

The Potential Impact of Decentralized Virtual Currency on Monetary Policy

By G.C. Pieters



Electronic money is a broad term for any money, currency or asset not held in physical form—it can include representations of a sovereign currency or claims on a real-world good.

One of the most unexpected global monetary developments in the past decade has been the emergence of decentralized virtual currencies. Bitcoin, the largest and best known of the decentralized virtual currencies, has well-documented market properties—including its use as an international vehicle currency. Decentralized virtual currencies are of particular interest to central bankers because eventually they could change administration of monetary policy globally by allowing users to circumvent capital controls and managed exchange rates.

Digital Currency? Virtual Currency? Cryptocurrency?

The terminology used when discussing currencies such as bitcoin is rapidly evolving. Chart 1 is a visualization of the relationship between the various terminologies, created by merging definitions suggested by the European Central Bank, Bank of International Settlements and *Bitcoin Magazine*.

Electronic money is a broad term for any money, currency or asset not held in physical form—it can include representations of a sovereign currency or claims on a real-world good. The online payment system PayPal digitally represents many sovereign currencies, such as the U.S. dollar, and therefore trades in electronic money. *Digital currency* is a subset of electronic money that has no broadly accepted physical counterpart. Finally, *virtual currency* is a subset of digital currency that is intentionally created, or predominately used, for purchasing both digital and nondigital (“real-world,” or tangible) goods.

Digital and virtual currencies can either

be *centralized* or *decentralized*. A centralized currency is any currency that is issued and maintained by a central group or organization, while decentralized currencies are not.¹ Simulated currencies (also called *game currencies*) are examples of centralized digital currencies. These currencies are created to purchase items within a simulated system, primarily video games, belonging to a nongovernment company or group. For example, the online game Second Life (created by Linden Labs) uses an in-game currency referred to as Linden dollars. World of Warcraft (WoW) (created by Blizzard Entertainment) primarily relies on a currency referred to as WoW gold. Eve Online (created by CCP Games) has a currency called ISK. All are designed to be earned through in-game tasks and spent on in-game items within the respective simulated system, ranging from armor and clothes to flying pigs and spaceships.

Some players may choose to buy Linden dollars, WoW gold or Eve ISK using government-issued currencies on third-party exchanges instead of spending time on in-game tasks. These exchanges tend to be very limited—usually involving only the U.S. dollar, the euro and the British pound—and may be deemed illegal by some companies. An example of a centralized virtual currency is E-gold, founded in 1996. E-gold was a digitally traded currency backed by gold that could be traded for sovereign currencies, with the issuance and trading system managed by the company Gold & Silver Reserve.

Cryptocurrency refers to any electronic money created using cryptographic technology to regulate its creation and ensure the legitimacy of transactions conducted using

that money. Formally, bitcoin can be described as a decentralized virtual cryptocurrency. However, because all cryptocurrencies are decentralized virtual currencies, the two terms are used interchangeably.

Cryptocurrency technology is essential for decentralized digital currencies, which face a severe double-spending problem—someone could “copy and paste” the digital monetary unit and spend it over and over again because there is no central authority to validate the authenticity of a transaction. Bitcoin’s founder(s) solved this problem with the invention of blockchain technology—an accounting system in which a complete history of transactions of any bitcoin user is both unalterable and publicly viewable to ensure that no user can spend more bitcoins than they have acquired. This also means that no central entity or organization clears transactions, which is why decentralized currencies are difficult to regulate.²

Table 1 lists the names, U.S. dollar value of the stock of the currency (market capitalization) on Dec. 27, 2016, and founding date of the five most highly capitalized cryptocurrencies. As the oldest and largest of them, bitcoin is frequently studied and is the best understood. Alternatives to bitcoin are collectively referred to as *altcoins*.

Bitcoin Markets

Why do people purchase bitcoins? The reasons are evolving as bitcoin becomes more established and integrated into the world economy. Wilson and Yelowitz (2015) find a correlation between interest in criminal activity and interest in bitcoin. Brière, Oosterlinck and Szafarz (2015) show that

Chart 1
Definitions Based on Issuer and Intended Scope of Use, Transaction Verification and Technology

