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CIO Special

Central bank digital currencies
Money reinvented

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01 Introduction

Money is central to our lives but is still something very abstract. From a consumer's perspective, over the centuries it has evolved from touchable objects (coins and, later, banknotes) to a gradually more "touchless" system – via credit cards or, increasingly, smart phones. The coronavirus crisis has speeded up this process of evolution, at least as regards the willingness of consumers to use electronic payments – especially in those countries where previously there was some reluctance. At the same time, modern technologies such as block chain (previously associated with privately-managed cryptocurrencies) allow for new ways of payment.

The next level of abstraction, in the form of central bank digital currencies (CBDC), may soon be upon us. CBDC will present multiple challenges to consumers and financial institutions, central banks and governments as well as opportunities. It could be disruptive both for the banking sector and the practicalities of central bank policy. If implemented, CBDC could change the world we live in significantly.

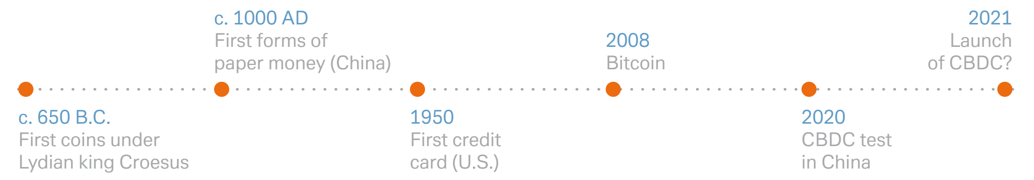
CBDC could change all financial relationships

CBDC may have advantages and disadvantages which cannot be ignored. The potential advantages relate to the speed and ease of monetary transactions (between individuals and also government to individual), as well as the scope for policy improvement and enhancement – whether through being able to move interest rates yet lower, to stimulate growth, or through identifying and stopping illegal money transfers. And there would be more subtle benefits too: for example, from an investor's perspective, some existing risks from bad corporate governance could be reduced by the better transparency and traceability of CBDC transactions. But the challenges posed by CBDC are multiple and the implications for the financial system, the commercial banking system, individuals and society in general are major. Topics such as privacy, scalability and regulation need to be addressed. If consumers can hold their own digital central bank accounts, the role of banks may need to be redefined (with, for example, withdrawal of conventional deposits restricting banks' ability to lend) and CBDC will also have broader implications for the global economy and international relations.

Central banks are working on CBDC with several (China's and Sweden's being the most prominent) now testing initial versions. These developments cannot be ignored and this report explores some of the issues involved and their implications from an economic perspective. From an individual's perspective, of course, cash still has its two great attributes of anonymity and accessibility (without recourse to electronics). Cash also has two and a half millennia of history behind it. But, with technological and social barriers likely to be overcome, CBDC may soon become part of our lives – so we need to learn how to use them best.

Figure 1: Money timeline

Source: Bankenverband, BIS, Diners Club, Deutsche Bank Wealth Management. As of September 2020.



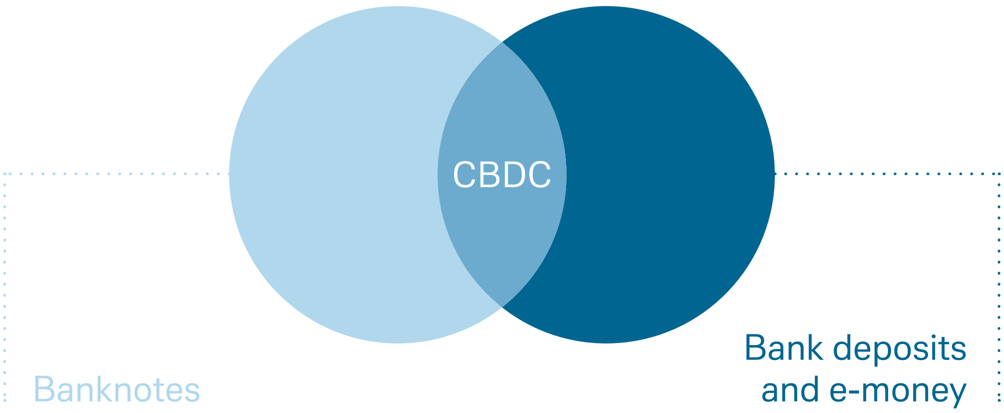
02

What are central bank digital currencies (CBDC)?

