

Crypto-asset markets

Potential channels for future financial stability implications

10 October 2018

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Executive Summary

Crypto-assets,¹ such as bitcoin² and ether, reached an estimated total market capitalisation of \$830 billion on 8 January 2018, before falling sharply in subsequent months. These markets remain small compared to the global financial system, and crypto-assets are not yet widely used for financial transactions, but markets are changing rapidly. The growth of crypto-asset trading platforms (often misleadingly called ‘exchanges’);³ the introduction of new financial products (such as crypto-asset funds and trusts and exchange-traded products); and the growing interest by retail investors, raise questions about the implications of crypto-assets for financial stability.

Over the course of 2018 the Financial Stability Board (FSB) has worked to assess these implications. It has concluded that, based on the available information, crypto-assets do not pose a material risk to global financial stability at this time. However, crypto-assets raise several broader policy issues (see below), and vigilant monitoring is needed in light of the speed of market developments.⁴ This report sets out the reasoning behind this view, and describes the FSB’s framework for monitoring potential financial stability risks from crypto-assets.

The FSB’s assessment includes consideration of the primary risks present in crypto-assets and their markets, such as low liquidity, the use of leverage, market risks from volatility, and operational risks. Based on these features, crypto-assets lack the key attributes of sovereign currencies and do not serve as a common means of payment, a stable store of value, or a mainstream unit of account.

In the future, should the use of crypto-assets continue to evolve, it could have implications for financial stability. These implications may include: confidence effects and reputational risks to financial institutions and their regulators; risks arising from direct or indirect exposures of financial institutions; risks arising if crypto-assets became widely used in payments and settlement; and risks from market capitalisation and wealth effects.

Assessing and monitoring these potential risks is challenging. In part, this is because available information on the potential materiality of risks is sparse. In particular, there are gaps in the information on the extent of leverage in crypto-asset markets, and on direct and indirect exposures of financial institutions.

¹ This document contains a glossary (in Annex 2) that defines how certain terms, like ‘crypto-assets,’ ‘crypto-asset funds’ or ‘distributed ledger technology’ are defined for the purposes of this discussion. To the extent possible, these are aligned with definitions used in past FSB work, and by other standard-setting bodies.

² In some cases, this report refers to specific crypto-assets as examples. These examples are not exhaustive and do not constitute an endorsement by the FSB or its members for any crypto-asset, firm, product, or service.

³ FATF 2015 [Guidance for a Risk-Based Approach to Virtual Currencies](#) refers to ‘crypto-asset’ trading platforms, including virtual currency trading platforms, as exchanges; however, use of that term may not connote any particular legal or regulatory status.

⁴ This view was shared with the G20 ahead of the March 2018 Finance Ministers and Central Bank Governors meetings. See FSB (2018a), [FSB Chair’s letter to G20 Finance Ministers and Central Bank Governors](#), March; FSB (2018b), [Crypto-assets: Report to the G20 on the work of the FSB and standard-setting bodies](#), July. See also G20 (2018), [Communiqué: Finance Ministers & Central Bank Governors](#), 19-20 March 2018, Buenos Aires, Argentina and [Communiqué: G20 Finance Ministers and Central Bank Governors Meeting](#), 21-22 July 2018, Buenos Aires, Argentina.

In this rapidly developing area, the paucity of relevant and reliable data warrants further monitoring and analysis of the market. The FSB has developed a monitoring framework, predominantly based on public data, to track the evolution of these markets over time.⁵ As it implements this framework, the FSB will assess and address data quality issues and refine the metrics accordingly.

In addition to the risks covered in this report, crypto-assets raise policy issues that do not currently present financial stability concerns, such as the need for consumer and investor protection; strong market integrity protocols; anti-money laundering and combating the financing of terrorism (AML/CFT) regulation and supervision, including implementation of international sanctions; regulatory measures to prevent tax evasion; the need to avoid circumvention of capital controls; and concerns relating to the facilitation of illegal securities offerings. These are the subject of work at national and international levels and are outside the primary focus of this report.

FSB members have to date taken a wide variety of domestic supervisory, regulatory, and enforcement actions related to crypto-assets. These actions are balanced between preserving the benefits of innovation and containing various risks, especially those for consumer and investor protection and market integrity. National authorities and standard-setting bodies have issued warnings to investors about the risks from crypto-assets, as well as statements supporting the potential of the underlying distributed ledger technology (DLT) that they rely on to enhance the efficiency of the financial system.

The analysis in this report does not cover DLT in any capacity other than as it relates to crypto-assets. There is considerable public and private interest in this technology and in the putative economic benefits that may accrue from applications beyond crypto-assets. Exploration of these applications remains at an early stage.

⁵ FSB (2018b).

1. Introduction

Crypto-assets, as the term is used in this report, are a type of private asset that depends primarily on cryptography and DLT as part of its perceived or inherent value. Crypto-assets can function as, or have characteristics of, digital means of exchange that are not backed by an issuer (such as bitcoin), or other digital tokens, including securities tokens, asset-backed tokens representing ownership interests in property, or so-called utility tokens used to obtain access to goods or services on a particular digital platform.⁶ Moreover, there are a range of instruments based on crypto-assets. So-called initial coin offerings (ICOs) involve a process in which companies, entrepreneurs, developers, or other promoters raise capital for their projects in exchange for digital tokens that may represent payment for a good or service, or a security, commodity, or derivative thereof, depending on the nature of the ICO's structure and the participants' activities. This report focuses on *private* crypto-assets and does not consider proposals for central bank digital currencies (CBDCs) or crypto-assets issued by other public sector entities.⁷

Crypto-assets were originally designed to facilitate the transfer of value without the need for a trusted third-party intermediary.⁸ Crypto-assets are at times referred to as 'cryptocurrencies.'⁹ However, at present these do not reliably provide the standard functions of money and are often unsafe to rely on as a medium of exchange or store of value.¹⁰ Crypto-assets are not currently used as a unit of account, and the significant associated price volatility suggests that crypto-assets do not generally function as a reliable medium of exchange or store of value. Importantly, crypto-assets are neither backed by any government or other authority, nor are they legal tender in any jurisdiction. However, some private enterprises and some public sector entities have chosen to accept some crypto-assets as payment.¹¹