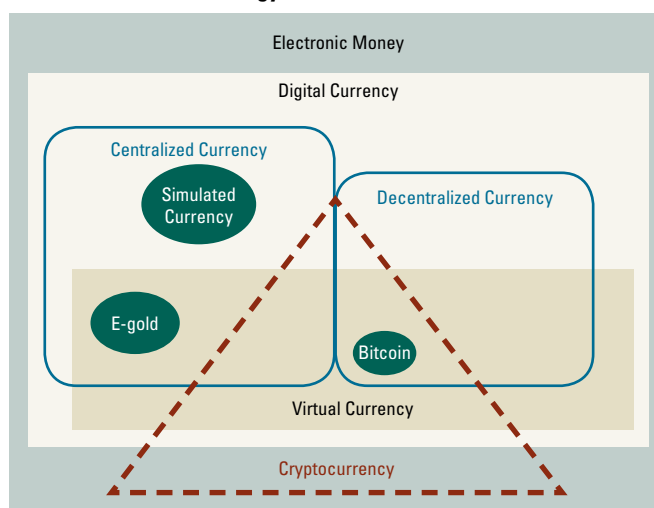


Table 1
Largest Cryptocurrencies by Market Capitalization, Founding Date

Cryptocurrency name	Market capitalization (U.S.\$)	Founding date
Bitcoin	\$13,872,012,671	2009
Ethereum	\$670,845,473	2014/2016
Ripple	\$228,099,345	2012
Litecoin	\$182,040,688	2011
Monero	\$123,119,681	2014

SOURCE: CoinMarketCap, <https://coinmarketcap.com>, accessed December 2016.

Bitcoin is globally traded, yet there is no global regulatory framework for it. Some countries, such as Ecuador, have attempted to ban bitcoin.

bitcoin can be a useful diversification asset in a financial portfolio. Bitcoin can also be used to buy tangible goods on an increasing number of websites such as Amazon and Overstock or in some physical stores as an alternative to sovereign currencies.³

There are multiple ways to acquire a bitcoin, but one of the most common is through a bitcoin exchange. It is like any other online marketplace: Anyone wishing to purchase (or sell) a bitcoin indicates the amount of bitcoin and pays (or receives) the price in the monetary unit they select from those accepted by the exchange. The available electronic money ranges from sovereign currencies such as U.S. dollars, Chinese yuan, or New Zealand dollars, to other cryptocurrencies such as ethereum or litecoin. Exchanges differ in the range of electronic monies they accept, their fees, regulatory requirements and other properties. The impact of these on the price of a bitcoin in an exchange is examined in Pieters and Vivanco (2016).

Bitcoin is globally traded, yet there is no global regulatory framework for it. Some countries, such as Ecuador, have attempted to ban bitcoin. Others, such as Cyprus, encourage its use. Within the U.S., virtual currency exchanges are regulated by the Financial Crimes Enforcement Network (FinCEN). It requires that all bitcoin exchanges collect the identification of purchasers. Pieters and Vivanco (2016) test the enforceability of this ruling by attempting to purchase bitcoins using U.S. dollars from a location within the U.S. While all bitcoin exchanges within the U.S. collected information, very few outside of the U.S. did, circumventing FinCEN regulations.⁴

Bitcoin-Based Exchange Rates

Chart 2 shows how \$1,000 can be directly exchanged for euros using official exchange rate markets, at a hypothetical exchange rate of \$1 for €0.97. Alternatively, one bitcoin (BTC) can be purchased for \$1,000, and the bitcoin can then be sold to obtain euros at a price of 1 BTC for €970. In this second scenario, bitcoin is used as a vehicle currency to move from one currency to another. This process is simple to implement on any exchange that allows the sale and purchase in at least two currencies. In Chart 2, both the official exchange rate and the bitcoin-based exchange rate are the same. However, it is possible that the bitcoin market is too small, or that bitcoin users ignore and are ignored by international markets, so that bitcoin-based exchange rates are actually uninformative and bear little similarity to the official exchange rate markets.

Pieters (2016) examines exchange rates derived from bitcoin trades and finds that in the absence of a policy of exchange-rate management, bitcoin-based exchange rates reflect official exchange rates. Additionally, they also provide information on black market exchange rates and capital controls. Chart 3 shows both the official and bitcoin exchange rate between the U.S. dollar and the British pound, normalized to begin at the same exchange rate value. These two currencies are highly traded with minimal restrictions, and movements in bitcoins and official exchange rates are essentially identical.

Argentina, in contrast, had a period of financial market restrictions to support a desired exchange rate, during which a substantial and well-developed black market for trades between the U.S. dollar and Argentine peso arose. This black market was so well established that newspapers quoted both the official (government supported) exchange rate and the unofficial (black market) rate, called the dólar blue.