Central bank digital currencies (CBDC) are what they say on the tin: a form of digital money established by recognised authorities (governments, central banks) and with legal tender, but without some of the attributes of traditional money. This differentiates them from so-called cryptocurrencies which are not subject to such official control.

Figure 2: CBDC combine multiple functions

Source: Deutsche Bank Wealth Management, Bank of England. As of September 2020.



Three general variants of CBDC have been proposed. These vary according to the intended scope of the CBDC (e.g. whether it is intended for general or wholesale use) and also the system used (e.g. individual accounts or token-based). The basic features of these three variants are summarized below.

01 General access (account-based): Individual accounts are held at the central bank. Transfers would be made directly through the central bank. Once the claim is verified through a central ledger, the transaction occurs between these accounts.

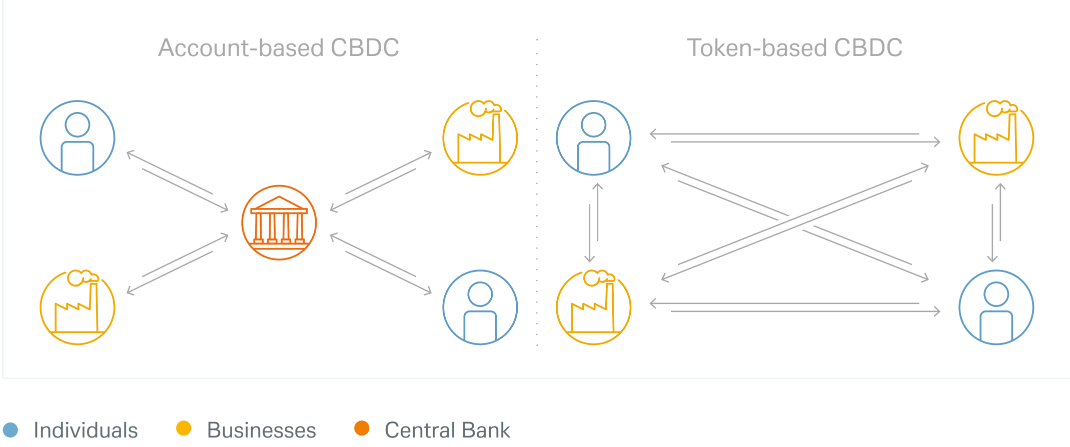
02 General access (token-based): The central bank issues a digital token for the general public. The transfer of these digital token would allow for cash-like transactions. This variant of CBDC could provide immediate and anonymous settlements (so a decentralized system).

03 Wholesale access (token-based): Limited access to banks and other financial institutions; CBDC is intended for wholesale settlements such as interbank payment and securities settlement. This approach is closest to the current wholesale account-based system where commercial banks hold their accounts at central banks.

Much of the discussion in this report is focused on Variant 1 – although many of the issues identified will also apply to the other variants too. For more information on the technology used to tokenize money please see our CIO special report: A deeper look – demystifying Distributed Ledger Technology, published in September 2018.

Figure 3: Account-based vs. token-based CBDC

Source: Deutsche Bank Wealth Management. Data as of September 2020.



According to a BIS survey from January 2020, more than 80% of the world's central banks are investigating the possibility of issuing their own digital currencies (for sources, see the glossary at the end of this report – Boar, Holden and Wasworth, 2020). These include China and Sweden, seen as the furthest down this track. Note however that some countries have already expressed their concerns about CBDC in their studies, believing that the additional advantages from CBDC may currently be low and outweighed by risks particularly with regard to financial stability.

The Swedish interest in an *e-Krona* is noteworthy as Sweden is an EU member state and therefore covered by the law of free capital movements in the EU. If an *e-Krona* is initiated all EU citizens could have access to the digital currency. In Sweden, most transactions are already paid for with digital money and not cash, so the general acceptance level throughout the population could be higher. Many restaurants and shops do no longer accept cash as a payment method.

