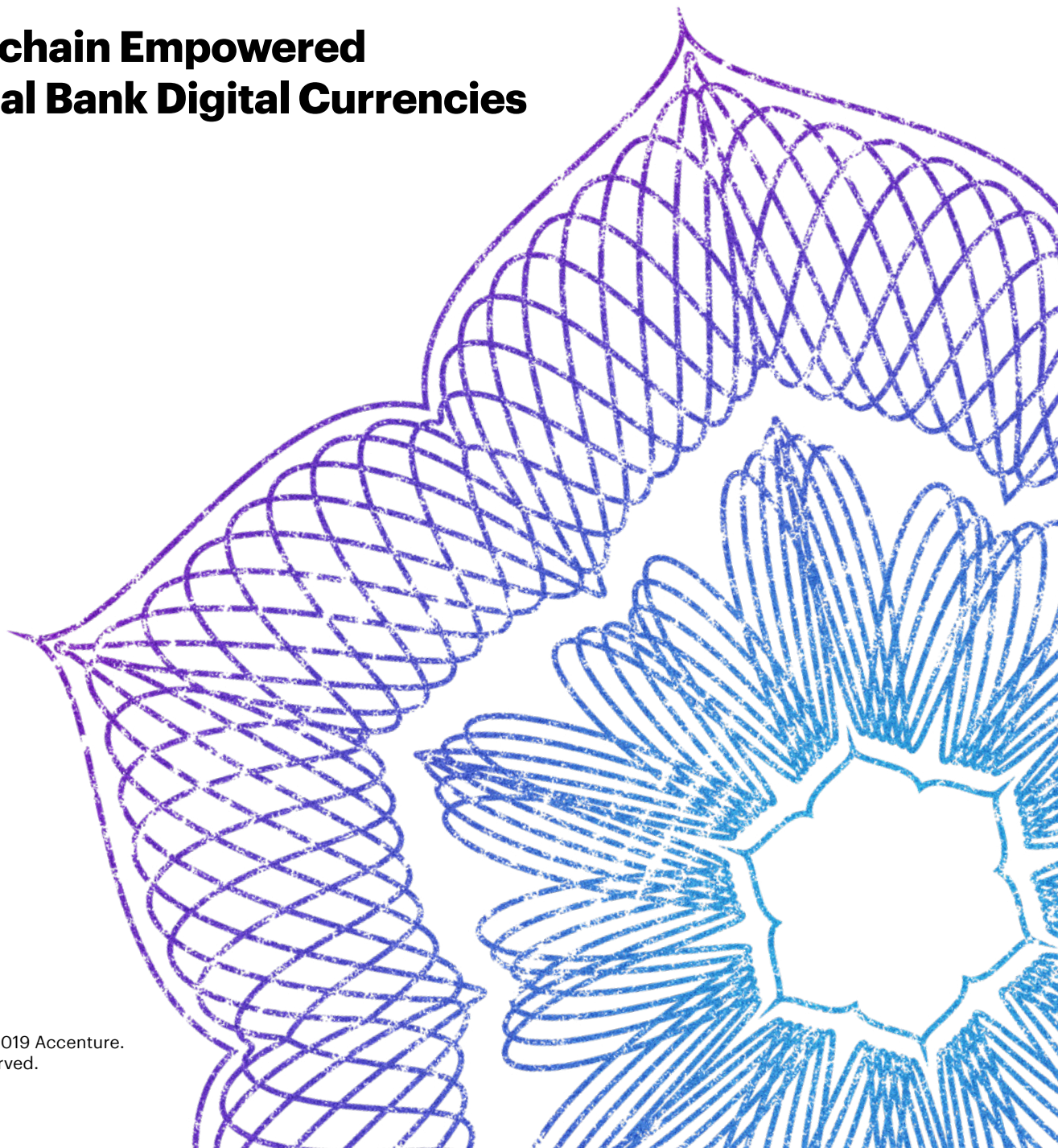




THE (R)EVOLUTION OF MONEY II

**Blockchain Empowered
Central Bank Digital Currencies**



CONTENTS

Foreword	3
Introduction	4
Recent blockchain developments	6
Money and payment challenges	7
Central bank digital currency (CBDC)	9
CBDC design	15
CBDC projects	18
Conclusion	20
References	21

FOREWORD

What is the future of central bank money?

The needs for central bank money are evolving. The emergence of new financial ecosystems requires new media of exchange. Central bank money remains the preferred settlement medium for large value transactions, but a new format of money is required.

The financial architecture is strained. National payments infrastructures are siloed, excessively concentrated and exhibit high barriers of entry. International payments are hindered by important friction amid undue reliance on correspondent banks, use of a narrow set of currencies and high transaction costs. This risks creating financial fragmentation and instability, producing liquidity blockages and inducing inefficiencies in payment relations.

Accenture believes that the future of money likely rests in the broad-based adoption of both tokenization and decentralization. Both may be critical to meet new demands for money and establish more direct, transparent and efficient payment relations for national and international financial transactions.