Certain crypto-assets, especially those like bitcoin and ether that are not backed by a contractual claim, have experienced significant price fluctuations and bouts of volatility over the past year (graph 1). On 8 January 2018, the combined market capitalisation of crypto-assets peaked at an estimated \$830 billion, of which approximately 35% was attributable to bitcoin. This later dropped to just above \$210 billion as of 4 October 2018. The rapid price increases in 2017 elicited interest from retail investors and attracted the attention of regulated financial institutions and intermediaries. Moreover, a supporting ecosystem has begun to develop,

⁶ Digital tokens refer here to any digital representation of an interest, which may be of value or of a right to receive a benefit or perform specified functions or may not have a specified purpose or use. A special case is asset-backed tokens, which represent a claim on an actual asset or revenue stream. Securities dematerialised using DLT would only be considered crypto-assets where their value is primarily derived from their cryptography (ie not the underlying asset, claim or anticipated cash flows).

⁷ For a discussion of CBDCs and their relationship with crypto-assets and other digital tokens, see Morten Bech and Rodney Garratt (2017), "Central bank cryptocurrencies," *BIS Quarterly Review*, September. See also CPMI (2015), *Digital Currencies*, November; and FSB (2017), *Financial Stability Implications from FinTech*, June.

⁸ Satoshi Nakamoto (2008), "[Bitcoin: A Peer-to-Peer Electronic Cash System](#)."

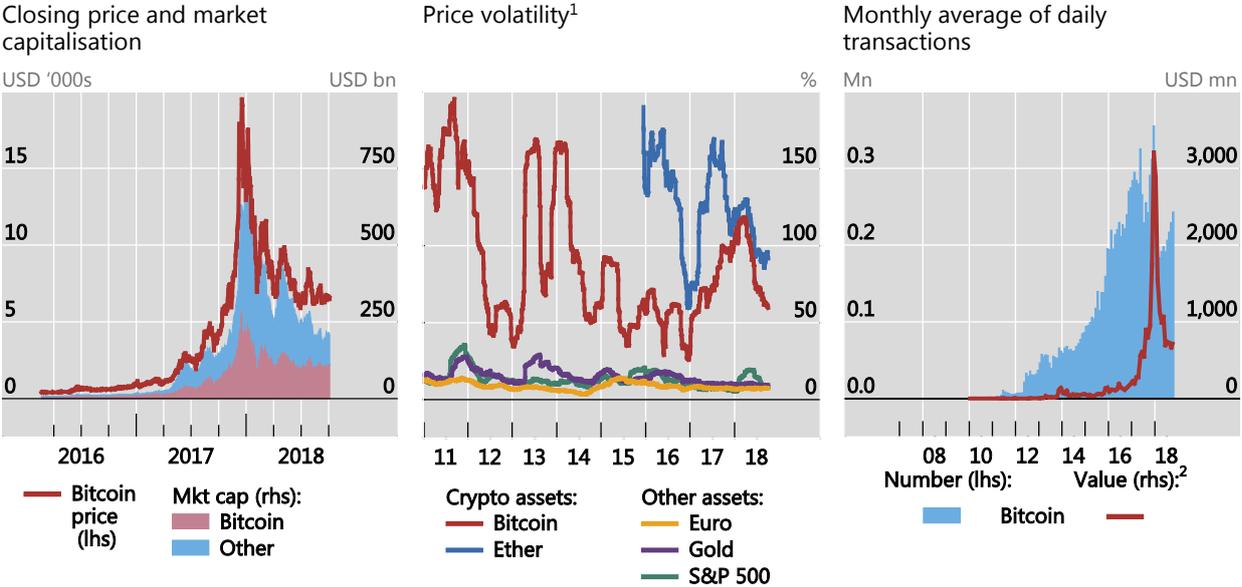
⁹ Some jurisdictions use the term "virtual currency" in AML/CFT regulations. See for example, FinCEN guidance at <https://www.fincen.gov/resources/statutes-regulations/guidance/application-fincens-regulations-persons-administering>. See also FATF (2015), "[Guidance on a Risk-Based Approach to Virtual Currencies](#)," June.

¹⁰ See BIS (2018), "[Cryptocurrencies: looking beyond the hype](#)", *Annual Report*, June, pp. 91-114; Agustín Carstens, (2018), "[Money in the digital age: what role for central banks?](#)", lecture by General Manager, Bank for International Settlements, at the House of Finance, Goethe University, Frankfurt, 6 February.

¹¹ In Switzerland, the cantons of Zug and Chiasso have accepted crypto-assets for the payment of some fees.

including crypto-asset trading platforms (many of which are referred to misleadingly as ‘exchanges’, but have not registered as such); crypto-asset derivative markets; and crypto-asset funds and trusts (including exchange-traded notes).

Market capitalisation and transactions in crypto-assets Graph 1



¹ Ninety-day moving standard deviation of daily returns. ² Total estimated value of transactions on the Bitcoin Blockchain, in USD value.
Sources: Bloomberg; coinmarketcap.com; CoinDesk, <https://www.coindesk.com/price/>; www.blockchain.info; BIS calculations.

Crypto-asset trading platforms operate in the vast majority of FSB member jurisdictions. In early 2018, roughly a third of FSB member jurisdictions indicated that some regulated financial institutions were investing, trading or dealing in crypto-assets or crypto-asset derivatives.

While the FSB is vigilantly monitoring the potential financial stability risks associated with crypto-assets, it recognises that the underlying DLT may provide some important benefits in the future. Although there are a number of technical and other challenges to surmount, the technology may have applications for securities settlement, asset registers, trade reporting and financial inclusion, amongst others.