China is already testing the *e-Renminbi* – with major potential domestic and international ramifications

The launch of the *e-Renminbi* by China could obviously play a more important role in a global context – given China's 1.4bn population and economic size. Issuing one of the first CBDC would also be a step towards China's target of becoming a world leader in science and innovation by 2050 and provide a reserve currency. China is already testing the *e-Renminbi* in four cities (namely Shenzhen, Suzhou, Chengdu, and Xiongan) via local businesses and some international firms (Peters, Michael A., Benjamin Green and Haiyang Yang, 2020). More testing is planned for the Winter Olympic Games, to be hosted by China in February 2022.

Countries that are involved in China's One Belt and One Road program could be the first adopters, followed by companies that trade in general with China or distribute their products there. Another global implication is that a CBDC could remove the need for China to use the SWIFT system (Society for Worldwide Interbank Financial Telecommunications) on transactions within the country and with other country users of this CBDC. China's digital payments could thereby make the country more independent from international money exchange systems and controls – one example of the complex implications of CBDC which we discuss below.

03

CBDC and central banks

The launch of a whole new digital currency system will not only be a change in the payment system for customers. It will change monetary policy and the traditional financial system as we know it.

Central banks are always on the look-out for ways to improve the effectiveness of monetary policy transmission channels. For further information about transmission channels please see our CIO special report, Inflation: drivers and implications, published in June 2020.

One problem for central banks is that when they change monetary policy, they then have to wait for intermediaries (e.g. commercial banks) to transmit policy decisions to individuals and companies, often with a delay or in a modified form. CBDC might reduce the role of intermediaries and thus policy dilution. This could also be a major shift for commercial banks as their role as a financial intermediary is changing. In the case where individuals can have their own CBDC central bank accounts, the role of banks as a gatherer of private savings could change significantly, at least they would need to offer higher interest rates than the central bank in order to attract savings.

CBDC will give central banks more policy options – both conventional and radical

Central banks could also use CBDC to ameliorate specific problems around low or negative interest rates. The trend towards lower interest rates has been established for many decades. Several factors, such as demographics, globalization or digitalization have weighed on the so called natural rate of interest (the interest rate level when the economy is in equilibrium). Over the last decade or so, policy rates have also been cut by central banks as a result of the global financial crisis and, most recently, the hit to demand from the coronavirus pandemic has left central banks even keener to reduce rates well under the equilibrium rate and thereby stimulate the economy. As a result of all these factors, interest rates are currently very low or even negative in many economies (although not, notably, the U.S.).

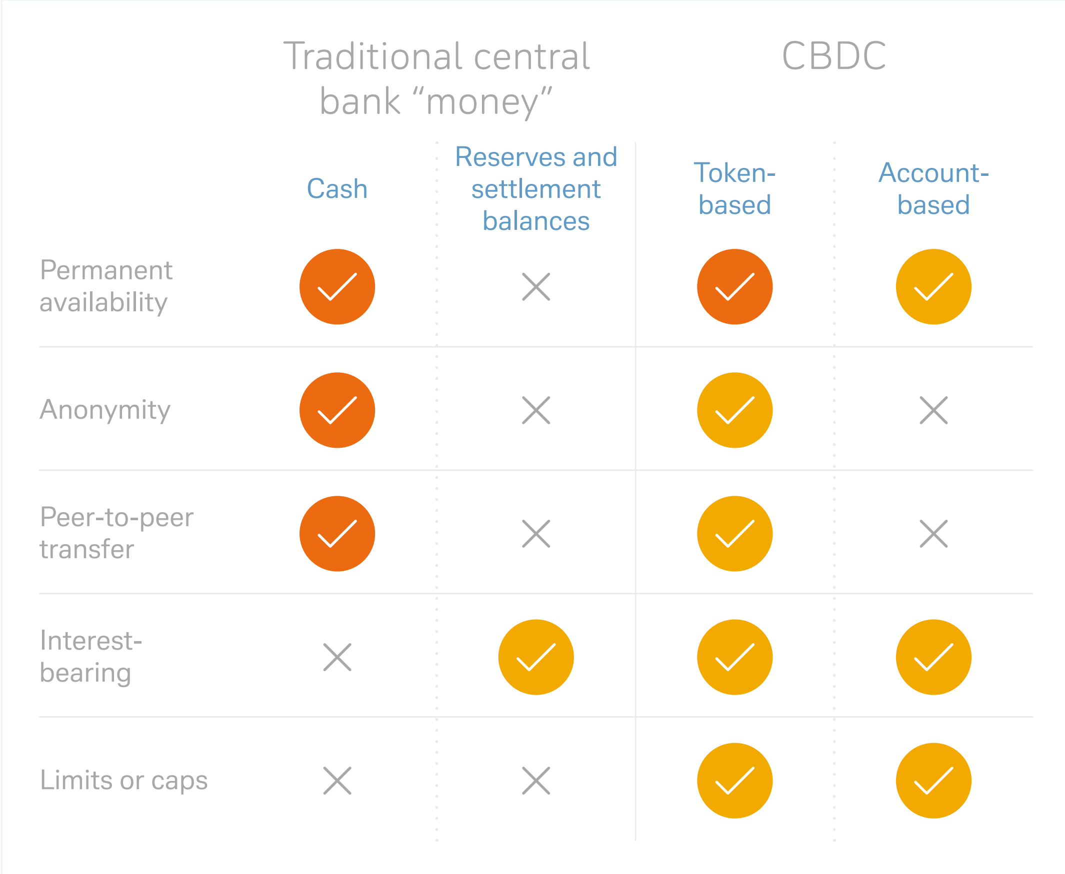
At present, however, central banks may face a problem in pushing rates much further down in the form of the so-called "lower bound" of interest rates. If interest rates paid on bank balances become even more negative, then investors may prefer simply to hold balances in physical cash – despite the evident disadvantages of holding cash including storage costs, insurance and other opportunity costs.