Central banks may have the unique catalytic power to facilitate those changes with the introduction of blockchain-enabled central bank digital currencies (CBDC).

The present report invites central banks and commercial banks to consider the introduction of CBDC. It represents a complementary document to The (R)evolution of Money report of 2017.¹

INTRODUCTION

The requirements of what money does are changing.

Money as medium of exchange has seen little innovation since the introduction of paper currencies and cashless transfers in the nineteenth century. The emergence of new financial ecosystems necessitates new money functionalities. Technology determines largely what money can do. Changes in technology now offer new money uses. A new money format is needed.

Monetary and payment relations are strained. The global financial and economic crisis has reinvigorated concerns about large concentrated financial risks, elevated barriers to entry and transaction costs and increasing vulnerability to security breaches and outright failures. Inefficiencies in securities clearing and settlement impose undue risks. Persistent high exchange rate volatility seems indicative of the fact that financial liquidity does as needed. It is quite possible that we are nearing the end-of-life of large value payment systems, which in turn offers an opportunity to revisit whether existing payment technologies remain best adapted to address prevailing payment challenges.

The (R)evolution of money addresses the considerations of what money should do next. It is not about a mere substitution of money but to broaden the functionality and utility of money.

Tokenization emerges as a new format to represent goods, assets and rights. It offers new financial utility and attributes and promises greater flexibility and liquidity of the underlying. To transfer tokens, a simple token swap is performed. This requires a tokenized settlement medium. Since central bank money remains a preferred and for large value transactions, the preferred settlement medium, a central bank issued digital currency (CBDC) or tokenized central bank money is needed in token-based exchanges.

CBDC leverages the advantages of blockchain. Blockchain is a fitting technology to administer tokens and is set to enable new payment relations through a combination of tokenization, decentralization and secure information sharing. This enables peer-to-peer transactions, offers a more resilient payment infrastructure, reduces transaction costs, enhances information sharing capabilities and facilitates data reconciliation.

The emergence of private currencies, crypto-assets, as media of exchange has projected scope for payments innovation and fostered the debate towards change. While the proliferation of crypto-instruments remains uncertain, the co-existence of private and official currencies appears to be a high probability outcome. The proliferation of stable coins, and utility settlement coins, both exhibiting shortcomings, indicates that there is demand for tokenized currencies.^{2, 3, 4}

Central banks have a historical opportunity to define new standards for digital currencies.

Similar to their role at the beginning of modern central banking to harmonize notes and coinage, central banks can provide needed support for new token-based financial ecosystems.

Many central banks have engaged in central bank digital currency projects. Safety and efficiency are cited as main motivations to consider digital currencies. Among emerging markets, central banks payment efficiencies in cross-border transactions and financial inclusion are additional motivators.⁵ The typical interdependence between large value payment systems, in particular real-time gross settlement (RTGS) systems, and central securities depository-securities settlement (CSD-SSS) systems implies that the impact of central bank digital currencies extends to immediate and intermediate payment applications.

Recent advances in blockchain technologies allow to largely refute residual concerns about maturity, privacy, inter-operability and scalability. Successful pilot projects have demonstrated that blockchain can meet performance of existing technologies in payments, clearing and settlement. Privacy concerns can mostly be addressed with the design and configuration of the blockchain and recent breakthroughs in inter-operability enables communication and connection of different blockchains with one another.

Central banks can act now as catalysts to help shape a new emerging financial architecture.

Central banks have facilitated key innovations and new standards of money in the past. The adoption of CBDC now offers the opportunity to set the standard for digital currencies and helps to ensure central bank money remains future-proof. While considerations for CBDC will differ amid various use cases for retail, wholesale and cross-border transactions, national preferences and international arrangements will be critical.



RECENT BLOCKCHAIN DEVELOPMENTS

The readiness of blockchain enabled payment solutions has made significant progress during the past 6 months.

Blockchain can now address residual concerns about scalability and inter-operability and therefore offers the foundations for advancing towards select real-life applications and implementation plans.

Bank of Japan and European Central Bank (Jun 2019)⁶ – A joint project (Stella) to conduct cross-border payments concluded that the safety of cross-border payments could potentially improve using DLT-enabled payments with synchronized settlement and locking of funds.

Bank of Canada and Monetary Authority of Singapore (May 2019)⁷ – A joint (Jasper-Ubin) project to show that tokenized central bank money can safely be exchanged in cross-border payments across different distributed ledger platforms.

Norges Bank (Feb 2019)⁸ – Norges Bank reiterated that it considers introducing a public central bank digital currency similar to cash.

Swedish Parliament (Feb 2019)⁹ – The Swedish Parliament in response to a decline in the use of physical money pressed for moving the e-krona project one step further.

Switzerland stock exchange (SIX) (Dec 2018)¹⁰ – SIX reiterated that it founded a new company, SDX to develop a fully integrated trading, settlement and custody platform for digital assets based on blockchain-enabled technologies.