In addition to the potential financial stability concerns relating to any significant increases in the use of crypto-assets, a variety of broader policy concerns exist, including: risks to consumer and investor protection and market integrity; money laundering, terrorist financing, sanctions evasion, fraud, and other illicit financing risks; tax evasion; and the circumvention of capital controls. These problems are exacerbated when crypto-assets are not backed by an accountable entity that can be bound by regulation and held responsible for potential breaches of regulation. Given the inherently global nature of most crypto-asset platforms, these issues generally have cross-border elements that necessitate international coordination and are the subject of ongoing initiatives within international standard-setting bodies (SSBs).

Certain features of crypto-assets may make them attractive to persons undertaking illicit activities, such as money laundering, terrorist financing, or tax evasion. These risk factors

include their distributed, cross-border nature; their easy transferability; and the strong potential for anonymous or pseudo-anonymous crypto-asset transactions. Another risk factor is the fact that crypto-assets are often transacted through entities operating in a non-compliant manner or with limited regulatory oversight.

The remainder of this report provides the FSB's view on the potential financial stability implications of crypto-assets, both at present and if they were to become more widely used in the future. It first assesses the primary financial stability risks within crypto-assets (section 2), then potential transmission channels to financial stability (section 3). It finishes by describing the main regulatory approaches and communications, including at the international level (section 4).

2. Primary risks in crypto-asset markets

This section assesses primary risks in crypto-asset markets. If there were significant growth in crypto-asset markets, these primary risks could possibly lead to financial stability implications through the transmission channels discussed in the next section. The risks discussed include: (i) market liquidity risks; (ii) volatility risks; (iii) leverage risks; and (iv) technological and operational risks.¹² Some risks, such as volatility risks and technological and operational risks, are particularly notable for crypto-assets, while others, such as market liquidity and leverage risks, are common to many types of assets.

2.1 Market liquidity risks

A number of factors may contribute to illiquid and fragile markets in crypto-assets and limit the ability of participants to buy or sell crypto-assets.

Ownership of crypto-assets appears to be concentrated among relatively few market participants, limiting market depth and reducing the capacity of markets to accommodate large trading volumes.¹³ Illiquid markets may also exacerbate risks from volatility.

Operational issues on trading platforms can also lead to fragmented market structure. While a strong network of regulated trading platforms, brokers, and dealers can increase market liquidity by connecting buyers and sellers, most crypto-asset trading platforms globally are not registered as regulated exchanges, and many have experienced service disruptions or hacking that have halted or limited the ability of buyers and sellers to transact, or resulted in the large-scale theft of customers' and/or the exchanges' crypto-assets. Often because crypto-asset

¹² Other risks not directly discussed in this section, such as the risk of fraud and manipulation, may be especially prevalent in the crypto-asset space, given the potential for anonymous or pseudonymous transactions and for operating in a non-compliant manner or with limited regulatory oversight. See further section 4.

¹³ See for example, the distribution of bitcoin value among Bitcoin addresses at <https://bitinfocharts.com/top-100-richest-bitcoin-addresses> (accessed on February 6, 2018). Olga Kharif (2017), "[The Bitcoin Whales: 1,000 People Who Own 40 Percent of the Market](#)," Bloomberg, 8 December.

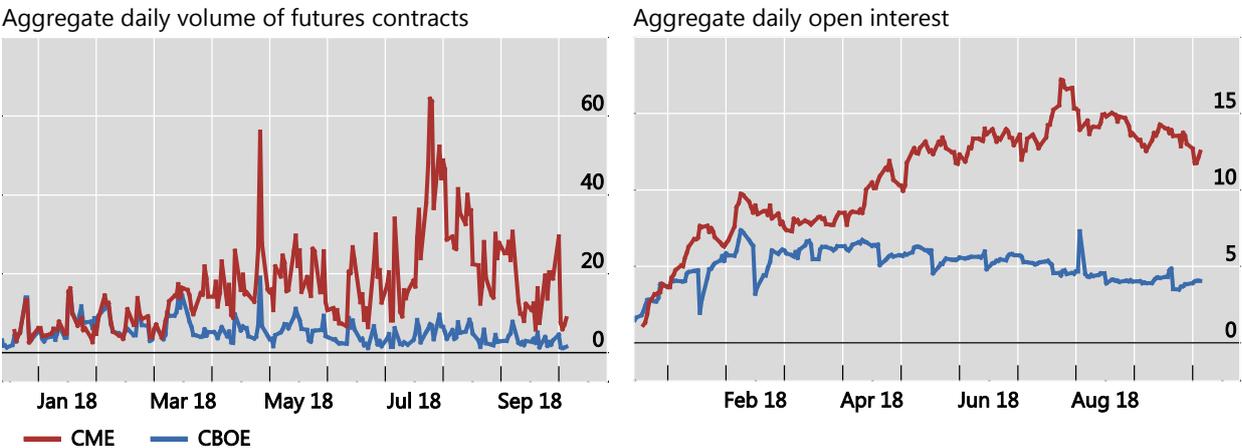
trading platforms either are not registrable or fail to register, in most jurisdictions their activity is not supervised in any capacity, unlike traditional financial institutions or infrastructures.¹⁴

Centrally cleared, collateralised, and asset- or cash-settled bitcoin derivative markets were established in late 2017. Some argue that these markets will increase the depth and liquidity of the spot bitcoin market by increasing the demand for bitcoin and by facilitating short-selling.¹⁵ Likewise, others suggest the presence of derivative markets help contain speculative dynamics by providing financial instruments to short the market.¹⁶ However, trading volumes and open interest on the US-based bitcoin futures exchanges remain relatively small (graph 2) and exchanges have tight position limits and substantial margin requirements for investors.¹⁷

Bitcoin futures¹

Number of bitcoins, in thousands

Graph 2



¹ First day of trading for CME futures is 18 December 2017 and for CBOE futures is 11 December 2017 CME contract size is five bitcoin and CBOE contract size is one bitcoin. Data are up to 4 October 2018.

Source: Bloomberg.

