

**DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS
STATISTICS AND DATA DIRECTORATE**

Working Party on Financial Statistics

How to deal with Bitcoin and other cryptocurrencies in the System of National Accounts?

Meeting of the Working Party on Financial Statistics

**5 November 2018
OECD Conference Centre**

Since 2009, with the creation of Bitcoin, and in part driven by its open-source protocol, there has been a notable proliferation in cryptocurrencies. However, guidance on how to record cryptocurrencies in the SNA is absent. This paper provides a general overview and definition of cryptocurrencies and considers their range of different applications, in order to open a discussion on their treatment. It considers whether they meet the asset boundary of the SNA and if so, what type of assets they reflect (i.e. financial or non-financial, produced or non-produced) and summarises key measurement challenges such as the identification of data sources. This document will be presented under item 2.f of the draft agenda.

Contact: Mr Jorrit Zwijnenburg (jorrit.zwijnenburg@oecd.org) ; Mr Matthew de Queljoe (matthew.dequeljoe@oecd.org) or Ms Isabelle Ynesta (isabelle.ynesta@oecd.org)

JT03438447

Table of contents

1. Introduction	3
2. General overview	3
3. Linking cryptocurrencies to the System of National Accounts	10
4. Statistical measurement of cryptocurrencies under incomplete data sources	15
5. Conclusions	16
Annex A. Overview of potential blockchain applications (at varying stages of development) (World Bank, 2017)	20

Figures

Figure 2.1. Market capitalisation of the 10 largest cryptocurrencies	5
Figure 2.2. M1 end of quarter money supply for the Euro Area, Japan, the United States and the period-average market capitalisation for Bitcoin	5
Figure 2.3. Daily price history of Bitcoin, Ethereum, XRP, and Bitcoin Cash.....	6

Boxes

Box 2.1. Blockchain technology	4
Box 2.2. Key actors in cryptocurrency activities.....	8

1. Introduction

1. The introduction of Bitcoin in 2009 and its open-source protocol has precipitated a significant proliferation in cryptocurrencies (as well as other types of cryptoassets) in recent years, with an increasing number of companies now accepting them as a means of payment. However, guidance on how to record cryptocurrencies in the SNA standards is largely absent.

2. This paper intends to open a discussion on how to treat these digital coins in the accounts. It first provides a general overview and definition of cryptocurrencies and considers their range of different applications in Section 2. It then examines whether they meet the asset boundary of the SNA and, if so, what type of assets they reflect (i.e. financial or non-financial, produced or non-produced) in Section 3. Lastly, Section 4 summarises some of the evident issues in the statistical measurement of these digital coins such as the identification of data sources. The paper finalises with main conclusions in Section 5.

2. General overview

3. According to international organisations (European Central Bank [2012]; International Monetary Fund [2016]; Bank for International Settlements [2015]) a cryptocurrency is an unregulated digital (or virtual) currency designed to work as a medium of exchange that uses strong cryptography¹ to secure financial transactions, control the creation of additional units, and verify the transfer of values. It does not exist in physical form and is usually issued and controlled by its developers, and used and accepted among the members of a specific virtual community. There are a number of motivations for creating and using cryptocurrencies, the most important being the possibility to transact without the intervention of a third party (which may provide more independence to economic actors) and the creation of an alternative means of payment to official currencies (which may be particularly relevant if an official currency is suffering from lack of confidence, e.g. in times of high inflation or large exchange rate fluctuations). In addition to these basic underlying purposes, the last couple of years have also seen a large increase in the use of cryptocurrencies for investment and speculation purposes.

4. All cryptocurrencies (including those created by a central authority) are decentralised currencies which means that transactions are not validated by a central authority, but by a peer to peer architecture (p2p)² that enables two parties to directly transact with each other and to make electronic payments without the need for financial institutions serving as a trusted third party to process electronic payments. However, p2p networks do not ensure that the same unit is not spent more than once by the same holder. Bitcoin, launched in January 2009, solved this ‘double-spending’ issue with the invention of the blockchain technology that allows users to verify the validity of any given transaction (see Box 2.1). On the basis of this technology, Bitcoin uses a peer-to-peer distributed

¹ Cryptography is a method of storing and transmitting data in a particular form (encrypted) so that only those for whom it is intended can read it by possessing a secret key. Cryptography not only protects data from theft or alteration, but can also be used for user authentication.

² A peer to peer network can be defined as a network of computers that are connected, where each computer plays the role of both client and server. In a peer to peer architecture, each computer stores part of the data belonging to the network and requests other data from the other computers in the network. By nature, peer to peer networks are decentralised as data is stored across the various computers constituting the network.

timestamp server to generate computational proof of the chronological order of transactions, preventing double spending of the same unit by the same holder (see Box 2.2 for an overview of the key actors in cryptocurrency activities).³

5. In addition to cryptocurrencies, other types of digital assets have been created that also rely on blockchain technology. These are assets that use the distributed ledger technology (see Box 2.1) for different purposes than cryptocurrencies, such as providing access to services (Ernst & Young, 2018). These other types of crypto-assets can be broadly categorised into payment tokens, utility tokens, asset-tokens, and hybrid-tokens. They are not further discussed in this paper. For more information on other crypto-assets, see IMF (2018).

Box 2.1. Blockchain technology

The blockchain technology can be defined as a distributed account receivables ledger (or distributed database) recording all transactions of a system at regular time intervals. The distributed ledger is based on a chain of connected information blocks in which each new transaction is recorded in a block of information which is added to previous blocks in order to update the ledger. Each new transaction should first be validated by the members of the system which is done on the basis of a consensus mechanism. Blockchains employ cryptographic and algorithmic methods to record and synchronize data across the network in an irreversible manner. With the blockchain technology, the double spending issue is solved as transactions are timestamped, keeping track of all transactions in a chronological way. In addition, the propagation rule in the network enables harmonisation of the information in the blockchain and reinforces protection against possible double spending.

Cryptocurrencies are only one of the potential applications of the blockchain technology. This new technology can be applied in a large variety of sectors (e.g. trade and commerce, health care and governance) and for various purposes (e.g. the registration of shares, bonds and other assets, the registration of transfers of property titles, and the operation of land registers⁴). Annex 1 provides an overview of potential blockchain applications.

