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A state-of-art survey: Digitalization of money to cryptocurrency

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Abstract

Within the last decade, Digital currency has attracted more and more attention in recent years. Its existence and application not only changes people's consumption patterns, but also brings in changes to the modern economy model as digital currency becomes an investment choice. Despite its popularity and advancement, an extensive review of recent research on digital currency in the financial market has not been available. Accordingly, this article conducts a comprehensive review of digital currency in the financial markets by reviewing the existing literature. We demonstrate the importance of digital currency through different perspectives and applications. In addition, this paper outlines the challenges and trends in digital currency.

Keywords: Digital Currency, Cryptocurrency, Centralization, Bitcoin

Introduction

Payment methods have been evolving over time. In ancient times, people used precious metals, such as gold and silver, as their exchange currency. With the establishment of the financial system and the increasing demands for convenience, people designed banknotes to replace precious metals as the payment method (Orrell and Chlupaty, 2016). Nowadays, traditional currency normally takes the form of bank deposits by recording on physical or electronic ledgers (Bech and Garratt, 2017). In recent years, Bitcoin (Goldfeder et al., 2017), a new scheme of "cryptocurrency", has appeared. It is a new type of digital currency that uses different algorithms to secure money. Bitcoin is not controlled by any central bank or government. Its decentralized architecture enables transactions directly between two accounts without any financial intermediaries.

Digital currency is defined as any form of money or money equivalences in the digital form, whereas cryptocurrency is the digital currency issued by private entities with some type of decentralized cryptography technologies. Digital currency includes both the cryptocurrency and the traditional currency stored and processed electronically. It also includes virtual currency, a type of merchant voucher issued by companies to buy virtual goods in computer games or on social media platforms. Some examples of cryptocurrency include Bitcoin, and Ethereum.

With cryptocurrency gradually gaining attention from practitioners and academic researchers, many people began to debate whether this currency will affect the existing payment system. Compared with traditional currency, cryptocurrency mostly resembles a product for investment and wealth management in the

financial markets. As of 2019, only 3% of people in the UK invest in digital currency (Ali et al., 2014). However, cryptocurrency has seen significant growth within the last few years. It is reported that the value of Bitcoin, a benchmark for cryptocurrency, has reached \$160 billion as of June 2020. Compared with the market share of traditional currency or precious metals, cryptocurrency still has a lot of potential of gaining market share.

In this survey, a systematic survey of traditional currency and digital currency is conducted through the lens of their structures and development processes. We focus on different systems of digital currency and their impact on the world financial markets. Bitcoin is used as an example to evaluate the advantages and disadvantages of cryptocurrency. To the best of our knowledge, this is the first survey to discuss the impact of digital currency, especially cryptocurrency, on the global economy by comparing different currency systems (centralized vs. decentralized). We outline the development of the currency systems and demonstrate the importance of digital currency through different applications. Additionally, the challenges and future trends of digital currency are discussed in this paper.

The rest of the paper is organized as follows: Section 2 provides an overview of the traditional currency and the digital currency. The two types of digital currency platforms, centralized and decentralized, are discussed in the section. The policy roles of digital currency are discussed in Section 3, and Section 4 lays out various applications of digital currency. Challenges and future research in digital currency are discussed in Section 5, and Section 6 summarizes and concludes this paper.

Digital Currency

From Traditional Currency to Digital Currency

Traditional currency, issued by the financial authority of a country, is usually attached to the political and economic conditions of the country. Commodity money is one type of traditional currency. It is created from precious metals, such as gold and silver, and is more than a medium of exchange. Fiat money such as the US dollar, the Euro, and other major world currencies, is a legal tender without intrinsic value that has been established as money, often by government regulators.

The development of information technology reshaped the modern financial system. Traditional currency can be stored and processed electronically thanks to the computer system. The emergence of digital currency is revolutionary (Plassaras, 2013). First, people no longer need to carry cash all the time. Unlike traditional currency, people can use digital currency to complete transactions online without geographical restrictions. Second, it is much more efficient to process a large number of financial transactions through electronic systems. However, this type of digital currency is only an extension of traditional currency. The currency is still issued and regulated by government authorities.

