

Central bank digital currencies and gold: implications for reserve managers





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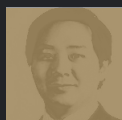
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FOREWORD

Future of gold



Shaokai Fan
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TECHNOLOGICAL change has always been a driving force in the evolution of money. The barter system could only give way to commodity money because refining and standardisation built trust in precious metal coinage. Paper notes gained acceptability because improved printing technology reduced the risk of counterfeiting. Throughout the history of money, technological change has helped to reduce the core challenges of transacting: ease, reliability and trust.

The world is poised for the next step in the evolution of money. Private cryptocurrencies have emerged as potential new mediums of exchange, although their long-term viability is yet to be proven. Central banks have also seized on the possibilities brought about by our highly digitised world with the development of central bank digital currencies. Although several different models for CBDCs are being considered, they all represent a step forward in the relationship between central banks and the currencies they issue.

CBDCs can potentially enable a wide range of new features. Money can become programmable, allowing policy-makers to incentivise certain spending behaviours that can optimise economic impact or address social concerns. The trackable nature of CBDCs can also help to deter financial

crimes or the use of money to pay for illegal items. However, these features also touch on concerns about personal privacy and the freedom to spend as one sees fit. Although the exact function of CBDCs will only be determined as they begin to be used in the real world, their potential impacts on societies may be significant.

It is interesting therefore to examine the impacts of this newest form of money on one of the oldest – gold. Gold functioned as money for centuries, a role which it lost only fifty years ago with the end of the Bretton Woods system. Nevertheless, gold has continued to thrive as a distinct asset class, a form of money that is outside the control of policy-makers. With CBDCs on the horizon, discussions about privacy, monetary policy and programmability will inevitably emerge. Some may turn to gold to allay these concerns. Increasing cross-border usage of CBDCs may lead to greater currency volatility, prompting some central banks to potentially build up greater gold reserves as a result.

This report examines the potential paths which CBDCs might take and their impact on gold as well. While the possibilities that we explore are all speculative, this report can serve as a starting point for thinking about the wider impacts of CBDCs on our relationship with money. Money will continue to evolve with changing technology, but how these changes will impact how we spend, save and transact can only be understood over time. •

1. INTRODUCTION: WHY CENTRAL BANKS ARE CONSIDERING DIGITAL CURRENCY

Gold's role set to change in face of CBDC

Most central banks are exploring the introduction of central bank digital currencies, which could have a major impact on the gold market.

REPRESENTING over 90% of global gross domestic product, 81 countries are exploring issuing central bank digital currency, according to the Atlantic Council. The status of these projects varies widely, however (Figure 1). Some countries have already issued a CBDC, such as the Bahamas. Others are on the cusp of issuance, such as China, which has extensively trialled its digital currency/electronic payment project. Others – such as the US and euro area – are more than half a decade away from a potential launch, should they decide to pursue issuing a CBDC.

CBDC is often regarded as a public sector response to the spread of private sector cryptoassets and stablecoins, such as bitcoin, dogecoin and Facebook's Diem project, formerly known as Libra. In causal terms this may be partly true, but their role, function and status will differ significantly from the more speculative, largely unregulated coins that the private sector has offered so far. CBDC also has considerable potential to facilitate policy transmission for central banks and ministries of finance, for example

by allowing the former to modify the remuneration of issued tokens at varying or tiered rates. But CBDC may also present new challenges for policy-makers. Their impact on the banking system and cross-border flows remains, for example, ambiguous but will significantly shape the outlines of a post-CBDC world. Public digital currency could foster financial inclusion by making remittances significantly cheaper, but it could also lead to currency substitution and more volatile capital flows. Possible use cases driving central bank decision-making may have inadvertent ramifications.

As such, the possible issuance and diffusion of CBDC, particularly in major currencies such as the dollar, will have important implications for the international monetary system and the reserves management practices of major central banks. Importantly, it will also have implications for gold. According to OMFIF's 2021 Global Public Investor, roughly 8.3% of total global central bank reserves are allocated to gold, a share roughly equivalent to that of equities and corporate bonds.

The market for gold, a major reserve asset, stands to change in different ways as a result of the different features of CBDC.

This report explores the ways in and channels through which the gold market and gold's role as a reserve asset might change as a result of the development and diffusion of CBDCs. It will look at some of the possible characteristics of CBDC and examine some of the key use cases and their impact on investment demand for gold: enhancing policy transmission, ensuring privacy and transparency and facilitating cross-border flows.

Each of these use cases may play out in different ways and this report sketches possible scenarios for adoption, spread and how these may impact the gold market. Gold investors should think through the way in which market behaviour might change. Yet they should also be conscious of the fact that the choices of central banks – on remuneration, technology and design, among many other variables – will indelibly shape the market and macroeconomic implications of CBDC. •



1. Reserve currencies and the status of their CBDC projects

RESERVE CURRENCY (share of reserves, %, Q12021)	STATUS OF CBDC PROJECT
US dollar (60%)	Congressional lawmakers have pushed for the development of digital public money. However, per the Federal Reserve, 'no decision has been made on whether to issue a CBDC in the US payment system. However, given the dollar's important role globally, it is essential that the Federal Reserve remains fully engaged in CBDC research and policy development.' The Fed actively participates in multilateral CBDC initiatives and the Boston Fed has established its own digital currency initiative with the Massachusetts Institute of Technology.
Euro (21%)	Launched its digital euro project on 14 July, 2021, starting with an 'investigation phase.' Consultations and advisory groups with European citizens, markets and intermediaries are due to take place over the next 24 months. This follows on from a 2020 digital euro report which identified that 'the Eurosystem needs to be equipped to issue it in the future' and that the CBDC would 'support strategic objectives of the Eurosystem.'
Japanese yen (6%)	Launched the first phase of a CBDC proof-of-concept in April 2021, due to take place over the course of 12 months, to test basic issuance, transfer and redemption functions. Early white papers suggested that 'it might become appropriate to issue CBDC in order to support private payment services.'
Pound sterling (5%)	The Bank of England has not yet decided whether to introduce CBDC. It has announced a joint task-force with HM Treasury in April 2021 'to coordinate the exploration of a potential UK CBDC,' and set up an internal team focused on CBDC to manage development of the project within international forums.
Chinese renminbi (3%)	Concrete trials of the DC/EP system have taken place across a number of Chinese jurisdictions. A full launch is likely to take place in 2022.
Other (7%)	Although the Swiss National Bank participates in cross-border trials and has studied how CBDC works, its chief economist has said that he sees 'no need' for a digital franc. The Reserve Bank of Australia has adopted a similar stance, stating that it sees no 'policy case' for CBDC. The Bank of Canada is 'building the capability to issue a cash-like CBDC... should the need ever arise.'

Source: Relevant central bank publications, OMFIF analysis

2. CHARACTERISTICS OF CBDC

Crucial design choices will be central to shaping the impact of CBDC

How central banks deal with programmability, anonymity and interoperability will have major impact on how gold responds to the introduction of CBDC.

THE design choices and technology underlying CBDC will shape its market and policy implications. Some of the most relevant ones for investment and policy-making are programmability, anonymity and interoperability.