Illiquidity, concentrated ownership, fragmented market structure, and other issues also make crypto-assets potentially susceptible to price manipulation and other misconduct.

¹⁴ See e.g. SEC staff (2018), “Statement on Potentially Unlawful Online Platforms for Trading Digital Assets,” 7 March.
¹⁵ Aaron Brown (2017), “[LedgerX will transform cryptocurrencies](#),” Bloomberg, 2 August; CME Group (2017), “[CME Group Self-Certifies Bitcoin Futures to Launch Dec. 18](#),” 1 December; and Cboe (2017), “[Cboe plans December 10 Launch of Bitcoin Futures Trading](#),” 1 December, announcing the launch of their respective Bitcoin futures contracts.
¹⁶ Galina Hale, Arvind Krishnamurthy, Marianna Kudlyak, and Patrick Shultz (2018), “[How Futures Trading Changed Bitcoin Prices](#),” Federal Reserve Bank of San Francisco.
¹⁷ Average daily trading volume on the US futures markets (CME and CBOE) from their launch dates to 30 January 2018 was 6,393 bitcoin and 5,822 bitcoin respectively. By way of comparison, the 24-hour trading volume in bitcoin spot markets on 30 January 2018 was approximately 950,000 bitcoin (source: [coinmarketcap.com](#)).

2.2 Volatility risks

The prices of crypto-assets have been highly volatile. Volatility is especially relevant in the case of assets that are not backed by any contractual claim, since their value is not derived from the value of such underlying claim but is rather subject to speculation. The price volatility of the top two crypto-assets by market capitalisation was between six and 13 times higher than that of the euro, gold and the S&P 500 US equities index as of 4 October 2018 (graph 1).¹⁸

High volatility can give rise to several concerns. Investors may not be prepared to bear exposures to rapid boom/bust cycles. Some crypto-assets, including bitcoin, have been susceptible to ‘flash crashes,’ or a sudden steep decrease in price. Unlike regulated stock and derivatives exchanges, many crypto-asset trading platforms do not have measures such as circuit breakers to help mitigate price swings, even if such measures are required by existing regulations. In addition, the high volatility of crypto-assets may contribute to difficulties in their use for payments or settlement.

2.3 Leverage risks

As with any financial asset, positions in crypto-assets can present greater risks to holders and their creditors if the positions involve leverage. Leverage may magnify volatility and transmission of risks, as it indicates that investors have less equity to absorb losses from market movements. These losses can then spread to other entities.

Information about the role of leverage in crypto-asset markets is incomplete. According to one recent survey, nearly 20% of crypto-asset owners used debt to finance purchases.¹⁹ In principle, this debt can take the form of retail purchases of bitcoin and other crypto-assets with credit cards or home equity loans, or lending backed by crypto-assets as collateral. Similarly, trading on margin is currently available to crypto-assets investors in some jurisdictions, providing leverage of between 2.5x and 100x. The total volumes of leveraged contracts and the extent of actual use of leverage at these trading platforms are generally not reported, and it is not clear which entities are providing the financing.

2.4 Technological and operational risks including cyber security risks

The DLT underlying crypto-assets may be beneficial for many applications. However, crypto-assets, especially those that are decentralised and operate with limited or no formal governance structure, present particular technological and operational risks. As discussed further below, the particular application of DLT that underlies most crypto-assets is relatively nascent, and may be subject to technological errors and limitations. Technological limitations and network governance issues regularly arise in networks for different crypto-assets.²⁰ These include the following:

¹⁸ Price volatility in \$ as at 28 September 2018.

¹⁹ Olga Kharif (2018), “[Bitcoin on Credit? For 20 Percent of Owners, That's a Yes](#),” Bloomberg, 7 February.

²⁰ See Mauro Conti, Sandeep Kumar E, Chhagan Lal, and Sushmita Ruj (2018), “A Survey on Security and Privacy Issues of Bitcoin,” DOI: [10.1109/COMST.2018.2842460](https://doi.org/10.1109/COMST.2018.2842460), for a survey of technology-related issues with the Bitcoin network.

- There are concerns about the long-term viability of ‘mining’-based systems, not least because the energy consumption may not be sustainable if the size of the crypto-assets market grows.²¹
- Similarly, returns to scale in mining can lead to the creation of concentrated mining pools that have substantial control over a crypto-asset.²² In other cases, there may be concentrated governance structures around network nodes or software standards.
- Many crypto-asset networks have limited bandwidth, or lack the ability to quickly process large numbers of transactions at the same time. This leaves them susceptible to operational challenges from both targeted attacks and relatively benign applications.²³
- Decentralisation and lack of or inadequate governance makes it difficult to resolve technological limitations or errors and may lead to uncertainty and “hard forks” by a subset of miners.

Crypto-asset trading platforms can be, and in some cases have been, vulnerable to fraud, hacking, and other cyber incidents for a variety of reasons,²⁴ including weak custody and cyber security arrangements and in many cases operating without being registered as regulated exchanges. A number of trading platforms with poor security have collapsed after cyber incidents, with real losses for customers.²⁵

3. Transmission channels affecting financial stability

If crypto-assets become a more significant part of the financial system, negative developments involving crypto-assets could undermine confidence in certain aspects of the financial system and in financial regulators. Additionally, the primary risks present in the crypto-asset markets could have financial stability implications through a variety of other transmission channels. These include (i) confidence effects; (ii) financial institutions’ exposures to crypto-assets, related financial products and entities that are financially impacted by crypto-assets; (iii) the level of market capitalisation of crypto-assets; and (iv) the extent of their use for payments and settlements.

²¹ Karl J. Dwyer and David Malone (2014), “[Bitcoin Mining and its Energy Footprint](#),” IET Conference Proceedings, 280-285. These concerns may be more or less justified or pronounced depending on the consensus protocols chosen by a particular blockchain, e.g. proof-of-work, proof-of-stake, etc. For an explanation of proof-of-work, see BIS (2018), p. 98.

