Evidence submitted by Bank of England (DGC0055)

TREASURY SELECT COMMITTEE INQUIRY ON DIGITAL CURRENCIES

Background

1. The Bank of England's mission is to promote the good of the people of the United Kingdom by maintaining monetary and financial stability. Our work on digital currencies and Distributed Ledger Technology (DLT) is concerned with how these technologies could impact monetary or financial stability.

2. It is important to distinguish between privately-issued digital currencies (or 'crypto-assets'[1]) and the distributed ledger technologies (DLT) on which many of them rely. In particular, the Committee may find it useful to draw a clear distinction between:

    a. **Crypto-assets themselves** (for example, Bitcoin, Litecoin or Ether/Ethereum), which are often referred to as 'coins' or 'tokens';

    b. The underlying technology powering the majority of existing crypto-assets, in the form of **public or 'permissionless' distributed ledgers**, and

    c. The significantly adapted versions of DLT that are being developed for use in financial services on **private or 'permissioned' distributed ledgers.**

3. Each of these has a different set of potential risks and benefits. Importantly, many applications of DLT in financial services do not require or make use of a crypto-asset such as Bitcoin.

Crypto-assets are very unlikely to replace commonly used payment systems

4. The Inquiry asks: "Are digital currencies ultimately capable of replacing traditional means of payment?"

5. Widespread use of a non-sterling crypto-asset within the UK could impair the Bank's influence over monetary stability.[2] However, this possibility is far from becoming a real threat, since the current generation of **crypto-assets are currently failing to perform the three key functions of money**: as a store of value, a means of payment, and a unit of account.

6. Crypto-assets are too volatile to be a good **store of value**.

    a. Measured against the US dollar, Bitcoin is ten times more volatile than sterling, and other cryptocurrencies are even more volatile.[3] If contracts were specified in cryptocurrencies, the value received in payment may be significantly less (or more) than the value at the time of the agreement. Retailers accepting payment in crypto-assets would have to take significant exchange rate risk whilst holding the crypto-asset.

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[1] The Bank prefers the term 'crypto-assets' over 'cryptocurrencies', since they do not currently function as currencies.
[2] See our 2014 Q3 Quarterly Bulletin articles "Innovations in payment technologies and the emergency of digital currencies" and "The Economics of Digital Currencies", available at https://www.bankofengland.co.uk/research/digital-currencies
[3] Crypto-assets are also very volatile relative to other financial assets: in 2017 the average volatility of the top ten cryptocurrencies by market capitalisation was more than 25 times that of the US equities market.

7. Crypto-assets do not function well as a **means of payment**:

    a. They are **not widely accepted:** No major UK high street or online retailer accepts Bitcoin, although there are around 500 independent shops that may do – an average of less than one per town. Only a handful of the top 500 US online retailers accept Bitcoin.

    b. They face significant **capacity constraints** and so cannot handle the payment volumes required. Every day in the UK, more than 30 million electronic payments are made through Bacs and Faster Payments.[4] In contrast, Bitcoin's *global* peak capacity is around 0.6 million transactions per day. The Bank believes that no decentralised cryptocurrency platform is currently capable of handling more than a fraction of the UK's payment needs.

    c. These capacity constraints can result in **high cost transactions**. When demand for crypto-asset payments exceeds the capacity of the network, users must offer fees to ensure that their transaction is at the front of the queue of payments. In December 2017, when demand for the Bitcoin platform was highest, average fees peaked at nearly $60 per transaction, whilst tens of thousands of lower-fee transactions sat pending for hours at a time.

    d. **Speed:** Cash and contactless card payments can be confirmed instantly. In contrast, transactions on crypto-asset platforms are only 'confirmed' when they have been included in a block of transactions that is written to the ledger. For Bitcoin, it takes an average of 10 minutes to receive the first confirmation. As good practice and for higher value sales, sellers are advised to wait for 6 confirmations (around 60 minutes) before considering the payment to be irreversible. This is impractical for most physical retailers.

    e. **Inherent cost due to energy usage:** The very high energy usage required by Bitcoin and most other crypto-asset platforms stems from the use of 'proof of work' consensus mechanism, which is effectively a competition used to determine who gets to update the ledger and be rewarded for doing so with new coins and transaction fees.[5] If crypto-assets were to replace traditional currencies, the use of proof-of-work would make crypto-assets inherently more energy intensive per transaction than conventional payment systems, and imply a higher cost per transaction. There are efforts within the crypto-asset industry to move away from proof-of-work to other consensus mechanisms, but the effect of these changes on the integrity of decentralised networks is unclear.

