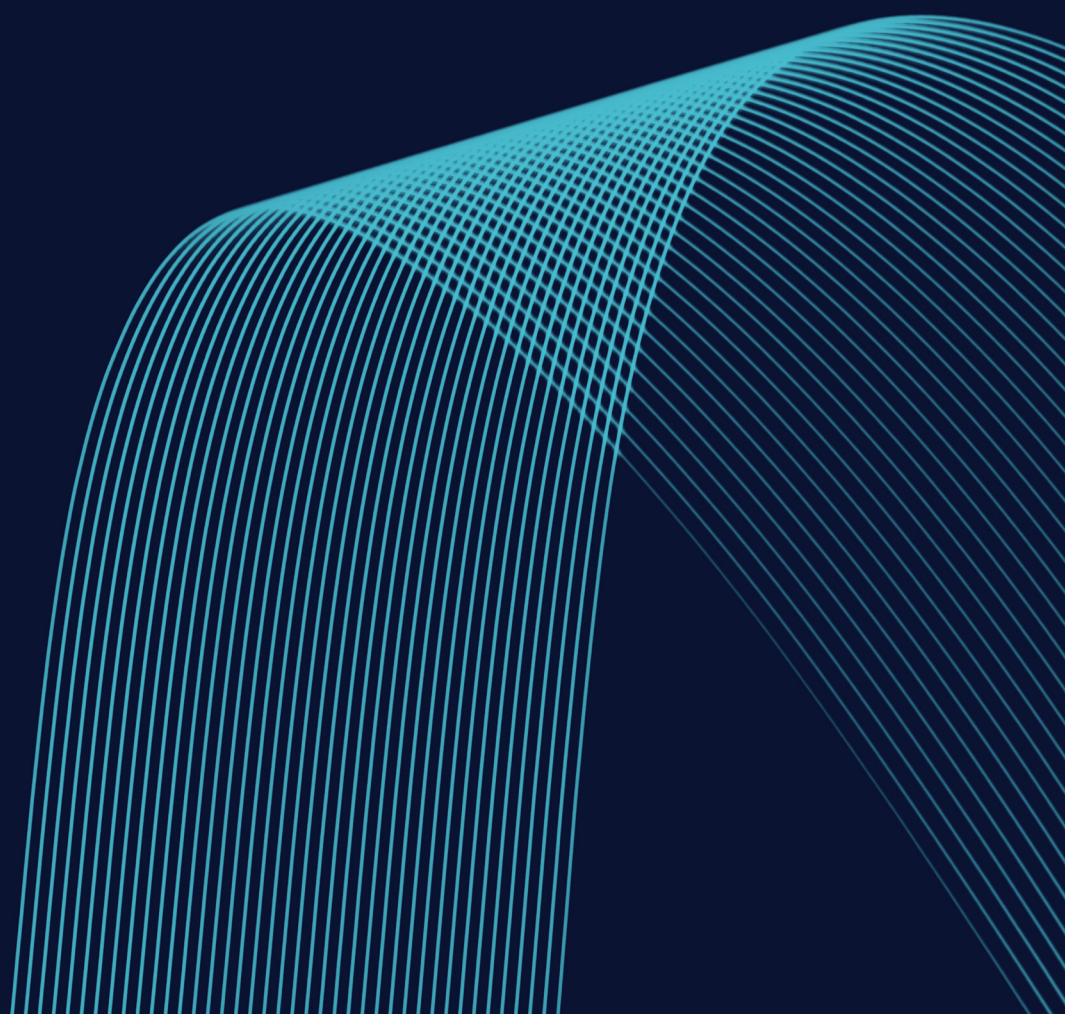


DEPOSIT TOKENS

A foundation for stable digital money



Commercial bank money holds the key to a safer tokenized economy

“[The increasingly important use of DLT] requires a new form of money — tokenised commercial bank money — which will enable efficient, fully digital handling of payment transactions.”

GBIC, Europe needs new money — an ecosystem of CBDC, tokenised commercial bank money and trigger solutions (2021)

“The goal [of tokenizing deposits] is the additional creation of programmable money that could be used within the framework of smart contracts, which in turn permits for more efficient transactions and refined payment controls.

Depending on the design and structure of the tokenised deposits, bank depositors could have the fungibility between deposits and digital asset tokens within the DLT based network and its participating commercial banks.

For the purpose of the [Government vouchers] pilot, DBS Bank issued digital SGD in the form of tokenised deposits.”

MAS, Project Orchid (2022)

“[Tokenized deposits] would enable peer-to-peer settlement and make depository institutions’ money programmable and usable in smart contracts and other blockchain applications. Despite the novel technology, in legal and economic terms, an on-chain tokenised bank deposit would be identical to a traditional off-chain deposit.

We believe that the market will likely move away from e-money tokens toward tokenized commercial bank deposits as the preferred form of on-chain money. On-chain deposits, being economically and legally equivalent to off-chain deposits, can be expected to fall under and benefit from existing deposit insurance schemes. [They] may qualify as legal tender in some jurisdictions and are likely to function as such in practice. Banks have access to the central bank as lender-of-last-resort, widening the scope of assets in which token holders’ funds can be invested while maintaining liquidity requirements.”

CEPR, E-Money tokens, tokenised money-market shares, and tokenised bank deposits (2022)

“We already have an efficient form of digital money; we just need to adapt it to a new environment. Central bank actions over the last century have resulted in a well-functioning banking and payment system. Why not take advantage of that, and issue tokenized deposits?”

Commercial banks hold deposits for customers that are fractionally backed by reserves, avoiding locking up liquidity. These bank deposits support bank lending to the real economy and the transmission of monetary policy.

Bank deposits have a number of other attractive features. They are issued by regulated institutions and are protected by deposit insurance (up to \$250,000), which makes them extremely safe. In addition, banks facilitate compliance with policies meant to reduce the risk of criminal activities, such as money laundering.”