Initial CBDC discussions began in response to the spread of blockchain-based innovations, such as bitcoin – for which decentralised ledgers are an essential part of the appeal. Increasingly, however, major central banks are expressing the view that retail CBDC will not be based on distributed ledger technology; the role of the central bank as a trusted counterparty makes this redundant. At the 2020 European blockchain convention, Thomas Moser, an alternate member of the governing board of the Swiss National Bank, and Martin Diehl, head of payment systems analysis at the Bundesbank, argued that there was little sense in using any form of blockchain as a basis for a retail CBDC, though some form of shared ledger may make sense for a wholesale version.

As a result, major CBDC projects are proceeding on the foundation of existing technologies, forgoing decentralised ledgers. Both the People's Bank of China's DC/EP and the Riksbank's e-krona – two of the most advanced CBDC projects – do not use blockchain. Yet the central policy use cases for CBDC, such as monetary policy transmission or financial inclusion, can be implemented nonetheless.

Programmability

Programmability is central to the potential for improved policy transmission via CBDC. It refers to a specific phenomenon in which money inextricably combines both a coded logic, generally through smart contracts, and a measure of value.

Some existing forms of financial technology combine coding and value but in a different way. Temasek's Antony Lewis gives the example of a standing order to pay rent on a specified date every month that fails if an account balance contains insufficient funds. This is one example of a code that transfers value when specific if/then conditions are satisfied. But the notion of 'programmable money' imbues the tokens themselves with an inherent logic, regardless of who owns the token at any given time. At present, tokens owned by different financial institutions, while they might be used to fulfil preprogrammed payments, are not heterogeneous and programmable in the same way. At different banks, different privately created dollar tokens will be subject to different anti-money laundering checks, risk management systems and institutional peculiarities.

Under a CBDC regime, these differences may be resolved. Programmable CBDC would work through what Alexander Lee at the Federal Reserve Board calls a 'coherence guarantee' – a term for 'a mechanism guaranteeing that the technical components of the

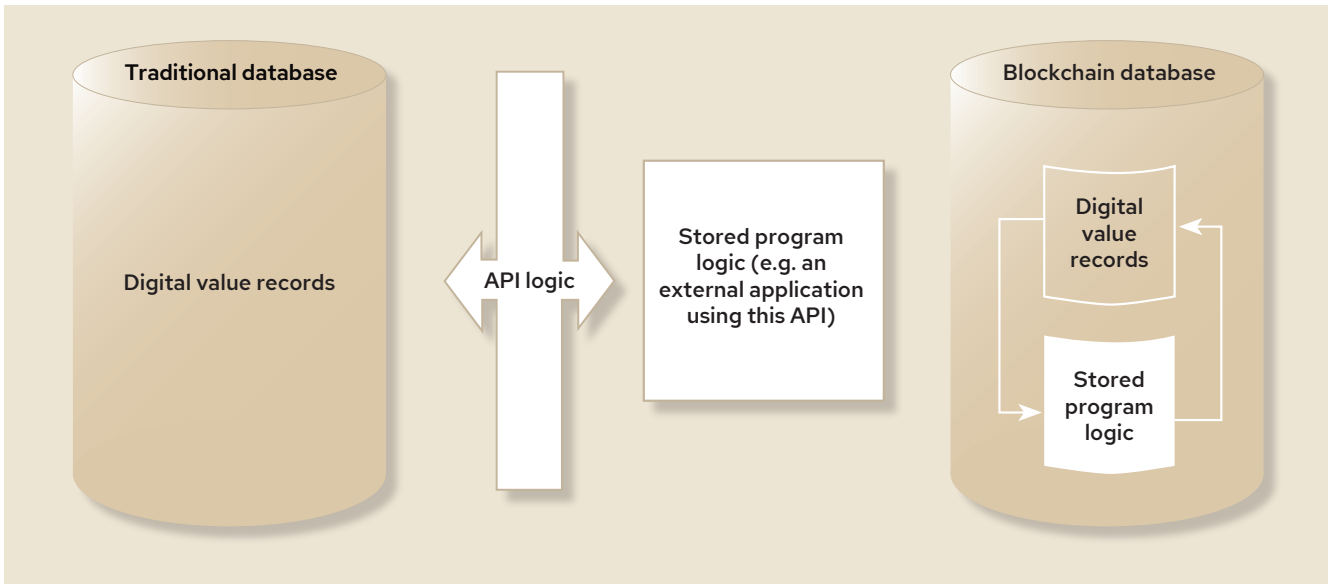
programmable money product are "inseparable" and that those components are consistently functional.' To execute something like a standing order, a financial institution will typically rely on a database to store the 'value' of the token in question as well as, separately, an application programming interface built on a separate technology platform from the database itself. But programmable money is defined by the tight integration of these two features – and thus is defined by the 'coherence guarantee' (Figure 2). This distinguishes programmable money from other forms of money existing today, such as central bank reserves or bank deposits.

Design options allowing for programmability are broad. Public blockchains generally pursue one of two, either a transaction scripting approach or a virtual machine approach. In the former, programmability is tacked on to every unit of value in the system to determine the conditions on how that unit may be spent. In the virtual machine approach, the system itself contains programming instructions that can manipulate the value stored in the ledger. An example of the first is bitcoin, while ethereum is an instance of the second.

Privacy and anonymity

A 2020 OMFIF study on consumer trust in payment systems found that 'privacy' and 'security' were the

2. How CBDC fuses together code and value



Source: Federal Reserve Board

two most prized potential features of CBDC across 12 jurisdictions. Globally, respondents identified ‘privacy’ as the second-most important feature of a CBDC, with only ‘safety from fraud or theft’ selected by more respondents (Figure 3).

It is clear, both from this survey as well as central banks’ own findings, that ensuring a putative CBDC meets users’ demands for privacy and anonymity will be critical to its success. ‘The fact that citizens place a high value on privacy is a consistent finding of many surveys,’ the ECB wrote in a 2021 paper. These citizens have become increasingly aware of the vast troves of data collected and stored by state and industry; this is particularly acute in the space of payments data.

But this overwhelming and legitimate demand for privacy in payments belies the complexity of achieving that privacy. For one, privacy is not black and white. CBDC designers and issuers have to make a series of choices about what information to protect and what information to scrutinise. In addition, central banks have to choose to whom what information should be

disclosed and the technical means through which different degrees of privacy might be implemented

Existing payment methods vary in their degree of anonymity. A cash payment, for example, is far more anonymous than a credit card payment, given the number of parties involved and the information they require to process a transaction. As the Bank of Canada adds in a paper, ‘a system may be more private with respect to one entity (e.g., merchant) and less so for another (e.g., government).’

Design choices which have implications for the number of parties involved have a crucial first-order impact on the level of privacy a CBDC can have. Central banks have to make a number of choices, including who will administer CBDC accounts and who will manage the relevant infrastructure, with differing implications for the relative anonymity of a CBDC. For instance, a token-based CBDC model, in which a token representing monetary value is distributed by the central bank via private sector intermediaries, requires more parties to have access to user data than an account-based model, where users have direct

access to accounts with the central bank. The important questions revolve not so much around whether there should be anonymity, but on the degree of anonymity required and from whom transactions should be anonymous.

