Futures Trading Commission (“CFTC”) have also brought some Bitcoin-related enforcement actions, but these enforcement

280. Financial Action Task Force, *supra* note 28, at 9.

281. *Id.* at 10 (noting that transactions consummated with the virtual currency “may seem to exist in a digital universe entirely outside the reach of any particular country”).

282. *Investor Alert: Bitcoin and Other Virtual Currency-Related Investments*, SEC. & EXCH. COMM’N (May 7, 2014), http://www.sec.gov/oiea/investor-alerts-bulletins/investoralertsia_bitcoin.html.

283. *Id.*

284. ECB 2015, *supra* note 45, at 30.

285. See *Bitcoin: More than a Bit Risky*, FIN. INDUS. REG. AUTH., <http://www.finra.org/investors/alerts/bitcoin-more-bit-risky> (last updated May 7, 2014); *Investor Alert: Bitcoin and Other Virtual Currency-Related Investments*, *supra* note 282; *Risks to Consumers Posed by Virtual Currencies*, CONSUMER FIN. PROT. BUREAU (Aug. 2014), http://files.consumerfinance.gov/f/201408_cfpb_consumer-advisory_virtual-currencies.pdf.

actions are responding to problems with virtual currencies *after* they have occurred.²⁸⁶

To date, the most high profile attempts at *proactive* regulation of virtual currencies have come from FinCEN and the New York Department of Financial Services (“NYDFS”). One of the most challenging aspects for both of these regulatory agencies has been identifying the persons who should be regulated. In March of 2013, FinCEN issued guidance on the application of Bank Secrecy Act regulations to virtual currencies.²⁸⁷ In that guidance, FinCEN determined that exchangers²⁸⁸ and administrators²⁸⁹ of virtual currencies are “money services businesses” who are therefore required to register and comply with FinCEN’s anti-money laundering regulations.²⁹⁰ Users (including miners) who obtain the virtual currency for the purpose of purchasing goods and services, are not.²⁹¹ In June 2015, the NYDFS finalized rules for virtual currency operations.²⁹² Although the rules are colloquially known as the “BitLicense,” these rules apply to virtual currencies generally.²⁹³ The BitLicense requires registration and supervision of anyone carrying out a “Virtual Currency Business Activity,”²⁹⁴ which is defined to include:

- (1) receiving virtual currency for transmission or transmitting virtual currency, except where the transaction is undertaken for non-financial purposes and does not involve the transfer of more than a nominal amount of virtual currency;
- (2) storing, holding, or maintaining custody or control of virtual currency on behalf of others;
- (3) buying and selling virtual currency as a customer business;
- (4) performing exchange services as a customer busi-

286. See, e.g., Press Release, Commodity Futures Trading Comm’n, CFTC Settles with TerraExchange LLC, a Swap Execution Facility, for Failing to Enforce Prohibitions on Wash Trading and Prearranged Trading in Bitcoin Swap (Sept. 24, 2015), <http://www.cftc.gov/PressRoom/PressReleases/pr7240-15>; Press Release, Sec. & Exch. Comm’n, SEC Sanctions Operator of Bitcoin-Related Stock Exchange for Registration Violations (Dec. 8, 2014), <http://www.sec.gov/News/PressRelease/Detail/PressRelease/1370543655716>; Press Release, Sec. & Exch. Comm’n, SEC Charges Texas Man With Running Bitcoin-Denominated Ponzi Scheme (July 23, 2013), <http://www.sec.gov/News/PressRelease/Detail/PressRelease/1370539730583>.

287. U.S. DEP’T OF THE TREASURY, *supra* note 64.

288. *Id.* at 2 (“An *exchanger* is a person engaged as a business in the exchange of virtual currency for real currency, funds, or other virtual currency.”).

289. *Id.* (“An *administrator* is a person engaged as a business in issuing (putting into circulation) a virtual currency, and who has the authority to redeem (to withdraw from circulation) such virtual currency.”).

290. *Id.*

291. *Id.*

292. See N.Y. COMP. CODES R. & REGS. tit. 23 §§ 200.01–200.22 (West 2017).

293. See *id.* § 200.2 (defining the term “virtual currency”).

294. See *id.* §§ 200.3, 200.7, 200.13, 200.14.

ness; or (5) controlling, administering or issuing a virtual currency.²⁹⁵

At this stage, it is not particularly clear which businesses would fit within these categories, but in its analysis of the BitLicense, law firm Davis Polk has suggested that regulated businesses would include exchanges, dealers, providers of wallets, and processors of payments (and may also include mutual funds that invest in virtual currencies).²⁹⁶ Importantly, though, most consumers and merchants will not be regulated by the BitLicense.²⁹⁷

Any person required to register for a BitLicense is required to implement consumer protection measures,²⁹⁸ establish requirements for custody and protection of customer assets,²⁹⁹ and develop comprehensive cybersecurity and anti-money laundering programs.³⁰⁰ The one provision of the BitLicense that relates directly to financial stability concerns is Section 200.8, which requires supervised entities to “maintain at all times such capital in an amount and form as the superintendent determines is sufficient to ensure the financial integrity of the [supervised entity] and its ongoing operations based on an assessment of the specific risks applicable to each [supervised entity].”³⁰¹ Capital requirements are intended to create a “cushion” of liquid funds at an institution so that it is better able to absorb losses and will therefore be less likely to fail or require public support—or to contaminate other institutions that have exposure to it.³⁰² The BitLicense capital requirement set out in Section 200.8 could potentially limit contagion from the failure of a virtual currency-related business, but it is highly discretionary—much more discretionary than the capital requirements for banks.³⁰³ Depending on how it is applied, the BitLicense capital requirement may turn out to be insufficient to prevent failure of the businesses involved.

295. *Id.* § 200.2(q).

296. DAVIS POLK & WARDWELL LLP, NEW YORK’S FINAL “BITLICENSE” RULE: OVERVIEW AND CHANGES FROM JULY 2014 PROPOSAL 11–19 (2015).

297. *Id.* at 2.

298. R. & REGS. tit. 23 §§ 200.18; 200.19; 200.20. Consumer protection measures include disclosures relating to risk and rules on advertising, as well as including anti-fraud provisions and complaints procedures. *See id.*

299. *Id.* § 200.9.

300. *Id.* §§ 200.12(a), 200.15, 200.16, 200.17.

301. *Id.* § 200.8.

302. Allen, *supra* note 87, at 129, 132.

303. For a discussion of these requirements, see *id.* at 127–33. Capital regulations such as Section 200.8 of the BitLicense will be administered by state regulators, and state regulators have been criticized as having a limited jurisdictional perspective that renders them ill-equipped to deal with systemic risks that exist at a national or international level. *See* Brief for Scholars of Insurance Regulation as Amici Curiae Supporting Defendant Financial Stability Oversight Council, *MetLife, Inc. v. Financial Stability Oversight Council*, Civil Action No. 15-45 (RMC), 2015 WL 3422512, at *1 (D.D.C. May 22, 2015).

Other than this one capital provision, the focus of the BitLicense is clearly on crime and investor protection, rather than on financial stability.