NY Fed Staff, The Future of Payments Is Not Stablecoins (2022)

“Banks issue stablecoins as deposits. They are already subject to prudential regulations and stablecoin holders are protected by deposit insurance in the same manner as conventional bank deposits.”

FSA (Japan), Regulatory Framework for Crypto-assets and Stablecoins (2022)

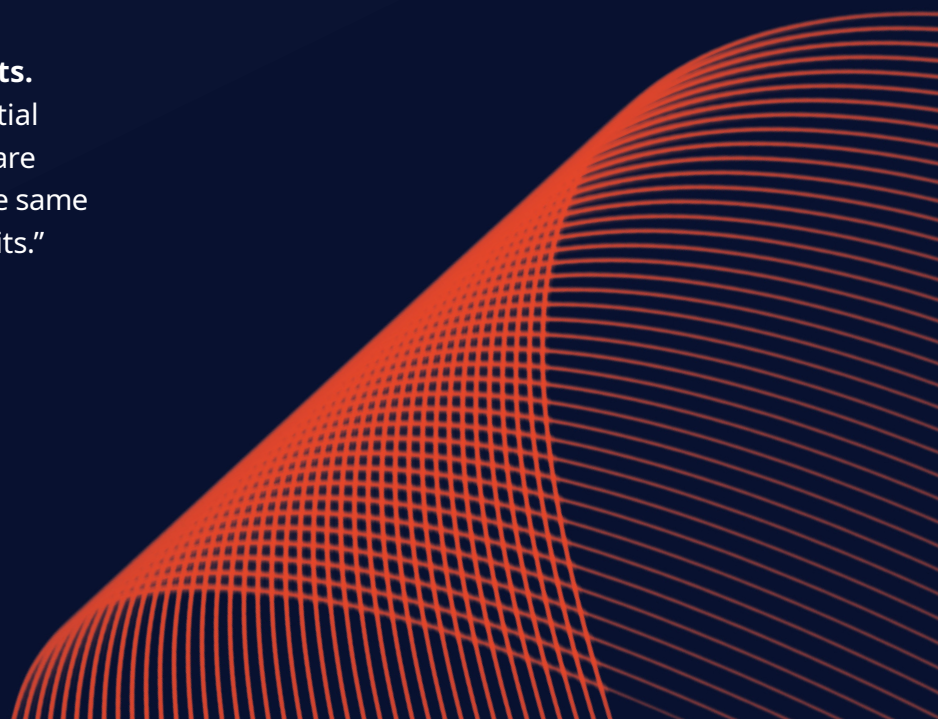
“In an effort to advance industry thinking on these issues, the Monetary Authority of Singapore launched Project Guardian in May 2022. It sought to determine whether tokenized real-world assets and deposits could be transacted on a public blockchain leveraging DeFi protocols, in a compliant manner that preserves financial stability and integrity.

The Project Guardian pilot carried out transactions involving foreign exchange with tokenized deposits and separate transactions with government bonds, in each case, on a public blockchain network, using digital identity solutions and logic adapted from existing DeFi protocols.”

Oliver Wyman Forum, Institutional DeFi: The Next Generation of Finance? (2022)

“I believe the next generation for markets, the next generation for securities, will be the tokenisation of securities.”

BlackRock CEO, 2022



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INTRODUCTION

• Ongoing progress in developing blockchain technologies for commercial applications is creating demand for blockchain native “cash equivalents” that act as liquid means of payment and stores of value in blockchain-native environments. Stablecoins have predominately met this demand to date. However, the foreseeable adoption of blockchain for complex commercial transactional activity, including institutional activity, has brought into focus the question of what form of digital money may be needed to continue to support blockchain payments at scale. Deposit tokens and central bank digital currencies (CBDCs) in particular have come to the forefront in examining the optimal future state of digital money.

• Deposit tokens refer to transferable tokens issued on a blockchain by a licensed depository institution which evidence a deposit claim against the issuer. Given that deposit tokens are commercial bank money embodied in a new technical form, they sit comfortably as part of the banking ecosystem, subject to regulation and supervision applicable to commercial banks today. This includes existing bank minimum capital and liquidity requirements, and other technology risk management regulations and supervisory expectations, that control prudential and operational risks associated with deposit-taking and related bank activities.

• Deposit tokens can support a variety of use cases as commercial bank money does today, including domestic and cross-border payments, trading and settlement, and provision of cash collateral. The token form enables new functionality, such as programmability and instant, **atomic settlement*** to speed up transactions and automate sophisticated payment operations. By supporting these use cases, deposit tokens may become an important part of a broader ecosystem of tokenized assets, which are expected to significantly impact financial services and will likely require payment solutions provided by trusted institutions; 97% of institutional investors surveyed agree that tokenization will revolutionize asset management and benefit the industry. Institutions are also increasingly comfortable using digital money, but provided it comes from a trusted player¹.

***Atomic settlement**

Simultaneous settlement of assets, whereby assets are linked to ensure the transfer of an asset only occurs if the others are simultaneously transferred (e.g., to achieve delivery versus payment in a securities transaction or payment versus payment in a foreign exchange transaction).

Stablecoins have been an important financial innovation in the last several years, and their development has contributed to the growth of the digital assets ecosystem. However, stablecoins might present challenges at scale relating to their impact on financial stability, monetary policy, and credit intermediation, as on-chain transactional activity increases in size and complexity. By leveraging the existing practices and regulations applied to traditional commercial bank deposits, deposit tokens can be positioned to address certain risks posed by stablecoins approaching systemically significant scale, preventing strain on stablecoin issuers and instability in the space. Additionally, deposit tokens may provide more seamless connectivity to traditional payment rails and bank services, which would be a desirable feature for financial institutions and commercial transaction counterparties.

We believe deposit tokens will become a widely used form of money within the digital asset ecosystem, just as commercial bank money in the form of bank deposits makes up over 90% of circulating money today². The token form will benefit from connectivity to traditional banking infrastructures and regulatory safeguards that already support commercial bank deposits.