2.1. Development of the cryptocurrency market

6. The emergence of Bitcoin and its open-source protocol has allowed for a notable proliferation of different cryptocurrencies commonly referred to as ‘altcoins’. The number of cryptocurrencies available over the internet as of 19 August 2018 is over 1,600, with a total market capitalisation of well over 300 billion Euros in May 2018 (CoinMarketCap). Furthermore, new cryptocurrencies can be created at any time.

7. As seen in Figure 2.1, Bitcoin is by far the largest cryptocurrency with a market capitalisation of 110.9 billion USD as of September 2018, followed by Ethereum (21.4), XRP (13.0) and Bitcoin Cash (7.4).⁵

³ The Bitcoin white paper provides more technical details, see <https://bitcoin.org/bitcoin.pdf>.

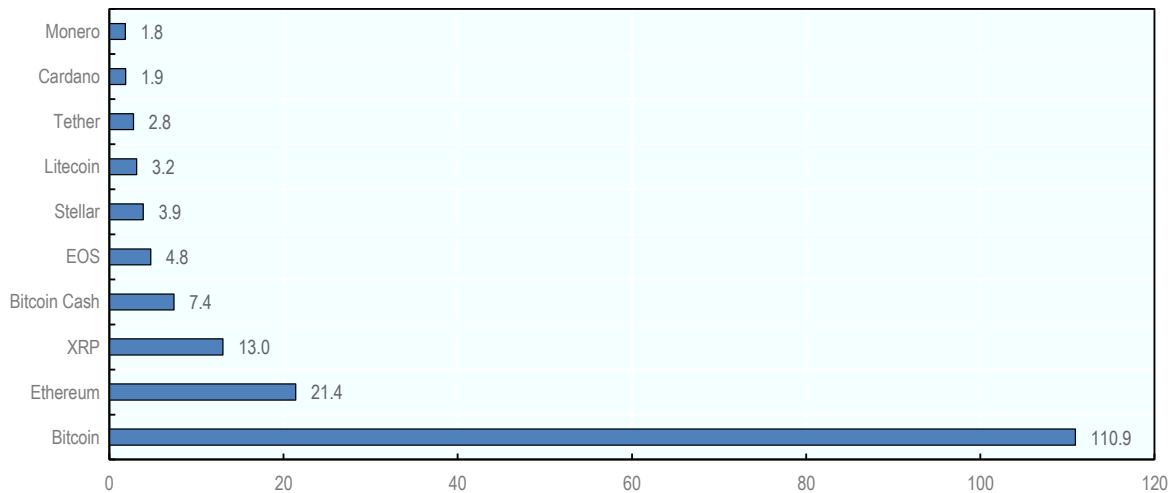
⁴ See World Bank Group (2017).

⁵ The data are sourced from coinmarketcap (<https://coinmarketcap.com/>).

8. Although the number of cryptocurrencies increased substantially over the last couple of years, Figure 2.2 shows that the market capitalisation of these digital coins is still relatively small when comparing for example the value of Bitcoin to the M1 money supply⁶ for the Euro Area, Japan and the USA at the end of the second quarter of 2018.

Figure 2.1. Market capitalisation of the 10 largest cryptocurrencies

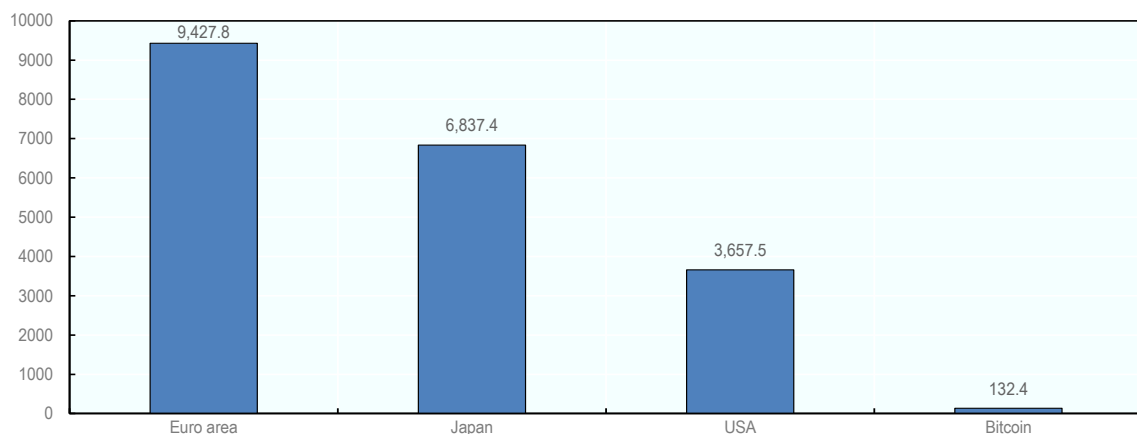
In billions of USD, as of 20/09/2018



Source: CoinMarketCap

Figure 2.2. M1 end of quarter money supply for the Euro Area, Japan, the United States and the period-average market capitalisation for Bitcoin