²² According to Blockchain.info, ten mining pools control more than 90% of the creation of bitcoin. Until the recent measures by Chinese authorities to discourage mining, 75% of the mining power was concentrated in China.

²³ An example of the latter is the game CryptoKitties, which significantly slowed down the second largest crypto-currency network. See BBC (2017), “[CryptoKitties craze slows down transactions on Ethereum](#),” 5 December.

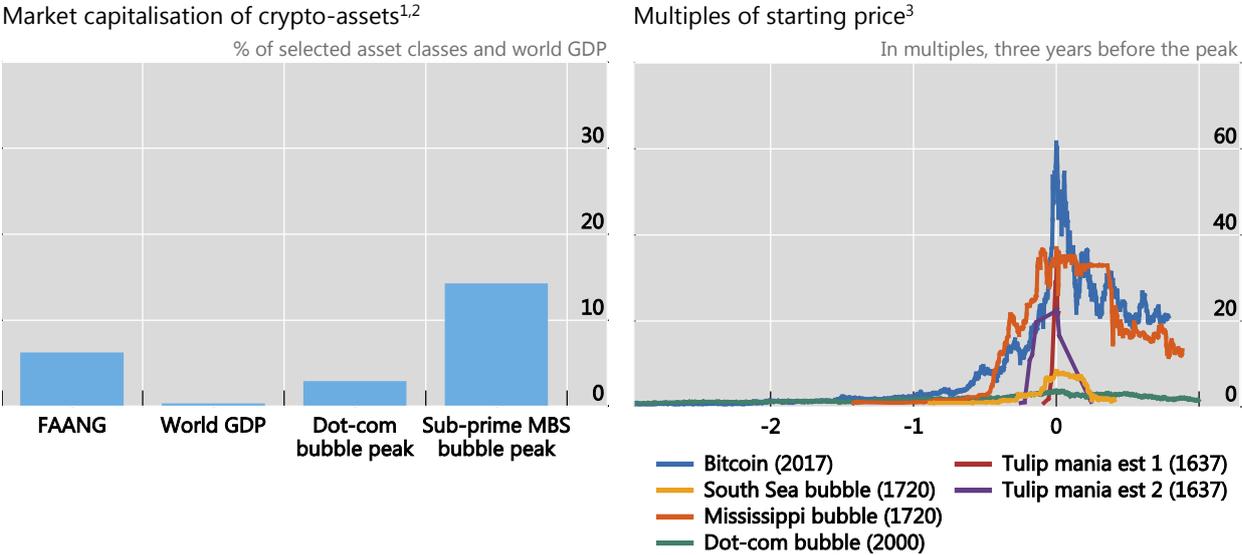
²⁴ For example, in one recent very large incident, Coincheck was illegally accessed in January and lost JPY 58 billion (about \$530 million) equivalent of NEM, a virtual currency, belonging to about 260,000 customers. In June, over \$30 million equivalent was lost through hacking of accounts at the Bithumb trading platform.

²⁵ For example, nearly 25,000 customers of Mt. Gox, once the world’s largest bitcoin trading platform, are still waiting for compensation more than three years after its collapse into bankruptcy in Japan. For lists of other major crypto-assets cyber incidents in bitcoin or other crypto-assets, see, for example Steve Stecklow, Alexandra Harney, Anna Irrera and Jemima Kelly (2017), “[Chaos and hackers stalk investors on cryptocurrency exchanges](#),” September.

Overall, although some data gaps remain (as discussed below), it appears that risks to global financial stability are not significant at present, given the limited size of crypto-asset markets relative to other financial markets and the limited interconnectedness between crypto-asset markets and the regulated financial system. While the increase in prices was very large, and in fact larger than comparable historical asset bubbles, the market capitalisation relative to other financial markets and comparators has remained small (graph 3).

If any of the risks factors above were to change materially, this may warrant reassessment of financial stability risks. Moreover, such risks could arise first within specific jurisdictions, where they could become relevant for domestic financial stability, before they became relevant for the global financial system.

Crypto-assets compared to historical episodes Graph 3



¹ Percentages as of 30 September 2018 for crypto-assets and FAANG, 2017 for World GDP, market peaks for the dot-com bubble and sub-prime mortgage-backed securities (MBS). ² "FAANG" refers to Facebook, Apple, Amazon, Netflix and Google. The dot-com bubble peak refers to the level of the NASDAQ in March 2000 and the sub-prime peak to 2006. Sub-prime market size is defined as the sum of sub-prime, non-prime and Alt-A US non-agency residential real estate securities. ³ The chart shows price evolution, starting from a level of three years before the peak, over a period of four years. Owing to uncertainty about data on the tulip mania, two separate estimates of the size of that bubble are displayed. The years of the peaks are shown in brackets.

Sources: CoinMarketCap; Haver Analytics; IMF, World Economic Outlook; SIFMA; Thomson Reuters; Yale School of Management; ECB; ECB calculations.

3.1 Confidence effects

If crypto-assets become significantly more actively traded by financial institutions or significantly more widely used by the general public, then materialisation of the primary risks described above could damage faith in those institutions and the financial system. If the public were to judge the policy response to the emerging risks in crypto-asset markets to be inadequate, trust in the financial system and in financial regulators could be further eroded.

Confidence in crypto-asset markets themselves can be impaired by price manipulation, cyber-incidents at crypto-asset trading platforms and questions over governance. Damage to the

credibility of crypto-assets could hinder prospects for the future application of blockchain and DLT to financial services.

3.2 Exposures of financial institutions

Risks stemming from crypto-assets could also be transmitted to the broader financial system through the exposures of financial institutions to crypto-asset markets.

Firms could acquire direct holdings from trading activities or provision of crypto-asset custody services to customers. If these firms are also large providers in traditional financial markets, then primary risks in crypto-asset markets (set out in section 2) could transmit stress to them and affect their activities in more traditional markets.