This paper focuses on deposit tokens, their use cases and benefits, and how they are distinguished from stablecoins and CBDCs. In doing so, we intend to provide a focused discussion of deposit tokens as a distinct type of digital money, contribute to the ongoing policy discussions about different forms of digital money, and inform stakeholders as industry and regulators look ahead to understand the role commercial banks will play in the future digital money landscape.

GLOBAL DIGITAL MONEY LANDSCAPE

EVOLUTION OF DIGITAL PAYMENT SYSTEMS

Various forms of digital money solutions have been created to meet the demand for stable and liquid value on-chain, taking different forms in terms of issuers, claim rights, reserve characteristics, and regulatory requirements. The main forms of digital money and money alternatives, which we generally refer to as digital money in this paper, can be grouped as:

- Blockchain-based deposits, i.e., distributed ledger-based deposits issued by a licensed depository institution, including deposit tokens, which are forms of commercial bank money;
- Stablecoins, digital assets designed to maintain a stable value relative to an external reference asset, and serve as an alternative store of value for blockchain-native payments and liquidity needs; and
- Central Bank Digital Currencies (CBDCs), digital forms of national currencies issued by central banks, which are forms of central bank money.

There may be other candidates for alternative digital money solutions for various use cases that emerge as more parties consider tokenization, such as tokenized money market funds. This paper does not present an exhaustive discussion of all emerging alternatives — though we note that comparable considerations raised in this paper may be applied to examining other proposed digital money alternatives.

BLOCKCHAIN-BASED DEPOSITS

Blockchain-based deposits refer to deposit claims against a licensed depository institution for stated amounts recorded on blockchain. They are economic equivalents of existing deposits recorded in a novel form used to pay, settle trades between digital assets, and generally act as a store of value and means of exchange on blockchain ledgers.

Applying blockchain technology in this manner allows payments made with commercial bank money to benefit from programmability, instant and atomic transaction settlement, and improved transparency as to the status of transaction. These features help to address common pain points in liquidity management and cross-border payments.

Exhibit 1: Comparison of Blockchain-Based Deposits, Stablecoins, CBDCs

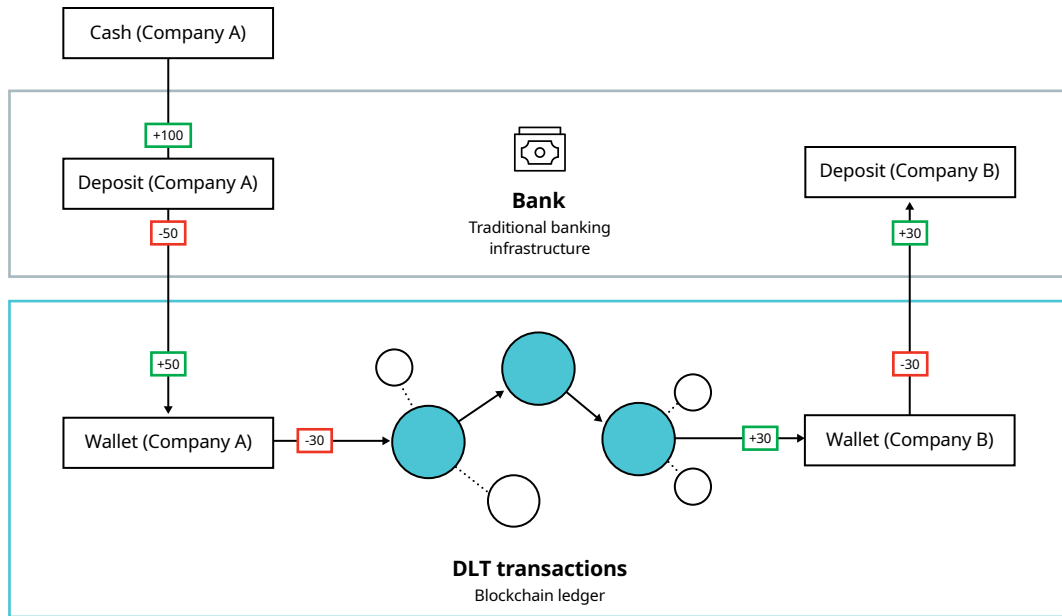
	Blockchain-Based Deposits	Stablecoins	CBDCs
Common issuer	Commercial banks	Non-bank private entities	Central banks
Examples	<ul style="list-style-type: none"> • SGD deposit tokens by JPMorgan¹ • Blockchain deposit accounts on JPM Coin System 	<ul style="list-style-type: none"> • USDC by Circle and Coinbase • USDT by Tether • BUSD by Paxos and Binance 	<ul style="list-style-type: none"> • Digital Yuan (extended pilot) • Swedish E-Krona (pilot) • Digital Euro (investigation)
Adoption	<ul style="list-style-type: none"> • JPM Coin System is live with material transaction volumes • Deposit token projects are generally in early pilot phases 	<ul style="list-style-type: none"> • Over US\$140 billion market capitalization (as of November 2022) since 2014 when the 1st major stablecoin was issued² 	<ul style="list-style-type: none"> • Over 90% of central banks are reportedly investigating CBDCs — live projects are still in early pilot phases³
Backing assets	<ul style="list-style-type: none"> • Claim on the issuer, like regular deposits 	<ul style="list-style-type: none"> • 1:1 assets held by issuer to meet redemptions, typically held as HQLA 	<ul style="list-style-type: none"> • Central bank balance sheet
Regulatory oversight	<ul style="list-style-type: none"> • Subject to similar supervision and oversight as other regulated bank deposits 	<ul style="list-style-type: none"> • No regulatory framework in most markets, although regulatory frameworks are emerging 	<ul style="list-style-type: none"> • Secured and governed directly by national entities
Risk management practices	<ul style="list-style-type: none"> • Subject to mandatory minimum liquidity, capital and risk management requirements by regulators • Subject to banks' internal risk management practices 	<ul style="list-style-type: none"> • No unified risk management framework • Subject to issuers' internal risk management practices 	
Emergency protections	<ul style="list-style-type: none"> • Strength of existing bank balance sheet • Access to contingency funding sources at central bank • Resolution and recovery planning to overcome financial distress 	<ul style="list-style-type: none"> • Liquidation of reserve assets • Resolution under traditional bankruptcy laws 	