In Europe and Japan, where rates are already negative, this means that national central banks have little room for lowering rates further. But remove the option of holding cash – which CBDC, in some forms, would do – and then the "lower bound" could fall very much further.

With very negative interest rates on offer on their bank accounts, and no ability to hold back cash for future purchases, investors could find it more desirable to spend money now, so stimulating economic activity, or to invest in (non-deposit) financial assets and thereby create a wealth effect. On the other side, deeply negative interest rates would incentivize consumers and business to borrow money to spend now.

Figure 4: CBDC features vs. traditional central bank "money"

Source: Bank for International Settlements, Deutsche Bank Wealth Management. As of September 2020.



Existing or likely feature   Possible feature   Not typical or possible feature

Aside from broad interest rates, CBDC would give policy-makers more options to combat undesirably high savings rates, possibly through individual allowance limits (comparable to the existing ECB tiering system for banks' excess liquidity). Money in the form of CBDC could also have a designated shelf-life, making real the idea of "depreciative money", first articulated by Silvio Gesell (1862-1930, a German economist) more than 100 years ago. Negative interest rates directly imposed on CBDC would have a similar effect as they reduce the value of money over time.

Other radical options would also become easier. Central banks could make better use of the widely discussed concept of "helicopter money" to stimulate demand and fight deflationary tendencies via directly transferring money to individuals instead of relying on the transmission via banks (as discussed above). This instrument can be extremely useful in times of bank lending tightening and declining consumer confidence due to a deterioration in economic conditions. Conditionality could also be set. Time-restricted access, consumption allowances for certain products as well as pay-outs linked to the ordinary income are all imaginable. With this new (and perhaps worrying) creative freedom the velocity of money could be significantly increased as opportunity costs, associated with holding liquidity, rose.

Other traditional monetary transmission channels could be affected by the start of a CBDC. For example, the interest rate differential between the new central bank accounts and those on offer in other jurisdictions or bank accounts could lead to major funds movements and associated volatility.

04

CBDC and individuals

Central bank digital currencies could bring many changes for individuals. Without an intermediary (e.g. commercial banks), money transactions could occur at lower costs and potentially in real time. Counter-party risk (the failure of one or more parties in the transaction) could also be eliminated. Depending on the CBDC technology used (see above), money transfers could be anonymous and completely decentralized – as, ironically, old-fashioned cash transactions are now.