In addition to the BitLicense, other attempts at direct *ex ante* regulation of virtual currencies may be forthcoming in the United States. In particular, virtual currencies may be proactively regulated as securities or commodities.³⁰⁴ The SEC has indicated that, depending on the facts and circumstances, it may regulate virtual currencies as securities in some situations.³⁰⁵ The CFTC has also ruled that Bitcoin is a “commodity,” as defined in the Commodity Exchange Act, and thus falls within its jurisdiction.³⁰⁶ It is also possible that the CFPB could determine that certain virtual currencies fall within the definition of “consumer financial products and services,” and are thus within its purview.³⁰⁷ However, not one of these three agencies has a clear mandate to monitor virtual currencies (or any other financial instrument for that matter) from a financial stability perspective.³⁰⁸

B. Financial Stability-Oriented Approaches to Virtual Currency Regulation

The Financial Stability Oversight Council (“FSOC”) is the only United States agency with a mandate to “identify gaps in regulation that could pose risks to the financial stability of the United States”³⁰⁹ and to “respond to emerging threats to the stability of the U.S. financial system.”³¹⁰ In its 2015 Annual Report, the FSOC mentioned virtual currencies, noting that:

At this time, digital currencies do not appear to pose financial stability concerns, as the extent to which digital currencies are used is extremely small, and their connection to the broader financial system is limited. Nonetheless, the potential applications and uses of the peer-to-peer network for transferring value in the

304. Brito et al., *supra* note 159, at 155.

305. Letter from Mary Jo White, Chairman, SEC, to Sen. Thomas R. Carper, Chairman, Comm. on Homeland Security and Governmental Aff. (Nov. 12, 2013), <http://online.wsj.com/public/resources/documents/VCurrenty111813.pdf>.

306. Press Release, Commodity Futures Trading Comm’n, CFTC Orders Bitcoin Options Trading Platform Operator and its CEO to Cease Illegally Offering Bitcoin Options and to Cease Operating a Facility for Trading or Processing of Swaps Without Registering (Sept. 17, 2015), <http://www.cftc.gov/PressRoom/PressReleases/pr7231-15>.

307. See Dodd-Frank Act, Pub. L. No. 111-203, § 805, 124 Stat. 1376, 1809 (2010) (now codified at 12 U.S.C. § 5491 (2012)) [hereinafter Dodd-Frank Act].

308. Hilary J. Allen, *Putting the “Financial Stability” in Financial Stability Oversight Council*, 76 OHIO ST. L.J. 1087, 1129 (2015).

309. Dodd-Frank Act § 112, 125 Stat. at 1394.

310. FINANCIAL STABILITY OVERSIGHT COUNCIL, 2015 ANNUAL REPORT i (2015), <http://www.treasury.gov/initiatives/fsoc/studies-reports/Documents/2015%20FSOC%20Annual%20Report.pdf>.

payment and financial service industry warrant continued monitoring.³¹¹

It is heartening that the FSOC is keeping an eye on potential systemic risks posed by virtual currencies; however, if it does detect any such risks, the FSOC faces severe structural limitations on its ability to actually respond to such risks.³¹² The FSOC is, in the end, only a council of regulators rather than a regulatory body with its own substantial staff and budget—as a result, any meaningful response to systemic risks posed by virtual currencies will need to come from one of the financial regulatory agencies represented on the FSOC.³¹³

The Federal Reserve is currently the most proactive member of the FSOC when it comes to threats to the stability of the financial system as a whole.³¹⁴ It also has the authority under Section 805 of Dodd-Frank to regulate systemically important payment systems.³¹⁵ The Federal Reserve therefore seems the best candidate to respond to any threats posed by virtual currencies, but Federal Reserve Chair Janet Yellen has said on record:

Bitcoin is a payment innovation that's taking place outside the banking industry. To the best of my knowledge there's no intersection at all, in any way, between Bitcoin and banks that the Federal Reserve has the ability to supervise and regulate. So the Fed doesn't have authority to supervise or regulate Bitcoin in any way.³¹⁶

There is a real possibility then, that there will be no official United States response to the systemic risks that arise with respect to virtual currencies.³¹⁷ Turning to Europe, although the ECB is currently monitoring the systemic risks posed by virtual currencies,³¹⁸ it is not at all clear that it would have any legal authority to take regulatory action with respect to

311. FINANCIAL STABILITY OVERSIGHT COUNCIL, *supra* note 310, at 114.

312. Allen, *supra* note 308, at 1120–38.

313. *Id.* at 1120.

314. *Id.* at 1121–22.

315. Dodd-Frank Act § 805, 124 Stat. at 1809.

316. Brito et al., *supra* note 159, at 181.

317. Even though the Federal Reserve has no mandate to regulate virtual currencies, members of the public do not pay attention to the niceties of a central bank's jurisdictional boundaries—in the public's eyes, the central bank is likely to bear responsibility for any systemic crash. A failure of a widely used virtual currency could imperil confidence in the central bank, which could adversely affect its ability to govern the more traditional money supply and payment systems, as the ability of central banks to effect policy is in part contingent upon the trust and confidence that the market reposes in the institution itself. *See* Holmes, *supra* note 100, at 38.

318. ECB 2012, *supra* note 37, at 37, 40; ECB 2015, *supra* note 45, at 4.

those systemic risks.³¹⁹ There are, however, other bodies in the European Union (at the national and supranational level) that do have a financial stability mandate, and they may choose to take up the issue of systemic risk posed by virtual currencies.³²⁰

Putting aside issues of regulatory authority, the remainder of this Part will consider the form that financial stability-oriented regulation of virtual currencies might take. In some ways, it might be superficially appealing to embrace virtual currencies—after all, much of the post-Financial Crisis scholarship on financial stability laments the existence of systemically important (or, more colloquially, “too big to fail”) financial institutions, which are so large and interconnected that their failure threatens to drag the entire financial system into chaos.³²¹ In principle, no financial institution, let alone any institution that is “too big to fail,” need be involved in the payments effected by virtual currencies,³²² so virtual currencies might appear at first blush to reduce systemic risk. However, as this Article has explored, a widely used decentralized virtual currency would not be benign from a financial stability perspective, particularly because a number of linkages between virtual currencies and traditional financial institutions are developing.³²³ Furthermore, we cannot expect virtual currencies to self-regulate to avoid systemic risk. There is little incentive for any developer of a virtual currency to even think about the instability that such currency could cause because financial stability is a benefit that accrues to society as a whole, and

319. Although the ECB seems to have been more aggressive in pursuing financial stability since 2012, its legal authority to do so is not entirely clear. ECB 2015, *supra* note 45, at 4. As ECB Vice President Vítor Constâncio recently said:

After the crisis, there has been a trend, albeit without legislative expression, to attribute an explicit goal of financial stability to central banks. Nevertheless, in order to be justified, central banks have to be entrusted with a new set of tools of a macro-prudential nature, that can be applied to the financial system as a whole.

Vítor Constâncio, Vice President, European Central Bank, Speech at the Warwick Economics Summit: Financial Stability Risks, Monetary Policy and the Need for Macro-Prudential Policy (Feb. 13, 2015), <https://www.ecb.europa.eu/press/key/date/2015/html/sp150213.en.html>.