Bank of Canada, Bank of England and Monetary Authority of Singapore (Nov 2018)¹¹ – The cross-border payment project concluded that tokenization can help overcome prevailing inefficiencies and constraints in cross-border payments.

Australian Securities Exchange (ASX) (Oct 2018)¹² – ASX reaffirmed that it will proceed with implementing a blockchain based system to become operative by the first quarter of 2021. It will replace the current clearing house electronic subregister system (CHES) that processes clearing, settlement and other post-trade services of cash equities.

Depository Trust and Clearing Corporation (DTCC) (Oct 2018)¹³ – The DTCC showed that blockchain can support peak trading volumes in U.S. equity markets.

Accenture (Oct 2018)¹⁴ – Accenture provided a solution to allow synchronization of business processes across blockchain platforms from different technology providers, offering corporations the possibility to operate in a broader ecosystem not bound by a specific choice of a blockchain platform. In addition, it demonstrated inter-operability in a cross-border environment.

Deutsche Börse and Deutsche Bundesbank (Oct 2018)¹⁵ – Deutsche Börse and Deutsche Bundesbank successfully tested securities settlement based on a blockchain-enabled system including executing security settlement delivery versus payments (DvP), free of payment transactions, coupon payments while preserving needed confidentiality of data in a permissioned blockchain setup. The study concluded that the blockchain-enabled system in principle fulfilled the performance requirements and could therefore be considered a candidate for building a production grade system.

MONEY AND PAYMENT CHALLENGES

The existing monetary architecture exhibits significant pain points.

Money and payment relations are not operating as intended based on the repeated incidence of:

- financial crises
- liquidity shortfalls
- high transaction costs in cross-border payments
- elevated exchange rate volatility
- undue delays in securities clearing and settlement
- security breaches
- market manipulation

The prevailing financial architecture relies on large financial institutions that provide the foundations of financial intermediation. This poses undue concentration risk and distributive inequities and inefficiencies.

Financial crises impose considerable economic and societal costs. The notion of “too big to fail” remains a fundamental concern to address systemic risks in finance amid considerable concentrations of financial institutions’ activities including for custodial services nationally and internationally.

The establishment of new financial institutions like central counter party clearing houses have reinforced concentration of financial risks.

The significant expansion of central banks’ balance sheets amid policies of quantitative easing in several advanced economies has not led to the intended increase in broader monetary aggregates. Banks have been hoarding large reserves as credit expansion and inter-bank lending have remained impaired undermining effective financial intermediation.¹⁶

Cross-border payments are marred by long delays and high transaction costs. The importance of correspondent banking has remained while international claims of banks have been declining significantly since the global financial and economic crisis. The reliance on the dollar to conduct international transactions reinforces dependence on dollar-based financial institutions and dollar-denominated financial assets. This risks creating undue bottlenecks in the distribution of international liquidity. Persistent high exchange rate volatility illustrates the asymmetries in international liquidity distribution.

The securities life cycle offers considerable scope for improving efficiency. T+2 or T+3 clearing and settlement delays remain the norm in many exchanges. The reduction in clearing and settlement times would allow shortening risk exposures and freeing-up collateral tied-up to secure transactions.

Compared with T+3, T+1 would reduce counter-party exposure in a stress scenario by up to 70 percent and clearing fund requirements by up to 25 percent in average periods and 37 percent in high volatility periods.¹⁷ Prevailing financial market infrastructures are siloed, hierarchical and impose undue transaction friction.

The analytical exploration of data from payment transactions has remained constrained amid limited data content. The lack of data analysis despite seemingly vast amounts of data points generated from payments may unduly hamper economic policy formulation, oversight and supervision.

The concentration of financial activities by institutions create large attack surfaces. The significance of security breaches, cyber-attacks and system failures multiply with financial concentration and increase generalized financial vulnerabilities.

Market manipulations like the LIBOR fixing and tax evasion scandals highlight flawed consensus market mechanisms. Market rigging is possible because a narrow set of large participants can corner the market or conduct transactions without requiring broad-based consensus.

The shortcomings of the current financial architecture are evident:

- Large financial concentration risks amid “too big to fail”
- Ineffective financial intermediation through bank channel
- Elevated transaction costs in cross-border payments
- Inefficiencies in securities life cycle
- Limited payments data content
- High vulnerabilities due to large attack surfaces
- Heightened susceptibility to market manipulation

These shortcomings are expected to prompt a broad-based response to seek alternative approaches to changing incentives and mitigating prevailing constraints and vulnerabilities. Blockchain-enabled solutions can help meeting those challenges offering important social gains.



CENTRAL BANK DIGITAL CURRENCY (CBDC)

Blockchain-enabled CBDC is a tokenized form of central bank money allowing token-based exchanges and enhancing transparency and security in payments.

CBDC should be considered as a new central bank money format and another central bank liability as part of the monetary base. CBDC would be fully fungible with reserves and bank notes. Any alteration in the monetary base would be a monetary policy decision.