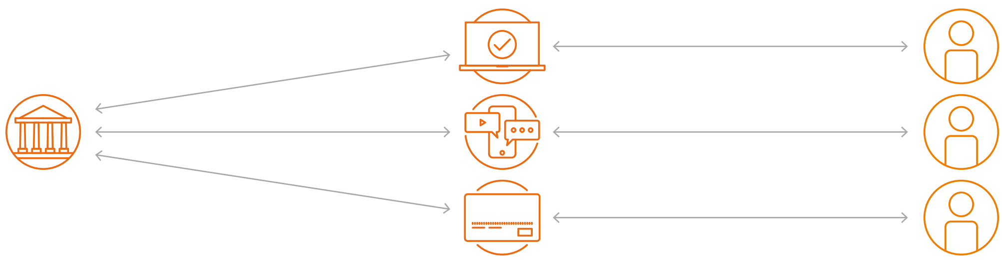
But if individuals are to adopt CBDC, the new digital currency needs to quickly fulfil cash-like functions to overcome initial scepticism. To do this, the currency should serve as a medium of exchange, as a measurement of value and as a store of value (although the latter need may clash with a central bank's policy goals, as we noted above). Payments need to be secure and simple. Universal access has to be guaranteed. On top of this, to really add value to the existing currency system, cross-border transactions should be straightforward and cost-efficient.

For individuals, CBDC must quickly fulfil cash-like functions – but there will be a trade-off between privacy and convenience

There is also a clear trade-off between privacy and convenience. Empirical evidence shows that younger age groups are less concerned (in general) about possible reductions in privacy and are more open towards new technology and the opportunities it may bring. This leads to an intriguing question. Will emerging market economies with their younger populations be more willing to adopt such a currency system with these pluses and minuses than developed countries? Surveys (e.g. Deutsche Bank Research, *The Future of Payments – Part 1. Cash: the Dinosaur Will Survive... For Now*) have shown that especially in western European countries like Germany, scepticism amongst individuals about digital payment methods is still high and traditional cash payments are still widely used. Implementation of CBDC could therefore, in a worst case scenario, encounter political resistance and, possibly, encourage social unrest.

Figure 5: Individuals' CBDC transactions – multiple access points

Source: Deutsche Bank Wealth Management. As of September 2020.



05

CBDC and governments

From a government's perspective, one advantage of CBDC is that they could make it easier (working in collaboration with central and commercial banks) to enhance capital movement controls – again, depending on the chosen technology. Centrally-organized digital currencies would make it easier for regulatory authorities and commercial institutions to see and trace every transaction. Governments could spot certain behavioural patterns and identify users, making it easier to crackdown on money laundering or tax evasion.

The greater transparency and therefore traceability of CBDC payments could have other advantages. Governments or other parties could use CBDC as a better control mechanism to manage social benefit transfers. The coronavirus crisis has underlined the need for secure, accurate and fast transmission of social benefit payments. With CBDC, claims by companies and individuals could be directly met, with a lower possibility of mispayment or fraud. More broadly, the implementation of CBDC could, through enforcing transparency and traceability around money transactions should help improve corporate governance generally. This is something we think will become even more important to investors, for reasons we discuss in our recent CIO special report: The "G" in ESG: Governance – a question of balance, released in August 2020. (CBDC are also relevant for the "S" – social policies – in ESG, and not just for their potential use for making government to individual financial transfers as discussed above.)

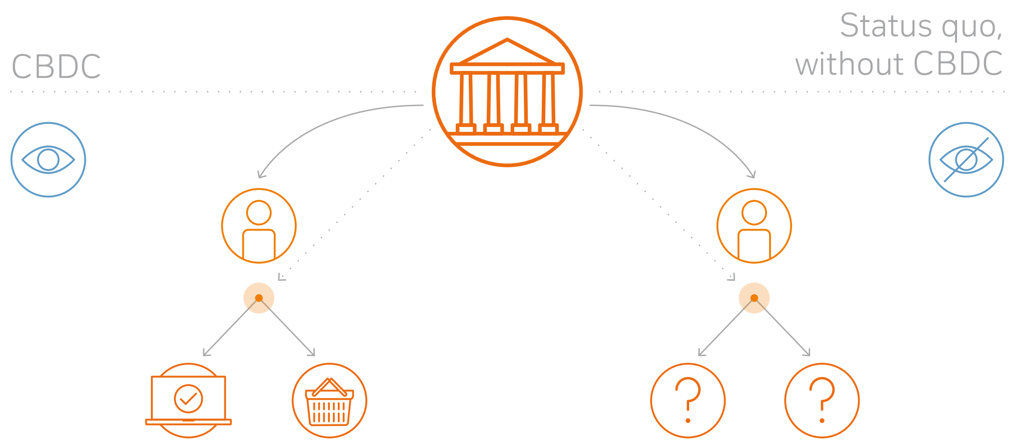
But here we also run quickly into political issues, across a broad spectrum – from the control of individuals to the management of international trade relations.

