

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT
ECONOMIC AND SCIENTIFIC POLICY **A**



The Implications of Digital Currencies for Monetary Policy

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**The Implications of Digital
Currencies for Monetary Policy**

**Monetary Dialogue
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In-Depth-Analysis



DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY

The implications of digital currencies for monetary policy

IN-DEPTH ANALYSIS

Abstract

Numerous digital currencies have emerged over the past few years. This entirely new form of money has the potential to play a significant role in the payments landscape of the future. This note provides an overview of the current relevance of digital currencies and assesses their impact on the ability of central banks to continue to implement monetary policy effectively.

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AUTHOR

Daniel HELLER (Peterson Institute for International Economics, Washington DC)

RESPONSIBLE ADMINISTRATOR

Dario PATERNOSTER

EDITORIAL ASSISTANT

Irene VERNACOTOLA

LINGUISTIC VERSIONS

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To contact the Policy Department or to subscribe to its newsletter please write to:

Policy Department A: Economic and Scientific Policy
European Parliament
B-1047 Brussels
E-mail: poldep-economy-science@europarl.europa.eu

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EXECUTIVE SUMMARY

- Digital currencies such as Bitcoin have spread rapidly in recent years. They are an entirely new form of money. They are neither issued by central banks (like banknotes) nor by commercial banks (like deposit accounts).
- While digital currencies will not replace sovereign currencies, they have the potential to play a significant role in the payment system as they enable electronic payments without relying on third parties such as banks or clearinghouses.
- Widespread use of digital currencies will reduce the demand for central bank money and thus reduce the size of the balance sheets of central banks. Seignorage or profits of central banks will shrink, but not disappear.
- Even if demand for central bank money falls to zero, central banks will still be able to effectively conduct monetary policy.

1. INTRODUCTION

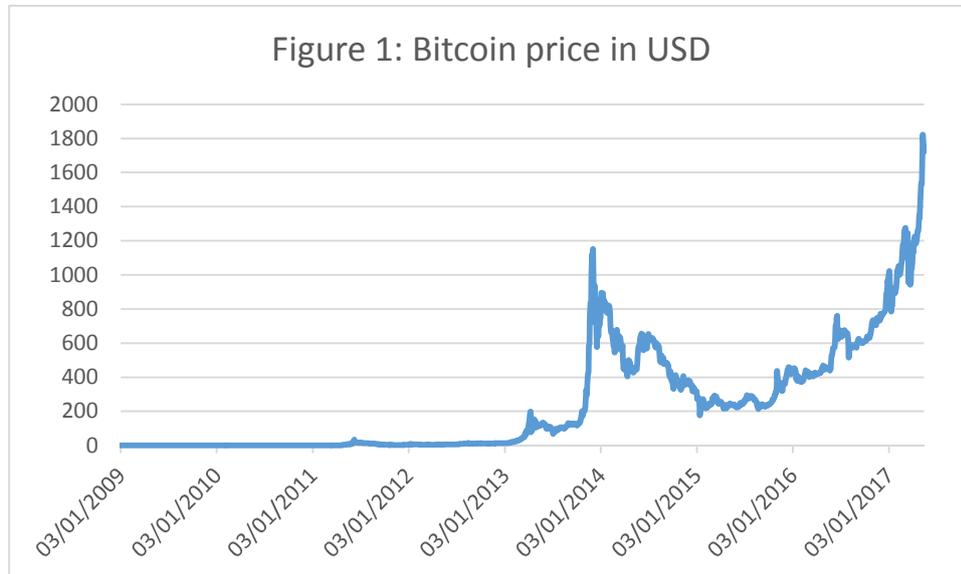
Since Nakamoto's seminal white paper (Nakamoto 2008) hundreds of digital currencies have emerged. Digital currencies such as Bitcoin are an entirely new form of money. They are neither issued by central banks (like banknotes) nor by commercial banks (like deposit accounts). Digital currencies are issued by a software protocol in the form of a digital token.

Digital currencies have the potential to compete with sovereign currency as a means of payment since they allow for relatively fast and inexpensive peer-to-peer payments. Payments in digital currency settle without the intermediation of third parties like banks, credit card companies or clearinghouses. Digital currencies are also a substitute for cash (banknotes) and could, if used widely, have an impact on the balance sheets of central banks and the conduct of monetary policy. Currently, digital currencies are not used much for conventional payments, but they have become very popular in funding rounds of start-up companies (so-called Initial Coin Offerings; Kastelein (2017)). This note provides an analysis of these impacts.¹

¹ This note does not describe the functionalities of digital currencies like Bitcoin. Accessible descriptions can be found, for instance, in Vigna and Casey (2015) and Heller (2017).