CBDC is to serve financial ecosystems that require tokenized central bank money for settlement.

The innovation of CBDC rests on the combination of tokenization, decentralization and secure information sharing.

Tokenization

Tokens are digital representations of an asset good, right or currency with properties sufficient to attest and transfer ownership. Tokenization records assets, goods, rights or currencies on a blockchain-enabled ledger. In the securities life cycle, for example, this would allow for a stock to be sold by a simple exchange of an asset token for a currency token in true delivery versus payment. It also offers the possibility that only part of an asset is sold. The latter could significantly increase the liquidity of assets that are currently immobile or indivisible.

Decentralization

The possibility of a peer-to-peer exchange enables new possibilities to reducing delays and costs associated with intermediaries.

The decentralized nature of blockchain can bring significant resiliency benefits and efficiency gains and reduces single points of failure. It also implies that networks can expand or contract seamlessly allowing for flexibility in network relations.

Secure information sharing

The nature of blockchain greatly facilitates secure access and administration of access to data while ensuring only needed information is shared. Blockchain also enables information consistency and facilitates reconciliation of data and ascertains every permissioned participant in the network sees the same information.

Blockchain offers new opportunities to obtain relevant payments data content bringing data analytics to payments and enhancing sophistication for payment tracking, transaction disputes, AML, ATF and KYC compliance.

Central banks should be technology neutral and not favor one payment format over another. The issuance of CBDC can be a critical catalyst to facilitate broader-based tokenization. CBDC would enable exchange of tokens in central bank money, lending support and confidence in tokenization. While stable coins and utility settlement coins may offer substitutes for CBDC as representations of cash legs in payments, they have been subject to undue speculation and may give rise to counterparty and credit risks and not offer the possibility of settlement with finality.

Central bank money history

CBDC is grounded in the beginnings of central bank money. Starting in the nineteenth century, central banks were established to assume critical roles in the adoption of monetary innovation.

The implementation of unified coinage, cashless or giro transfers and issuance of paper currencies advanced payments transformation from metal coin based exchange. Bank notes significantly facilitated exchange and were essential to support rapid economic development. Under the classical gold standard, bank notes were mere tokens representing an unconditional claim of convertibility into gold.

Central banks were catalysts for needed monetary innovation in the past

Central banking evolved from decentralization in bank note issuance to centralization. The shape of central banks was largely determined by a perceived conflict between monetary policy effectiveness and monetary stability. The emergence of single central banking systems followed in large part the example of the Bank of England with the adoption of the 1844 Bank Charter Act with sole bank note issuance rights granted to e.g. in 1848, the Bank of France; in 1882, the Bank of Japan; in 1888, the Bank of Portugal; in 1897 the State Bank of the Russian Empire; in 1907 the Swiss National Bank. During the nineteenth century, decentralized central banking models persisted in Canada, Mexico and Scotland and to a lesser extent in Germany.

The establishment of the Federal Reserve system in the U.S. highlighted concerns about centralization in central bank money. The 1913 Federal Reserve Act established 12 Federal Reserve Banks that maintained broad-based independence in bank note issuance and policy rate settings. The decision to adopt a decentralized or “sectional” approach was based in large part on the assumption that a single institution could not effectively respond to the varying liquidity needs that prevailed in the U.S. largely amid its spatial differences.

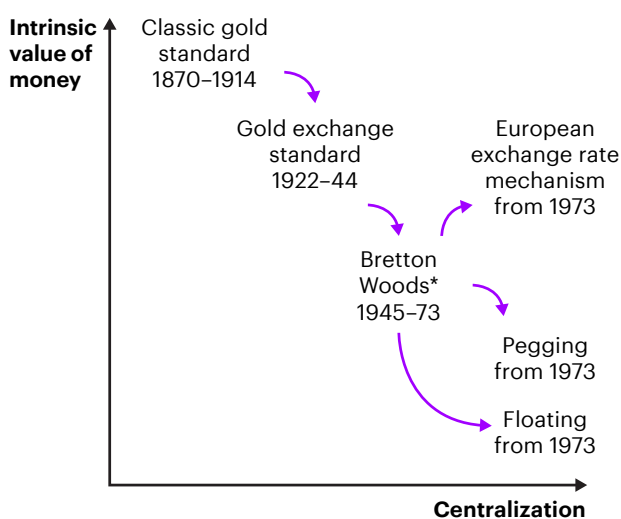
During the deliberation to establish a central bank in the U.S. Senate in 1913, Victor Morawetz, a period leading voice in favor of a decentralized system argued:

“The reason it seemed to be advisable to have in this country what practically amounts to five central banks or reserve banks [...], is that in this way you are able to avoid the conflict which arises from the great difference in the requirements of the different sections of the country for credits and for currency.”¹⁸

Money and central banking evolved from central banking decentralization under the classical gold standard to increasing centralization under different monetary policy standards (Figure 1). Money evolved from exhibiting high intrinsic value and being highly decentralized to representing no intrinsic value and being highly centralized. The value of money shifted from money itself to the institutions managing it.