1. SGD deposit tokens issued by JPMorgan in connection with MAS Project Guardian pilot transaction. SGD deposit tokens are not a generally available live product offering

2. Figure sourced from [DefiLlama](#) as of November 2022

3. See, for instance, Federal Reserve (2022), [Money Stock Measures — H.6 Release](#) in the US, European Central Bank (2022), [Monetary developments in the euro area: September 2022](#) in the European Union and Monetary Authority of Singapore (2022), [Project Orchid Programmable Digital SGD](#) page 15, in Singapore

Exhibit 2: Deposit Tokens Process



Source: Oliver Wyman and Onyx by J.P. Morgan Analysis

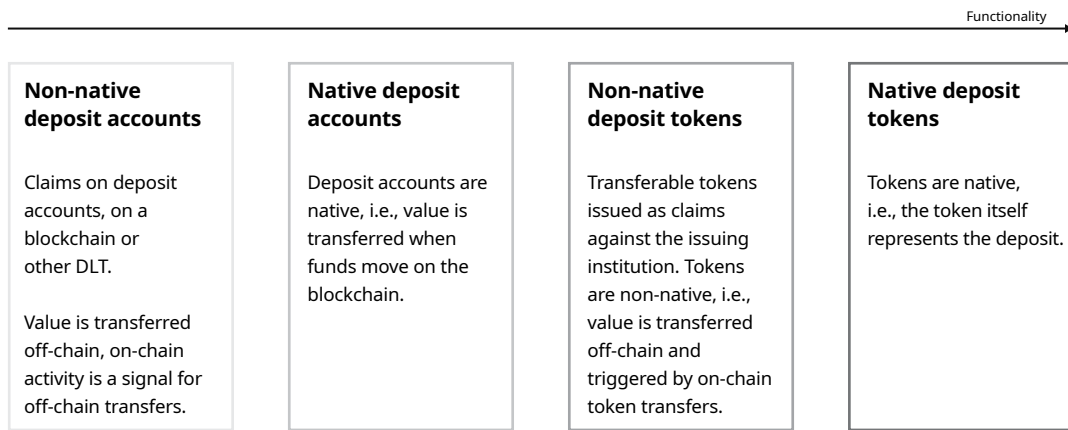
Blockchain-based deposits come in different forms based on their usage of ledger technologies, partnerships, and permission requirements. Blockchain deposits can be broken down into different categories based on two main factors, (i) whether they are account or token based, and (ii) whether they are “native” to the blockchain. For purposes of this paper, we refer to “native” as reflecting value recorded on the blockchain directly as the primary record. We refer to “non-native” as mirroring value for which the definitive record exists off-chain.

Account-Based	Token-Based	Native	Non-Native
Traditional deposits held at a depository institution, represented as an account balance on a blockchain-based ledger system.	Transferable tokens issued by a depository institution on a blockchain that evidence deposit claims for stated amounts against the issuing institution.	Blockchain serves as the primary record-keeping ledger.	Blockchain represents the mirroring of an off-chain record keeping ledger.
Depository institution at which the account is held is liable to the holder of that account for the account balance.	Depository institution that issued the token is liable to the holder of the token for the fiat amount of the claim evidenced by the token.	Blockchain record keeping treated as the prevailing source of truth over any other ledger in the event of a discrepancy.	Off-chain record keeping treated as the prevailing source of truth over any other ledger in the event of a discrepancy.

Using the above definitions we see that there are four forms in which blockchain deposits can exist. Non-native deposit accounts, native deposit accounts, non-native token-based and native token-based. We refer to deposit tokens as “native,” token-based, blockchain deposits described below.

Native deposit tokens look to be the most promising form of tokenized deposits because firstly, they are not limited by off-chain reconciliation processes, and, secondly, they can take advantage of new blockchain functionality and open up new use cases and options.

Exhibit 3: Distinctions of Blockchain-Based Deposits



Source: Oliver Wyman and Onyx by J.P. Morgan Analysis

A handful of banks and consortia are already in the process of developing deposit tokens. Examples include the pilot issuance of Singaporean Dollar (SGD) deposit tokens by JPMorgan in connection with MAS Project Guardian³, and the USDF coin, which plans to launch on a permissioned basis on a public blockchain, for transactions within a consortium of approved banks⁴.

Deposit tokens can be used on ledgers that vary in the permissibility and interoperability they allow.

There are three broad types of ledger designs that financial institutions can choose to introduce blockchain-based deposits: (i) single bank ledgers, (ii) shared ledgers, and (iii) universal ledgers. The JPM Coin System is a live example of a single bank ledger for blockchain deposit accounts — it is operated by JPMorgan and acts as its own ledger and payments rail for US\$ balance transfers among JPMorgan participating customers.

Single bank ledgers, such as the JPM Coin System, offer greater operational efficiencies relative to traditional systems by facilitating faster transfers with extended operating hours. This can offer significant improvements when moving money across geographies or systems even among accounts held with one institution globally.

Shared ledgers bring multiple institutions onto the same network, allowing institutions to seamlessly interact with a common set of digital assets and operational protocols, and share in increased transparency around the status of transactions. However, they also demand coordination and agreement on common standards and governance from participants in the network.

Universal ledgers are public blockchains that maximize interoperability by facilitating broad access by many participants, but their permissionless nature also requires regulated financial institutions to establish appropriate alternative controls to create a trusted environment for funds transfers.

As financial institutions explore blockchain, they may operate multiple types of ledgers — JPMorgan’s deposit token concept is the next evolution of the bank’s work in blockchain-based deposit products. It follows the offering of blockchain deposit accounts on a single-bank ledger via the JPM Coin System and its work helping to co-found the Partior⁵ shared ledger system.