In billions of USD, 2018Q2



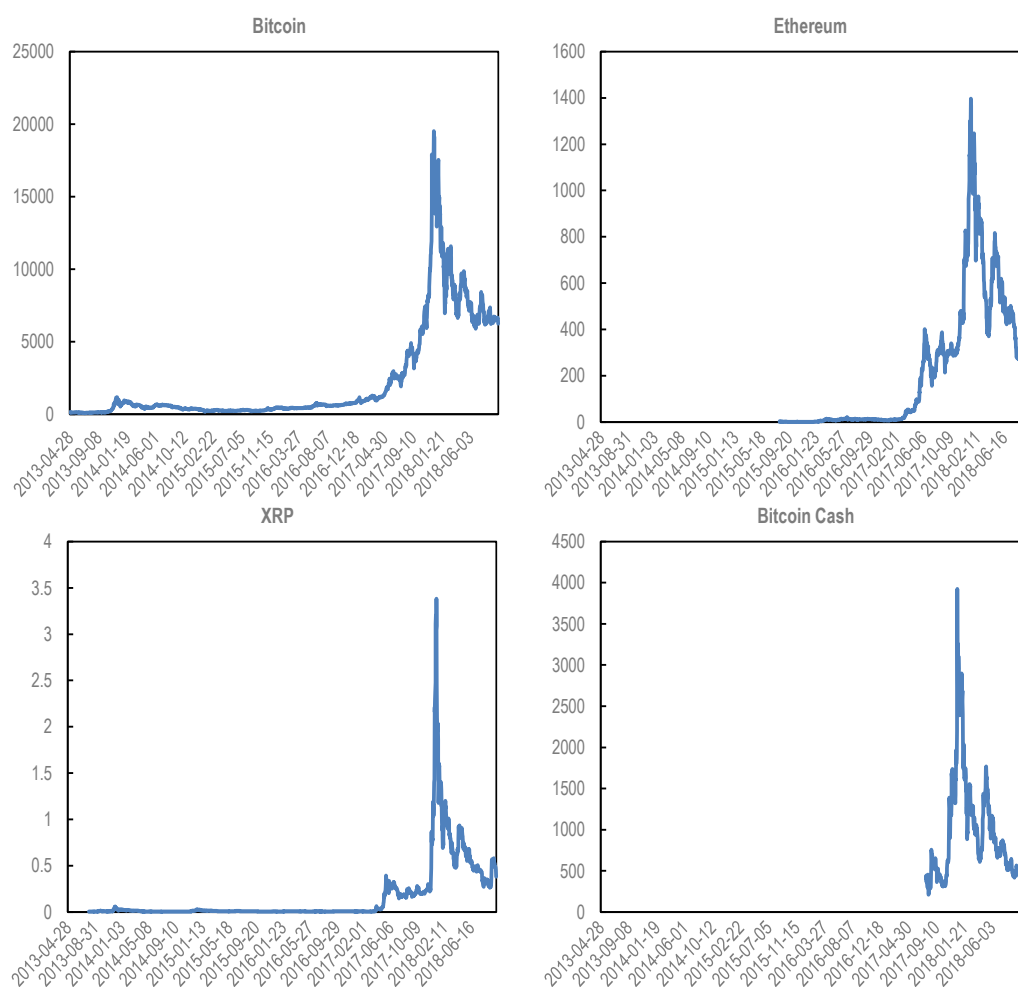
Source: OECD.stat, CoinMarketCap

⁶ The M1 money supply includes currency (banknotes and coins) plus overnight deposits.

9. Figure 2.3 shows that the value of cryptocurrencies can show large fluctuations over time. Near the end of 2017, the value of the various cryptocurrencies increased sharply, followed by sharp declines in the course of 2018. The same pattern was observable for most cryptocurrencies, implying that their values tend to move hand in hand. The question automatically arises what is causing these large fluctuations and, related to that, what is actually underlying these digital coins. When looking at their main purpose, they should probably derive their value from serving as an independent means to transact not dependent on any intervention by a third party and as an alternative (possibly perceived as more reliable) means of payment to official currencies. In order to explain their value, the question then is how much people value these characteristics in comparison with traditional currencies. However, when observing the trends in Figure 2.3, it is questionable whether these can be (fully) explained by how people value these two characteristics. It can be argued that these trends may be more related to speculative use of the currencies, investors hoping to earn money by trading them on related markets.

Figure 2.3. Daily price history of Bitcoin, Ethereum, XRP, and Bitcoin Cash

In USDs (please note that y-axis is not fixed across charts)



Source: CoinMarketCap

2.2. Examples of cryptocurrencies

10. As mentioned above, there is a wide variety of cryptocurrencies available on the internet. To obtain more insight in the characteristics of cryptocurrencies, this section provides an overview of the most important or prominent ones.

11. **Bitcoin** is the first virtual, decentralised currency that is not government-backed or backed by any other legal entity. The issuance of Bitcoins takes place via a process called “mining”. Anyone with access to the internet and suitable hardware can participate in mining, without having to be approved by any central entity. The mining process involves compiling recent transactions into blocks and trying to solve a computationally difficult puzzle. The participant who first solves the puzzle gets to place the next block on the blockchain and to claim the rewards. The rewards consist of both the transaction fees associated with the transactions compiled in the block and a newly released Bitcoin. Bitcoins can be bought with and directly converted into fiat currency on a wide array of cryptocurrency exchanges (e.g. Coinbase, Kraken, Anycoin Direct). As a recent development, Bitcoin is being accepted as a legitimate source of funds by a relatively large number of (online) merchants, among which various large companies (e.g. Microsoft, Expedia).

12. **XRP** is the native currency of Ripple, a real-time global settlement network that allows for near-instantaneous transfers of currency regardless of their form (e.g. US Dollars, Yen and Bitcoin). Launched in 2012 by the private company Ripple, it enables banks to settle cross-border payments in real time, with end-to-end transparency, and at lower costs. It remains one of the most attractive digital currencies among traditional financial institutions looking for ways to revolutionise cross-border payments. It is getting support from a number of big players in the financial services industry, such as Bank of America, Merrill Lynch and Santander. Ripple is being accepted as a means of payment by a growing number of (online) merchants.

13. **Bitcoin Cash** holds an important place in the history of altcoins because it is one of the earliest and most successful ‘hard forks’⁷ of the original Bitcoin. In the cryptocurrency world, a fork takes place as a result of debates and arguments between developers and miners. Due to the decentralized nature of digital currencies, wholesale changes to the code underlying the token or coin at hand must be made due to general consensus, the mechanism varying according to the particular cryptocurrency. When different factions can’t come to an agreement, sometimes the digital currency is split, with the original remaining true to its original code and the other copy beginning life as a new version of the prior coin, complete with changes to its code. Bitcoin Cash began its life in August 2017 as a result of one of these splits. The debate which led to the creation of Bitcoin Cash had to do with the issue of scalability; Bitcoin has a strict limit on the size of blocks, i.e. 1 megabyte. Bitcoin Cash increases the block size from 1 MB to 8 MB, with the underlying idea that larger blocks will allow for faster transaction times. Bitcoin Cash can easily be converted into fiat currency and vice versa through a number of cryptocurrency exchanges.