But there are additional layers of complexity to these design and policy choices. For example, once a central bank has made relevant choices on institutional access to user transaction data, there are still ways of anonymising data and important computational choices to be made. A recent European System of Central Banks proof of concept proposed a way in which a central bank might calibrate the degree of anonymity even after important architectural choices have been made. The scheme relies on the use of ‘anonymity vouchers’ to preserve privacy in low-level transactions while ensuring that relevant AML and know-your-customer checks are still conducted for higher-value ones. In the ESCB model, the relevant AML authority issues a fixed, time-limited quantity of ‘vouchers’ to CBDC users that can be redeemed alongside the currency itself, effectively setting an upper limit on the number of tokens

	Global average	US	Britain	South Africa	India	Brazil	Canada	France	Germany	Japan	Italy	China	Russia	Malaysia
Safety from fraud or theft	60%	62%	72%	75%	52%	52%	69%	56%	58%	42%	63%	56%	64%	53%
Privacy protection	39%	37%	30%	49%	45%	36%	41%	40%	41%	34%	34%	51%	32%	42%
Ease of use	30%	25%	28%	22%	35%	35%	26%	26%	28%	33%	32%	32%	47%	23%
Being widely accepted	28%	36%	39%	28%	25%	25%	35%	23%	24%	33%	24%	26%	19%	27%
Speed	15%	12%	8%	13%	19%	14%	10%	15%	13%	12%	14%	17%	26%	26%
Other	1%	1%	0%	1%	2%	1%	1%	1%	2%	2%	1%	1%	0%	1%

3. Safety from fraud and privacy protection most important characteristics

From the characteristics of payment methods, which one or two, if any, of the following, are most important to you?’,
 ■ most selected,
 ■ second most

Source: Ipsos MORI, OMFIF analysis

that can be spent anonymously. In essence, the vouchers present a way to enforce AML/KYC checks above a certain value, much in the same way merchants have to clear some transactions in precious metals above a certain level.

Another option, delineated in a paper co-authored by Swiss National Bank board member Thomas Moser, involves the use of a cryptographic technique called ‘blind signatures’ to achieve user anonymity in a token-based CBDC – a recapitulation of David Chaum’s digicash concept. In this case, there is no account or ledger (including blockchain-based ones) involved, but rather, a technological operation ‘hides’ the numeric identity of the token being transferred before it is authorised by the central bank via its own signature. This is then verified by the receiving merchant, who matches the signatures and thereby verifies the authenticity of the CBDC. The authors describe the balance of anonymity and transparency achieved, which is different from, for example, the ESCB ‘anonymity vouchers’ system:

‘...central banks do not learn the identities of consumers or merchants or transaction amounts. Central banks only see when electronic coins are withdrawn and when they

are redeemed. Commercial banks continue to provide crucial customer and merchant authentication and, in particular, remain the guardians of know-your-customer information. Commercial banks observe when merchants receive funds and can limit the amount of CBDC per transaction that an individual merchant may receive, if required.’

These examples underscore the complexity of the different choices, whether political or cryptographic. Few things are certain about the future degree of privacy in CBDC and this is likely to differ across jurisdictions.

China’s DC/EP, for example, will feature what PBoC officials describe as ‘controllable anonymity,’ in which users will be able to transact in small amounts anonymously (i.e., without extensive KYC/AML data) with second parties (i.e. not the central bank). However, users seeking to make purchases or transfers beyond a certain volume will have to upgrade their wallets and provide more data to authorities.

The sand dollar, already in circulation in the Bahamas, has adopted a similar tiered approach. Wallets provided through private sector partners are segregated into three tiers, each of which has different KYC/AML requirements.

The first and lowest tier limits wallet holdings to \$500 and monthly transactions to \$1,500. It does not require government identification and cannot be linked to a bank account. However, the tier above this, with an \$8,000 holding limit and \$10,000 monthly transaction cap, does require official ID. In this way, low-value transactions can be processed anonymously while preserving the ability to conduct relevant checks for higher-value transactions. It should be noted, however, that even the lowest tier requires both a mobile phone number and e-mail address (standard KYC processes) – making the sand dollar less anonymous than cash even though it can be used offline. Put differently, CBDC may promote more secure and transparent payment systems.

Interoperability

One key variable that will determine the degree to which CBDC is adopted and can be used across borders is interoperability – the degree to which new, CBDC-based payment systems are interlinked. This can be structured in different ways.

As noted in a 2021 paper by Raphael Auer, Philipp Haene and Henry Holden at the Bank for

Frictions in existing correspondent bank arrangements for crossborder payments	Model 1–mCBDC arrangement based on compatible CBDC systems	Model 2–mCBDC arrangement based on interlinked CBDC system	Model 3–single mCBDC multi-currency system
Operational costs to sustain cross-border banking relations and prefunding	Compatible systems allow for efficiency gains in existing banking relations	A common clearing mechanism could reduce the number of relationships and provide economies of scale	A single system does not require such relations (however a single system may add to operational costs)
Mismatch of opening times across time zones	CBDCs can be open 24/7, eliminating any mismatch of opening times		
Mismatch of communication standards	Compatible message standards allow payments to flow without data loss or manual intervention	The message standard (eg ISO 20022) adopted by the interlinkage would act to harmonise standards across systems	Single message standard across the system eliminates mismatches
Unclear FX rates and unclear incoming fees	Compatibility requirements for wallet providers could enable users to calculate fees and rates prior to a payment	Common calculation of rates and fees for transfers using any interlinkage would aid transparency	Unclear FX rates & unclear incoming fees
Limited transparency on status of payment	CBDCs could settle instantly, reducing the need for status updates		
High costs of compliance across borders	Compatible compliance regimes reduce uncertainty and costs	Interlinking systems does not impact multiple or conflicting compliance requirements	Single set of access requirements means compliance could be equivalent across the system

4. Potential improvements of different mCBDC arrangements to frictions in correspondent bank arrangements for cross-border payments

Source: Raphael Auer, Philipp Haene, and Henry Holden, 'Multi-CBDC arrangements and the future of cross-border payments,' BIS Papers No 115, March 2021

International Settlements, these interoperable 'CBDC zones' can be simply compatible, they can be interlinked or they can consist of a single system for multiple CBDCs (mCBDC). Each of these options has different implications for the nature of their currency blocs.

The first option – compatibility – suggests a 'CBDC zone' in which there is a private sector offering correspondent and clearing services between different interoperable CBDCs within a region, but each of these domestic-level systems has their own rulebook, governance and broader discretionary framework. This would still significantly reduce frictions in cross-border payments, but it would take significant amounts of time to implement and still leave major hurdles in place (such as the compatibility of those legal and regulatory governance structures). In many ways, this would replicate the problems of the existing global payments network. The second option – interlinkage – concretely

'The important questions revolve not so much around whether there should be anonymity, but on the degree of anonymity required and from whom transactions should be anonymous.'

links up payment systems through either a shared technical interface or a common clearing mechanism. But the BIS authors note that interlinking options are difficult to implement and 'do not deliver their anticipated benefits or even fail to reach the operational stage despite significant investments.'

The third option – a single mCBDC system – is the most integrated. These would involve a single governance arrangement and ledger as well as common infrastructure

and access criteria. This allows for a deeper level of integration between domestic payment systems – no cross-border correspondent banking systems or prefunding payments, a single messaging system and harmonised compliance across the system. This would require a significant degree of co-operation between central banks, including agreeing joint standards and designing and establishing payment system links (Figure 4).

Achieving interoperability is a policy choice; several central banks have already sought to set up mCBDC 'bridges' to facilitate real-time cross-border payments. In early 2021, the PBoC and the Central Bank of the UAE announced they were joining the 'bridge' project set up by the BIS Innovation Hub for the Hong Kong Monetary Authority and the Bank of Thailand. The degree of smoothness between national currencies will be important in determining the success of CBDC regimes. •

3. IMPLICATIONS FOR POLICY-MAKING

Improved policy transmission could have a significant impact on the gold market

Programmable and expiring digital money give central banks greater tools to implement monetary policy.