Similarly, the financial system could be exposed through the provision of credit and other financial services to crypto-asset trading platforms and wallet providers,²⁶ firms accepting crypto-assets as a means of payment, or to households investing in crypto-assets. This exposure may be particularly important for institutions with small concentrated portfolios, although it seems unlikely that even significant losses at institutions with small portfolios would be on a scale to pose financial stability risks. Investment firms may also face costs relating to reputational damage or legal liability related to investments made in crypto-assets, although unless significant and on a wide-spread basis such costs seem unlikely to implicate financial stability risks. Furthermore, insurers offering protection against crypto-asset theft, and payments providers interacting with crypto-asset markets, could be exposed to technological and operational risks described in section 2.

At this juncture, there is relatively little information on direct investments in crypto-assets and related products including derivatives and funds by banks and mainstream financial institutions. To date, traded volumes and open interest of bitcoin futures remain low (graph 2). Regulated financial institutions are investing, trading or market making in crypto-asset markets or their derivatives to varying degrees in a number of FSB member jurisdictions. However, a number of data gaps remain and most authorities indicate that these issues are under further study.

Although there is currently no indication that banks or other institutions are significantly exposed to or reliant upon crypto-assets or that regulatory mechanisms may be insufficient to mitigate these risks, it will be important to monitor whether crypto-asset holdings and exposures by financial institutions are building up.

3.3 Market capitalisation and wealth effects

The market capitalisation of crypto-assets remains small relative to the global financial system, at \$210 billion as of 4 October 2018, about 0.9% of the market capitalisation of the S&P 500 and 2.8% of the global value of gold.²⁷ While this is substantially smaller in terms of market

²⁶ These enterprises are typically funded by venture capital funds and may obtain credit, either short-term credit lines or long-term, from banks and private debt funds. This could entail credit risks, though in many cases exposures would likely be limited through portfolio holdings or participation in syndicated loans.

²⁷ Sources: <http://siblisresearch.com/data/total-market-cap-sp-500/> and <http://onlygold.com/Info/All-The-Gold-In-The-World.asp>.

size than selected historical speculative bubbles, the run-up in the price of bitcoin in the 3 years to its peak was steeper (graph 3).²⁸

While the sustained fall in prices since the end of 2017 may dampen investor interest in the short-term, there is a lively debate on whether crypto-assets may gain wider use in the economy in the future. Crypto-asset markets could become systemically important in particular jurisdictions if the market capitalisation grew significantly larger and/or the breadth of ownership in those jurisdictions increased significantly. This could have an impact on the real economy via wealth effects.

Relatedly, should the market grow, crypto-assets could be also used as collateral for consumer and business loans.²⁹ As with any asset, a decline in value of such collateral, if used broadly, may lead to margin calls, defaults of borrowers and lenders, and reduced borrowing affecting economic activity.

Finally, a large market capitalisation of crypto-assets and easy convertibility with fiat currencies could entail new risks to the financial system, if funds were suddenly shifted from deposits into crypto-asset holdings. This may entail bank funding pressures, which could materialise much quicker than in the case of physical banknotes or existing alternatives.

3.4 Payments and settlements

The FSB is not aware of any reports of widespread use of crypto-assets for payments and settlements for retail or wholesale purposes. Moreover, it appears unlikely that crypto-assets in their current form would be widely used for daily payments and settlement in the near future in most jurisdictions.

First, the high volatility of prices of crypto-assets (as noted above) makes it difficult to rely on them as a means of low-risk payment or settlement. In fact, to the extent that crypto-assets do not represent a claim or liability, valuation of these assets does not reflect the evaluation of an underlying contractual claim. Second, crypto-assets exemplify the limitations of current decentralised distributed ledger technologies. It is costly to create trust, which is indispensable for credible payment and settlement instruments, in networks that do not rely on trusted intermediaries. The decentralised nature of many crypto-assets can result in inadequate governance, giving rise to disputes among network participants and, in extreme cases, in ‘hard forks’ on the blockchain or other distributed ledger, which may undermine the credibility of these assets. Moreover, most existing crypto-assets cannot currently be used to process large numbers of transactions quickly³⁰ and may have scalability issues in the future. Additionally,

²⁸ For instance, in the Dot-com bubble of 1997-2001, the value of tech stocks peaked at \$3 trillion. In the lead-up to the subprime crisis, the total volume of securitised mortgages was about \$7.3 trillion – although the volume of subprime mortgage backed securities was just \$700 billion.

²⁹ Currently only a few lenders provide crypto-assets-backed loans, see, for example Frederik Reese (2017), “Top 7 Borrowing and Lending Platforms for Bitcoin,” December, available at <https://www.bitcoinmarketjournal.com/bitcoin-borrowing/>. However, there are no reliable data on the aggregate size of the crypto-assets backed loans market.

³⁰ As an example, bitcoin allows a maximum of seven transactions per second and ether allows for a maximum of 20. In comparison, PayPal manages on average 193 transactions per second and Visa manages 16,671 transactions per second. Recently, an increase in the transaction volume of bitcoin and ether (as a result of their rising prices) led to congestion. Market participants have to pay a higher processing fee to the miners in order to be competitive with one another for the limited mining resources needed for transaction confirmation.

the lack of certainty around settlement finality makes it difficult to define when key financial risks are transferred.

Third, jurisdictions' approaches to crypto-assets may further restrain their use in payments. For instance, implementing international AML/CFT standards should limit the anonymity of crypto-asset transactions and reduce their appeal, insofar as anonymity features may drive such use. In addition, approaches directed at, for example, anti-fraud, consumer protection, and/or cyber security safeguards may also affect the business case for certain uses of crypto-assets.

These conditions can change as technological advances can conceivably resolve scalability and anonymity issues.

In particular, the use of crypto-assets to effect cross-currency international payments may become an option where current payment or banking services are less convenient or are slow and/or expensive. It remains to be seen whether emerging markets, especially remittance-receiving countries facing relatively high costs of cross-border payments, might consider using crypto-assets as an alternative to traditional correspondent banking services.