320. *See, e.g.*, Financial Services and Markets Act 2000, c.8 (U.K.), http://www.legislation.gov.uk/ukpga/2000/8/pdfs/ukpga_20000008_en.pdf. At the national level, for example, the U.K.’s Prudential Regulation Authority is mandated to seek “to ensure that the business of PRA-authorized persons is carried on in a way which avoids any adverse effect on the stability of the UK financial system” and “to minimise the adverse effect that the failure of a PRA-authorized person could be expected to have on the stability of the UK financial system.” *Id.* At the European level, the European Systemic Risk Board, established in 2010, is a “Union-level body . . . with a mandate to oversee risk in the financial system.” *Mission & Establishment*, EUROPEAN SYSTEMIC RISK BOARD, <http://www.esrb.europa.eu/about/background/html/index.en.html> (last visited May 17, 2017).

321. *See, e.g.*, JOHNSON & KWAK, *supra* note 247, at 214–17; Arthur E. Wilmarth, *Reforming Financial Regulation to Address the Too-Big-To-Fail Problem*, 35 BROOK. J. INT’L. L. 707, 707 (2010).

322. Plassaras, *supra* note 170, at 379.

323. *See supra* Part IV.B.

therefore neither the developer nor users of the currency can profit from generating it.³²⁴ Even assuming that such individuals did altruistically wish to avoid harming financial stability, they would be unable to do so without a broader understanding of, and significant information about, all the other moving parts in the financial system.³²⁵

It is for these reasons that we need regulation to address financial stability. Regulating to minimize systemic risks in a highly complex financial system, however, is difficult at the best of times.³²⁶ This problem is compounded when dealing with the systemic risks posed by virtual currencies because of the decentralized nature of such currencies: as with the anti-money laundering and anti-fraud regulation discussed in the previous Part, it can be difficult to identify the entities to be regulated.³²⁷ Even the most innovative approaches to dealing with the systemic risks posed by shadow banking tend to focus on the institutions that are providing the shadow banking services,³²⁸ but there are no obvious institutional candidates for regulation in the context of a decentralized virtual currency.

To the extent that we are concerned about problems with a decentralized virtual currency contaminating the more traditional financial industry (as explored in Scenario 2), then regulation could focus on members of that traditional financial industry. It would be worthwhile, as the European Banker's Association has recommended, to implement policies that discourage financial institutions from trading and holding virtual currencies.³²⁹ Such policies might include requiring financial institutions to hold high levels of capital against their direct and indirect virtual currency exposures,³³⁰ or prohibiting financial institutions from issuing obligations denominated in virtual currencies.³³¹ Alternatively, there could be a prudential requirement mandating that banks match their virtual currency liabilities with a stock of virtual currency assets.³³² However, if a decentralized virtual currency were to become widely used, its failure would have ramifications independent of any impact on financial institutions (as discussed in Scenario 1), so the

324. Allen, *supra* note 226, at 184.

325. *Id.* at 184–85.

326. *Id.* at 192–93.

327. *See supra* Part V.A.

328. *See, e.g.,* Morgan Ricks, *Money and (Shadow) Banking: A Thought Experiment*, 31 REV. BANKING & FIN. L. 731, 731 (2012).

329. EUROPEAN BANKING AUTHORITY, *EBA OPINION ON VIRTUAL CURRENCIES 5–6* (2014), <https://www.eba.europa.eu/documents/10180/657547/EBA-Op-2014-08+Opinion+on+Virtual+Currencies.pdf>.

330. *See* Hilary J. Allen, *Let's Talk About Tax: Fixing Bank Incentives to Sabotage Stability*, 18 FORD. J. CORP. & FIN. L. 821, 828–32 (2013) (discussing capital requirements).

331. *See* Morgan Ricks, *A Simpler Approach to Financial Reform: Financial Instability Is a Problem of Monetary System Design*, 36 REGULATION 36, 39 (2014).

332. Mishkin, *supra* note 18, at 1524.

measures discussed in this paragraph, while important, might not be sufficient.

To help address the concerns raised in both Scenarios 1 and 2, regulators could also give thought *in advance* to the type of emergency measures that might need to be deployed in the event that a widely used virtual currency system does experience a crisis. The decentralized nature of virtual currencies does not mean that the systemic risks they pose have disappeared, only that such risks have become so dispersed that it is difficult for *ex ante* regulation to address them. The result is likely to be an increased need for *ex post* intervention,³³³ and it would be preferable if the intervention plan were well thought-out, rather than a messy, *ad hoc* plan developed in the heat of a crisis. However, purely *ex post* solutions are often costly, as well as limited in their efficacy.³³⁴

To avoid these eventualities, but nonetheless encourage the improvement of payments infrastructure, the ideal approach would be for decentralized virtual currencies to be marginalized, but for distributed ledger technology to be developed for use in conjunction with payments denominated in sovereign currencies. In other words, the goal is to find a way to cabin the provision of payment services *within* the regulated financial industry, so that they can be regulated *ex ante*. One way to try to achieve this would be to ban virtual currencies.³³⁵ While it would be highly impractical and prohibitively expensive to enforce such a ban against the *users* of a virtual currency,³³⁶ it might perhaps be more feasible to target ancillary services that facilitate the use of the virtual currency (a whole infrastructure of Bitcoin-related services has flourished in recent years, including Bitcoin exchanges, online wallets, and Bitcoin ATMs).³³⁷ Internet service providers could perhaps be pressured to block websites used to transact in virtual currencies³³⁸—although, admittedly, blocking websites is like playing “whack-a-mole,” and new ones will likely spring up.³³⁹ The banning jurisdiction’s

333. See Iman Anabtawi & Steven L. Schwarcz, *Regulating Ex Post: How Law Can Address the Inevitability of Financial Failure*, 92 TEX. L. REV. 75, 96–98 (2013) (discussing the need to develop *ex post* responses in advance when *ex ante* regulation is impracticable).

334. Allen, *supra* note 308, at 1104–07.

335. ECB 2015, *supra* note 45, at 31–32. A ban on Bitcoin has been implemented in China (where financial institutions and payment services providers are not permitted to trade in bitcoins), and Russia forbids transactions in cryptocurrencies more generally. *Id.*

336. See Brito et al., *supra* note 159, at 218 (noting that “[i]f there are no intermediaries, but only thousands or millions of users interacting peer-to-peer, then the costs of enforcement may well outweigh any perceived potential benefits of regulation.”).

337. *Id.* at 152.