THE advent of programmable CBDC in major economies could have important implications for fiscal and monetary policy transmission. These implications depend to a significant extent on several technical choices and the degree of use of the CBDC among consumers. There are two major examples of policy options that could be implemented or facilitated in the event of programmable CBDC with a significant potential impact on the gold market.

The first is a CBDC with a specified expiration date to discourage hoarding and encourage spending. This concept has a long history. In the 1890s, German entrepreneur Silvio Gesell first proposed the idea of ‘free money’ – money that would ‘rot like potatoes’ and ‘rust like iron,’ in Gesell’s words. In his view, money with an expiration date would stimulate economies stuck in a long, protracted depression and increase welfare.

The possible emergence of programmable central bank money has made this once far-flung notion a plausible policy option. In Shenzhen, the People’s Bank of China deployed \$1.5m worth of digital yuan with an expiration date to 50,000 residents as part of a DC/EP trial and its Covid-19 stimulus measures. The issued tokens (which were not based on blockchain technology) were valid for a period of just over eight days, to be used across 3,389 designated stores

in the metropolis’s Luohu district. This was followed by further trials in late 2020 and early 2021 with an expanded range of permitted transactions and slightly longer ‘validity periods’ (up to 16 days in Chengdu’s March 2021 trial. Figure 5). According to the South China Morning Post, the initial Shenzhen trial, in which recipients received 200 yuan (\$30) each, generated 62,000 individual transactions. It is not clear, however, to what extent this would help bolster ‘internal circulation’ on a larger scale in the event of a severe economic shock.

A related, novel stimulus transmission channel that could be facilitated through CBDC is helicopter money. Implementing helicopter money by itself does not require programmable money in the same way that implementing expiring tokens does – however, it could be made more practical to execute. Most importantly, authorities would be able to place limits on when and where helicopter ‘drops’ are spent, allowing them to stimulate a depressed economy in a more direct manner. Tokens could be programmed to be spent on consumer goods more likely to contribute to an economy’s growth rather than speculative or store of value instruments, generating growth and inflation more directly.

Interest rate transmission

Another policy option that CBDC may facilitate is negative central

bank policy rates. The current zero lower bound on nominal interest rates is determined by the de facto nominal rate on cash, which is nil (although there are transaction and storage costs for certain quantities).

CBDC has been touted as mechanism through which to enable this transmission: if a digitalised version of cash were to replace physical coins and banknotes to a significant extent, it would become possible for central banks to circumvent the current zero lower bound on policy rates. In an early report on the development of its e-krona pilot, the Swedish Riksbank underscored that one important policy question is ‘where the lower bound for the Riksbank’s policy rate will be, i.e. at what level do cuts to the policy rate stop having an effect on real interest rates’ in a CBDC world. A 2020 Bank of Canada paper suggests, meanwhile, that a tiered CBDC system would ‘induce agents to maintain an efficient level of liquidity’ by making interest rates conditional on the level of balances held. It should be stated clearly that these arguments around policy transmission depend on crucial design choices, such as the remuneration of CBDC holdings and whether or not there are limits on a given user’s holdings. If there are significant limits on the latter, for example, most consumers may simply continue to circumvent

Year	Location	Number of red envelopes	Total amount	Validity period of red envelopes	Application scenarios
2020	Luohu district, Shenzhen	50,000	Rmb10m	18:00, 12 Oct - 24:00, 20 Oct	3,389 designated businesses in Luohu district
2020	Suzhou	100,000	Rmb20m	20:00, 11 Dec - 24:00, 27 Dec	Nearly 10,000 physical stores and JD.com
2021	Futian district, Shenzhen	100,000	Rmb20m	08:00, 7 Jan - 24:00, 17 Jan	Over 10,000 designated businesses in Shenzhen
2021	Longhua district, Shenzhen	100,000	Rmb20m	09:00, 1 Feb - 24:00, 9 Feb	Over 3,500 designated businesses in Wangfujing and JD.com
2021	Beijing	50,000	Rmb10m	21:00, 11 Feb - 24:00, 17 Feb	Designated businesses in Wangfujing and JD.com
2021	Suzhou	150,000	Rmb30m	18:00, 10 Feb - 24:00, 26 Feb	Over 16,700 designated businesses in Shenzhen
2021	Chengdu	200,000	Rmb40m	08:00, 3 Mar - 24:00, 19 Mar	Over 11,000 designated businesses in Chengdu and JD.com

5. Chinese CBDC trials accelerate

Source: Forkast. News

negative interest rates by moving into cash (depending on how they evaluate the cost of holding cash).

Similarly, writing in the *International Journal of Central Banking*, Katrin Assenmacher and Signe Krogstrup suggest that 'the introduction of a dual domestic currency system could lead people to switch to other forms of currency for their payments, such as foreign currency, gold, or even cryptocurrency... Mechanically, such substitution would lead to a depreciation of the domestic currency and higher inflation, potentially stimulating demand domestically and from abroad.' This may in part be counteracted through the introduction of a domestic digital currency. However, the authors emphasise that the introduction of a CBDC 'would reconfirm the central bank's commitment to the inflation target rather than raise doubts about it' if executed well and communicated clearly.

This is related to arguments about helicopter drops and expiring

'Money with an expiration date would stimulate economies stuck in a long, protracted depression.'

money. In a 2019 paper in the *Journal of Monetary Economics* Jordi Gali notes that 'when the zero lower bound is not binding, a money-financed fiscal stimulus is shown to have much larger multipliers than a debt-financed fiscal stimulus.' Should CBDC facilitate the circumvention of the zero lower bound, policies enabled by programmable tokens, such as expiring currency, become much more effective at achieving higher growth and on-target price levels, in turn benefitting gold. As such, designing away the zero lower bound may well become

an important priority for policy-makers in a future CBDC regime.

On the other hand, Michael Bordo and Andrew Levin argue in a 2017 paper that 'with the elimination of the effective lower bound on nominal interest rates' after the introduction of CBDC, 'it would become feasible to foster true price stability... the monetary policy framework would ensure that the value of CBDC remains stable over time in terms of a general index of consumer prices.' The authors note that there remain convincing macroeconomic reasons to maintain a positive inflation target and that 'an abrupt shift from a positive inflation target to a stable price level could be disruptive.'

Alternatively, if we take the argument about policy transmission at face value, however, it is possible that more effective monetary policy in the form of negative rates in the short-term would lead to somewhat higher rates in the long term as inflation stabilises at a desired higher level. •

4. IMPLICATIONS FOR THE BANKING SYSTEM

CBDC as store of value could have dire financial instability risks

Separating the roles of CBDC could help stabilise the banking system in the transition to digital money.

FOR central banks, the most pressing question from a financial stability perspective is how much of a particular CBDC a user could hold in total. Given that CBDC would be a risk-free liability of the central bank, it is possible that periods of instability in the financial system might result in 'runs' towards the CBDC, which would likely come to be regarded as more attractive than bank deposits. Without limits, this could have a destabilising effect on the banking system, spurring a shift towards other forms of wealth including, but not limited to, gold.