4. Regulatory approaches and communications

4.1 Regulatory actions taken and under active consideration by authorities

Different FSB member jurisdictions have taken and are actively considering a range of regulatory approaches to crypto-assets. These approaches have varied across jurisdictions. They include: regulating or increasing regulatory oversight of crypto-asset trading platforms, hosted wallets, and certain other intermediaries, for AML/CFT or other law enforcement purposes; regulatory guidance, including about the application of AML/CFT laws and securities and other applicable law and related consumer and investor warnings; registration or licensing regimes; clarification of the legal status of crypto-assets for tax purposes; regulatory sandboxes that permit pilot initiatives under close regulatory supervision; regulatory and other law enforcement actions; and bans on providing financial services to crypto-asset firms and/or on their use by financial institutions or for payment.

In addition to steps by authorities, private firms also have acted to limit the risk of or exposure to crypto-assets. For instance, in February 2018 Lloyds Banking Group indicated it would not accept credit card transactions involving the purchase of cryptocurrencies across Lloyds Bank, Bank of Scotland, Halifax and MBNA.³¹ There have also been moves towards self-regulation by some crypto-asset trade associations.

While a discussion of policy responses specific to financial stability may be considered premature, a number of options may be available to domestic authorities, consistent with applicable law, including around the prudential treatment of exposures to crypto-assets, or to

³¹ Martin Arnold (2018) "[Banks divided on cryptocurrencies card purchases: UK banks may follow move by Lloyds after sharp fall in value of bitcoin](#)", Financial Times, 5 February.

SSBs.³² A large number of authorities and some SSBs³³ have issued statements or warnings about bitcoin and other crypto-assets, for example that assets offered in ICOs are highly speculative and that investors should exercise caution.

Among FSB member jurisdictions in the Asia-Pacific region, authorities in Australia, China, Hong Kong, India, Indonesia, Japan, Korea, and Singapore have issued these types of statements or warnings.

Similar activity has occurred in the Americas, as well as significant enforcement actions. In the United States, the Securities Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC) have taken enforcement actions including those involving virtual currencies used in various securities schemes, unregistered and fraudulent ICOs, unregistered platforms, and false and misleading statements by publicly traded companies concerning DLT-related claims, and other illicit activity.³⁴ Both the CFTC and SEC Chairmen and staff have issued a number of statements to investors and consumers on virtual currencies as well as so-called ICOs and have communicated to the public on risks relating to virtual currencies and other digital assets, including that many of these offerings may be illegal offerings or fraudulent.³⁵ Canadian authorities have also issued investor warnings.³⁶ In Latin America, Argentina, Brazil and Mexico have likewise issued consumer warnings.

In the European Union (EU), many national authorities have issued some type of communication to the market, either as formal warnings or as statements such as speeches or public interventions.³⁷ A second round of communications was launched in 2017, and in early 2018 a joint European Supervisory Agencies' warning was issued.³⁸ The EU also recently amended its Fourth Anti-Money Laundering Directive to include virtual currency trading platforms and hosted wallets as entities subject to AML/CFT requirements.³⁹

³² The BCBS has undertaken a stocktaking exercise of bank exposures to crypto-assets. Preliminary results suggest that exposures remain limited at this stage. The BCBS intends to collect additional data on banks' direct and indirect exposures to crypto-asset exposures as part of its half-yearly data-collection exercises. Based on the results of these exercises, the BCBS will consider whether there is a need to clarify the prudential treatment of banks' crypto-asset exposures.

³³ See for example IOSCO (2018), "[Board communication on concerns related to initial coin offerings](#)," 18 January.

³⁴ The Departments of the Treasury (FinCEN) and of Justice have taken regulatory enforcement and criminal actions, respectively, against virtual currency exchanges involved in Bank Secrecy Act violations and money laundering. FinCEN has conducted examinations of virtual currency exchanges since 2014.

³⁵ See, e.g., Jay Clayton and J. Christopher Giancarlo (2018), "[Regulators Are Looking at Cryptocurrency](#)," Wall Street Journal, 24 January.

³⁶ For instance, the Bank of Canada Governor warned investors in a speech and an interview. See Stephen Poloz (2017), "[Three Things Keeping Me Awake at Night](#)," December; Karen Tso and Arjun Kharpal (2018), "[Bitcoin is 'gambling' and regulations are needed, Canada central bank head says](#)," CNBC, 25 January.

³⁷ Typically, the messages conveyed by authorities are in line with the contents of the EBA's 2013 [warning](#) and 2014 [opinion](#) on virtual currencies.

³⁸ See ESMA, EBA and EIOPA (2018), "[ESAs warn consumers of risks in buying virtual currencies](#)," February.

³⁹ See Fifth Anti-Money Laundering Directive of the EU (Directive 2018/843 of the European Parliament and of the Council, 30 May 2018). The Directive will go into effect by 2020.

Similar statements have been made across the remaining FSB jurisdictions, Russia, Saudi Arabia, South Africa and Turkey.⁴⁰ In general, warnings have been issued by national central banks and market supervisors, either individually or jointly, and they have been mainly addressed to consumers and retail investors.

4.2 FSB and standard-setting bodies actions

As stated above, the FSB view is that crypto-assets do not pose a material risk to global financial stability at this time. But in light of the speed of developments and the existence of data gaps the FSB has committed to monitoring the risks to financial stability on an ongoing basis, via a framework developed jointly with the Committee on Payments and Market Infrastructures (CPMI).

The framework includes risk metrics that are most likely to highlight risks to financial stability, using data from public sources where available. Supervisory data pertaining to crypto-assets are potentially more reliable and could complement data from public sources.

Annex 1 sets out the metrics that the FSB will collect initially. Metrics focus on the transmission channels identified in this report. They were selected based upon several criteria, including comparability over time and across jurisdictions, ease of access and repeatability, the degree to which the metric is anchored in data, and analytical effort to compute. The metrics are proportionate to the FSB's assessment of the current level of risk. Should potential financial stability concerns increase it may prove wise to supplement these with additional measures.⁴¹

The SSBs are carrying out further work according to their mandates:

- The International Organization of Securities Commissions (IOSCO) has established an ICO Consultation Network to discuss experiences and concerns regarding ICOs, and is developing a Support Framework to provide a resource for members in considering how to address domestic and cross-border issues stemming from ICOs that could impact investor protection. IOSCO is discussing other issues around crypto-assets, including, for example, regulatory issues around crypto-asset platforms.
- The CPMI has conducted significant work on applications of distributed ledger technology, and is conducting outreach, monitoring, and analysis of payment innovations.