The historical concerns about centralization remain. The distribution of money can be hampered if intermediation is impaired by undue concentration, restricted access to payments and high transaction costs. Reconsideration for decentralization therefore seems largely warranted in particular for international payments.

Figure 1. Monetary policy and centralization¹⁹



CBDC use cases

The greatest benefits of CBDC are to be found in the broader context of reshaping payments relations and rests in the integration of assets and currency on a single ledger in the combination of tokenization, decentralization and secure information sharing. CBDC attracts payment applications in retail, wholesale and cross-border transactions. Considerations differ largely dependent on local circumstances and preferences. The adoption of CBDC will depend on set policy objectives.

Retail

The substitution of physical bank notes and coins with CBDC would address increasing digitalization in retail payments and expedites distribution of currencies to the non-bank public. The former responds to public choice concerns that the absence of digital central bank money may unduly restrict the non-bank public's ability to use and convert assets into central bank claims amid the decline in the use of physical cash. The latter allows central banks to assume the distribution of currency directly, for example using mobile phone technologies. The distribution of digital currencies could play a critical role to advance financial inclusion where the public is significantly underbanked or altogether unbanked. CBDC facilitates peer-to-peer exchange, allowing to conduct autonomous transactions replicating a physical cash environment.

Wholesale

The adoption of CBDC offers the possibility to conduct end-to-end settlement in central bank money in token-based exchanges. CBDC providing the cash leg, can bring true DvP in the securities life cycle by allowing token for token exchange and offering the possibility of instantaneous clearing and settlement.²⁰ This lowers barrier of entry to payments enabling greater participation and competition in payments which in turn advances payment efficiency and ultimately more equitable access to payments. Due considerations need to be given if certain market entities require to retain end-of-day netting and settlement provisions.

Many RTGS systems are due for modernization. The relationship between RTGS and CSD-SSS implies that considerations for CBDC requires an integrated approach.²¹

Cross-border

The use of CBDC in cross-border payments would enable instantaneous payments irrespective of location. The current correspondent banks-based system imposes several transaction layers that cause numerous delays and costs.²² CBDC facilitates establishment of direct payment relations reducing the need for intermediaries and greatly lowering transaction costs. The blockchain enabled environment greatly simplifies sharing of information and reconciliation through continuous updating and sharing of records. The availability of CBDC may attract non-residents into holding CBDC and conduct cross-border and off-shore transactions.

CBDC concerns

The CBDC has the potential to change the operating environment of central banks, but it is important that it does not. The facilitation of decentralized exchange should in principle not affect central banks' ability to pursue price and financial stability.

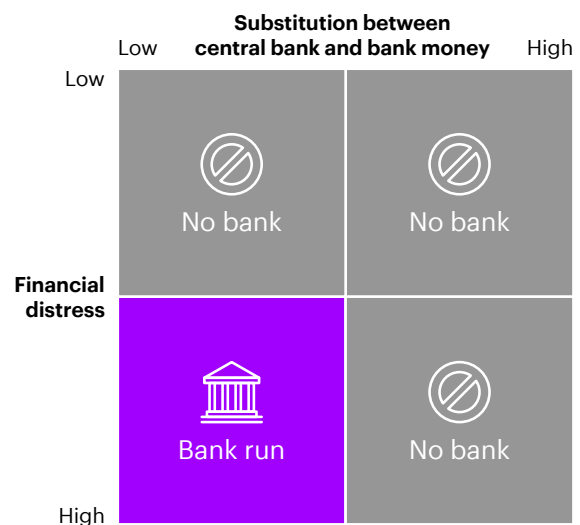
The effect of CBDC on set monetary policy objectives will depend on the CBDC design. While a simple substitution of existing notes, coins and reserves may not have any impact on monetary policy, additional features like the possibility for CBDC to pay interest to the non-bank public (see below), may alter the propensity to hold central bank money. The impact of CBDC on price stability may in large part depend on the propensity to hold CBDC.

CBDC that is interest bearing (see below) may broaden the channel for the transmission of monetary policy. The possibility to pay negative interest would also allow mitigating restrictions when the policy rate is near the effective lower zero bound and allow establishing symmetry between positive and negative policy rates. Indirect effects may arise if improvements in liquidity distribution reduce leverage in the economy and affect the price of collateral.

The possible perceived substitutability between central bank and bank money may make the non-bank public recalibrate its holdings of central bank money. This could reduce the non-bank public's desire to hold bank deposits. It will also depend in large part on the ability of banks to differentiate bank money from central bank money and, while there is the potential, it must not lead to a reduction in bank deposits (Figure 2).²³ In wholesale transactions, non-banks may similarly develop preference to settle in CBDC, increasing the amount of central bank liabilities.