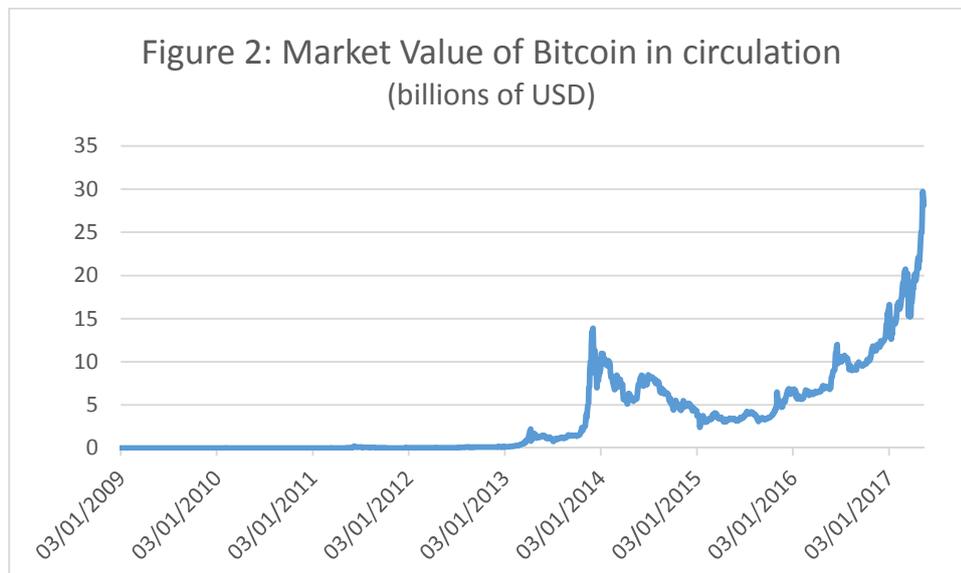
2. THE RAPID SPREAD OF DIGITAL CURRENCIES

While introduced in 2009, digital currencies have gained in popularity only in the past four years. In early January of 2013, the price of one Bitcoin was about \$13 (Figure 1). In late November 2013, it had reached a first peak of \$1120. By January 2015, the exchange rate retreated to \$200. Since then, the exchange rate rose rather steadily, albeit with rather high day-to-day volatility. Currently, the exchange rate is at an all-time high of just over \$2000.



Source: <https://coinmarketcap.com>

Figure 2 shows the value of bitcoins in circulation in billions of dollars (the “market capitalization”)². At present, bitcoins worth about \$32 billion are in circulation (16.3 million coins multiplied by the current exchange rate of \$2000).



Source: <https://coinmarketcap.com>

² New Bitcoin are generated every ten minutes based on «hard wired» rule with a total cap of 21 million coins. New bitcoins are distributed to network participants who keep are record of the transactions and validate them (so called miners).

Table 1 compares the latest market capitalization of bitcoin with the amount of banknotes that are issued by various central banks.

Table 1: Bitcoin relative to banknotes in circulation (in %)	
Euro Area	2.5
United States	2.1
Sweden	355
Switzerland	40.0
Hong Kong	63.5
Canada	51.9
Source: Committee on Payments and Market Infrastructures (2016)	

Compared to large currency areas such as the United States and the Euro Area, Bitcoin is still small. For a country like Sweden where card and mobile payments are used widely (and where cash is used rarely) the picture is different. Bitcoin exceeds banknotes issued by the Swedish Riksbank by a factor of 3.5. Relative to small countries like Switzerland and Hong Kong where demand for banknotes is high, Bitcoin amounts to 40% and 63.5%, respectively. Compared to a large country like Canada, Bitcoin currently accounts for 51.9%.

While these numbers may seem rather small, the following two points should be kept in mind. First, it took only four years for Bitcoin to reach its current place in the market. Should the exchange rate keep appreciating like in the past, its relevance will become larger rather quickly. Second, as mentioned, many other digital currencies already exist (so-called Alt-coins). The total market of Alt-coins is currently valued at \$50 billion³. Thus, the market of digital currencies as a whole is more significant than shown in Table 1.