⁴⁰ In the latter case, the authorities have made public statements regarding crypto-assets in 2013 and 2018 stressing that crypto-assets are not considered as electronic money and, due to their volatile nature, crypto-assets should be approached with caution.

⁴¹ Also, data quality issues merit vigilance in monitoring. The crypto-asset market is rapidly evolving, as are public data sources. The treatment and characterisation of crypto-assets may vary across jurisdictions or may not yet have been clarified. The market capitalisation of crypto-assets is estimated in publicly available sources, but, at present, the usage of crypto-assets as collateral is much more difficult for authorities to monitor due to lack of comprehensive and reliable data. Given that the monitoring metrics are mainly based on public data, the quality of the underlying data can vary, and might not always be satisfactory. Nonetheless, the FSB believes that the metrics outlined in this report (see Annex 1) provide a useful picture of crypto-asset markets and the financial stability risks they may present. As understanding develops and new sources of public data become available, the FSB, with other SSBs, will consider how improvements can be made. In particular, the FSB will – where possible – continue to work on assessing data reliability and data completeness for the existing metrics.

- The Basel Committee for Banking Supervision (BCBS) is quantifying the materiality of banks' direct and indirect exposures to crypto-assets, clarifying the prudential treatment of such exposures, and monitoring developments related to crypto-assets and FinTech for banks and supervisors.
- The Financial Action Task Force (FATF) has several areas of work underway to encourage appropriate and consistent safeguards that will contribute to the mitigation of the associated money laundering and terrorist financing risks while avoiding unnecessary barriers to legitimate use.

G20 Finance Ministers and Central Bank Governors considered risks arising from crypto-assets at their March and July 2018 meetings. At their July meeting, they welcomed the updates provided by the FSB and the other SSBs⁴² and looked forward to their further work to monitor the potential risks of crypto-assets, and to assess multilateral responses as needed.⁴³

⁴² See FSB (2018); and FATF (2018), [FATF Report to the G20 Finance Ministers and Central Bank Governors](#), July.

⁴³ G20 (2018), [Communiqué: G20 Finance Ministers and Central Bank Governors Meeting](#), July.

Annex 1 - Metrics to be initially monitored by the FSB^{44,45}

Channel	Metric	Collection/Source
Primary risks/ basic market statistics	Market capitalisation (size and rate of growth), price levels and volatility of major crypto-assets	Bank for International Settlements (BIS), based on public sources
	Developments in non-FSB jurisdictions (qualitative)	International Monetary Fund
Confidence effects	Qualitative market intelligence gathering	Periodically by the FSB, from members and through regular calls and meetings
Wealth effects/ market capitalisation	Market capitalisation metrics <ul style="list-style-type: none"> i. Size and rate of growth ii. ICO issuance iii. Inflows/outflows from fiat currencies 	BIS, based on public sources
	Price metrics <ul style="list-style-type: none"> i. Price levels ii. Price volatility iii. Rate of growth 	BIS, based on public sources
Institutional exposures	Derivatives metrics <ul style="list-style-type: none"> i. Trading volumes ii. Price levels and open interest iii. Number and type of clearing members iv. Margining 	FSB and member authorities, based on publicly available central counterparty (CCP) disclosures and/or publicly available market data
	Market capitalisation metrics	As above
	Banks' exposures to crypto-assets	BCBS
Payments and settlement	Wider use in payments and settlements	CPMI, based on member and collective intelligence gathering
Comparators	Comparisons of volatility and correlations between major crypto-currencies with other asset classes such as gold, currencies, equities	BIS, based on public sources

⁴⁴ As technology evolves and market conditions develop, other metrics may be appropriate for monitoring if the FSB deems it necessary.

⁴⁵ As outlined on pp. 1–2, any analysis of the metrics, as well as the interpretation of the results, should appropriately take into account the information outlined in the disclaimer on data quality and reliability.

Annex 2 - Glossary

This glossary sets out a (non-exhaustive) list of terms used in the report, which is intended to guide discussions in the context of this paper. It is based on usage in other FSB reports, as well as in the work of the CPMI, Markets Committee, BCBS, and IOSCO.

Asset-backed token: a digital representation of an actual asset or revenue stream.

Blockchain: a form of distributed ledger in which details of transactions are held in the ledger in the form of blocks of information. A block of new information is attached into the chain of pre-existing blocks via a computerised process by which transactions are validated.

Crypto-asset: a type of private asset that depends primarily on cryptography and distributed ledger or similar technology as part of their perceived or inherent value.

Crypto-asset trading platform: any trading platform where crypto-assets can be bought and sold, regardless of legal status.

Cryptography: the conversion of data into private code using encryption algorithms, typically for transmission over a public network.

Digital token: any digital representation of an interest, which may be of value, a right to receive a benefit or perform specified functions or may not have a specified purpose or use.

Distributed ledger technology (DLT): a means of saving information through a distributed ledger, i.e., a repeated digital copy of data available at multiple locations.

FinTech: technology-enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services.

Hard fork: a change to a (DLT) protocol that requires all nodes or users to upgrade to the latest version of the protocol software, or creates two versions of the protocol going forward.

Initial coin offering (ICO): an operation through which companies, entrepreneurs, developers or other promoters raise capital for their projects in exchange for digital tokens (or 'coins'), that they create.

Mining: one means to create new crypto-assets, often through a mathematical process by which transactions are verified and added to the distributed ledger.

Wallet provider: a firm that offers storage services to investors in crypto-assets. These may be connected online ('hot' storage) or kept offline ('cold' storage).