⁷ A fork occurs when there is a divergence from the previous version of the blockchain or when there is a change to the original protocol that is agreed upon and supported from certain members of the community.

2.3. Use of cryptocurrencies

14. There are currently several areas where cryptocurrencies are used. Financial firms ranging from hedge funds to large asset managers and bank trading desks are already trading in cryptocurrency or are showing interest in supporting cryptocurrency trading. Furthermore, more and more schools are accepting cryptocurrencies as a form of payment. For example, according to the website *Futurism.com*, universities in Germany, Switzerland and the United States have started to accept Bitcoin as means of payment. On the website “cheapair.com”, a travel agency, one can purchase flights, hotels, car rentals and cruises with cryptocurrencies since 2013. Many start-ups are now also using cryptocurrencies in order to fund their ideas, services and products. Instead of using traditional funding, or using fund-raising websites, start-up leaders are looking at cryptocurrency as a way to raise funds. And as more and more industries integrate blockchain technology into their infrastructure, it is not unreasonable to assume that there may be further take-up of cryptocurrencies and crypto-assets in the near future.

Box 2.2. Key actors in cryptocurrency activities

The cryptocurrency market is a new playing field where new categories of actors, which were not present in the payments environment before, play a specific role. It is important to understand what these actors are doing in the crypto market to better define cryptocurrencies and classify them in the accounts. This list provides a description of the most relevant actors in the cryptocurrency market and is based on ECB (2015) and European Parliament (2018):

- a. **Inventors** create a cryptocurrency and develop the technical part of its network. These individuals or organisations are either known or decide to remain anonymous.
- b. **Issuers** are able to generate units of cryptocurrency. The total issuance volume is either predetermined or dependent on demand. With decentralised cryptocurrencies, new units can be created automatically as the result of the activities performed by “miners”, who receive these units as a reward.
- c. **Miners** validate a set of transactions (called a “block”) made with a cryptocurrency by solving a “cryptographic puzzle”. Once validated, the block is added to the payment ledger (called ‘a blockchain’). The action of miners prevents double spending and the introduction of false units.
- d. **Cryptocurrency users** can be individuals or legal entities who obtain coins and use them to make p2p payments, purchase goods and services from a specific set of merchants, or hold them as a form of investment (including speculation). A cryptocurrency user can obtain his cryptocurrency units (called “coins”) in a number of ways. He can buy his coins on a cryptocurrency exchange with traditional money or with another cryptocurrency; he can also buy coins directly from another cryptocurrency user via a trading platform. He can also mine a new coin by participating in the validation of a set of transactions by solving cryptographic puzzles as explained above. Furthermore, he can sell goods or services in exchange for cryptocurrency. Finally, he can receive coins as a gift or donation.

- e. **Wallet providers** are entities that provide cryptocurrency users with digital wallets or e-wallets which are used for holding, storing and transferring coins. These also store their cryptographic keys and transaction authentication codes and provide them with an inventory of all their transactions in a readable format which looks like a regular bank account. A cryptocurrency account consists of a combination of a private key and a cryptocurrency account address. The latter functions similarly to a bank account number for fiat currencies.
- f. **Cryptocurrency exchanges** are persons or entities that offer trading services to cryptocurrency users for which they receive fees in return. They allow cryptocurrency users to sell or buy coins with fiat currency. They usually function as a bourse as they quote the exchange rates by which the exchange will buy or sell cryptocurrencies against the main currencies (e.g. US Dollars, Yen, Euro and Renminbi). They offer users many ways for payment such as cash, credit transfers, credit card and other digital coins. Well-known cryptocurrency exchanges are Bitfinex, Kraken and Coinbase. Some of these provide useful statistics on the cryptocurrency market (e.g. trading volume and volatility of the coins traded).
- g. **Trading platforms** are market places where cryptocurrency users can directly trade with each other. They differ from cryptocurrency exchanges as they do not buy or sell coins themselves and do not oversee and process all trades and there is no central point of authority. A well-known trading platform for Bitcoins is LocalBitcoins.

2.4. Risks associated with cryptocurrencies

15. Notwithstanding the possibility that they reflect a speculative bubble, there are several other risks related to the use of cryptocurrencies. First of all, the market of cryptocurrencies is not regulated by a central authority which would normally guarantee the acceptance of the currency as a general means of payment and provide legal protection against digital theft. Indeed, as the private key knowledge provides the ownership of the cryptocurrency account or wallets, hackers can attack these wallets and find the private key and passwords granting access to it. In that case, hackers can take full control of the account. However, it has to be understood that this relates to the hacking of the keys and passwords related to the wallets, rather than to the hacking of the underlying information as stored in the blockchain. The technique is setup in such a way to prevent this type of hacking.

16. Secondly, the market of most cryptocurrencies is not very liquid, possibly creating difficulties for owners to transfer them into fiat currency. The number of units (coins) is often limited and many cryptocurrencies have very low or no liquidity before being quoted on large trading platforms and generating interest. Adding to the illiquidity is the fact that the market is very concentrated. For example, two main wallets represent more than 2% of the total value of the Bitcoin (over 3 billion USD) and more than 50% of the wallets hold less than 0.001 Bitcoins.

17. Finally, being unregulated and being highly concentrated, the cryptocurrency market also lacks transparency and is full of asymmetric information. In this respect, it is difficult to prevent money laundering, insider trading, fraud, price manipulation and market abuse. These are some of the negative aspects related to the use of cryptocurrencies.

3. Linking cryptocurrencies to the System of National Accounts

18. This section considers how cryptocurrencies should be dealt with in the system of national accounts. It first discusses whether they should be regarded as an asset. Subsequently, it discusses in what asset category they should be classified when they are indeed considered to meet the characteristics of an asset, thereby exploring several options with their pros and cons.

3.1. Asset boundary

19. The first question that needs to be answered is whether cryptocurrencies meet the characteristics of an asset. To that end, they should be owned by some unit and the owner should be able to derive economic benefits by holding them over a period of time (see 2008 SNA §1.46).