During money transfers, digital currency is cheaper than the conventional banking system (Fung and Halaburda, 2016a). In the traditional transferring process, banks must maintain different processes with extra costs. Also, there is no border in digital currency. Social game companies can pay their users and developers Facebook Credits instead of physical currency because small businesses could accept digital currency such as Facebook Credits. Once those small businesses receive digital payments, they can use credits to reward their customers. As Gans and Halaburda (Gans and Halaburda, 2015) pointed out this situation is common in countries whose national debts are higher than the GDP since the digital currency is a safer currency than their national currency.

The emergence of Cryptocurrency is a technological innovation (Plassaras, 2013). Cryptocurrency, such as Bitcoin, does not have physical transaction records, The transactions are completely recorded and traded on the Internet. More importantly, the current cryptocurrency is all issued and regulated by private organizations. Cryptocurrency does not require any physical storage or any intermediary during transactions. Furthermore, transactions of the newest digital currency are anonymous. The traders' personal information is not displayed in the transaction, and it is replaced by encrypted code. Some types of cryptocurrencies, such as Bitcoin, ensure complete anonymity. Finally, cryptocurrency is an Internet-based global currency, which means that there is no exchange rate for it.

Although Bitcoin is widely known, it is not the first private digital currency. There are other types of cryptocurrencies invented before Bitcoin. The paper written by David Chaum in 1982 (Victor, 2018), Blind Signatures for Untraceable Payments, is considered of early publication of digital currency history. Since the release of DigiCash in 1990, the market of digital currency has been drawing more attention from the public. Hashcash, proposed by Adam Back in 1997, and Bit Gold, created by Nick Szabo in 1998, are two examples of new digital currency that aimed to implement a peer-to-peer server with a proof-of-work system. Although Bit Gold was never implemented, people always refer to it as the architecture of Bitcoin (Victor, 2018). More information on the timeline of cryptocurrency can be found in Table 1, and Figure 1 shows the unit price of the popular cryptocurrencies.

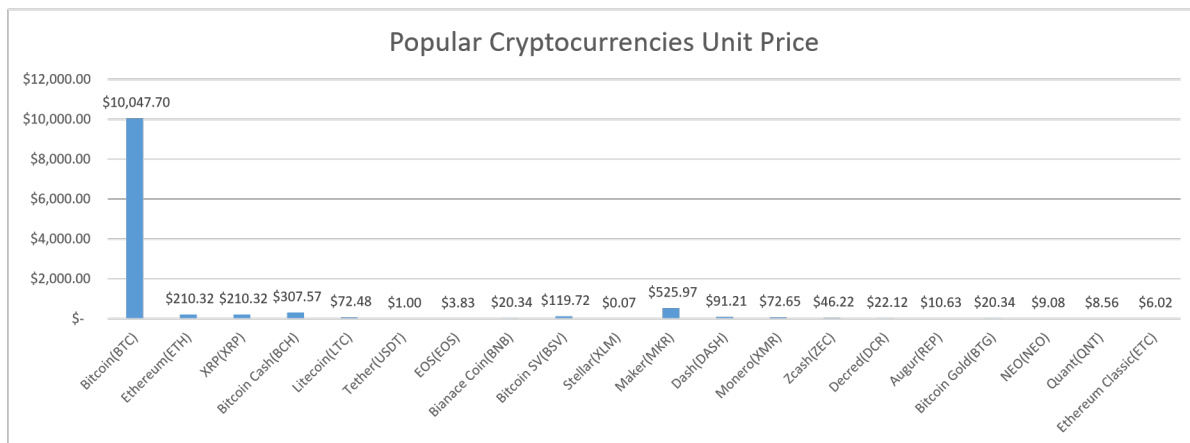


Figure 1: Popular cryptocurrency price in dollars (\$)/unit (CoinMarketCap, 2019)