Chart 4 shows the three exchange rates—the official, bitcoin and unofficial dólar blue rates—both during and after the end of the Argentinian exchange rate program in

Chart 2
Two Methods of Converting U.S. Dollars into Euros

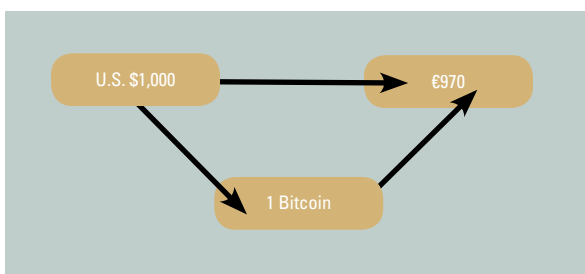
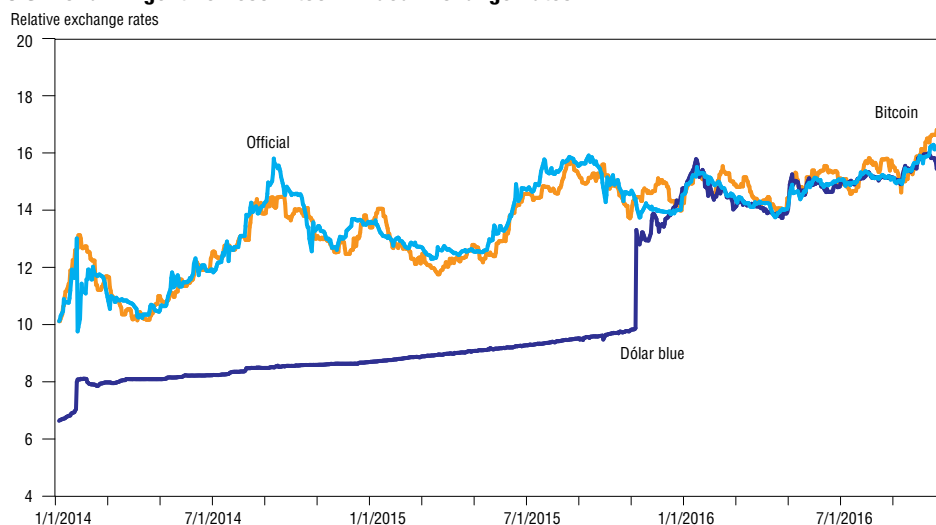


Chart 3

Official and Bitcoin-Based U.S. Dollar–British Pound Exchange Rate

SOURCES: Bitcoincharts.com (bitcoin prices); investing.com (official exchange rates); Pieters (2016); author's calculations.

Chart 4

U.S. Dollar–Argentine Peso Bitcoin-Aided Exchange Rates

SOURCES: LocalBitcoins exchange, bitcoincharts.com (bitcoin prices); investing.com (official exchange rates); Àmbito Financiero (unofficial exchange rates); Pieters (2016); author's calculations.

December 2015. The bitcoin exchange rate does not reflect the official exchange rate during the period of financial market restrictions. It, however, mirrors the movement of the unofficial exchange rate. This suggests that the bitcoin market was used as a channel to circumvent restrictions on currency trades. After capital controls ended, bitcoin and official exchange rates became similar. These two examples provide evidence that

bitcoin use is not limited to purchases within a domestic market; it also facilitates transactions across currencies on a global scale.

Trilemma of International Finance

The relative value of any two currencies—the exchange rate—is determined through their sale and purchase on the global foreign exchange market. If government policy interferes with this market by changing

the relative supply or demand of currencies, the exchange rate is managed.

The trilemma of international finance, illustrated in Chart 5, is a restriction on government policy that follows immediately from the interaction of exchange rates, monetary policy and international capital flows. The trilemma states that any country can have only two of the following: (1) unrestricted international capital markets, (2)

a managed exchange rate or (3) an independent monetary policy.

If the government wants a managed exchange rate but does not want to interfere with international capital flows, it must use monetary policy to accommodate changes in the demand for its currency in order to stabilize the exchange rate. In the extreme, this would take the form of a currency board arrangement, where the domestic currency

is fully backed by a foreign currency (as in the case of Hong Kong). In such a situation, monetary policy can no longer be used for domestic purposes (it is no longer independent). If a country wishes to maintain control over monetary policy—to reduce domestic unemployment or inflation, for example—it must limit trades of its currency in the international capital market (it no longer has free international capital markets). A country that chooses to have both unrestricted international capital flows and an independent monetary policy can no longer influence its exchange rate and, therefore, cannot have a managed exchange rate.