Exhibit 4: Classification of Deposit Tokens

	Single Bank Ledger	Shared Ledger	Universal Ledger
Description	Intra-bank value transfer	Inter-bank settlement and clearing	Connected regional clearing networks creating global connectivity
Primary users	Bank clients	Commercial banks and corporates	Global with possible restrictions imposed by the issuer
Examples	JPM Coin System	Partior	JPM SGD deposit token ¹

1. SGD deposit tokens issued by JPMorgan in connection with MAS Project Guardian pilot transaction. SGD deposit tokens are not a generally available live product offering

Source: Onyx by J.P. Morgan Analysis

Like traditional deposits, deposit tokens are a claim against an issuing depository institution. They should therefore be subject to the liquidity requirements and risk management standards imposed on deposit-taking banks today that seek to ensure the safety and soundness of deposits

recorded using non-blockchain methods. In addition, token holders may benefit from deposit insurance to the extent the depository institution is otherwise covered by an insurance scheme and the product meets scheme requirements.

STABLECOINS

Stablecoins are digital assets on a blockchain that are pegged to a **fiat currency***, and backed by fiat currency, high quality liquid assets, or crypto-assets (or a combination). Stablecoins were the first to offer an alternative to the volatility of crypto-assets such as Bitcoin and Ethereum.

They have since grown to a market capitalization of over US\$140 billion⁶, and are commonly used as a means of payment or transaction settlement, as stores of value, and in decentralized finance use cases.

They continue to see technical innovations from decentralized finance communities, while also drawing the attention of regulators⁷.

Stablecoins can come in different forms based on their reserve assets and peg mechanisms. Three main categories of stablecoins are: (i) fiat reserve backed, such as USDC, BUSD and USDT described in exhibit 1; (ii) crypto reserve backed, such as DAI; and (iii) algorithmic. This paper uses “stablecoin” to reference fiat reserve backed stablecoins, which are the largest category at over 90% market share.

Category	Market share	Description	Examples
Fiat reserve backed	93%	<ul style="list-style-type: none"> • Issuer holds reserve assets of equal value to amount of stablecoins outstanding • Reserves can be any type of asset (e.g., fiat-denominated securities), typically HQLAs for major stablecoins 	<ul style="list-style-type: none"> • USDT • USDC • BUSD
Crypto reserve backed	5%	<ul style="list-style-type: none"> • Decentralized stablecoins backed by other cryptoassets • Often require over-collateralization (typically 150%) to protect against losses due to price volatility of the underlying crypto-assets 	<ul style="list-style-type: none"> • DAI
Algorithmic	2%	<ul style="list-style-type: none"> • (Partially) Backed by highly volatile, non-standard crypto-asset collateral 	

Source: [DefiLlama](#), figures from November 2022

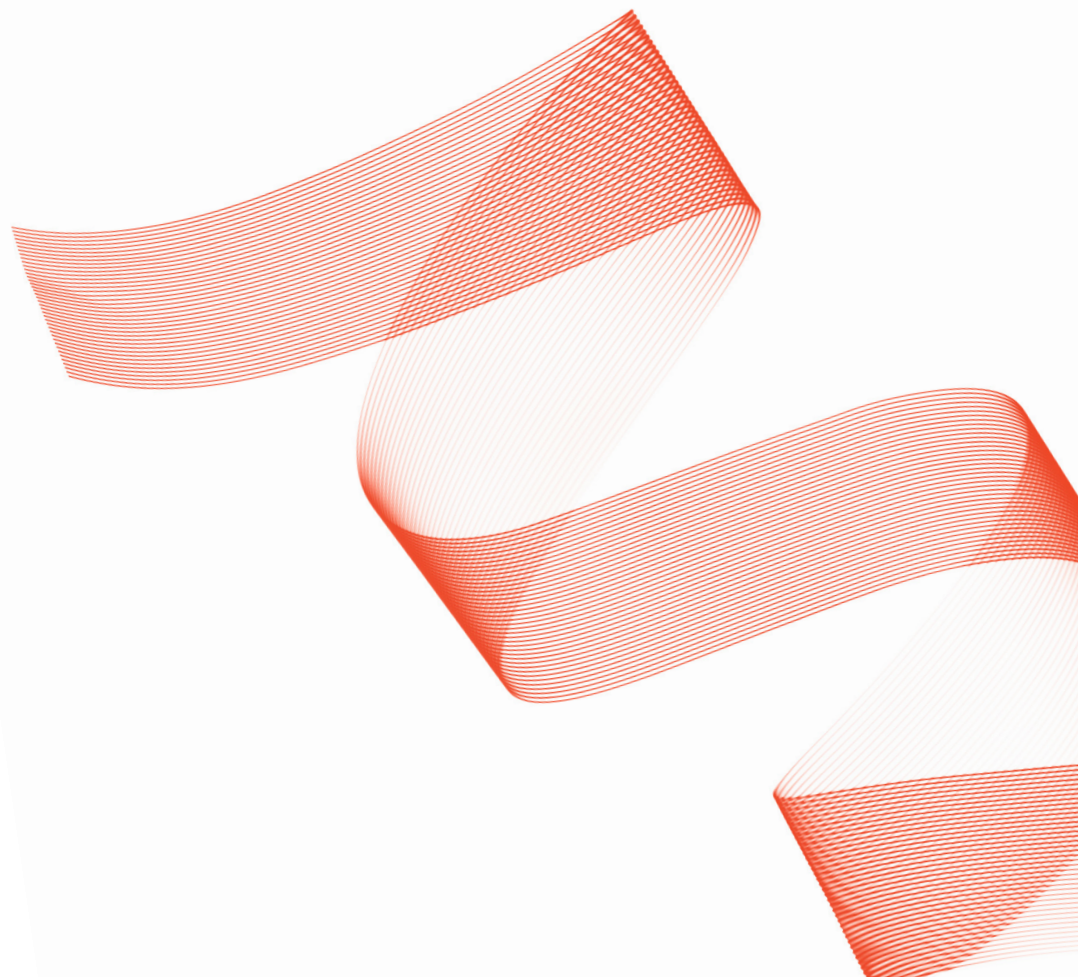
*Fiat currency

A government-issued currency that is not backed by any commodity.