338. Wright & De Filippi, *supra* note 23, at 51.

339. Delphine Strauss & Stephen Foley, *Bitcoin Hits \$785 with a Little Help from Bernanke*, FIN. TIMES (Nov. 18, 2013), <http://www.ft.com/cms/s/0/6c5b941c-5052-11e3-9f0d-00144feabdc0.html?siteedition=intl#axzz4IOvoJhII> (quoting Senator Tom Carper (D-Del.), Chairman of the Senate Homeland Security and Governmental Affairs Committee).

courts could also refuse to enforce any contract denominated in a virtual currency, and treating virtual currencies as property from a tax perspective would also put a damper on the use of such virtual currencies. Ultimately, however, the law is limited in its ability to constrain the development of privately issued money if individuals remain willing to forgo state-sponsored enforcement mechanisms for their transactions—and such a blunt ban on virtual currencies could stifle important innovations in payments (and other) technologies.³⁴⁰

If, as this Article argues, it is better for the bulk of payments to be denominated in sovereign currencies and effected by regulated financial institutions, then the surest way to achieve this is for financial institutions to outcompete the virtual currencies by providing a better service.³⁴¹ The remainder of this Article will therefore consider possibilities for encouraging payments innovation within the regulated financial industry and addressing the concerns raised in Scenarios 1 and 2 while nonetheless avoiding an increase in the systemic importance of the largest financial institutions.

C. Payments Innovation in the Regulated Financial Industry

The distributed ledger technology developed in conjunction with virtual currencies does not need to be attached to a virtual currency. Instead, a regulated distributed ledger could be created to record transfers of digitized versions of sovereign currency, and regulated institutions (rather than miners) could verify transactions on that ledger.³⁴² At the outset, it should be acknowledged that such a ledger would likely become a target for cyberattacks. But the threat of cyberterrorism is not unique to virtual currencies or distributed ledgers—it is a concern common to *all* payment systems (indeed, all electronic infrastructures), and needs to be addressed with funds and intelligence at the federal and international level.³⁴³ A discussion of the best way to protect key infrastructure from cyberterrorism is beyond the scope of this Article. Returning, then, to the benefits of a regulated distributed ledger, tax complications,³⁴⁴ as well as difficulties under the Uniform

340. *See id.* (“[W]e need to develop thoughtful, nimble and sensible federal policies that protect the public without stifling innovation and economic growth.” (quoting Senator Tom Carper (D-Del.))).

341. *See* Andolfatto, *supra* note 1 (advocating for “government-sponsored cryptocurrency”).

342. *Id.*

343. *See* Ian McKendry, *Obama Makes Cybersecurity a Focal Point in Final Budget*, AM. BANKER (Feb. 9, 2016), <http://www.americanbanker.com/news/law-regulation/obama-makes-cybersecurity-a-focal-point-in-final-budget-1079259-1.html?zkPrintable=true> (noting that the Obama administration had earmarked \$19 billion from the 2017 budget to fund a “Cybersecurity National Action Plan”).

344. *See supra* note 275.

Commercial Code,³⁴⁵ would be avoided by processing payments denominated in sovereign currencies, rather than in virtual currencies. More importantly (from this Article's perspective), the systemic risk concerns raised in Scenarios 1 and 2 would not apply to transactions involving electronic versions of sovereign currencies.

Furthermore, denominating entries on a distributed ledger in sovereign currency would be more efficient than using virtual currencies: while Bitcoin may be cheaper than traditional payment methods, transaction costs could be reduced further by eliminating costs for converting bitcoins to sovereign currency. At present, "[t]he exchange fee [from Bitcoin to sovereign currency] falls with the size of the transaction, ranging from 0.5% for small transactions down to 0.2% for large transactions,"³⁴⁶ but conversions from, say, USD to Bitcoin to USD would be eliminated with USD-denominated entries on the distributed ledger. Settlement risk for same-currency transactions would also be avoided.

The verification method for transactions could also be made more efficient: currently, the Bitcoin network uses validators known as miners to approve transactions. In theory, anyone can become a Bitcoin miner, and the Bitcoin system therefore requires complex proof-of-work before a miner can verify transactions.³⁴⁷ The time and expense involved in completing this proof-of-work is intended to prevent "bad" miners from taking over the blockchain in a so-called "51% attack,"³⁴⁸ because if such bad miners were to succeed, they could engage in nefarious actions like allowing double spending, or "forking" the ledger.³⁴⁹ The proof-of-work process is therefore, by design, enormously wasteful and inefficient—if it were not, it would be too easy for miners to guess the answer to the proof-of-work and the distributed ledger would be vulnerable to bad actors.³⁵⁰ Even given the resources involved, though, the Bitcoin proof-of-work requirement may not

345. Jeanne L. Schroeder, *Bitcoin and the Uniform Commercial Code* 21 (Cardozo Legal Studies Research Paper No. 458, 2015), <http://ssrn.com/abstract=2649441>. Schroeder explains:

If bitcoin is neither money nor a deposit account, it can only fall within the catchall category of "general intangibles" which is defined as personal property that does not fall within any other category. This categorization has the potential of negatively affecting the marketability of bitcoin. This is because Article 9 has *no* negotiation rule for the *buyers* of general intangibles that are subject to a perfected security interest. That is, once a security interest in a general intangible is perfected, it survives even after multiple transfers to third parties.

Id. (footnote omitted) (citing U.C.C. § 9-102(a)(43) (AM. LAW INST. & UNIF. LAW COMM'N 2014)).

346. ELWELL ET AL., *supra* note 35, at 2.

347. SWANSON, *supra* note 26, at 8.

348. *51% Attack, Majority Hash Rate Attack*, BITCOIN, <https://bitcoin.org/en/glossary/51-percent-attack> (last visited May 17, 2017).

349. SWANSON, *supra* note 26, at 4, 8.

350. *Id.* at 4, 12.

succeed in its goal of preventing a 51% attack. Although the code used in the Bitcoin system is open-source,³⁵¹ it is beyond the comprehension of most people. Given the sophisticated understanding of computer programming required, as well as the volume of computer power necessary to verify transactions, it should not be surprising that there are a select few performing the role of Bitcoin miners.³⁵² Increasingly, miners are working together in pools, making the prospect of a 51% attack much more than theoretical.³⁵³ There is also the possibility that, at some point in the future, miners might simply give up verifying transactions if they feel they are no longer being properly compensated (which might happen once new bitcoins cease to be released).³⁵⁴ It is questionable, then, whether Bitcoin can live up to its claim that “[n]o organization or individual can control Bitcoin, and the network remains secure even if not all of its users can be trusted.”³⁵⁵ In the future, some level of trust in the validators may be required.³⁵⁶

If trust in the validators will be required, it makes sense to use known, pre-authorized entities (like regulated financial institutions) to act in that capacity. If trusted validators were used, then time- and energy-consuming “proof-of-work” could be dispensed with, and payments processing would be cheaper and quicker (settlement could potentially occur in seconds, rather than the 10 minute average for Bitcoin).³⁵⁷ Because the pre-authorized verifiers would have the power to refuse to include a transaction on the ledger, they could block suspicious transactions, which would assuage some of the money-laundering concerns that have been raised regarding Bitcoin.³⁵⁸ Finally, there would also be some general societal benefits from dispensing with proof-of-work. For one, the enormous amount of electricity and computer power expended in Bitcoin’s verification process would no longer be required, which is salutary from an environmental perspective.³⁵⁹ There is also anecdotal evidence of Bitcoin miners hacking into others’

351. See *Frequently Asked Questions*, *supra* note 154 (“Bitcoin is fully open-source and decentralized. This means that anyone has access to the entire source code at any time.”).

352. Marc Hochstein, *Why Bitcoin Matters for Bankers*, AM. BANKER (Feb. 25, 2015), <http://www.americanbanker.com/news/why-bitcoin-matters-for-bankers>.