In a May 2021 VoxEU column, Eric Monnet and co-authors draw parallels between CBDC and other periods in which other forms of 'safe' deposits co-existed with bank deposits – most importantly, the French great depression of 1930-31. During this period, French savers withdrew their money from French commercial banks and placed them in 'caisses d'épargnes ordinaires' – deposits with a government-guaranteed national savings bank. While these two forms of deposits

were considered complements before the crisis, financial instability clearly produced a flight to safety effect. The authors conclude that 'ceilings applied to safe deposit accounts greatly matter during a crisis'.

Several proposals have sought to address this potential risk, though how successful these strategies will prove in the event of serious financial instability remains an open question. Also in VoxEU, the European Central Bank's Ulrich Bindseil and Fabio Panetta suggest that tiered remuneration of CBDC might prevent it from aggravating bank runs. As things stand, runs from bank deposits into safe havens can already happen, but are 'disincentivised through the price mechanism' and the costs of holding physical gold, among other things. CBDC, however, 'would neither create physical security issues nor be subject to scarcity-related price disincentives if it were to be supplied in unlimited quantities and without other control tools.'

Tiered remuneration, they suggest, would allow one CBDC tier to serve as a means of payment and another as a store of value – although the idea is to use the remuneration to make the latter as unattractive as possible. 'Central bank money should not become a large-scale store of value,' the authors write. Given this clearly expressed ambition, CBDC is unlikely to significantly exacerbate bank runs or dent gold's role as a safe haven in times of financial instability. However, as much as central banks may seek to disincentivise the use of CBDC as a store of value, it is difficult to discern exactly how users would behave in the event of financial stress – how much value would they be willing to give up in exchange for the government backstop behind CBDC?

Circumventing legacy systems

One of the most powerful and widely acknowledged use cases for CBDC is the reduction of frictions and costs in cross-border foreign exchange payments. For instance, one 2020 BIS paper notes that 'CBDCs could... address the frictions inherent in current cross-border payment systems... by offering secure settlement, reducing costly and lengthy intermediation chains throughout the payment process,

It is also possible that the ease of accessing foreign currency induced by CBDC diffusion means that classic safe havens such as gold moderately lose their shine.'

and eliminating operating hour mismatches by being accessible 24/7.' At this end of the scale, CBDCs would not enjoy significant international usage, except at the margins for cross-border payments. Possible use cases could include remittances, wherein the transacting party holds the CBDC for small value transfers over small periods of time.

Rather than transferring existing forms of fiat using expensive correspondent banking networks – transferring \$500 dollars from the US to Kenya costs around \$23, or 4.5% of the transaction, for example – CBDC could make these flows far cheaper and more efficient. When they are made interoperable and interlinked, CBDC can allow users to circumvent the existing system of pre-funded nostro and vostro correspondent accounts, one important way in which costs are reduced. But this is not a scenario in which there is widespread currency substitution or distinct multiple-CBDC 'zones.' One study by the University of Twente has estimated that 'settling a cross-currency payment through CBDC instead of legacy payments infrastructure yields a reduction in transaction costs of 51%', for example. Almost half of this reduction comes from cutting fixed operational expenses in correspondent network management, manual back office costs and so on.

Currency substitution

In another scenario, competitive CBDC issuance and wide diffusion lead to currency substitution in some economies, most probably those whose macrofinancial frameworks are already weak and have some degree of substitution in place. This would be a parallel to contemporary dollarised economies, whose reliance on the dollar is generally driven by poor macroeconomic outcomes.

'One of the most powerful and widely acknowledged use cases for CBDC is the reduction of frictions and costs in cross-border foreign exchange payments.'

The foreign CBDC may fulfil the traditional functions of money better than domestic fiat or even domestic CBDC. In addition, while the costs involved in moving and storing cash currently inherently limit the degree of currency substitution possible in any given economy, these are reduced to nil in the case of CBDC.

This is likely to intensify the trends identified in the first scenario. A high degree of substitution is likely to exacerbate balance sheet mismatches and make financial instability all the more probable. A 2018 IMF paper suggested that bank runs in high-substitution economies are commonly associated with runs on the currency itself. A higher likelihood of financial stability is a boon to gold, whose value as a store of wealth and safe haven should rise in economies with high CBDC-driven currency substitution. However, it is also possible that the ease of accessing foreign currency induced by CBDC diffusion means that classic safe havens such as gold moderately lose their shine, as transferring wealth into, say, a digital Swiss franc is relatively more frictionless. The implications for gold are ambiguous.

In addition to financial stability and balance sheet mismatches, Vinuela et al argue in a 2020 Sustainability journal article that long-term periods of high inflation could result in a country which experiences a loss of monetary sovereignty. It is not clear, however, that this would necessarily be the direction of causality. In a June 2021 speech Tobias Adrian, director of the monetary and capital markets department at the IMF, noted that 'for the CBDC of reserve currency countries, which are available across borders, there could be an increase in currency substitution (or "dollarisation") in countries with high inflation.' •

5. IMPLICATIONS FOR INVESTMENT DEMAND AND THE OFFICIAL SECTOR

Different scenarios and their impact on gold

A gold-backed CBDC could boost the metal’s role in the global financial system.

GOLD’S prominence as a store of value may rise significantly should CBDC facilitate the transmission of negative rates to retail deposits. Negative interest rates lower the opportunity cost of holding gold and there is a strong empirical relationship between the real yield on 10-year US Treasuries, the exchange rate of the US dollar and demand for the precious metal (Figure 6).

Similarly, in a world with expiring CBDC, gold’s role as a store of value may rise in prominence. As noted by Gesell in the 19th century, expiring money would help resolve the inherent tension between two key functions of money: its role as both a store of value and a means of payment. If the former is programmed out of CBDC, something else will have to take its place. Other forms of liquidity may fill this role, such as privately-issued demand deposits at banks, but it is likely that gold will become more attractive as a tool to circumvent the programmed

expiration and store wealth more generally. According to the World Gold Council’s survey of retail gold investors across six economies (Germany, India, the US, the UK, China and Russia), 67% of retail holders keep gold because it provides protection against inflation and currency fluctuations, suggesting that improved policy transmission may reverberate back into higher gold demand. The same is true of the helicopter money policy channel. However, central bank-imposed limits on where CBDC can be spent may preclude this option. The outcome will depend on exact policy and design choices.

Moving towards cashlessness

Many jurisdictions allow for limited purchases without identification. This threshold does not necessarily only apply to gold, but rather to anonymous cash transactions in general. In the US, the Bank Secrecy Act mandates that US dealers in vehicles, boats and

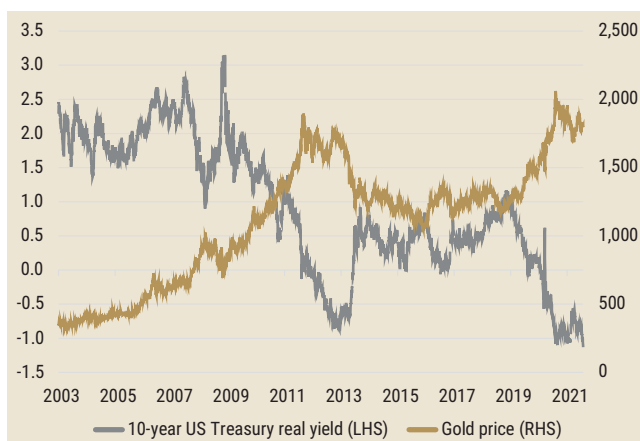
precious metals, among other things, have to disclose purchases involving cash amounts greater than \$10,000, according to JP Koning. In Canada, reporting for transactions above CAD10,000 (\$7,970) became obligatory in 2000. The EU’s 5th Anti-Money Laundering Directive requires traders in ‘high-value goods’, such as gold, to report transactions of €10,000 or more.