³ See <https://coinmarketcap.com/>

3. THE IMPACT OF DIGITAL CURRENCIES ON CENTRAL BANK BALANCE SHEETS

In order to illustrate the impact of digital currencies stylized balance sheets of the three main agents in the economy (households, commercial banks, and the central bank) are analysed. These balance sheets are shown in Table 2.

Households			Commercial banks			Central Bank	
<i>Assets</i>	<i>Liabilities</i>		<i>Assets</i>	<i>Liabilities</i>		<i>Assets</i>	<i>Liabilities</i>
Banknotes -	Loans		Loans	Deposits +		Foreign reserves	Bank notes in circulation -
Deposits +			Securities			Domestic assets	Commercial bank deposits +
Securities			Central bank deposits +				
			Vault cash + -				

The impact of technological change in retail payments instruments is first illustrated assuming a shift from cash payments to credit card payments. In essence, this implies that households reduce their holdings of cash and increase their deposits with banks as credit card bills will be debited to their deposit accounts (indicated in Table 2 with a - and + sign). The balance sheet of the commercial banks grows as their assets in the form of vault cash as well as their liabilities in the form of deposits increase. The balance sheet of the central bank is not affected immediately.

Once the commercial banks reduce their stock of vault cash back to the old level, they exchange their vault cash for deposits at the central bank. The size of the central bank does not change, but the composition of its liabilities does.

There will be fewer banknotes in circulation, but the commercial bank deposits at the central bank increase. Since banknotes are not remunerated, but commercial bank deposits are (at the deposit rate), profits or seignorage of the central bank will decrease. However, it is likely that the implementation of monetary policy will also require a reduction of the commercial bank deposits back to the previous level. This means the balance sheet of the central bank contracts and so does seignorage.

With digital currencies the effects are somewhat more complex. In order to see the impact of digital currencies, one needs to keep in mind how they are created by a computer systems (“out of the sky”). The creation of digital currencies is very similar to “helicopter money” where a central bank drops banknotes out of a helicopter or to commodity money like gold that is found in the ground. The stylized balance sheets with digital currencies are shown in Table 3.

Table 3: Stylized balance sheets with digital currencies

Households			Commercial banks			Central Bank	
Assets	Liabilities		Assets	Liabilities		Assets	Liabilities
Banknotes	Loans		Loans	Deposits		Foreign reserves	Bank notes in circulation
Deposits			Securities			Domestic assets	Commercial bank deposits
Securities			Central bank deposits				
Digital currencies			Vault cash				

At the beginning, the value of the digital currency is zero as can be seen for Bitcoin in Figure 1. Once trading of the digital currency in exchange for sovereign currency begins, there will be a positive market price or exchange rate. With digital currencies becoming more popular as a medium of exchange and also as a store of value, various asset substitutions take place. Households will reduce their cash holdings as they will start to make some payments with the digital currency. This will have the same effects as discussed above in Table 2. Household deposits will increase as cash is returned to the commercial banks. Seignorage of the central bank will decrease.

Another adjustment may be that households will reduce their short-term deposits which they have used to pay for their expenses with credit cards or wire transfers. Also, they may choose to hold fewer securities as they view the digital currency as a new asset class. With overall deposits shrinking, the demand of banks for central bank deposits is also likely to decline leading to a smaller central bank balance sheet and thus less seignorage.