353. Mike Hearn, *The Resolution of the Bitcoin Experiment*, MEDIUM (Jan. 14, 2016), <https://medium.com/@octskyward/the-resolution-of-the-bitcoin-experiment-dabb30201f7#.bbf7ex7ej>. As of January 2016, it was estimated that over half of the proof-of-work is currently done by two pools in China. *Id.*

354. SWANSON, *supra* note 26, at 11.

355. *Frequently Asked Questions*, *supra* note 154.

356. SWANSON, *supra* note 26, at 48.

357. *Id.* at 6, 12, 25.

358. FINANCIAL ACTION TASK FORCE, *supra* note 28; see also *supra* notes 280–281 and accompanying text.

359. The ECB has noted that Bitcoin “mining currently requires specialised computer hardware, suitable rooms to place such equipment in and considerable amounts of energy, including for cooling.” ECB 2015, *supra* note 45, at 9.

computer systems in order to access the power necessary to verify transactions—this too would be avoided if verification of transactions on the distributed ledger were instead to be performed by known and trusted entities.³⁶⁰ While it is true that institutions would require fees for verifying transactions on a regulated distributed ledger, and resources would need to be expended on regulating those institutions,³⁶¹ it is by no means clear that Bitcoin miners will not also start to charge transaction processing fees once new bitcoins cease to be released.³⁶²

Admittedly, the anonymity associated with Bitcoin and some other virtual currencies would be sacrificed if payments were processed by regulated institutions: no anonymity would be tolerated in a payment that is processed by an institution subject to anti-money laundering regulation.³⁶³ It is worth noting, though, that the benefits of anonymity associated with Bitcoin have been overstated: “researchers have found that, using sophisticated computer analysis, transactions involving large quantities of Bitcoin can be tracked and [they] claim that if paired with current law enforcement tools it would be possible to gain a lot of information on the persons moving the Bitcoins.”³⁶⁴ Furthermore, Bitcoin users are increasingly using services like Bitcoin wallets to store and access their bitcoins, and as the providers of these services come to be regulated by laws like the BitLicense, they will be required to identify those using their services.³⁶⁵ For these reasons, Bitcoin transactions are not truly anonymous (as a cash transaction would be).

If all aspirations to anonymity were abandoned, regulated banks could verify transactions effected in sovereign currencies, by pre-identified customers, on a distributed ledger.³⁶⁶ These banks could run an algorithm that would compare the proposed transaction to the existing entries on the ledger to ensure that the person purporting to transfer funds is, indeed, the owner of those funds and has not already attempted to send them elsewhere. If

360. SWANSON, *supra* note 26, at 55.

361. Fairfield, *supra* note 23, at 814.

362. Hearn, *supra* note 353. Once all of the 21,000,000 bitcoins have been mined and miners can no longer be compensated for their proof-of-work with new bitcoins, miners may require payment for their services. ELWELL ET AL., *supra* note 35, at 3–6. This may have already started to happen. According to one Bitcoin expert, “[o]nce upon a time, Bitcoin had the killer advantage of low and even zero fees, but it’s now common to be asked to pay more to miners than a credit card would charge.” Hearn, *supra* note 353.

363. Anti-money laundering legislation is reasonably consistent around the world, as it is based on international standards developed by the FATF. CHRIS BRUMMER, *SOFT LAW AND THE GLOBAL FINANCIAL SYSTEM: RULE MAKING IN THE 21ST CENTURY* 150–54 (2011) (citing Meiklejohn et al., *supra* note 51).

364. ELWELL ET AL., *supra* note 35, at 3.

365. See, e.g., N.Y. COMP. CODES R. & REGS. tit. 23 §§ 200.12, 200.15 (West 2017).

366. Reserve Bank economist David Andolfatto has argued that the only reason not to use pre-authorized verifiers, and to instead maintain the proof-of-work system, is to allow for anonymous transactions. Andolfatto, *supra* note 1.

everything is in order, the new transaction would be recorded on the distributed ledger, quickly achieving settlement finality. Regulated banks already have established reputations and experience dealing with customers, and they are subject to prudential and consumer protection laws.³⁶⁷ Regulated banks also have access to deposit insurance.³⁶⁸ These attributes “should contribute to the confidence among users—whether consumers or businesses—that their stored value is safe and that their transactions will be executed as expected,”³⁶⁹ making payment services provided by these regulated banks much more appealing to consumers who are wary of virtual currency payment services.

This idea of using distributed ledger technology to effect payments in sovereign currencies has already gained significant traction. For example, R3 CEV, a “consortium backed by some of the world’s largest banks,” is looking to develop a blockchain to, in its words, “revolutionize the financial services industry.”³⁷⁰ Similarly, there are rumors that the members of The Clearing House (“which acts as the trade group for the nation’s largest commercial banks”)³⁷¹ are “putting together a ‘proof of concept’ for a decentralized ledger, or blockchain, that would run on the computers of all the participating banks.”³⁷² However, there are serious concerns associated with concentrating essential market infrastructure like the distributed ledger in the hands of the largest banks.

A distributed ledger is the type of infrastructure that works best when not fragmented; it displays network effects in the sense that its “value increases if there are more users of the enterprise.”³⁷³ The first distributed ledger that is widely used by financial institutions is therefore likely to have

367. Murck, *supra* note 3, at 14.

368. 12 U.S.C. § 1815 (2012). While *transactions* using bitcoins are much safer than “pull” transactions, the theft from Mt. Gox illustrates that the *bitcoins themselves* are not particularly secure: deposit insurance for digital representations of USD would avoid the risk of runs that attaches to virtual currency. *See supra* note 234.

369. *The Present and Future Impact of Virtual Currency: Hearing Before the S. Banking Comm. and Subcomm. on Econ. Pol’y, Nat’l Sec., and Int’l Trade and Fin.*, 113th Cong. 6 (2013) (statement of Sarah Jane Hughes, University Scholar and Fellow in Commercial Law, Indiana University Maurer School of Law).

370. Robert Barba, *Bank Consortium CEO Wants to Build the Microsoft of Blockchains*, AM. BANKER (Nov. 30, 2015), <https://www.americanbanker.com/news/bank-consortium-ceo-wants-to-build-the-microsoft-of-blockchains>.

371. Kevin Wack, *How Big Banks Killed a Plan to Speed Up Money Transfers*, AM. BANKER (Nov. 13, 2013), http://www.americanbanker.com/issues/178_219/how-big-banks-killed-a-plan-to-speed-up-money-transfers-1063631-1.html?zkPrintable=1&nopagination=1.