20. Ownership is well defined for digital coins. Whoever possesses the private keys associated with a given cryptocurrency account has the ability to use them much as they would use cash. Furthermore, ownership can easily be verified via the blockchain which records the ownership of cryptocurrencies and transactions upon it.⁸

21. The second consideration that a given entity must provide economic benefits to the holder also holds for cryptocurrencies as they allow for carrying forward value between accounting periods (see 2008 SNA §10.8). The valuation of a given cryptocurrency depends on the market's expectations on its future benefits and in that respect, as noted by Berentsen and Schär (2018), a purchase order for a unit of a digital coin conveys an expectation that its dollar valuation will at least remain at the same price over the period of which it is to be held (although the market is, for now, characterised by significant volatility).

22. From the above, it is clear that cryptocurrencies meet the asset boundary. The next question then is what type of asset it concerns. To answer this question it must be assessed whether it concerns financial or non-financial assets and whether it concerns produced or non-produced assets.

3.2. Financial versus non-financial assets

23. According to the SNA, an asset is, in general, regarded as financial when there is a corresponding claim on another institutional unit and when it entitles the holder to receive an agreed sum at an agreed date (see 2008 SNA §11.5-11.8). This also covers shares and other equity that provide the holder with a claim on the residual value of a corporation or quasi-corporation. There is one important exception to this general rule, which is relevant for the discussion here, which is monetary gold that is currently the only financial asset for which no corresponding liability is recorded in the accounts.

24. If we consider the general case first, it follows that any digital coin with a corresponding liability is in scope to be recorded as a financial instrument. This will be the case for cryptocurrencies issued or authorized by central banks or a government. In line

⁸ In this regard, it should be noted that ownership can be established for digital coins, but generally not for the underlying blockchain technology as it is usually publicly owned. Only in the case that a blockchain is private or 'permissioned' (users may be granted various interaction rights) it may be possible to establish an economic owner. See for more information: <https://developer.ibm.com/code/2018/05/07/who-owns-the-blockchain/>.

with fiat currency issued by these authorities, they have a corresponding liability and should therefore be recorded as financial instruments. Although this type of issuance is not common practice yet, it can be envisaged that central banks or governments will start issuing their own versions of cryptocurrencies for use as a supplement to cash. Indeed, a number of central banks have already begun exploring the possibilities of doing so.⁹ As noted by the BIS in 2017, in order for an electronic representation of money to be considered as a central bank-issued cryptocurrency it would necessitate the use of the blockchain technology to allow for decentralised transfers. This would distinguish this form of currency from other electronic liabilities already issued by central banks such as reserve balances. In these cases households could hold these state-issued cryptocurrencies as liabilities of the central bank in the same way as cash and the relevant amounts could be included in the currency category as defined in the SNA.

25. For cryptocurrencies that are not issued by a central bank or government, however, there will usually be no corresponding liability¹⁰, as there is no contractual obligation for an economic actor to provide a payment or series of payments upon the redemption of a given coin unit, as is the case with fiat currencies (see 2008 SNA §11.52). On the other hand, it can be argued that the latter claim is often more a theoretical one than a practical one, as for most currencies it will not be possible to obtain any underlying value by redeeming the currency. Whereas fiat currencies were traditionally backed by gold and silver, over time most countries abandoned the possibility for holders to exchange currencies for these underlying metals (the gold and silver standards). Furthermore, whereas the issuance of new currency is sometimes accompanied by corresponding changes in other financial instruments that back the newly created liabilities (e.g. by providing more credit to banks or via open market operations), this need not always be the case. For example, in case of directly distributing cash to households (i.e. helicopter money) or in case of covering specific expenses by issuing new money, the newly created currency will not be backed by any assets. Nevertheless, as an accounting convention, the currency will still show up in the system of national accounts as an asset for the holder and a liability for the monetary authority. This raises the question as to whether recording cryptocurrencies would merit a different treatment. For that purpose, it would be necessary to assess the decisive criteria to record currencies as financial instruments and to see how these criteria would relate to cryptocurrencies. In case cryptocurrencies would meet these criteria, they should be treated similar to fiat currencies, preferably recording them in a separate subcategory to clearly distinguish them from the latter.

26. When assessing whether some cryptocurrencies act like traditional currencies, the ECB (2015) pointed out that they currently do not seem to meet the three functions of money: medium of exchange; store of value, and unit of account. Indeed, they currently have a low level of acceptance among the general public, although an increasing number of companies are accepting specific cryptocurrency as means of payment. Furthermore, the high volatility of their exchange rates to traditional currencies makes them less useful as a

⁹ The government of Venezuela for example issued a cryptocurrency in 2018, the Petro.

¹⁰ It is important to mention that several financial derivatives, such as options or forwards, are created on the basis of cryptocurrencies. Whereas the underlying assets may themselves not (yet) qualify as financial asset according to the SNA, these derived products may. The main difference is that whereas most cryptocurrencies do not have a corresponding liability, crypto-derivatives are based on a contract that is agreed upon between two or more parties, creating both an asset and liability. Recently, a New York-based blockchain company got the approval from the US Commodity Futures Trading Commission to function as Derivatives Clearing Organization. This approval is considered as a significant milestone in the crypto-world as it implies a 'go' to bring cryptocurrency trading into the real world. Also, it has kindled the interest of many institutional investors to shift their focus to also invest in derivatives related to Bitcoins, Ether, and other digital currencies.

store of value even in the short-term. With regard to the latter, cryptocurrencies are also not regarded as a cash equivalent according to the International Accounting Standards (IAS 7.6), since they often have significant short-term value changes. Moreover, in some cases there are constraints on the conversion to fiat currency, limiting their liquidity. However, looking at these criteria, it is questionable whether they can be regarded as decisive not to treat currencies as a financial instrument, as some of these considerations may also not apply to state-issued currencies nor indeed to other forms of financial assets, including equity and debt. It is possible that state-issued currencies may experience reduced acceptance amongst the public when their perception of its value changes. Furthermore, high volatility has also at times been evidenced for official currencies as well. Also restrictions on currency conversions may occur for state-issued currencies, for example due to capital market restrictions. Since these considerations do not affect the classification of these currencies as financial instrument, it is difficult to argue that these could be used to disqualify cryptocurrencies as currency according to the system of national accounts.