The U.S. has chosen (1) and (3): It allows unrestricted international movement of capital and has an independent monetary policy and, as a result, must accept a market-determined exchange rate. Hong Kong maintains a (2) fixed exchange rate and allows (1) unrestricted capital flows, with its monetary policy dedicated solely to maintaining its exchange rate. Prior to 2016, Argentina had a (2) managed exchange rate and (3) independent monetary policy and imposed restrictions on international capital flows.

Bitcoin creates a problem for Argentina and similar countries; it makes circumventing capital controls easier. As demonstrated

Chart 5
Depiction of the Trilemma of International Finance

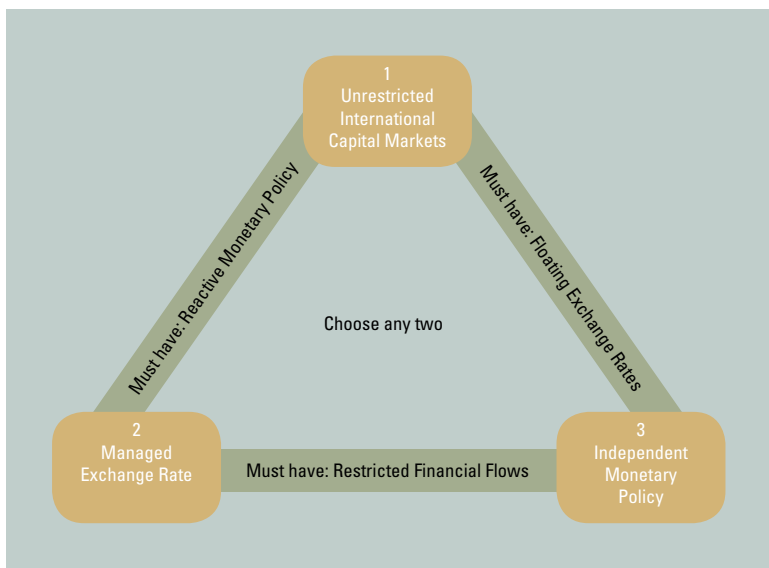
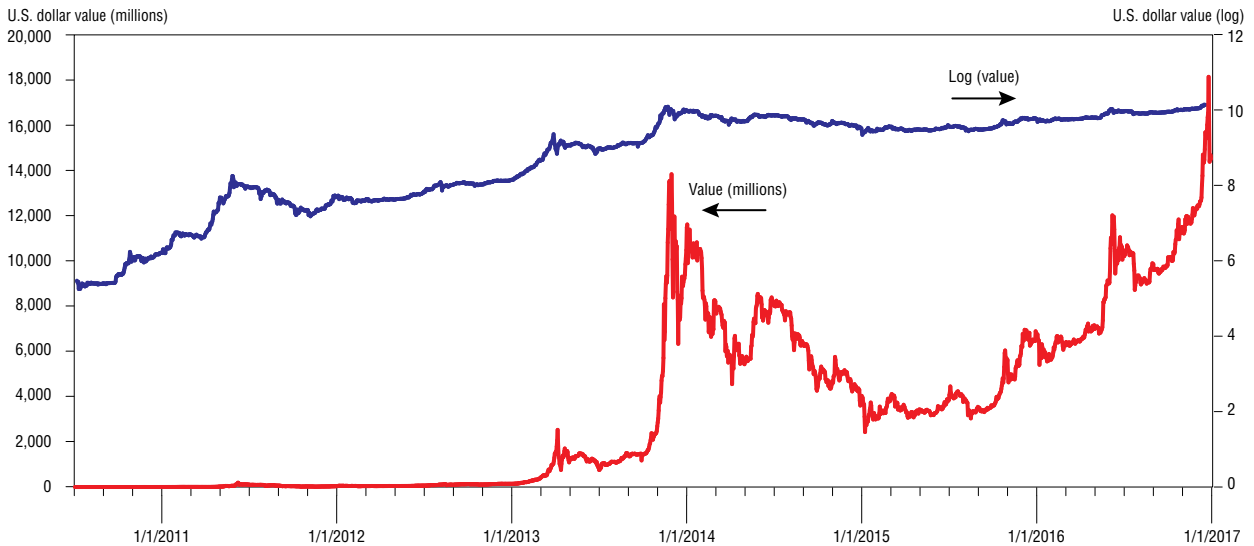


Chart 6
Bitcoin Market Capitalization from July 1, 2010, to Dec. 28, 2016



SOURCES: Coindesk.com; author's calculations.

in Pieters and Vivanco (2016), government attempts to regulate the globally accessible bitcoin markets are generally unsuccessful, and, as shown in Pieters (2016) and Chart 4, bitcoin exchange rates tend to reflect the market, not official exchange rates. Should the flows allowed by bitcoin become big enough, all countries will have, by default, unrestricted international capital markets.