372. Popper, *supra* note 140.

373. Felix B. Chang, *Financial Market Bottlenecks and the “Openness” Mandate*, 23 GEO. MASON L. REV. 69, 77 n.52 (2015) (citing Adam J. Levitin, *Priceless? The Economic Cost of Credit Card Merchant Restraints*, 55 UCLA L. REV. 1321, 1363 (2008)).

a natural monopoly,³⁷⁴ which “may become a bottleneck facility by which the facility’s owners can strengthen their hand in the downstream market by constricting access of the owners’ competitors to the bottleneck itself.”³⁷⁵ If a consortium of the largest banks is the first mover in developing a mainstream distributed ledger, and it excludes smaller banks from accessing that distributed ledger (or charges them large fees for access), smaller banks may be limited in their ability to effect payments for their customers and could become obsolete as a result. This would lead to even greater concentration of banking services in systemically important banks, and could potentially harm the small- and medium-sized enterprises that tend to rely on smaller banks for financing.³⁷⁶ Furthermore, if the largest banks hosted the distributed ledger on their servers, and were integral to processing everyday transactions, their “too big to fail” status (and their political power) would be cemented further.

In some countries, antitrust law might provide a solution to this problem, but United States’ antitrust law does not provide any clear guidance as to whether, and on what terms, the operators of a distributed ledger would be required to grant smaller banks access to such important market infrastructure.³⁷⁷ Therefore, large, systemically important financial institutions should not be permitted to operate the predominant distributed ledger in the first place. Nor should the distributed ledger be operated by a not-for-profit association of financial institutions, like the National Automated Clearing House Association (“NACHA”) that currently administers the widely used ACH payments clearing network. As a result of NACHA’s complicated governance structure,³⁷⁸ the largest financial institutions have significant clout in determining the way NACHA operates. For example, although NACHA’s membership recently approved changes to the body’s rules that would allow for same-day settlement of payments,³⁷⁹ a previous attempt to

374. *See id.* at 69 (“[Natural monopolies are] monopolies that arise because one producer can serve the market more efficiently than multiple producers.”).

375. *Id.* at 83 (citing RUBEN LEE, *RUNNING THE WORLD’S MARKETS: THE GOVERNANCE OF FINANCIAL INFRASTRUCTURE* 20–21 (2011)).

376. Community banks “provide essential services to small businesses, consumers and local economies.” Arthur E. Wilmarth Jr., *A Two-Tiered System of Regulation is Needed to Preserve the Viability of Community Banks and Reduce the Risks of Megabanks*, 2015 MICH. ST. L. REV. 249, 254. These “small and medium-sized businesses [are] responsible for generating the vast majority of jobs and of output in every contemporary economy.” Tamara Lothian & Roberto Mangabeira Unger, *Crisis, Slump, Superstition and Recovery: Thinking and Acting Beyond Vulgar Keynesianism* 38 (Columbia Law and Economics Working Paper No. 394, 2011), https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=1780454.

377. Chang, *supra* note 373, at 95–96.

378. Mark Edwin Burge, *Apple Pay, Bitcoin, and Consumers: The ABCs of Future Public Payments Law*, 67 HASTINGS L.J. 1493, 1515–16 (2016).

379. *Id.*

do so was blocked in 2013 by The Clearing House.³⁸⁰ It has been suggested that The Clearing House opposed the upgrade, notwithstanding that smaller banks were overwhelmingly in favor of the changes,³⁸¹ “in part because it would have jeopardized the fees they earn from wire transfers.”³⁸²

The influence of the largest financial institutions on the operation of the distributed ledger would be reduced if the distributed ledger were instead hosted and administered by the central bank.³⁸³ The Federal Reserve Banks, for example, which currently serve as an automated clearinghouse, “receive files of [automated clearinghouse] payments from originating depository financial institutions, edit and sort the payments, deliver the payments to receiving depository financial institutions, and settle the payments by crediting and debiting the depository financial institutions’ settlement accounts.”³⁸⁴ It is therefore not too much of a stretch to conceptualize the Federal Reserve Banks administering a distributed ledger on which transactions using USD-denominated tokens could be recorded.³⁸⁵ It is true that central banks are not necessarily known for their technological savvy and efficiency, but this Article is simply arguing that central banks should host the underlying infrastructure for the distributed ledger. The distributed ledger could then be used as a foundation for innovation by regulated financial institutions.

While a distributed ledger is most efficient if not fragmented (and thus there would ideally be no competition in terms of providing the distributed ledger itself), multiple financial institutions could compete in developing quicker, more secure, and more cost-effective protocols to verify and execute transactions on the ledger, whilst still benefitting from the ledger’s network effects. For example, banks could compete to provide trusted and

380. Wack, *supra* note 371.

381. *Id.*

382. Nathaniel Popper, *Small Bank in Kansas is a Financial Testing Ground*, N.Y. TIMES: DEALBOOK (Dec. 13, 2014, 11:33 AM), https://dealbook.nytimes.com/2014/12/13/small-bank-in-kansas-is-a-financial-testing-ground/?_r=0.

383. Admittedly, this would not entirely eliminate the influence of the largest banks. For a discussion of the capture of the Federal Reserve by financial institutions, and the conflicts of interest inherent in the Federal Reserve System (where some of the directors of the Reserve Banks are elected by financial institutions), see Peter Conti-Brown, *The Twelve Federal Reserve Banks: Governance and Accountability in the 21st Century* 13–14, 16–17 (Rock Ctr. for Corp. Governance at Stanford Univ. Working Paper No. 203, 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2574309.

384. *Automated Clearinghouse Services*, BD. OF GOVERNORS OF THE FED. RES. SYSTEM, https://www.federalreserve.gov/paymentsystems/fedach_about.htm (last updated May 16, 2016).

385. See JP Koning, *Why the Fed is More Likely to Adopt Bitcoin Technology than Kill it Off*, MONEYNESS (Apr. 14, 2013, 6:55 PM), <http://jpkoning.blogspot.com/2013/04/why-fed-is-more-likely-to-adopt-bitcoin.html>. The distributed ledger should be hosted on multiple servers. As a starting point, servers could be situated at each of the twelve Federal Reserve Bank locations around the country. *Id.*

secure wallet services for the bits of data that represent the customer's sovereign currency. These wallets would be the next generation of deposit accounts,³⁸⁶ and the hosting financial institution would pay interest on the funds stored in the wallet.³⁸⁷ Banks (and potentially other types of regulated financial institutions) could also compete to provide more innovative services using smart contracts that can be hosted on the ledger—these are contracts represented by machine-readable computer code that are self-executing because they include “explicit *transition* rules for shifting the relationship from one state to another, based on the realization of certain pre-defined *events*.”³⁸⁸ In the future, such smart contracts may be able to facilitate context specific payments, like a “debit card for a child that could be used during lunch hours only in the ZIP code near the child's school.”³⁸⁹ Such smart contracts may also be able to profitably effect micropayments (payments of amounts under, say, 30 cents). Currently, financial institutions do not process micropayments because the cost of such processing often exceeds the amount of the payment itself.³⁹⁰ However, micropayments may become viable if distributed ledger and smart contract technology can significantly reduce transaction costs.³⁹¹ Another area ripe for innovation is the provision of remittance services for workers sending funds home to their families who live abroad; institutions would be well-situated to provide these at a much lower cost if self-executing smart contracts were to be developed.³⁹²

In 2014, New York's then Superintendent of Financial Services Benjamin Lawsky lambasted the financial industry for its lack of innovation in the payments space: “‘At a certain point, enough is enough,’ Lawsky said.