Table 1. History of Cryptocurrency and Founders

Digital Currency Name	Released Year	Founder(s)
DigiCash	1989	David Chaum
E-gold	1996	Douglas Jackson & Barry Downey
Hashcash	1997	Adam Back
B-money	1998	Wei Dai
Bitgold	1998	Nick Szabo
Bitcoin	2009	Satoshi Nakamoto
Litecoin	2011	Charlie Lee
Peercoin	2012	Scott Nadal & Sunny King
Ripple	2012	Arthur Britto, David Schwartz
Tether	2014	Brock Pierce, Craig Sellars
Ethereum	2015	Vitalik Buterin, Gavin Wood
EOS	2018	Dan Larimer
Libra	2020	Facebook, Inc.

Centralized Digital Currency

Centralized digital currency, a more common form of digital currency, provides a central control of the money supply over the whole system. Debit cards and credit cards are examples of centralized digital currency (Grym et al., 2017). With the advancement of mobile technology, centralized digital currency architecture, as shown in Figure 2, became popular and can be applied in different business models. A growing number of electronic money systems use contactless payment transfers to make transactions more efficient. The centralized digital currency is operated, regulated, and managed by a single organization. The transactions between customers are processed through a third-party organization (Grym et al., 2017). Moreover, the centralized digital currency can prevent the counterfeiting of digital currency and avoid double-spending by using and verifying a series of serial numbers as unique identifiers (Han et al., 2019).

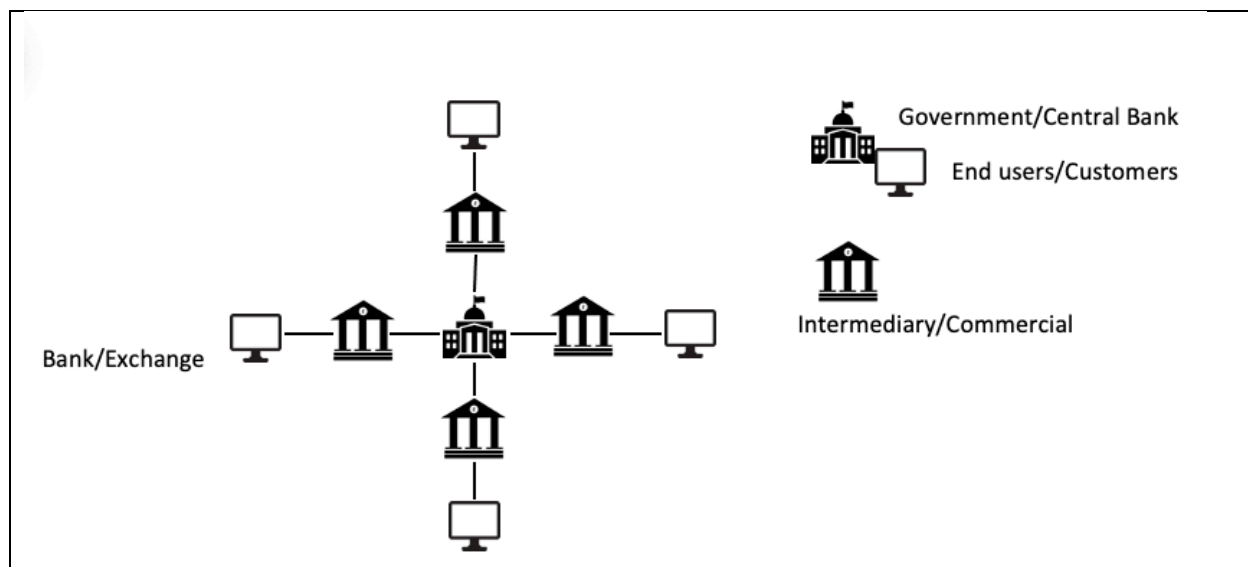


Figure 2: Architecture of centralized digital currency

Policy Roles of Digital Currency

Digital currency brings not only new choices and possibilities to the modern economy, but also changes in monetary policies. In the development of digital currency, the lack of relevant policies makes it difficult to keep pace with traditional currency. There are three policy goals digital currency should meet: financial inclusion, security and consumer protection, and privacy.