Some countries have set out to lower these ceilings gradually. Koning notes that Germany has significantly lowered the limit on anonymous gold purchases in recent years, far beyond what is required by the EU’s directive. This limit fell to €2,000 from €10,000 on 1 January, 2020, down from €15,000 two years prior. In late December 2019, reports surfaced of long lines forming outside of German gold dealers and precious metal shops as consumers sought to pre-empt the lower purchase limit. As of early 2020, the German population held around 9,000 tonnes of gold, according to BullionStar, of which just under 5,000 tonnes were in gold bars and coins. 38% of German adults held physical gold as an investment at that time.

The calibration between limits on anonymous CBDC and gold transaction levels is likely to shape the way in which gold fares under a future CBDC regime. If users can only transact \$500 of CBDC anonymously, for example, then that would become the new de facto limit on anonymous gold transactions in the absence of

6. Gold stores value when real yields are low

Real yield on benchmark 10-year US Treasuries, (LHS), %, and 10:30AM London gold fixing price (RHS), \$/oz., 2003-present
Source: FRED, OMFIF analysis



physical cash. It should be stated explicitly that anonymity is only one of many possible reasons for which individuals hold gold. In addition, this scenario is unlikely – central banks generally insist that CBDC will never replace physical cash. Unless they take an extreme form, the anonymity and privacy features of CBDC are unlikely to impact the gold market much.

India's 2017 demonetisation experiment provides another way to approach the issue of privacy and transparency. In November 2016, the Indian government announced that it would be withdrawing the legal tender status of Rs500 (\$6.67) and Rs1,000 banknotes, withdrawing 86% of currency in circulation in one fell swoop (or Rs15tn). While this was counterbalanced with greater issuance of smaller-denomination banknotes (to the tune of Rs12tn by mid-December), this still represented a substantial short-term shock to the Indian economy, especially given the overwhelming use of cash in nonagricultural employment.

This short-term shock had an immediate impact on gold demand, especially from retail consumers. Around 70%-80% of Indian consumers' purchases of gold jewellery are conducted in cash; the liquidity squeeze, exacerbated by caps on withdrawals from banks and automated teller machines, dented demand for gold. However, in the longer term, a trend towards cashless payments and greater supply chain transparency may benefit gold demand. 'Business practices across the gold trade will become more transparent,' the World Gold Council wrote in its analysis of the demonetisation case, and 'the organised trade will prosper as gold enters the mainstream financial system.' In other words, a push towards greater payments transparency – perhaps facilitated in the future by a CBDC

'Given that other reserve assets are likely to digitalise soon, gold itself may benefit from digitalising.'

– may generate a gold-supportive environment.

Reserve manager demand

The emergence and spread of CBDC, and specifically China's DC/EP project, has been touted as a potential trigger for upheaval in the reserve currency system. The use of CBDC does little to change the fundamental characteristics of a currency – until the renminbi is fully convertible, it is highly unlikely that there will be widespread internationalisation of the currency. But even if it might not yet spark systemic changes in the international reserve currency system, CBDC can change reserves management and the reserve currency system in other ways. It can have a significant impact on the smoothness and cost of cross-border payments and foreign exchange markets, change liquidity management processes, and sweep away rigid correspondent banking systems, to name but a few possible impacts.

Given that the current global fiat dollar standard is relatively young, it is difficult to ascertain precisely how gold might behave during a transition from one global currency to another (or towards a multipolar system). However, the emergence of the euro as the world's second-largest reserve currency in the early 2000s, building on the role of the Deutsche Mark and European currency unit, may prove instructive. In the first quarter of

2000, the euro held only a 17.5% share of allocated global foreign exchange reserves. This peaked at 28% in the third quarter of 2009. This came mostly at the expense of dollar reserves, which fell as a share of allocated reserves to around 60% from over 70% over the same period. Gold, meanwhile, stayed constant as a share of global reserves at around 11%, on average, growing in absolute terms.

While we should be cautious in drawing lessons from this episode, it suggests that gold holds up well during periods of change in the international reserve currency system. What does this mean for reserves and gold under a CBDC regime? It depends, to a significant extent, on how gold is treated by investors. Would a digital dollar be considered an extension of the existing greenback, though maybe as a more liquid version, or would it be treated entirely differently for accounting and investment purposes?

The three possible adoption scenarios sketched earlier in this paper can help us think about the implications of CBDC on investment demand. Consider, for example, a world in which CBDC is held strictly for transactional purposes, such as remittances. At first glance this will have few ramifications. Facilitating remittance flows is not per se a reason to hold larger foreign exchange reserves, for example. However, in the medium-term, CBDC can help alleviate some of the frictions that still plague international capital markets. Even at the margins, the spread of CBDC may make it easier for financial institutions to take speculative positions in foreign currencies by improving financial system plumbing and lowering costs. An International Monetary Fund team noted in October 2020 that 'there are significant transaction costs,' and 'markets are segmented by

informational asymmetries or familiarity effects.' If CBDC helps to reduce these, global capital flows may grow and become more volatile, even if they are just held for transactional purposes at first.

As such, risk-taking may grow and global financial resilience may be undermined by the spread of CBDC even in niche use cases. Growing currency mismatches, for example, may require the more stringent use of macroprudential tools and possibly larger foreign exchange reserves to guard against the reversal of hot money flows. This may bolster demand for gold as a reserve asset. At the same time, a fall in transaction costs in foreign exchange markets may increase turnover in global gold markets. These are overwhelmingly dollarised. Cheaper, smoother access to the requisite foreign exchange may raise transaction volumes at the margin.

The same may hold true for a scenario in which currency substitution becomes widespread. As in the first scenario, greater currency substitution may lead to higher foreign exchange reserves and, depending on the nature of the substitution, to a different composition of reserves. Larger and more volatile capital flows will require the central bank to hold greater reserves, part of which are likely to be in gold (though the CBDC in question is likely to benefit the most). While it is true that higher central bank reserves do not necessarily translate into greater gold holdings, recent experience suggests that central banks see value in gold as a reserve asset. As the reserve holdings of major east Asian economies grew rapidly over the course of the early 2000s, the share of gold held in those reserves generally stayed constant and, in some cases, grew, suggesting that their absolute holdings of the precious metal rose. For example, between the first quarter of 2000 and the first quarter of 2021, the share of gold in Indonesia's international reserves stayed roughly even, moving to 3.2% from

A fall in transaction costs in foreign exchange markets may increase turnover in global gold markets.'

2.9%, yet its reserves on the whole grew to \$132.7bn from \$28.5bn.

To limit the risk of currency substitution, it has been suggested that issuing central banks, especially those of reserve currencies, should limit the availability of CBDC holdings to foreign users – see for example Tobias Adrian's speech noted earlier. However, this would temper cross-border use of reserve currencies and limit the potential for internationalisation, a stated aim of many major CBDC issuers. In a 2021 VoxEU piece, Stephen Cecchetti and Kim Schoenholtz ask: 'Given the current high foreign demand for US paper currency, imagine what would happen if the Fed offered universal, unlimited accounts?' This potential, albeit extreme, scenario should draw our attention to possible substitution effects and the resulting instability, which may benefit gold in the long term.