8. As a result of these limitations as a store of value and means of payment, crypto-assets are not being used as a **unit of account.**

9. **Cyber risk** is a further barrier to more widespread adoption of crypto-assets. With crypto-assets the burden of security is on the holder. The private keys that enable users to spend crypto-asset balances are targets for hackers, and theft is irrecoverable. In cases of loss due to cyber-attack or fraud, there is no third party who will reimburse the victim.

[4] https://www.bankofengland.co.uk/-/media/boe/files/annual-report/2018/supervision-of-financial-market-infrastructures-annual-report-2018.pdf

[5] Note that this competitive process is currently required when there is no trusted authority to validate transactions, and is not needed in centralised payment systems or private/permissioned distributed ledgers

10. Clearly, crypto-assets lack the key attributes of sovereign currencies such as sterling. They are failing to fulfil the roles of money and do not serve as substitutes for national currencies. Given the magnitude of these challenges that crypto-assets face, the Bank does not think that crypto-assets have any reasonable prospect of replacing traditional payment systems in the foreseeable future. This view is widely shared internationally, and was a conclusion reached at the G20 meetings in Argentina in March.[6]

Crypto-assets do not currently pose a material threat to financial stability

11. In March 2018, the Bank's Financial Policy Committee concluded that **crypto-assets do not currently pose a material threat to financial stability** in the UK.[7] This is because:

    a. Their use in payments is minimal in the United Kingdom (as described above).

    b. The total stock of crypto-assets is small relative to the global financial system. Even at their recent peak, the combined global market capitalisation of crypto-assets was less than 0.3% of global financial assets.

    c. Systemically important UK financial institutions currently have negligible exposures to these assets and to the ecosystem around them.

12. **The scale of crypto-assets:** Crypto-assets are still small relative to the global financial system. Even at their peak in January 2018, the total value of all crypto-assets worldwide was less than 1% of global GDP, at $830bn. By comparison, at the peak of the dot-com bubble in March 2000, the combined market capitalisation of US technology stocks was close to a third of world GDP. Just prior to the global financial crisis, the notional value of credit default swaps was 100% of world GDP.

    a. Since the peak on 6 January 2018, the crypto-asset market has lost 65% of its value in just 12 weeks, and at the time of writing, stands around $300bn. Despite this fall, there has been no disruption to the financial system. This is partly because the majority of crypto-assets appear to be held by retail investors rather than financial institutions and in addition because much of this loss of value represents the loss of unrealised paper profits, rather than the loss of initial investments.

13. **Linkages to the UK financial system:** Systemically important UK financial institutions currently have negligible exposures to these assets and to the system around them

    a. Some banks have relationships with firms in or associated with the crypto-asset industry, but these links are indirect and small.

    b. In the PRA's discussions with regulated firms, there was little appetite on the part of banks to take direct exposure to the crypto-asset market in any significant way in the medium term.

    c. Some smaller non-banks, such as hedge funds, do invest directly in crypto-assets. However, these firms are not systemically important and their total exposures are small.

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[6] The G20 Communique concluded that "Crypto-assets lack the key attributes of sovereign currencies" https://g20.org/sites/default/files/media/communique_-_fmcbg_march_2018.pdf

[7] Financial Policy Committee statement from its meeting on 12 March 2018, available at: https://www.bankofengland.co.uk/statement/fpc/2018/financial-policy-committee-statement-march-2018

d. **Use of leverage:** One potential source of risk would be the application of leverage to already very volatile crypto-assets. One source of leverage at the moment is through the Bitcoin futures market launched in the US in December 2017. However, total trading volumes in this market are small relative to trading in the underlying crypto-assets themselves and very small relative to most other futures markets.

14. Crypto-assets could pose a threat to financial stability if (a) they became significantly larger as an asset class, and/or (b) systemically important firms took significant and/or leveraged exposures to the asset class. While the FPC does not expect this to happen in the near term, the market, industry and technology around crypto-assets is evolving rapidly, and so risks may emerge unexpectedly.

15. Consequently, the FPC will continue to closely monitor developments in the field for signs that (a) crypto-assets are becoming more widely used in payments and/or settlement, and (b) systemic firms are taking on significant and/or leveraged exposures to cryptocurrencies.

16. The PRA is also assessing how prudential regulations should apply if crypto-assets were held by banks and/or financial institutions, including whether additional requirements are merited to cover some of the associated risks, such as the extreme levels of volatility that they exhibit.