386. ECB 2012, *supra* note 37, at 39.

387. JP Koning, *Fedcoin*, MONEYNESS (Oct. 19, 2014, 1:28 PM), <http://jpkoning.blogspot.com/2014/10/fedcoin.html> (“Why aren't private banks at this very moment switching out deposits and replacing them with cryptolegders?”).

388. Mark D. Flood & Oliver R. Goodenough, *Contract as Automaton: The Computational Representation of Financial Agreements* 3 (Office of Fin. Res. Working Paper No. 15-04, 2015), https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2648460. Flood and Goodenough note that “[b]y formalizing contracts according to rules of the literature on computability, we expose them to a wealth of powerful machinery from that domain, such as programmatic testing for legal completeness and computational complexity, and tools for simplification, visualization, and even the automated generation of legalese.” *Id.*

389. Popper, *supra* note 382.

390. Fairfield, *supra* note 23, at 831.

391. Brito et al., *supra* note 159, at 152; Wright & De Filippi, *supra* note 23, at 30.

392. Andreessen, *supra* note 4. Andreessen noted:

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 in total annually, according to the World Bank. Every day, banks and payment companies extract mind-boggling fees, up to 10 percent and sometimes even higher, to send this money.

Id.

‘Four decades of slow-to-non-existent progress in the bank payments system seem like fair warning.’³⁹³ Lawsky went on to compare banks to Blockbuster, “which went bankrupt after it failed to innovate and was disintermediated by companies like Netflix,”³⁹⁴ but that comparison is not entirely apt. Unlike video rental stores, banks perform a quasi-public function in channeling funds to the broader economy, and so they are subjected to significant levels of regulation (as well as receiving exclusive privileges like the right to accept deposits).³⁹⁵ This regulation serves as a barrier to entry, and has so far largely insulated the banking industry from disruptive forces. As Barclay’s former chief executive Antony Jenkins stated, the established banking industry has not yet felt the “full disruptive force of technology”³⁹⁶—but this state of affairs may not persist for much longer.

The buzzword “fintech” was ubiquitous in 2015–2016, and the term encompasses a variety of trends.³⁹⁷ It includes tech start-ups that, like Bitcoin, seek to exist entirely outside of—and perhaps displace—the regulated financial sector.³⁹⁸ The term “fintech” also includes technology start-ups seeking their own bank charter—this has been a relatively unpopular, but not unheard of, route because obtaining a bank charter and navigating the banking regulatory environment can be a difficult process.³⁹⁹ An alternative, more popular option for tech start-ups seeking to enter the payments space has been to collaborate with the regulated financial industry to enable

393. Ian McKendry, *Lawsky to Banks: Speed Up Payments Innovation—or Else*, AM. BANKER (Dec. 18, 2014), <https://www.americanbanker.com/news/lawsky-to-banks-speed-up-payments-innovation-or-else>.

394. *Id.*

395. Ricks, *supra* note 15, at 78–79.

396. Giulio Prisco, *Barclays CEO: The Banking Sector Has Not Yet Felt the Full Disruptive Force of Technology, but It Will*, BITCOIN MAG. (Mar. 30, 2015), <https://bitcoinmagazine.com/19785/barclays-ceo-banking-sector-not-yet-felt-full-disruptive-force-technology-will/>.

397. Marc Hochstein, Opinion, *Fintech (the Word, That Is) Evolves*, AM. BANKER (Oct. 5, 2015, 7:12 PM), <https://www.americanbanker.com/opinion/fintech-the-word-that-is-evolves>.

398. *Id.*

399. Kevin Roose, *Is Silicon Valley the Future of Finance?*, N.Y. MAG. (June 1, 2014), <http://nymag.com/daily/intelligencer/2014/09/silicon-valleys-contract-worker-problem.html>. For example, a start-up known as Simple sought to provide “debit cards and a mobile app that featured cutting-edge saving and tracking functions. Fees and fine print were minimal; customer service was excellent.” *Id.* However, Simple struggled in its attempts to get a bank charter. In the end, it partnered with a more traditional bank before ultimately selling itself to another traditional bank. *Id.* Tech start-ups also tend to lack first-hand knowledge about how payment systems currently work, “something that [is] hard to see in detail from the outside [of a bank].” Popper, *supra* note 382. For examples of technology start-ups that are seeking bank charters despite these difficulties, see Mary Wisniewski, *Why U.K. Fintech Firms Are Becoming (Not Partnering with) Banks*, AM. BANKER (Sept. 16, 2015), <https://www.americanbanker.com/news/why-uk-fintech-firms-are-becoming-not-partnering-with-banks>.

those start-ups to benefit from banks' knowledge of existing payments systems and their surrounding regulatory environment.⁴⁰⁰

At present, there is a significant amount of fintech collaboration with systemically important banks—Goldman Sachs, for example, “has been particularly active” in investing in tech start-ups,⁴⁰¹ and Apple Pay,⁴⁰² perhaps the most visible payment innovation of recent years, was developed in conjunction with some of the largest banks, including JPMorgan, Bank of America, Wells Fargo, and Citigroup.⁴⁰³ These large financial institutions have the benefits of strong customer relationships and significant amounts of capital, which allow them the most room to innovate⁴⁰⁴ (they also have the capital to acquire start-ups that threaten to disrupt their business models).⁴⁰⁵ However, the profits generated by such innovation contribute to the incumbents' increasing size, and the larger these institutions grow, the more their “too big to fail” status is cemented.⁴⁰⁶ Ideally, partnerships would instead be forged between tech start-ups and smaller financial institutions (the latter of whom have been losing market share in recent years, in part because of an inability to keep up with the pace of technological change).⁴⁰⁷ However, doing so will require these smaller banks to reconcile their more

400. Murck, *supra* note 3, at 14. For further discussion of the relative strengths of banks and fintech start-ups, and the benefits of collaboration between them, see OFFICE OF THE COMPTROLLER OF THE CURRENCY, SUPPORTING RESPONSIBLE INNOVATION IN THE FEDERAL BANKING SYSTEM: AN OCC PERSPECTIVE 4 (2016).

401. Nathaniel Popper, *Wall St. Courts Start-Ups It Once May Have Ignored*, N.Y. TIMES: DEALBOOK (June 9, 2015), https://www.nytimes.com/2015/06/10/business/dealbook/wall-st-courts-start-ups-it-once-may-have-ignored.html?_r=0.

402. Andrew Ross Sorkin, *Pointing Fingers in Apple Pay Fraud*, N.Y. TIMES: DEALBOOK (Mar. 16, 2015), <http://www.nytimes.com/2015/03/17/business/banks-find-fraud-abounds-in-apple-pay.html>. Apple Pay allows users to make contactless payments with an iPhone, Apple Watch, or iPad. *Id.* Unfortunately, although Apple Pay uses “push” token technology to make payments (which should theoretically make transactions safer in the same way the Bitcoin does), fraud rates for Apple Pay payments have been far in excess of what is seen in the credit card market. *Id.*

The vulnerability in Apple Pay is in the way that it—and card issuers—“onboard” new credit cards into the system. Because Apple wanted its system to have the simplicity for which it has become famous and wanted to make the sign-up process “frictionless,” the company required little beyond basic credit card information about a user. Nor did it provide much information to the banks, like full phone numbers and addresses, that might help them detect fraud early.