Beyond the first two scenarios described here – the niche case and the currency substitution case – there is a third plausible scenario in which a select number of CBDC systems are used in different 'currency blocs' or 'CBDC zones'. A world in which interoperable CBDCs become widespread may result in the formation of distinct 'blocs' in which a single CBDC becomes dominant.

Currently, there are between two and four currency blocs in the global economy – a large dollar zone, a clearly defined euro zone in non-euro area Europe, and, arguably, a renminbi zone in southeast Asia (Figure 7). These are defined by close trade, financial ties and, most importantly, by the fact that a single currency is widely used in payments and invoicing. The existence of these blocs does

not put into doubt the dollar's hegemony as the global reserve currency. Rather, it highlights the fact that individual currencies may thrive in specific regional arrangements.

There is a plausible scenario in which the advent of CBDC solidifies these blocs and even intensifies their internal links. The interlinkage and solidity of these blocs depends on several variables, most importantly the relationship between economies. But there are a number of CBDC design choices that will shape where, how, when and why these blocs emerge. Membership in a payment bloc is likely to alter the size of required reserves as well as their composition – in the case of the latter, reserves are likely to shift towards the dominant currency in the payments bloc. This may come at the expense of other blocs' assets or at the expense of gold, again suggesting ambiguous implications.

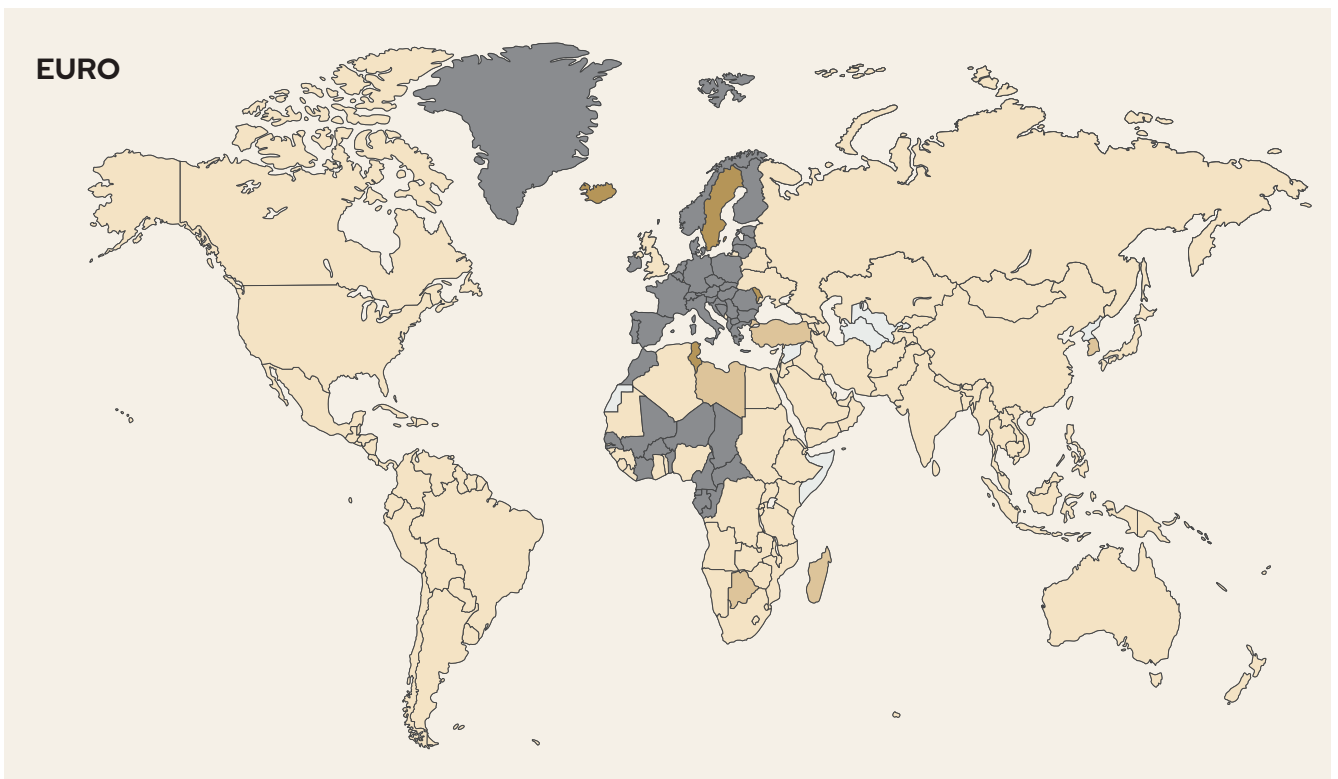
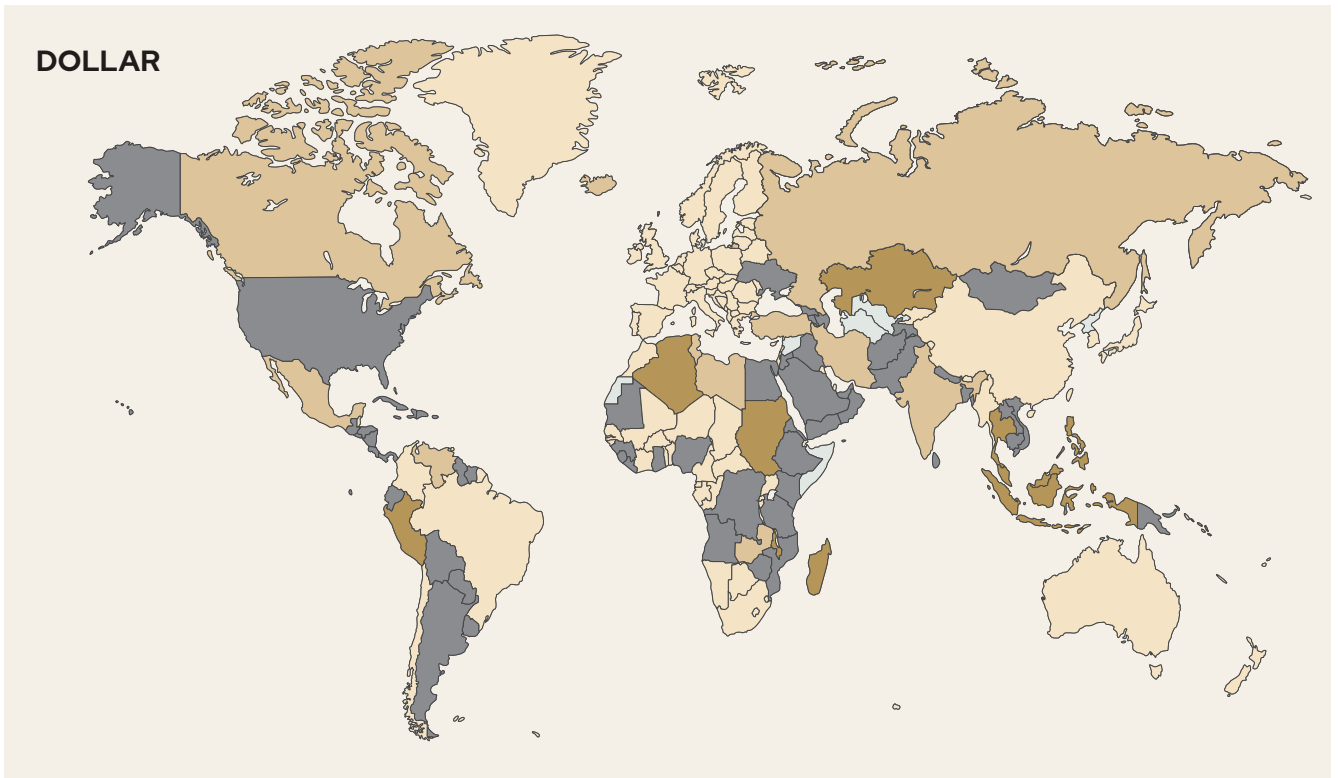
For the central bank that issues the dominant CBDC in each payments bloc, capital flow volumes and volatility are likely to grow, especially if the economy's financial markets are not particularly liquid or deep. At the same time, such a multipolar system may enhance the complexity of the global financial system and undermine existing stabilisation and liquidity provision mechanisms, at least during its early stages. During this period of uncertain transition, gold may thrive as a safe haven and transitional asset.