CBDC

Central Bank digital currencies (CBDC) are a digital form of central bank money directly issued by central banks. Over 90% of the world's central banks are exploring, and some are even issuing, CBDCs⁸. Most projects are experimental, such as Project Hamilton in the US and the RBA's CBDC pilot in Australia. The European central bank is expected to decide on a possible CBDC

by late 2023 and the Chinese central bank is already piloting its digital Yuan, which crossed 360 million transactions in late 2022. An important distinction between various CBDC designs is to whom the central bank issues the currency. Wholesale CBDCs are issued only to financial institutions whereas retail CBDCs are closer to "digital cash" issued to individuals and businesses.



USE CASES FOR DEPOSIT TOKENS

Deposit tokens can improve a variety of traditional payments and liquidity management related uses of commercial bank money by enabling advanced programmability features, the ability to exchange funds with other digital assets atomically, and the transfer of commercial bank money on shared or universal ledgers where enhanced transparency of transactions and 24/7 transfer availability are possible. Deposit tokens also operate as a realistic alternative to stablecoins, on both public and permissioned blockchain environments, and can be offered organically within the regulatory and commercial framework applicable to modern banking institutions. They are designed to meet demand at scale for blockchain-based payment technologies by enabling faster, cheaper, and more advanced solutions within established bank regulatory frameworks that offer clarity to banks, as well as their customers. Notable use cases include:

Payments

Today's operating model for funds transfers uses methods where the transfer of information and value are separated and intermediated by financial institutions. Often, instructions are communicated between different bank systems to prompt the movement of funds sequentially, such that information precedes the transfer of funds at each intermediary. This happens via a network of intermediaries that connect the institution housing the payment originator's account details with the institution housing the beneficiary's information. Deposit tokens instead embody both the information found in payment instructions and the transfer of value. As a result, when deployed on a shared blockchain infrastructure that can connect payment originator and beneficiary, deposit tokens can reduce

the reliance on third-party intermediaries that would traditionally be required to reconcile separated value and information flows across multiple banking systems.

By removing intermediaries from the chain, deposit token would enable the direct, peer-to-peer transfers of funds, which can also include bank-to-bank transfers to benefit customers off-chain. In this peer-to-peer model, the bank's role shifts from direct intermediation and clearing of every transaction, to establishing controls in the design of the deposit token and, if relevant, in the environment it chooses to issue deposit tokens in to create a trusted environment for funds transfers.

For example, in MAS' Project Guardian, whereby JPMorgan issued SGD deposit tokens for an FX pilot transaction opposite an affiliate of SBI Digital Asset Holdings (SBI) on a public blockchain, the tokens and protocol which facilitated the transaction were designed to restrict unknown parties from transacting with the SGD deposit tokens — both the token smart contract and transaction protocols were programmed to only interact with certain known blockchain addresses. The deposit token smart contract also required authorized parties who instructed transfers to attach a “verifiable credential”, developed by JPMorgan, that was provided by the issuer. The Project Guardian pilot demonstrated that even in providing a tool for peer-to-peer transfers on public blockchain, banks can implement controls within the funds transfer process. Digital identity tools, such as the verifiable credentials developed by JPMorgan, can support these transfers by ensuring that transactions are only executed with verified counterparties.

Additionally, as discussed throughout this paper, the issuing bank, and the regulatory environment it operates within will continue to play an important role in the stability of value of the deposit token, as with any other commercial bank money deposited today. Replacing today's intermediated and sequential model with direct funds transfers, including direct bank to bank funds transfers, will be critical to addressing the pain points around transaction costs, trapped liquidity, transaction turnaround time, and the lack of visibility in transactional use cases.

Banks issuing deposit tokens will also likely create interoperability between their banking systems and blockchain ledgers where they issue deposit tokens. Institutional and corporate customers in particular may be able to optimize treasury cash management by interoperating between legacy systems and blockchains more seamlessly, reducing the trapped liquidity needed to accommodate multi-day settlements.

Deposit tokens could further support economic activity in the digital space, including in a “Web3 economy” where significant economic activity happens on shared ledgers, with tokenized asset transfers settled via deposit tokens. This digital economy would be facilitated by direct, instant, and atomic exchanges between peers as discussed above, which are less reliant on intermediaries orchestrating a separate exchange of information and value. Cross-border payments in particular is a space where we anticipate some of the most pronounced benefits of merging information and value on shared ledgers. In 2020, it cost US\$120 billion and on average took 2-3 days in settlement to move US\$23.5 trillion across borders⁹. And while we estimate that a multi-currency CBDC could cut costs by 80%, down to approximately US\$20 billion, deposit tokens could unlock similar benefits by reducing fees, settlement times, and counterparty risks, and by enabling more direct funds transfers.

Programmable money

The programmable nature of deposit tokens enables innovative solutions to support existing deposit-taking activities, such as the conditional transfer of funds based on conditions at a **smart-contract*** level, as well as related banking services, such as conditional intra-day lending decisions or disbursement of interest payments.

A deposit token integrated into the banking system provides new benefits when it becomes programmable by automating manual solutions, enabling complex logic for transactions without manual intervention, and reducing the risk of human errors or delays. Such automation drives efficiency not just in payment execution, but also in liquidity and collateral management, as well

as reconciliation processes, among other areas. Reducing direct human involvement also introduces risks, such as potential for unnoticed errors due to software bugs, as well as limitations. Smart contracts should be reviewed and audited, and anticipated problems should be corrected. Banking institutions today regularly develop and employ sophisticated software in the course of providing banking services and their practices are subject to technology risk management standards overseen by risk management committees. Such expertise and risk management practices include robust development of programmability solutions, as with any other bank developed or bank employed software.