The desired relative holding of central bank and bank money may be state-of-the-world dependent. While in tranquil times, the non-bank public may consider bank and central bank money to be close substitutes (substitutability between central bank and bank money is high), in situations of financial distress, the non-bank public may proceed towards rapid conversion of bank for central bank money (substitutability between central bank and bank money is low) given the low transaction costs to do so (digital bank runs). At the same time, the central bank could always replenish possible deposit withdrawals and in a digital environment can do so instantaneously where the lending rate could become a policy variable. The latter may instill confidence among the non-bank public reducing the actual probability of runs (Figure 2).

Figure 2. Bank intermediation



The increase in the propensity to hold CBDC will naturally affect the size of the central bank's balance sheet. This may incur additional and at times unwanted risks for the central banks. The risks would depend on the assets the central banks would acquire from CBDC issuance.

The control of monetary aggregates may be altered if non-residents increase their holdings of CBDC. While the central bank will always know the location of CBDC it may not be able to control its off-shore use. Very large net cross-border movements of CBDC may complicate the conduct of monetary policy and undermine financial stability. Prudential regulation may be contemplated if undue large net movements of CBDC complicate monetary management. CBDC may also be equipped with features constraining off-shore use.

The transparency of blockchain implies that all transactions are recorded. While transactions can be made anonymously or configured to a varying degree of pseudonymity, all transactions are traceable. At the same time, blockchain offers important safeguards to administer dissemination and access to information that help protect privacy. Central banks will have to weigh privacy concerns against transparency gains in view of money laundering, terrorism financing and other illicit transactions.

International CBDC

The properties of CBDC may increase its attractiveness relative to other currencies and alter the propensity by non-residents to hold and use a given CBDC. This could affect the demand for blockchain enabled currencies relative to conventional ones.

CBDC of a given country could become a currency of choice to conduct international transactions. The properties conducive to conduct digital financial transactions could divert use away from conventional currencies.

The properties of CBDC may be conducive to establishing more international currencies. This would ease prevailing reliance on a narrow set of international currencies to conduct international transactions.

The greater variety of international currencies (establishment of a basket of highly liquid instantly transformable reserve or trading currencies) could create a more diversified and equitable international payment infrastructure.

The role of CBDC may be particularly relevant to promote regional local currency payments integration. The substitution of local currencies with a common multi-central bank CBDC would further reduce transaction costs and minimize foreign exchange exposure in international transactions.

Finality in payments

CBDC would need to enable certainty and be consistent with the notion that currency parity is maintained. CBDC would need to represent or be convertible at par into central bank money. The singleness of CBDC is a necessary condition to serve effectively in payments and to settle payments with finality.¹⁴ Regulation may need to be adjusted to allow CBDC to qualify towards settlement finality.

Crypto-currencies

The emergence of crypto-assets may to some extent indicate new use cases for currencies. Crypto-assets that exhibit currency-like functions—crypto-currencies—have raised important financial stability concerns.

The notion of private monies denominated in a unit of account unrelated to a central bank issued currency is novel though historically not new. The utility of such monies will depend on credible alternatives and use cases. The use of blockchain technologies may offer certain advantages relative to conventional currencies. The lack of a regulatory framework for crypto-currencies remains a significant constraint to broader based acceptance.

Stable coins

The proliferation of stable coins reflects a desire for tokenized currency as a stable unit of account. The coins are intended to be used as cash legs in exchanges and support in particular trading operations of crypto-assets.

Stable coins exhibit features akin to a currency board and represent a collective investment scheme. The scheme accumulates high quality assets funded by the issuance of tokens. Reserved tokens represent an unconditional claim on the reserve pool.





Stable coins are normally fixed to national currencies, a basket of national currencies or commodities. Stable coins can also be reserved with crypto-assets or tied to a net issuance algorithm set to maintain stability against a given numeraire.

The substitutability of stable coins and central bank money rests in the reserve portfolio and legal certainty of convertibility. A token that conveys unambiguous convertibility certainty and is reserved by central bank money should be considered “as good as” central bank money.²⁵ Stable coins to date do normally not exhibit convertibility certainty.

Utility settlement coin

The issuance of utility settlement coins serves mostly to conduct monetary transactions with tokenized currencies within a consortium of banks. The coins feature properties similar to stable coins and are used to settle inter- and intra-bank transactions as a substitute for central bank money. Utility settlement coins are normally pegged to a national currency or a basket of national currencies.

Figure 3. Digital media of exchange

 Crypto-currencies	Privately issued token denominated in non-official currencies
 Stable coins	Privately issued tokens backed by reservable assets and/or official currencies
 Utility settlement coins	Token issued by a consortium of private banks to serve as vehicle to intermediate intra-consortium flows. Can be backed by central bank money
 CBDC	Tokenized central bank money

CBDC DESIGN

The properties of CBDC can vary significantly. Possible design features include interest-bearing and encompass distribution, technology and information and can vary from a simple digital representation of central bank notes and reserves to more complex instruments.

Bank notes, within well-known limitations, allow autonomous, anonymous and decentralized peer-to-peer exchange whereby the payment infrastructure is completely atomized. Bank notes are generally immune to failure and undue manipulation, offering instantaneous settlement any time anywhere.