Id.

403. *Id.*

404. Roose, *supra* note 399.

405. Andrew Ross Sorkin, *Fintech Firms Are Taking on the Big Banks, but Can They Win?*, N.Y. TIMES: DEALBOOK (Apr. 16, 2016), <http://www.nytimes.com/2016/04/07/business/dealbook/fintech-firms-are-taking-on-the-big-banks-but-can-they-win.html>.

406. Allen, *supra* note 226, at 229.

407. Wilmarth, *supra* note 376, at 256.

conservative cultures with the pro-risk, “fail fast” approach of technological innovators.⁴⁰⁸

There are a number of interesting initiatives afoot in this vein, and further collaboration could be promoted by industry associations like the Independent Community Bankers of America, or by financial regulators who could provide “public policy perspective and analytical support” for such endeavors.⁴⁰⁹ For example, Umpqua, an Oregon-based bank with \$23 billion in assets, has launched a lab known as “Pivotus Ventures” in Silicon Valley, and is hoping that other smaller banks will pool resources with it to fund innovation and product testing with the aim of “explor[ing] the disruption in the industry and keep[ing] the bank relevant five to 10 years from now.”⁴¹⁰ The Silicon Valley location was selected to help “recruit technologists in areas such as data analytics and user design from outside the financial services industry.”⁴¹¹ Another small bank with cutting-edge technology is CBW Bank, a small community bank in Kansas that was purchased in 2009 by a couple with Silicon Valley and Wall Street credentials.⁴¹² Since that time, the bank has developed services like instant payments within the United States, and “software that can judge the risk involved in any transaction in real time.”⁴¹³ CBW Bank has also implemented “distributed ledger technology developed by Ripple Labs to establish direct, bilateral relationships with foreign banks” to assist with international transfers.⁴¹⁴

Ripple deserves special mention because, while it uses virtual currency technology that is not dissimilar to Bitcoin, Ripple seeks to partner with the traditional financial industry instead of eschewing it, explaining on its web-

408. Mary Wisniewski, *The Case for Bringing Innovation Inside a Bank*, AM. BANKER (Oct. 28, 2015), <https://www.americanbanker.com/news/the-case-for-bringing-innovation-inside-a-bank>.

409. PAYMENTS WHITE PAPER, *supra* note 6, at 17. Collaboration could take the form of “hosting hackathons; launching innovation labs; sending their employees to the Valley; creating mobile-first divisions; and working with and acquiring startups.” Wisniewski, *supra* note 408. The conference “Crossroads: Banking and Fintech,” held in April 2016, suggests a movement in this direction: it was designed to bring together community bankers and those knowledgeable about developments in the fintech space. Robert Barba, *Are Fintech and Community Banks a Perfect Match?*, AM. BANKER (Apr. 22, 2016), <https://www.americanbanker.com/news/are-fintech-and-community-banks-a-perfect-match>.

410. Bryan Yurcan, *Rallying Smaller Banks with the Will (But Not Means) to Innovate*, AM. BANKER (Dec. 9, 2015), <https://www.americanbanker.com/news/rallying-smaller-banks-with-the-will-but-not-means-to-innovate>.

411. *Id.*

412. Popper, *supra* note 382.

413. *Id.*

414. Sarah Todd, *Is Trailblazing Payment Technology Worth the Risk to Banks?*, AM. BANKER (Mar. 11, 2015), <https://www.americanbanker.com/news/is-trailblazing-payment-technology-worth-the-risk-to-banks>.

site how financial institutions can integrate the Ripple protocol into their payment services.⁴¹⁵ While Ripple has issued a virtual currency known as XRP, it is more focused on using its technology to allow for payments generally than it is in promoting XRP as a stand-alone currency.⁴¹⁶ Balances on the Ripple network can be held in USD, euro, yen, or bitcoins, amongst other things.⁴¹⁷ Like Bitcoin, Ripple operates on a distributed ledger,⁴¹⁸ but it diverges from Bitcoin in several important respects. Most notably, instead of having miners verify transactions (as Bitcoin does), Ripple uses a subset of validators from its network “chosen [by an algorithm] based on the expectation they will not collude in a coordinated effort to falsify data relayed to the network.”⁴¹⁹ Therefore, “validating transactions does not involve ‘proof-of-work’ that systems such as Bitcoin do,”⁴²⁰ and as a result, “[t]ransfers typically take 3-6 seconds and the process and fees are transparent.”⁴²¹

V. CONCLUSION

Money is a social technology that can arise, even without institutional backing or legal imprimatur, to store value and effect exchanges. However, while arguments have been made that privately issued money is just as good (if not better) than sovereign-issued money, at best this is only true when society as a whole has confidence in that privately issued money. Institutional support is needed to maintain ultimate trust in money in times of panic; it remains to be seen whether even the ECB can succeed in keeping the euro a trusted and stable currency without a single national government to stand behind it. Whatever the outcome of the ongoing Eurozone crisis, it does not bode well for virtual currencies, which have neither a government nor a central bank to fill the void in times of panic. Those who have heralded Bitcoin as the “destroyer of the dollar”⁴²² are therefore too far-fetched

415. *Network Financial Institutions*, RIPPLE, <https://ripple.com/network/financial-institutions/> (last visited May 17, 2017).

416. See *Bitcoin Is Far More Than a Currency for Speculators*, FIN. TIMES (Feb. 5, 2014), <https://www.ft.com/content/612ed094-8aaf-11e3-9465-00144feab7de> (“Ripple, another peer-to-peer currency network, emphasises such real-world uses rather than the value of its own XRP currency. ‘The world is not going to adopt a new math-based currency,’ says Chris Larsen, Ripple Labs’ chief executive.”).

417. Ariella Brown, *10 Things You Need to Know About Ripple*, RIPPLE (May 17, 2013, 11:00 AM), <http://www.coindesk.com/10-things-you-need-to-know-about-ripple/>.

418. Dave Cohen et al., *The Ripple Ledger Consensus Process*, RIPPLE, https://ripple.com/knowledge_center/the-ripple-ledger-consensus-process/ (last visited May 17, 2017).

419. *Id.*

420. SWANSON, *supra* note 26, at 34.

421. *Id.*

422. Jose Pagliery, *Ron Paul: Bitcoin Could ‘Destroy the Dollar’*, CNN MONEY (Dec. 4, 2013, 12:01 PM), <http://money.cnn.com/2013/12/04/technology/bitcoin-libertarian/>.

in their imaginings. Instead, Bitcoin's greatest contribution is its distributed ledger technology, but the benefits of that technology are best maximized by stripping it from Bitcoin. A central bank-administered distributed ledger, which processes payments denominated in sovereign currencies, could revolutionize the provision of payment services—without escalating systemic risk within the financial system. Ideally, outcompeted by the regulated banking industry, Bitcoin would “crash, but leave a lasting legacy.”⁴²³

423. *Virtual Currencies: Mining Digital Gold*, ECONOMIST (Apr. 13, 2013), <http://www.economist.com/news/finance-and-economics/21576149-even-if-it-crashes-bitcoin-may-make-dent-financial-world-mining-digital>.