Protocol interaction

Separate from the programmability of the deposit tokens themselves, deposit tokens are also better suited to interact with certain smart-contract protocols than account-based deposits.

A pilot transaction conducted as part of MAS' Project Guardian between JPMorgan and SBI recently showcased the feasibility of using deposit tokens with smart contract protocols for institutional applications.

It used a modified **decentralized finance*** ("DeFi") protocol to execute a foreign exchange transaction involving SGD deposit tokens issued by JPMorgan and a JPY tokenized asset issued by SBI¹⁰. The use of protocols may be another means of achieving certain benefits of automation and interoperability, particularly in respect to multiparty transactions that require the application of common rules.

***Smart contract**

Smart contracts are programs stored on a blockchain that run when a set of pre-determined conditions are met. Multiple smart contracts are often aggregated into larger applications that perform complex operations to provide a certain service.

***Decentralized finance**

Decentralized finance protocols are software applications, so-called "smart contracts", that run on decentralized blockchains where they enable financial services such as borrowing, lending, and trading.

Trading and settlement

The trading and settlement of tokenized assets on blockchains will become increasingly important as the fractionalization of assets, ease of transfer and the potential interoperability across institutions and institutional DeFi protocols create meaningful improvements to market efficiency. We have seen growth in the use and study of tokenized asset markets beyond crypto that support this trend, ranging from traditional securities and commodities to real estate and art. JPMorgan Onyx's Digital Assets platform processed over US\$430 billion repo transactions since launching in November 2020¹¹, Project Guardian (described above) explored the tokenization of bank deposits, tokenized securities are being issued experimentally like the European Investment Bank's €100 million bond in 2021¹², and regulatory frameworks are being reviewed in certain jurisdictions to account for tokenized assets and the use of distributed ledger technologies (DLT) for regulated financial services, such as the EU's DLT pilot regime¹³ which seeks to enable the use of DLT in the issuance, trading and settlement of digital assets that qualify as financial instruments.

Deposit tokens offer a blockchain-native means of using commercial bank money to settle transactions across these growing tokenized asset marketplaces "atomically"¹⁴,

or simultaneously and near instantly, removing the risk that parts of a transaction are not settled because a counterparty fails or cannot deliver an asset. Deposit tokens may separately facilitate very rapid or instant settlement by using more efficient rails even when a transaction is not subject to conditions for atomic settlement, as discussed in respect to payments above. Together, atomic and instant settlements enabled by deposit tokens using commercial bank money can reduce counterparty risk caused by delays between the delivery of assets and payments that require the custody of assets and reconciliation of trades.

The natural integration of deposit tokens with the banking sector positions them as a convenient payment or settlement tool for large entities that may wish to optimize their liquidity with commercial bank money on- and off-chain, enabling users to easily swap between non-tokenized deposits and deposit tokens. This integration with the traditional financial system will also enable deposit tokens to be used for complex, institutional use cases where the transaction party desires a high level of assurances, customer service, and protections from the issuer, or where the transaction itself requires integrations with other financial services¹⁵.

We recognize that integration with traditional financial services may be an unusual factor for a technology commonly associated with a DeFi movement that aims to remove institutional dependencies. Although DeFi is one use of blockchain with its own active set of users, we believe that demand for centralized financial services that are able to use blockchain will continue to thrive, whether they are used for operational efficiency and advanced programmability, or as “trust anchors” that issue tokenized assets on-chain, which include money-like instruments¹⁶. The importance of integrating with traditional finance is further supported by a survey of institutional clients who report being increasingly comfortable with digital cash on blockchains, but also cite the interoperability with existing infrastructure and the lack of solutions from trusted players as top concerns¹⁷.

Collateral

As an alternate form of commercial bank money, deposit tokens could also serve as a new means to provide cash collateral for both traditional and digital assets markets. For example, deposit tokens can be used as collateral to facilitate near-instant settlement on a blockchain for various financial instruments, including derivatives. Such collateral structures may also enhance intraday liquidity by enabling collateral to move in real-time and automatically as related trades are completed within a single day.

POLICY CONSIDERATIONS

Given the increasing interest in digital payments and the growth trajectory of stablecoins, public policy regarding blockchain-based forms of digital money (or money-like alternatives) should be guided by the assumption that they might become widely used and play an important role in the financial system in the future. Policy makers and regulators should further consider the unique risks and benefits of each new form of digital money and recognize the distinct characteristics of deposit tokens. The following section presents considerations for policy formulation on new forms of digital money with a focus on deposit tokens and comparisons to non-bank issued stablecoins where applicable.

DEVALUATION AND RUN RISK

Deposit tokens, stablecoins, and CBDCs are associated with a stability in value created by different factors. CBDCs achieve their stability by uniquely benefiting from confidence in the issuing central bank associated with a sovereign government, similar to cash today. The value of stablecoins has historically been rooted in market trust that the issuer will be able to redeem at the stated value, and can rely on information about their reserves and liquidity offered in secondary markets. Deposit tokens derive their stable value in the same manner that non-tokenized deposits do today: confidence in the issuing bank's creditworthiness supported by a number of factors, including the bank's balance sheet and capital reserves, the regulatory environment in which it operates, its operational history, and, in some cases, the availability of deposit insurance.

If users cannot redeem their digital money or transact with it for the stated face value, then that digital money will decline in market value. Like bank runs, the existence *and* perception of redemption risks against an issuer can lead users to redeem digital

money issued by that institution suddenly, creating a "run" on the issuer for redemptions. This, in turn, pressures the specific digital money that is subject to the run, causing it to lose further value relative to its fiat peg in a repeating cycle. Moreover, real-time transparency of on-chain activity, such as redemptions, may exacerbate the perception of redemption risks by displaying the activity of users who redeem in significant amounts, triggering the same fear and redemption activity in others.