17. The Bank is engaged in wider discussions around the policy approach to crypto-assets:

    a. The Bank is a member of the Crypto-asset Task Force established by the government, alongside HM Treasury and the FCA, to help the UK manage the risks of crypto-assets whilst harnessing any potential benefits of the underlying distributed ledger technologies.

    b. At an international level, the G20 has called on international standard-setting bodies (SSBs) to continue their monitoring of crypto-assets and their risks, according to their mandates, and assess multilateral responses as needed.

    c. The Financial Stability Board (FSB), which I chair, reached an initial assessment that crypto-assets do not pose risks to global financial stability at this time.[8] The FSB, in consultation with other SSBs, including CPMI and IOSCO, and FATF will report back to the G20 in July 2018 on their work. The Bank will be contributing to this work.

18. Crypto-assets raise a number of other public policy concerns, including around consumer and investor protection, market integrity, and the potential to facilitate money laundering and terrorism financing. It is possible, if the use of crypto-assets were to increase substantially, that these issues could also pose risks to confidence in the financial system.

Distributed Ledger Technology

19. It is important to distinguish between crypto-assets themselves and the distributed ledger technologies upon which many of them rely. These underlying technologies have significant potential and, over time, could have material benefits, including for the efficiency and resilience of the financial system. Importantly, the application of these technologies in financial services rarely requires or makes use of a crypto-asset such as Bitcoin, Ether or Ripple's XRP.

[8] http://www.fsb.org/wp-content/uploads/P180318.pdf

20. The technical innovations behind DLT emerged from the initial crypto-asset, Bitcoin, which was introduced in January 2009[9]. Bitcoin was an attempt to build a payment system that did not rely on a trusted authority (such as a commercial or central bank) to maintain the record of payments and balances (the 'ledger'). Importantly, anyone can participate in the validation of Bitcoin transactions – the network is **'permissionless'** and its underlying blockchain (the database or ledger of transactions) is **public**. The Bitcoin network relies on multiple participants maintaining identical copies of the ledger, and employs a process to come to consensus on the contents of, and updates to, this ledger.

21. The emergence of Bitcoin, and the more than 1,000 crypto-assets that followed, has led technology firms and financial institutions to explore the possible adaption of the underlying distributed ledger technology for use in financial services. However, applying DLT to financial services typically requires significant and fundamental changes to the designs used by Bitcoin and other crypto-assets.

22. DLT arrangements being explored in financial services are generally **'permissioned'** – i.e. participants require permission to participate in the network, and its underlying distributed ledger is **private**. This is because these networks are usually intended for use by a closed group of participants, such as a network of banks who regularly trade with each other. This difference allows DLT to avoid some of the key disadvantages of permission*less* systems – for example, permissioned DLT systems do not usually require the complex, costly and energy-intensive proof-of-work consensus mechanisms used by Bitcoin and other crypto-assets.

23. DLT could have material benefits when adapted for use in the financial system, including:

    a. Increasing the **efficiency** of managing data, by reducing data replication and associated reconciliation processes;

    b. Improving **resilience** by eliminating central points of failure, as multiple parties share replicated data and functionality;

    c. Enhancing **transparency** and auditability through the creation of instant, permanent and immutable records of transactions; and

    d. Expanding the use of **straight-through processes**, which largely eliminate manual processes, including with 'smart contracts' that make automatic updates or payments on receipt of new information.

24. These benefits suggest a number of **potential use-cases in financial services**, including domestic and cross-border payments, securities settlement and trade finance. In particular, DLT may have the greatest benefit in applications where existing processes still rely on manual or even paper-based processes. Financial institutions are already working towards applying these technologies to wholesale markets, while banks and payment providers are innovating to improve the speed and efficiency of payments.

25. However, DLT is still a relatively immature technology, and there are few examples of live, real-world deployments at scale in financial services. There are also significant **challenges around the application of DLT**, including:

[9] https://bitcoin.org/bitcoin.pdf

a. **Scalability and reliability** – the technology will need to prove it can reach the performance standards of more conventional technologies.

b. **Privacy** – the origins of DLT are based on sharing identical copies of the ledger across multiple participants, but this may involve the undesirable sharing of private data.

c. **Security** – assurance will be needed over the security of any system from cyber-attack, including considerations around future developments in computing power and techniques.

d. **Governance** – consideration will be needed around how a distributed system is controlled and governed. However, permissioned implementations of DLT will have fewer governance challenges than permission*less* implementations, as by definition there must be an entity (or group of entities) with some level of control in order to grant access to participants.