CBDC would normally represent tokenized money issued on a permissioned blockchain to enable DvP exchanges while preserving privacy at the highest security standards.

Accounts-based CBDC

CBDC based on book entries, accounts-based issuance, is limited to processing reserve balances at the central bank by holders of reserve accounts and do not allow DvP transactions and peer-to-peer transactions in assets and currency exchanges. An account-based system for the general public requires they have an account at the central bank and must also allow off-line transactions.

Tokenized CBDC

The issuance of central bank money into an account at the central bank as a token, also referred to as value-based issuance, allows digital asset for currency exchanges in retail and wholesale transactions and enables autonomous peer-to-peer transactions. The tokenized currency would be held in an electronic wallet on a wallet-enabled device that would have to be enabled for off-line transactions.

Tokenization may represent central bank money or a claim on central bank money. The former would be an unambiguous substitution of and fully fungible with existing central bank money. The latter would represent a digital twin of central bank money.



Permissioned and public blockchain

The data to process transactions can be stored on a private or permissioned or public blockchain. The former would restrict access to the blockchain to select parties including with differential access and editing rights. The latter allows broad-based participation in line with the original intent of the bitcoin blockchain, is normally open source and allows public interaction with the network. The participation in the blockchain network needs to be broad enough to offer sufficient decentralization in network validation. CBDC would normally be based on a permissioned blockchain.

Information sharing

Blockchain applications exhibit advanced information sharing and data reconciliation facilities. A critical feature of blockchain is the establishment of a common set of shared data to ensure all needed parties can share the same information. The blockchain facilitates greatly the continuous validation and exchange of data.

The information capabilities of blockchain allows to record and mobilize valuable transaction data amid the universal record of all payments transactions.

This will provide unprecedented access to trade payments, liquidity and economic transactions and help enhance the formulation of monetary and economic policies.

Smart contracts

The blockchain allows to embed self-executing or smart contracts to pre-determine certain transactions without the intervention of a third party. This may facilitate strict rules-based decisions in financial regulation and other applications.

Delivery versus payment

CBDC enables tokenization of currency and assets on a shared ledger. This allows direct interactions for all financial market infrastructure participants with assets and facilitate DvP. CBDC enables immediate finality of settlement and reduces the amount of liquidity and collateral needed in securities clearing and settlement and reducing or eliminating credit extensions normally used to meet currency requirements in settlement.

Figure 4. Blockchain

	Permissioned	Permissionless
 Crypto-currencies	X	X
 Stable coins	X	X
 Utility settlement coins	X	
 CBDC	X	

Interest bearing

CBDC offers the possibility to make positive and negative interest payments on currency. This would significantly alter the fundamental functionality of central bank money in the hands of the non-bank public and could broaden the channels for the transmission of monetary policy. The possibility to pay negative interest may ease the constraints for monetary policy at the lower zero bound.²⁶

The introduction of interest-bearing central bank money in the hands of the non-bank public would establish a direct relationship between monetary policy and the non-bank public. Holders would see their central bank balances increase or decrease with changes of the central bank policy rate, irrespective of location affecting residents and non-residents alike. While as a direct instrument it could in theory broaden the transmission channel of central bank policy, it would represent a significant departure from current central bank practices.

Resiliency

Token based financial ecosystems would diversify the financial market infrastructure and bring greater resilience. It would also broaden and make more equitable the delivery of central bank liquidity. The decentralized nature of blockchain reduces systemic vulnerabilities. Blockchain-based applications rest on the co-existence of various data sites. This ensures there is no single point of failure. Breakdown of an individual network node may exclude that node from participating in the network but does not preclude the rest of the network to operate.

Privacy

The recording of all digital transactions implies that transactions are traceable. However, transactions can be private by using pseudonyms. The provisions for privacy can follow permission in some jurisdictions to enable small amounts to be conducted without revealing the identity of the exchange parties. The blockchain can enable select information sharing such that only the parties to an exchange can view the relevant information underlying the exchange.

The flexibility of the blockchain enables certain entities to view most or all transactions net of transactions classified as private. The possibility to introduce special nodes to allow specific network participants to monitor or authorize certain transactions enables the building of a tiered information structure that facilitates monitoring and select access.

Identity

The relationship between identity and financial transactions offers the opportunity of a simultaneous solution for identity and payments transactions. Blockchain supports management of needed standards to identify customers unambiguously and maintain customer records to be shared with authorized parties enabling a seamless infrastructure between identity and payments. This may be particularly relevant where the payment infrastructure is characterized by a low banking ratio amid a high under or unbanked population.

KYC, AML and ATF

Standards of know-your-customer and anti-money-laundering and anti-terrorism financing provisions are essential for a safe payment infrastructure. In payment infrastructures where banks maintain customer standards, CBDC would rely on existing standards. Where central banks engage directly in the distribution of CBDC, they may set minimum amount-based standards to limit needed customer checks.