27. It can also be assessed whether cryptocurrencies can be regarded as a form of equity. According to the 2008 SNA, equity reflects the claim on the residual value of a corporation or quasi-corporation after the claims of all creditors have been met and is treated as a liability of the issuing institutional unit (see 2008 SNA §11.83). One might possibly consider a cryptocurrency as a form of a collectively owned entity in which coin holdings represent a stake in its value. However, this would require that the owner of a given unit would have a claim on any residual value, and as explained above, this does not seem to be the case for cryptocurrencies. Instead of a claim on any future benefits or remaining value, they seem to derive their value from serving as an independent means to transact and as an alternative means of payment to official currencies.¹¹

28. It is important to note of course that whilst the need to have a liability is the case for the overwhelming majority of financial assets, it is not a pre-requisite as the case of monetary gold well illustrates. Indeed, as mentioned, even the ‘notion’ of a liability is in itself a relatively abstract concept, based as much on trust and confidence as it is on legality, as is well illustrated by hyperinflation, debt defaults and bankruptcies. Arguably therefore, one could reason that the need to have a liability is not a condition for an asset to be treated as a financial asset but rather a useful construct that provides a means of identifying the nature of inter-dependencies between two counterparties. Trust and confidence in this respect are also key characteristics that underpin monetary gold’s classification as a financial asset, and in this respect, these characteristics are very similar to those that underpin the value of cryptocurrencies. Certainly the fact that they are beginning to be accepted more widely as a general means of payment suggests that there is arguably a sufficient degree of trust and confidence for them to be considered as being akin to monetary gold in this respect.

29. If on the other hand it is decided that cryptocurrencies do not qualify as financial instruments, they will need to be recorded as non-financial assets. Their classification will then depend on whether they are regarded as produced or non-produced assets. This is discussed in the next section.

¹¹ Please note that while cryptocurrencies are seemingly outside the SNA’s scope of equity, other forms of crypto-assets such as asset-tokens may be classified here when the holder has a stake in the venture’s future profits.

3.3. Produced versus non-produced assets

30. Cryptocurrencies involve the development of software that allows for their existence to be realised, among other things enabling users to maintain wallets and send and receive transfers through the blockchain network. The validation of these transactions is the work of ‘miners’. This mining process requires the use of both intellectual property for developing algorithmic solutions to the cryptographic puzzles as well as the use of computing equipment needed to scale the process.¹² Furthermore, miners usually spend a lot of time in solving these puzzles and ‘creating’, or rather ‘discovering’, new coins. The creation of cryptocurrencies could in that regard be considered as an action of production that requires both the input of labour and capital, similar to the mining of gold or the extraction of energy resources. In that case, the currencies are regarded as produced assets. In this regard, it has to be borne in mind that also the creation of a lot of fiat currency involves a production process that is captured within the production boundary (on the basis of a sum of cost approach), albeit whose value does not typically reflect the value of the currency produced.

31. Alternatively, it could be argued that although the miners engage in production activities, they are not actually producing cryptocurrencies, but mining services via which already existent cryptocurrencies may be discovered. In this regard, it has to be borne in mind that the discovery of a new coin does not necessarily mean that the coin itself is a produced asset. Telling the general public, for example, that you lost a suitcase worth of 1 000 000 USD and that you are prepared to pay a large finder’s fee may very well involve activity that should be recorded in the production boundary but the cash in the suitcase does not magically transform into a produced asset. It could also be argued that miners work on validating the transactions recorded in the distributed ledgers, designed to ensure the value of the cryptocurrency and to govern the amount of the cryptocurrency in circulation (both of which are necessary to maintain its value, which could be much less (and in fact, zero) without this system in place) rather than producing new coins. The cryptocurrencies would in that regard be similar to contracts and leases as included in non-produced non-financial assets. One issue that needs further consideration in this case is determining where the cryptocurrency actually originated and what recordings will be needed when the mining activities take place in a different country.

32. Finally, it could also be argued that the creation (or discovery) of cryptocurrencies does not meet the production boundary of the SNA, i.e. that the activities do not involve the production of goods and services that can be sold on markets or that at least can be provided by one unit to another with or without charge (see 2008 SNA §1.40). The answer to the validity of this argument amongst others depends on the assessment of the type of output that is derived from these activities, i.e. new cryptocurrencies versus mining or validation services that contribute to the discovery of new coins. Moreover, in case the output is looked upon as mining or validation services, the question may also need to be answered whether part of the activities actually constitutes household production of services for own consumption, which is typically excluded from production in the SNA. As part of the mining activities may be carried out by companies, this will not hold for all mining activities, but it most certainly could apply to a significant part of it.

33. If the mining of cryptocurrencies is regarded as production, a next question is how to determine the output value of these activities. Taking the view that the mining in and of

¹² The computing equipment along with the software used to perform the mining would be evidently classified under ‘other machinery and equipment’ and computer software respectively.

itself unearths or creates the cryptocurrency (which would make it a produced asset), in the same way that mining may unearth gold and silver, one approach would be to record the value of the activity as being equal to the sum of the fee and the value of the newly released coin (which would make it significantly different to the approach used for fiat currencies). In case of successful mining¹³, the production process then leads to the output of ‘cryptocurrencies’ valued at market prices which would show up in either the capital account (as gross fixed capital formation) or the financial account (as creation of a financial asset) for these miners.

34. Another possibility is to record it in line with the production of fiat currency, i.e. on the basis of the sum of cost approach. This would be a more suitable approach when the view is taken that the ‘miners’ are not engaged in ‘creating’ coins but rather in ‘discovering’ already existent coins (in which case the currencies would not be regarded as produced assets as a result of the mining process). However, even in the case when the currency is regarded as being created as result of the mining process, it would be possible to apply the sum of cost approach, in line with the treatment for fiat currency. In the sum of cost approach, the output value would be derived upon the costs related to the use of computing equipment and other inputs needed in the mining process as well as a compensation for the time spent on mining. As this value will usually fall short of the market value of the new asset, this would require an additional entry in the other changes in assets account to account for the full value that will appear in the balance sheet. This is both the case for when it is regarded as a financial asset and when it is regarded as a non-financial asset.