CBDC could lead to the controls on individuals' spending for political as well as criminal reasons. They could also become an external as well as internal political tool – either at times of specific tensions (e.g. around trade) of for longer-term development purposes. Adoption of CBDC in key bilateral trading relationships could erode the dollar's primacy in the global financial market.

CBDC could also change the internal institutional dynamics of a country – for example, by reducing the independence of central banks and other institutions as the distinctions between monetary and fiscal policy become ever-more blurred.

Figure 6: CBDC may give governments visibility on individual transactions depending on the chosen technology

Source: Deutsche Bank Wealth Management. As of September 2020.



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06

Conclusions

CBDC is likely to change the financial world we live in – and soon, with some schemes possibly implemented over the next few years.

Two basic observations are possible at this stage.

First, there has not yet been any broad empirical real-time test of CBDC. There are obvious questions as to their short-term impact on capital markets and the reliability of new systems in times of crisis and/or major market disruption. There would appear to be specific risks related to CBDC issuance via Distributed Ledger Technology (DLT) – an evolving technology and not yet been proven as sufficiently robust for a wide-scale implementation. A related issue is how to ensure interoperability with existing processes and infrastructures: we need a reality-check here.

Second, the way in which CBDC are implemented is difficult to predict, as are their implications. The launch of one CBDC in one economically important or populous country could force others to follow quickly because capital market adjustments would be expected. Other reasons make the launch of CBDC likely in the near future. These will include a desire to maintain monetary sovereignty as privately-organized initiatives such as privately-organized digital currencies get greater public awareness. CBDC could also have an impact on the international role of global conventional currencies. The difficulty in predicting the effects of CBDC operating in parallel with these conventional currency systems is probably the most important reason why there has been no widespread introduction of a CBDC in the recent past. Side effects like the potential for indirect support in building speculative asset price bubbles or the creation of shadow banking activity is hard to forecast.

But uncertainty is not a reason to avoid this issue – CBDC, if implemented, will have major and profound implications for all economic actors which should not be underestimated. These implications will go well beyond making transactions easier and improving the effectiveness of monetary policy: more transparent and better corporate governance, for example, should make a real difference to how companies operate. We will monitor these developments closely.

Glossary

The Bank for International Settlements (BIS) aims to foster cooperation between central banks, and acts as a counterparty in their transactions.

Distributed ledger technology allows shared and synchronised digital data across multiple sites without a central administrator.

The European Central Bank (ECB) is the central bank for the Eurozone.

ESG investing pursues environmental, social and corporate governance goals.

A reserve currency is a currency held in large amounts by many central banks as part of their foreign exchange reserves.

SWIFT (the Society for Worldwide Interbank Financial Telecommunication) provides a network for transmitting information about financial transactions.

Bibliography

Auer, Raphael and Böhme, Rainer (2020). *The technology of retail central bank digital currency.* BIS Quarterly Review

Bank of England (2020). *Central Bank Digital Currency – Opportunities, challenges and design.*

Bindseil, Ulrich (2020). *Tiered CBDC and the financial system*. ECB Working Paper Series 2351

Boar, Cordruta; Holden, Henry and Wasworth, Amber (2020). *Impending arrival – a seque to the survey on central bank digital currency*. BIS Paper 107

Coeuré, Benoît and Loh, Jacqueline (2018). *Central Bank Digital Currencies*.

Deutsche Bank Research (2020): *The Future of Payments – Part 1. Cash: the Dinosaur Will Survive… For Now.*

Fernández-Villaverde, Jesús, et al. (2020). *Central Bank Digital Currency: Central Banking For All?*. NBER Working Paper 26753

Hanl, Andreas and Michaelis, Jochen (2019). *Digitales Zentralbankgeld als neues Instrument der Geldpolitik*. Wirtschaftsdienst 99(5), 340-347

Kiff, John et al. (2020). *A Survey of Research on Retail Central Bank Digital Currency*. IMF Working Paper 20/104

Peters, Michael A., Benjamin Green and Haiyang Yang (2020). *Cryptocurrencies, China's sovereign digital currency (DCEP) and the US dollar system.*

Sveriges Riksbank (2020). *The Riksbank's e-krona pilot*.

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