26. Addressing these challenges can result in **trade-offs**, especially between resilience, performance and privacy. For example, addressing privacy concerns by not sharing all data with all participants can reduce the resilience of the network, while ensuring privacy through encryption of all data can negatively impact scalability and throughput.

The Bank's Approach to DLT

27. The PRA's regulatory approach is neutral towards the technology used to achieve an outcome. Instead, we focus on whether the operational processes and governance of any use of technology adequately mitigate any risks that may arise. In this context, we need to consider that DLT-based solutions might offer certain benefits (e.g. increased resilience), but may also pose new risks or challenges (e.g. governance, privacy concerns).

28. Work has been done across the Bank and PRA to ensure that we understand the implications of DLT and its applications to the financial system. In particular, we consider how DLT may impact the firms we regulate, and how it could be applied to our own operations.

29. The Bank has a renewal programme to deliver the next generation of our real-time gross settlement (RTGS) service. We have concluded that DLT is not yet sufficiently mature or reliable to provide the exceptionally high levels of robustness required for RTGS settlement[10] – a system which settles the equivalent of a third of the UK's annual GDP every day. However, we have placed a high priority on ensuring that the new service is capable of interfacing with DLT, and supporting DLT-based services as and when they develop in the wider sterling markets.

30. The Bank is currently undertaking a Proof of Concept (PoC) to understand how a renewed RTGS service could be capable of supporting settlement in systems operating on innovative payment technologies, such as those built on DLT.[11] We plan to introduce functionality to support the 'synchronisation' of cash movements made in RTGS with the movement of cash and assets held in other systems; this functionality may improve wholesale and retail cross-border payments. The Bank is partnering with a range of firms developing payment arrangements using innovative technologies, to give a broad insight into the range of functionality we might need to offer to support this sector.

[10] https://www.bankofengland.co.uk/-/media/boe/files/payments/a-blueprint-for-a-new-rtgs-service-for-the-uk.pdf
[11] https://www.bankofengland.co.uk/-/media/boe/files/payments/rtgs-renewal-proof-of-concept.pdf?la=en&hash=2367D4475E64266B1C1F0399851C19DA05749543

31. Through the Bank's programme of work on fintech, we have completed several other PoCs in relation to DLT, including an exploration of the use of DLT to synchronise payments between the RTGS systems of two central banks, using Ripple's Interledger Protocol (but not Ripple's XRP crypto-asset), and an academic exercise with Chain, looking at techniques to achieve privacy in a DLT system.

32. Bank staff have published research looking at the economics of the use of DLT in securities settlement, concluding that it has the potential to improve efficiency and reduce costs in securities settlement.[12]

Central bank digital currency (CBDC)

33. At the moment, the Bank provides electronic accounts to commercial banks and key financial institutions, but the public can only hold central bank money in physical form – as banknotes. If a central bank issued a digital currency then everyone (including businesses, households and financial institutions other than banks) could store value and make payments in electronic central bank money.

34. This could have wide-ranging implications for monetary policy and financial stability.[13] Some research has suggested that the existence of a CBDC might make the pass-through of monetary policy changes more immediate.[14] But it could also introduce new risks. In particular, the possibility of large moves from bank deposits to CBDC could reduce the funding and liquidity of commercial banks.[15] This could restrict their ability to provide credit, or in the extreme case pose a threat to financial stability.

35. At this point, it is not clear that any beneficial impact of CBDC on monetary and financial stability would outweigh the risks it could introduce. Further research is needed by both academics and central banks to explore these complex issues. There are also broader societal questions that others would need to answer – the decision to introduce a CBDC would not be exclusively for the central bank to make.

36. The Bank has an open mind about the eventual development of a CBDC, but does not plan to issue one in the medium term. We continue to research the topic and have published a list of research questions to encourage external research.[16] We are also working with other central banks to explore these complex issues. However, in terms of policy actions, the Bank is currently focussed on measures that will deliver more immediate improvements to payments, such as the programme to rebuild our Real Time Gross Settlement system.

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[12] https://www.bankofengland.co.uk/working-paper/2017/the-economics-of-distributed-ledger-technology-for-securities-settlement
[13] *The Future of Money*, speech by Mark Carney, 2nd March 2018
[14] https://www.bis.org/cpmi/publ/d174.pdf
[15] *Central banks and digital currencies,* speech by Ben Broadbent, on 2nd March 2016.
[16] https://www.bankofengland.co.uk/research/digital-currencies