CBDC PROJECTS

Central banks have embarked on a number of CBDC-related projects.

Around 70 percent of surveyed central banks are currently or will soon be engaged in central bank digital currency work.²⁷ The projects have typically performed proofs of concept to assess the use of blockchain in a banking environment to address scalability, resilience, privacy, securities settlement and cross-border transactions.

E-krona – Central Bank of Sweden (2019)²⁸

The Central Bank of Sweden (Riksbank) is procuring suppliers to develop proposals for a digital currency (E-krona) for the non-bank public. An earlier E-krona project in 2018 concluded that E-krona is compatible with the Riksbank's task to promote a safe and efficient payment system.²⁹

Stella – Bank of Japan, European Central Bank (2019)³⁰

The Stella project in phase 3 attested that improvements can be obtained in cross-border payments in terms of safety by using distributed ledger technologies.

Project Jasper-Ubin – Bank of Canada, Monetary Authority of Singapore (2019)³¹

The project successfully tested that distributed ledger technology can be used to make safe cross-border payments by an exchange of wholesale CBDC across different distributed ledger platforms.

ECCB CBDC pilot – Eastern Caribbean Central Bank (2019)³²

The Eastern Caribbean Central Bank (ECCB) embarked on a pilot to introduce a digital version of the EC dollar (DXCD) based on blockchain to be used as generalized medium of payment to reduce cash usage by 50 percent, promote greater financial sector stability and support economic growth and development.

Cross-Border Interbank Payments and Settlements – Bank of Canada, Bank of England, Monetary Authority of Singapore (2018)³³

The project reviewed root causes of the problem of cross-border interbank payments to identify “future-state capabilities”. The initial results of the project show that blockchain-enabled platforms extend availability and payment tracking and offer the possibility of a shift away from the existing correspondent banking model.

Jasper III – Bank of Canada, Payments Canada, TMX (2018)³⁴

The proof of concept demonstrated that a blockchain-based system can perform an irrevocable settlement of equities against central bank currency including successful implementation of a DvP settlement flow of currency and equities on a shared ledger. The set-up enabled immediate finality in settlement and resulted in the ability to instantly reuse cash and equity tokens reducing liquidity needs.

Project Aber – Saudi Arabia Monetary Authority, Central Bank of the United Arab Emirates (2019)³⁵

The project is a proof of concept for a common digital currency between the Saudi Arabia Monetary Authority (SAMA) and the Central Bank of the United Arab Emirates (CBUAE) to conduct cross-border settlement with the opportunity to reduce remittances costs.

Khokha – South African Reserve Bank (2018)³⁶

The proof of concept was aimed at wholesale settlement and affirmed that blockchain systems can process the typical volume of the South African payment system using ISO 20022 standard messages across geographically distributed nodes. The SARB was able to view all transaction details to ensure regulatory oversight.

Ubin II – Monetary Authority of Singapore and Association of Banks in Singapore (2017)³⁷

The proof of concept showed that blockchain is able to satisfy key functionality of a RTGS in terms of volume, liquidity savings mechanisms, gridlock resolution and resilience and mitigated the risk of a single point of failure. The project showed that fund transfers, queue prioritization and gridlock resolution can all occur in a decentralized manner while preserving the privacy of the transactions. The project also gave rise to considerations that participation in a decentralized network must not be equal across participants as needs differ. The possibility to deploy a blockchain enabled system that operates 24x7 had been confirmed even when not all network participants are active.



CONCLUSION

Recent advances in blockchain technology demonstrate that blockchain is ready for select real-life applications.

Central banks have an opportunity to enable a better payments architecture that connects with broader blockchain-based applications. CBDC represents a critical element in the evolution of money to facilitate this architecture and provide a level playing field with conventional platforms that can settle in central bank money.

CBDC supports essential central bank policy objectives by offering enhanced payments efficiency and resiliency. The design of CBDC may also enable greater scope for the implementation of monetary policy. The changing architecture may offer important liquidity saving that facilitates national and international financial transactions. The enhanced information capabilities provide additional critical input for the formulation of economic policies.

Central banks naturally maintain different policy priorities. CBDC can help address financial inclusion and be an effective substitute for physical currency; it can support a compression of the securities life cycle; it can facilitate regional or international payments integration by reducing transaction friction including information cost and possibly offering a greater variety of currencies conducive to conduct international exchange thereby mitigating undue concentration and dependence on a narrow set of international currencies.

CBDC offers unique payment features in the combination of tokenization, decentralization and secure information sharing. The relationship between tokenization and decentralization allows to establish new payments relations that offer more diversified and equitable access to payments.

The proliferation of private sector payment initiatives illustrates the perceived gap in money developments. The changing functional requirements of money and new expected user experiences reveal that the scope for change in money is significant.

Central banks have the opportunity to enable a better performing and more resilient payment architecture. They have been key money innovators in the past. CBDC can help ensure central bank money remains relevant and future-proof.

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