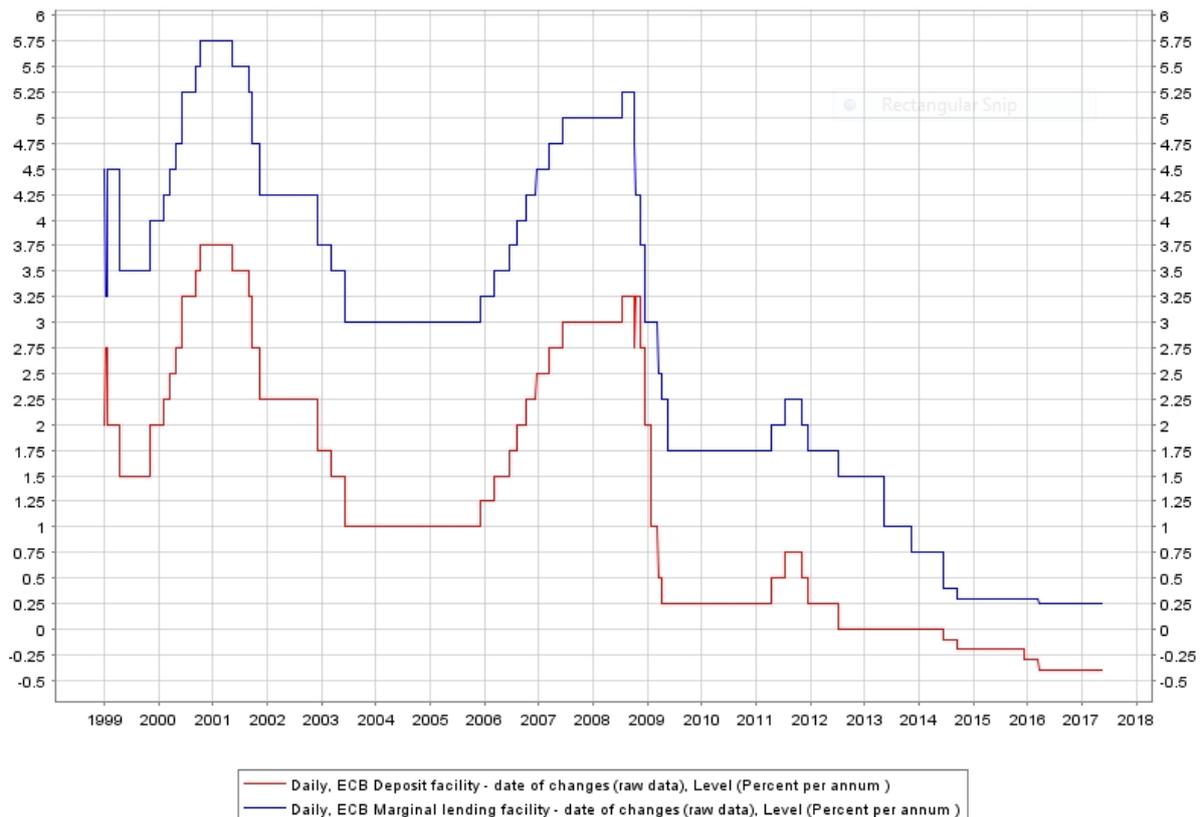
At the extreme banknotes in circulation as well as commercial bank deposits could approach zero. The liability side of the central bank’s balance sheet would then only contain its capital. Of course, it would still have assets which generate a profit, albeit a much smaller one than today.

4. MONETARY POLICY WITHOUT CENTRAL BANK MONEY

With central bank money (banknotes in circulation and commercial bank deposits) becoming increasingly small and possibly approaching zero, the question arises whether the central bank would still be able to conduct an effective monetary policy.

Woodford (2000) and Lahdenperä (2001) analyse this question and conclude that central banks will always be in a position to set the desired policy rate even without central bank money.

Figure 3: Marginal Lending and Deposit Rates of the ECB



Source (all series) : European Central Bank (ECB)

In a channel system for interest rates like the one of the European Central Bank (ECB), interbank lending rates will always fluctuate between the deposit rate of the central bank (red line in Figure 3) and its marginal lending rate (blue line in Figure 3). If the interbank rate for short-term funds exceeds the marginal lending rate of the ECB, it is cheaper for a commercial bank to borrow from the ECB, i.e. there will be no demand in the interbank market. In turn, if the interbank rate is below the deposit rate, a commercial bank with excess deposits at the ECB will not lend in the interbank market and keep its balances at the ECB. This mechanism also holds in case where the aggregate deposits of the banking sector at the central bank are zero. What is important is that the ECB keeps offering the deposit and the lending facilities. To what extent they are used is not relevant. Thus, the ECB will always be able to keep the interbank interest rate within the targeted band (or channel).

5. CONCLUSIONS

Innovations in the technology for payments has always had an impact on the demand for central bank money. While non-cash payment instruments such as credit cards have led to a substitution of banknotes with short-term deposits at commercial banks, the emergence of digital currencies is likely to reduce the demand for both, banknotes and household deposits with commercial banks.

Widespread use of digital currencies will imply that the balance sheets of central banks will become smaller. This has a negative impact on the seignorage of the central bank. In the extreme case where demand for central bank money were to become negligible, effective monetary policy will still be possible. Short-term market rates will keep fluctuating between the deposit rate and the marginal lending rate of the central bank, even if there is little to no demand for the central bank facilities.

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