Alternative reserves arrangements?

These scenarios represent plausible ways in which CBDC could spread in the global economy. Several

7. Dollar still dominates trade finance

Weight of reserve currency blocs based on Kawai and Pontines (2016) methodology used in Tovar and Mohd Nor (2018)



Source: Camilo E. Tovar and Tania Mohd Nor, 'Reserve Currency Blocs: A Changing International Monetary System?', IMF Working Paper 18/20, January 2018

alternative arrangements to these models of CBDC issuance in the international reserve currency system are possible, however. Two are particularly notable: the idea of a ‘synthetic hegemonic currency’ and a gold-backed CBDC.

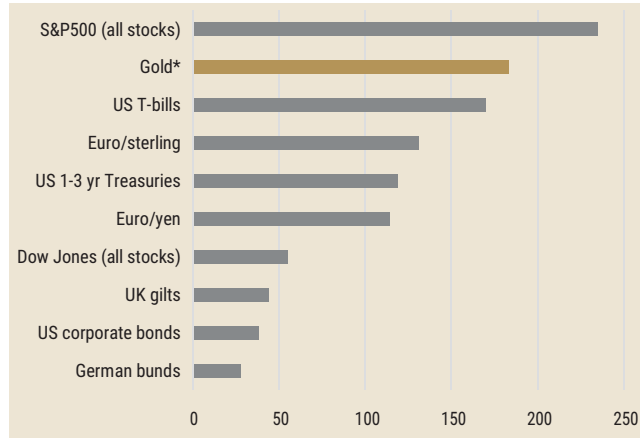
(1) Synthetic hegemonic currency

In some sense, the idea of a basket of currencies serving as an international unit of account and means of exchange is not a new one – Keynes’s bancor and the much-maligned IMF special drawing right are only two examples. Mark Carney’s 2019 proposal for a ‘synthetic hegemonic currency,’ put forward in a speech at the Jackson Hole symposium, lies squarely in this tradition. It would draw on a basket of CBDCs, benefitting from the technological efficiencies digital currency provides, in order to stem the possible emergence of privately-issued stablecoins and diversify global reserves away from the dollar.

In Carney’s vision, using a SHC would avoid a disruptive transition away from the dollar – though the nature of multipolar reserve currency systems means that gold may still benefit in its role as a transitional and safe haven asset. As for the nature of foreign exchange reserves within this possible regime, it is hard to draw a clear conclusion. On the one hand, the inherent diversification and convertibility provided by a SHC may mean that foreign exchange buffers can dwindle slowly. Diminishing the dominance of the dollar may stabilise global capital flows, to a similar end. However, a multipolar system may breed uncertainty, encouraging countries to hold larger reserves. How this would shake out is not clear.

(2) Gold-backed CBDC

Gold continues to play a prominent role in central bank reserves. However, given that other reserve assets are likely to digitalise soon, gold itself may benefit from digitalising. While private, gold-backed tokens already exist, these lack the credibility required to



8. More liquid than Treasuries and bunds

Average daily volumes from 31 December 2010 to 31 December 2020, \$bn

Source: World Gold Council

*Includes estimates of OTC transactions and statistics on futures exchanges, as well as gold

‘It is difficult to ascertain precisely how gold might behave during a transition from one global currency to another.’

become reserve assets. Rather, a publicly-issued gold-backed digital token may allow gold to benefit from the liquidity and smoothness of digitalisation while preserving its essential role as a store of value and safe haven asset.

The gold market is highly liquid – comparable in nature to US Treasuries or major foreign exchange pairs (Figure 8). That being said, it risks being left behind should CBDC transform foreign exchange liquidity and the cross-border transferability of major currencies. In this event, tokenising gold would allow it to maintain and potentially expand its place as a major reserve asset. It would likely stand to benefit from the reduced friction and greater liquidity in the same way traded currencies would.

In part, this would depend on how publicly issued digital gold is treated from a regulatory perspective. Basel III rules shook up gold’s market liquidity in 2015, as it drew a sharp distinction between allocated, physical gold and unallocated claims on gold assets. The former was classified as a risk-free asset whereas banks are now required to hold additional reserves against the latter. How digital, public gold is treated in this regime would shape its future as a reserve asset. However, it is difficult, for the time being, to imagine any single entity or central bank issuing a public gold CBDC. Private, gold-denominated tokens are a different issue, but these are outside the scope of the CBDC discussion. •

6. CONCLUSION

Future of digital money and gold

Switch to a model dominated by CBDC will bring opportunities, as well as pitfalls, for gold.

THE international reserve currency and payment systems are in flux. While the dollar remains the world's preeminent currency of choice for cross-border debt issuance, trade and invoicing, its share of global foreign exchange reserves has been steadily declining as other currencies emerge as potential challengers. At the same time, the gradual emergence of central bank digital currency in some of the world's most powerful economies is changing the way we pay and transact: smoother payment systems based on interoperable CBDC systems could dramatically change the landscape for cross-border payments, remittances and foreign exchange liquidity. In addition, CBDC has the potential to modify the effectiveness of monetary policy, potentially facilitating the pass-through of negative interest rates, for example.

This paper has examined some of these main use cases for CBDC and their potential impact on the banking system, on fiscal and monetary policy options and on demand for gold. The emergence of CBDC in major economies could transform the options available to policy-makers for macroeconomic management, as tools such as expiring money and negative interest rates become easier to implement. At the same time, CBDC issuers will have to pay close attention to digital currency's impact on their banking systems – a CBDC that can be held without limits, or which is too well-remunerated, may transform existing banking structures in seismic ways. Finally, the cross-border applications of CBDC will present new challenges to policy-makers, such as the prospect of currency substitution in more fragile economies as well as greater

capital flow volatility globally.

The impact of these changes on gold is ambiguous and will depend on a number of crucial policy design choices, such as the degree of remuneration available on any given CBDC. The easier transmission of negative interest rates, while undergirding the appeal of gold as a store of value, does not present an unambiguous bull case for the precious metal. The prospect of greater currency substitution in some economies, meanwhile, will require greater foreign exchange reserve holdings, but it is not a given that this will translate into greater gold holdings. The only certainty is that gold investors, whether retail, institutional, or in the official sector, will have to examine closely the development of central bank digital currency, the shape it takes and its implications for policy, financial stability and global flows. •

While the dollar remains the world's preeminent currency of choice for cross-border debt issuance, trade and invoicing, its share of global foreign exchange reserves has been steadily declining.'





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