For financial inclusion, digital currency can be a better choice for users who are in remote regions where face-to-face transactions with cash are challenging. Furthermore, banks can provide services more easily if the central bank issues a new form of digital currency. In terms of security and consumer protection, digital currency provides a cheaper alternative to traditional currency. Bills and coins carry intermediary costs, which are not faced by digital currency. Digital currency can be a backup payment option that boosts competition by offering a low-cost and efficient alternative. At the same time, digital currency uses a variety of encryption algorithms to protect user information, which avoids the inconvenience of traditional currency such as counterfeit money. For the privacy goal, digital currency can provide an anonymous transaction method. By using decentralized digital currency, the finished transaction as well as any previous transaction are not traceable. (Lagarde and Festival, 2018). Digital currency has also brought challenges to the development of financial markets. There are two different threats of digital currency to current financial markets – financial integrity and financial stability.

Decentralized digital currency may not be welcome from a policy perspective because it lacks government control and could weaken the monetary policy (Tucker, 2009). On the other hand, the government and related financial institutions have regulatory power over a centralized digital currency (Fanning and Centers, 2016). It is easy for regulatory intuitions to implement monetary policy through centralized digital currency to smooth out the economic cycle. Compared to the decentralized digital currency, the centralized digital currency has the advantage of increasing efficiency for small businesses and decreasing the risk of fraud transactions as well. (Ahamad et al., 2013).

Challenges and Opportunities in Digital Currency

Although the digital currency has received attention in different fields and even at the national level in recent years, the deficiencies and development challenges of centralized or decentralized digital currency still exist. First, although it is more convenient for people to use digital currency for consumption, they have to spend more time considering handling fees and policy differences of different countries in conducting large-value transactions or foreign transactions. Second, while the existing Internet and mobile terminal technologies have developed mechanisms to protect consumers' privacy, the risk of financial fraud or hacker attacks still exists. Third, there will be corresponding problems at the policy level. For example, when the government-issued and privately issued digital currencies coexist, will there be competition in the market? How should the competitive relationship be resolved?

The current market of digital currency is chaotic. Different types of digital currency come out without enough regulations or long-term plans. A new type of decentralized cryptocurrency can be released in a very short period (McDonald and Wilson, 2016). There are hundreds of similar products in the cryptocurrency market. Therefore, there is a valid concern about whether those products can provide a stable and long-term investment environment for investors.

Several recent research studies focus on addressing the explosive behaviors, i.e., financial bubbles, in the price dynamics of the cryptocurrency market (Agosto and Cafferata, 2020, MacDonell, 2014, Kyriazis et al., 2020). Some researchers argue that the Bitcoin price movements are caused by the collective behavior of Bitcoin users and the underlying transaction network Bitcoin (Bovet et al., 2019). One solution to reduce the risk of financial bubbling proposed by (Hassani et al., 2018) is the integration of cryptocurrencies and blockchain technology as this technology allows real-time big data sharing and analytics in a secured network, which creates a safe and efficient environment for both risk management and strategic decision making.

The lack of government support also makes Bitcoin vulnerable to illegal transactions and money laundering. Some people argue that without the support of the government and relevant financial organizations, Bitcoin will always be in the global financial system as a niche currency or a digital commodity, however decentralized digital currency is not ready to be a competitor of the traditional currency (Chowdhury and Mendelson, 2014).

These deficiencies are also the main factors that restrict the continued development of the decentralized digital currency. Until a reasonable solution can be found, the decentralized digital currency represented by Bitcoin will only appear as an investment product in the market rather than the widely accepted currency in the real currency system.

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