35. As the above approaches for valuing the output of the mining activities will normally lead to quite different output values, it has to be borne in mind that they will also have a different impact on GDP. The valuation of the output on the basis of the market price of the cryptocurrency will almost certainly lead to a (significantly) higher value added than valuing the output at the sum of costs. Furthermore, value added in the former case may be expected to show more fluctuation over time, at least in current prices, particularly when market prices continue to be very volatile. The impact in constant prices, on the other hand, may be much smaller, depending on the deflation method. When assessing the possible impact on GDP, it is also important to decide how to deal with (the costs of) unsuccessful mining activities, as these may significantly lower the value added of these activities. In any case, an example for Georgia shows that the impact may be significant. An IMF issues paper prepared for BOPCOM showed that mining companies in Georgia receive an estimated amount in fees and newly mined Bitcoins which is around 5% of GDP (IMF, 2018).

36. Particularly when considering that new cryptocurrencies can be created at any time and that their price is still very volatile (affecting the output price of new coins), the treatment of mining activities as production may create some discomfort as it is difficult to assess where this may lead to and how possibly large changes in (nominal) GDP as a result of this decision may be explained to users. That is not to say that volatility should be used a reason to exclude mining activities from the production boundary or to disregard the option of valuing these activities at market price, rather it is to emphasise the care needed in considering these issues. Looking at the example of Georgia, it could also be argued that these companies are actually receiving rewards on the basis of their activities for which they use both capital and labour input. Whereas these rewards may seem relatively large at the moment, they reflect the price that the market currently puts on these newly created coins. Furthermore, it is not said that every newly created coin will automatically increase

¹³ Non-successful mining would have an output value of zero.

GDP. As they serve a specific purpose, currencies will have to fulfil certain requirements before being accepted as a valid cryptocurrency and before obtaining a market value, and there is also the question of how newly created coins will affect the market price of existing coins, as they will lead to an increase in the supply of digital currencies.

37. If cryptocurrencies were regarded as produced non-financial assets, it has to be decided in which subcategory they should be included. The SNA currently distinguishes between fixed assets, inventories and valuables. As inventories concern goods and services which came into existence in the current or an earlier period, and that are held for sale, use in production or other use at a later date, it is immediately clear that cryptocurrencies would not qualify for this category. Furthermore, fixed assets concern produced assets that are used repeatedly or continuously in production processes for more than one year (see 2008 SNA §100.11). When looking at the characteristics of cryptocurrencies they do not seem to meet this definition as they are not intended to be used in the production process.¹⁴ The last category within produced non-financial assets concerns valuables. These include those items that are held as an alternative form of investment such as precious metals or art objects (see SNA §10.149). At various times investors may choose to buy these valuables rather than a financial asset “when the prices of financial assets [are] behaving in a volatile matter”. Although cryptocurrencies currently also suffer from high volatility, they indeed serve as an alternative form of investment and are expected to maintain some value over time. In that regard, one could argue that they should be treated as valuables. An alternative would be to create a separate subcategory within produced non-financial assets for cryptocurrencies.

38. If cryptocurrencies would be regarded as non-produced non-financial assets, their creation would not result from a production process, but most likely appear in the other changes in assets account. Such as with valuables, the recognition of their value would then be probably best regarded as an economic appearance (see 2008 SNA §12.16). Regarding their specific classification, there are currently three subcategories for non-produced non-financial assets, i.e. natural resources, contracts, leases and licenses, and purchased goodwill and marketing assets. As explained above, a classification as contracts, leases and licences could be envisaged, if the systems are indeed regarded as being designed to ensure the value of the cryptocurrency and to govern the amount of the cryptocurrency in circulation. Alternatively, a new separate category should be created for these new instruments that did not yet exist at the time of the drafting of the 2008 SNA.

4. Statistical measurement of cryptocurrencies under incomplete data sources

39. Perhaps the most evident challenge in adequately measuring the economic activity generated by cryptocurrencies is the general anonymity of transactions. If national statistical authorities deem that the size of cryptocurrency assets are sufficiently large enough to warrant incorporation into compilation procedures, this will then require the identification of reliable data sources where there is transparency regarding the identity and

¹⁴ There is a separate issue pertaining to the underlying blockchain technology that is used in the mining activities, which could be viewed as being similar to creation of intellectual property for use in production. However, as the blockchain technology is regarded as public knowledge, no ownership rights can be exercised on the basis of which benefits may be claimed in the future, and consequently the knowledge created on the basis of mining does not meet the current asset boundary of the SNA.

location of transactions. The fact that new developments and uses of cryptocurrencies can emerge quickly highlight the need for timely and accurate information.

40. The underlying blockchain of a given cryptocurrency would be an evident starting point in the collection of transaction and stock data. While this would provide the primary information on all the transactions that have taken place and the amount of currency holdings at specific points in time, discerning more detailed information such as linking a wallet to a resident or non-resident institutional unit may be more difficult to achieve or impossible by design. It may be possible to supplement this raw information by requesting information from major exchange platforms, however it appears that there would be significant reluctance in disclosing this type information voluntarily. Alternatively, looking to existing administrative sources of information may in many cases present a more viable option. It is evident that national tax authorities also have an interest in determining identity of cryptocurrency owners and have already made progress on this front. As a notable example, the United States Internal Revenue Service obtained a court order obliging Coinbase, a major trading platform to disclose this information.¹⁵

5. Conclusions

41. This paper has provided an overview of cryptocurrencies and their main characteristics. It underlines a number of general considerations of how cryptocurrencies may be captured under the SNA:

- Cryptocurrencies should be regarded as assets according to the 2008 SNA.
- Cryptocurrencies issued or authorized by central banks or governments should be classified as currency when they serve the same role and have the same status as fiat currency issued or authorized by these entities.
- For a correct classification of cryptocurrencies that are not issued or authorized by central banks or governments, it is necessary to reach agreement on whether they concern financial or non-financial assets and – in the latter case – whether they concern produced or non-produced assets. Furthermore, if they are considered as produced assets, it is important to also reach agreement on the valuation of the output of the production process. The paper discussed several pros and cons to answer these questions, leading to different classifications and to a different recording of cryptocurrencies and their creation in the accounts.
- The blockchain technology underlying cryptocurrencies generally falls outside the asset boundary.
- Determining the residency and institutional sector of the entities involved in cryptocurrency transactions presents the main obstacle in the statistical measurement of their flows and stocks.