Thus, with bitcoin, (1) unrestricted international capital markets is chosen by default. Therefore, the only remaining policy choice is between (2) managed exchange rates or (3) independent monetary policy. If the country chooses (1) and (2), it must use reactive monetary policy to achieve the managed exchange rate. If the country chooses (1) and (3), it must have a floating exchange rate because it has no remaining tools with which to maintain a managed exchange rate.

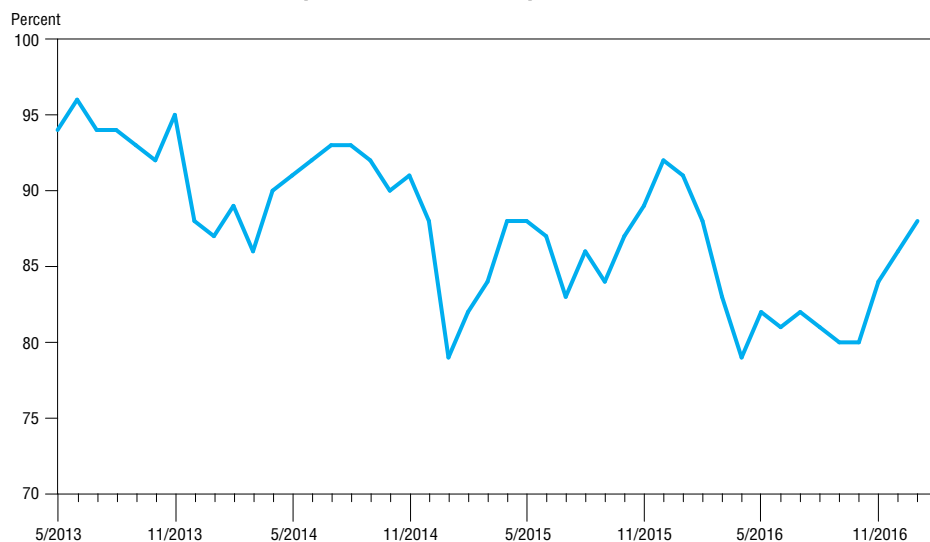
Ali et al. (2014), the European Central Bank (2015) and the Bank for International Settlements (2015) all concur that cryptocurrencies may eventually undermine monetary policy, but at the time of their writing, all found that the small size of cryptocurrency markets did not represent any tangible restrictions. However, the market capitalization of bitcoin is growing rapidly, doubling from \$7 billion on Jan. 2, 2016, to nearly \$14 billion by Dec. 28, 2016 (*Chart 6*).

Additionally, despite bitcoin's rapid growth, data show that bitcoin's share of the cryptocurrency market has fallen from a dominating 95 percent to as low as 80 percent (*Chart 7*). While Table 1 shows that no individual altcoin has a market size comparable to bitcoin, the altcoins are collectively becoming more important. They achieved a combined \$2 billion market capitalization on Dec. 28, 2016, for a collective cryptocurrency market capitalization of \$17 billion—and unlike the much larger foreign exchange market, there is high liquidity between currencies.

If adoption of cryptocurrencies continues growing, the size of cryptocurrency flows relative to international financial markets will increase and central banks in economies of all sizes will have to make monetary policy

Chart 7

Bitcoin's Monthly Share of Cryptocurrency Market Capitalization Declines



SOURCE: CoinMarketCap, <https://coinmarketcap.com>.

decisions in an environment in which consumers can opt to use a globally traded and unregulated alternative currency.

Notes

¹While not represented on Chart 1, any electronic money that is not a digital currency is centralized. This is because it must, by definition, have a physical representation, which in turn requires implied approval (or disapproval) by an agency (such as a central bank).

²For an explainer on blockchain technology, see Koch and Pieters (forthcoming).

³Websites such as coinmap (<http://coinmap.org>) or usebitcoins (<http://usebitcoins.info>) maintain lists of businesses that accept bitcoins.

⁴Pieters and Vivanco also show that persistent price deviations arise based on the extent of information gathering by a given exchange. Exchanges that require users to provide identification to open an account had prices that did not significantly deviate from the prices of the largest exchange. Those that required ID to transfer a sovereign currency posted slight price deviations over short intervals, while those that required no identification could post large and persistent deviations.

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