42. Delegates are invited to provide comments and suggestions on the following principal points:

- Do you agree that cryptocurrencies have to be regarded as assets?

¹⁵ <https://www.nytimes.com/2018/01/22/opinion/irs-bitcoin-fear.html> highlights some further accounting issues of cryptocurrencies for tax purposes.

- If so, do you think that they should be classified as financial assets, or as non-financial assets?
- If you think that cryptocurrencies are non-financial assets, should they be treated as produced or non-produced, and if so what should be the valuation?
- If you think that cryptocurrencies are non-produced non-financial assets or financial assets, do you think that the underlying mining activity involved in creating or discovering cryptocurrencies should be recorded in the production boundary, and if so how should the activity be valued.
- Do you already include transactions and/or stocks of cryptocurrencies in your accounts? If so, where are these recorded in the accounts?
- Do you know of any data sources that may be available to obtain more information on cryptocurrencies?
- Do you have any other comments or suggestions with regard to the analysis in this paper?

References

- Bank for International Settlements (2015), “Digital currencies”, November 2015, <https://www.bis.org/cpmi/publ/d137.htm>.
- Bank for International Settlements (2018), “Cryptocurrencies: Looking beyond the hype”, BIS Annual Economic Report 2018, <https://www.bis.org/publ/arpdf/ar2018e5.pdf>.
- Barrdear, J. and Kumhof, M. (2016), “The macroeconomics of central bank issued digital currencies”, Bank of England Staff Working Paper, No. 05, July 2016, <https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2016/the-macroeconomics-of-central-bank-issued-digital-currencies.pdf?la=en&hash=341B602838707E5D6FC26884588C912A721B1DC1>.
- Bech, M. and Garratt, R. (2017), “Central bank cryptocurrencies”, https://www.bis.org/publ/qtrpdf/r_qt1709f.pdf.
- Berentsen A. and Schär F. (2018), “A short introduction to the world of cryptocurrencies”, Federal Reserve Bank of St. Louis Review, First Quarter 2018, <https://files.stlouisfed.org/files/htdocs/publications/review/2018/01/10/a-short-introduction-to-the-world-of-cryptocurrencies.pdf>.
- [CoinMarketCap, Webpage, Accessed on 20/09/2018, www.coinmarketcap.com](http://CoinMarketCap.com)
- Ernst & Young (2018), “Accounting for crypto-assets”, [https://www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/\\$File/EY-IFRS-Accounting-for-crypto-assets.pdf](https://www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf).
- European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, New York (2009), “System of National Accounts 2008”, <https://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf>.
- European Central Bank (2012), “Virtual currency schemes”, October 2012, <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf>.
- European Central Bank (2015), “Virtual currency schemes – a further analysis”, February 2015, <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemesen.pdf>.
- He, D., Habermeier, K., Leckow, R., Haksar, V., Almeida, Y., Kashima, M., Kyriakos-Saad, N., Oura, H., Saadi Sedik, T., Stetsenko, N. and Verdugo Yepes, C. (2016), “Virtual currencies and beyond: initial considerations”, IMF Staff Discussion Note, SDN/16/03, January 2016, <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2016/12/31/Virtual-Currencies-and-Beyond-Initial-Considerations-43618>.
- IBM (2018), “Who owns the blockchain?”, information available from their webpage, published on May 7, 2018, <https://developer.ibm.com/code/2018/05/07/who-owns-the-blockchain/>.

International Monetary Fund (2018), “Treatment of crypto-assets in macro-economic statistics”, paper prepared for the 2018 BOPCOM meeting.

Nakamoto, S. (2018), “Bitcoin: A peer-to-peer electronic cash system”.
<https://bitcoin.org/bitcoin.pdf>

Norges Bank (2018), “Central bank digital currencies”, Norges Bank Papers, No. 1, 2018,
<https://static.norges-bank.no/contentassets/166efadb3d73419c8c50f9471be26402/nbpapers-1-2018-centralbankdigitalcurrencies.pdf?v=05/18/2018121950&ft=.pdf>

World Bank Group (2017), “Distributed Ledger Technology (DLT) and blockchain”, FinTech Note, No. 1, 2017,
<http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf>

Annex A. Overview of potential blockchain applications (at varying stages of development) (World Bank, 2017)

Financial Sector Applications

Money and Payments

- Digital currencies
- Payment authorization, clearance & settlement
- International remittances and cross-border payments (alternative to correspondent banking)
- Foreign exchange

Financial Services & Infrastructure (beyond payments)

- Capital markets: digital issuance, trading & settlements of securities
- Commodities trading
- Notarization services (e.g. for mortgages)
- Collateral registries
- Syndicated loans
- Crowdfunding (as initial coin offerings)
- Insurance for automating insurance pay-outs

Collateral registries and ownership registers

- Land registries, property titles & other collateral registries

Other sectors applications

Identity

- Digital identity platforms
- Storing personal records: birth, marriage & death certificates

Trade & Commerce

- Supply chain management (management of inventory and disputes)
- Product provenance & authenticity
- Trade finance
- Rewards & loyalty programs
- Invoice management
- Intellectual property registration

Governance

- E-voting systems
- E-Residence
- Government record-keeping, e.g. criminal records
- Reducing fraud and error in government payments
- Reducing tax fraud
- Protection of critical infrastructure against cyberattacks

Healthcare

- Electronic medical records

Humanitarian & Aid

- Tracking delivery & distribution of food, vaccinations, medications, etc.
- Tracking distribution and expenditure of aid money