While such runs have not yet occurred on major fiat-backed stablecoins, market stress and uncertainty have pressured the pegs of certain stablecoins. USDT traded down to approximately US\$0.97 on secondary markets during the de-pegging of the UST algorithmic stablecoin in May 2022¹⁸, a de-pegging event which in itself showed how a crisis of confidence can cause a run for redemptions¹⁹. Such de-pegging risks are typically caused by negative market sentiment regarding the credit worthiness of the issuer if the issuer carries excessive risk on the balance sheet, a lack of liquidity of the issuer, deterioration in the value of reserve assets, or issuer solvency.

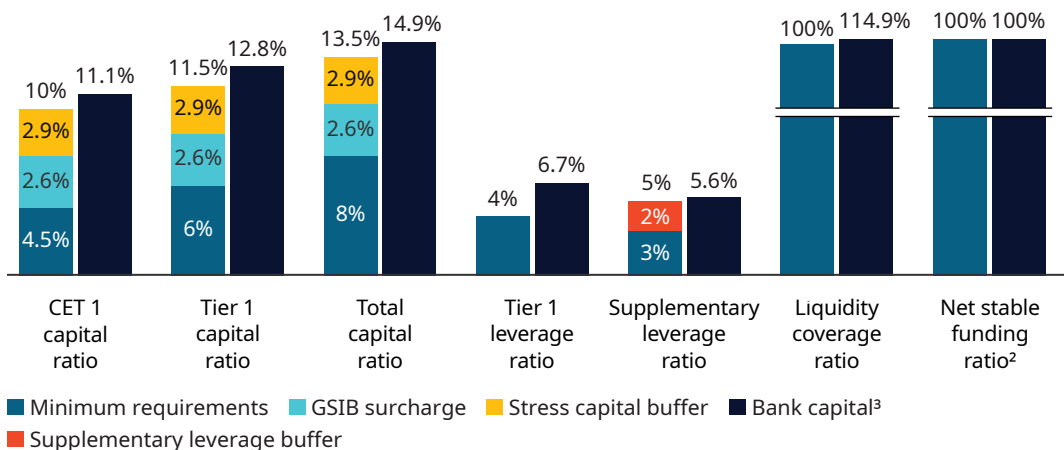
Naturally, devaluation and run risks present themselves and are managed differently for various forms of digital money. Deposit tokens are issued by banks that are regulated with stringent minimum liquidity, capital, and risk management requirements that evolved over decades to create stable and reliable ecosystems. Such requirements include:

- Existing minimum liquidity requirements, such as the Liquidity Coverage Ratio, Net Stable Funding Ratio, and multiple internal liquidity stress test and cash requirements, account for a wide range of liability and asset structures with different liquidity and behavioral profiles under stressed conditions.
- Minimum capital levels which are determined following risk-based, leverage-based and stress scenario-based requirements to serve as buffer for unexpected market and bank-specific risks. Globally systemically important banks are subject to even higher minimum capital requirements, bringing additional safety to their activities.
- Independent risk management practices ensure prudential approaches when identifying and managing financial and non-financial risks across all exposures.
- Other protections and contingency sources include large and diversified balance sheets backing deposit tokens, access to central bank contingency funding (e.g., discount window funding in the US, standing facilities in the Eurozone), and deposit insurance schemes for deposits below certain thresholds (where applicable).

Banks **must** follow these minimum liquidity, capital, and risk management requirements at all times today — their activities are monitored regularly by supervisors with strict implications in case of a breach. Such existing practices would further extend to the offering of deposit tokens by banks.

Exhibit 5: Top 3 US Bank Capital and Liquidity

As of Q2 2022, combined capital and liquidity requirements¹ (JPMC, BOA, and WF).



1. Sum of bank capital and regulatory requirements

2. NSFR ratios were at least 100%

3. Data shown includes J.P. Morgan, Bank of America, and Wells Fargo

Source: [JPMC](#), [Bank of America](#) and [Wells Fargo](#) Q2 2022 10-Q

(Exhibit 5 continued) Existing bank risk management practices

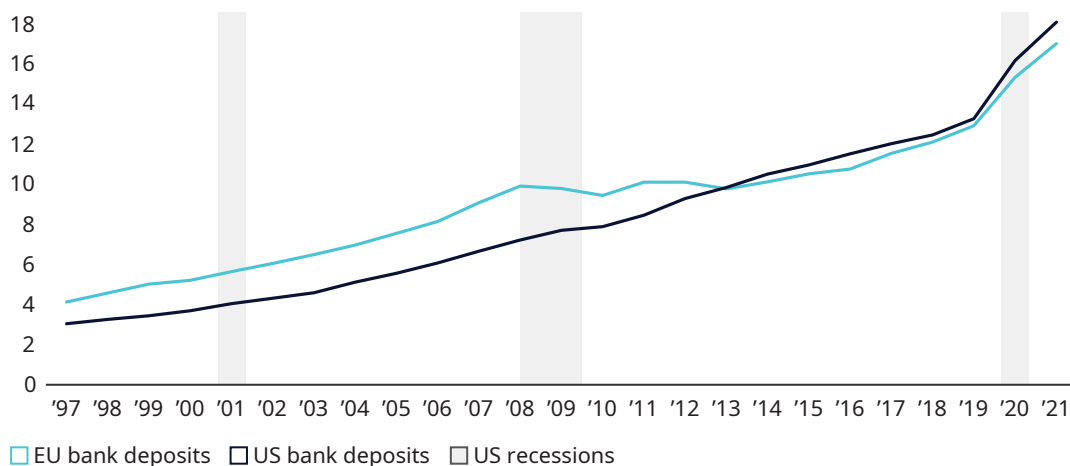
- **General risk management practices** such as concentration limits and diversification of funding and lending, credit loss allowances, estimates of market risks, and management of operational risks
- **Consumer supervision and regulation** set by the Consumer Financial Protection Bureau
- **Stress testing** to calibrate capital buffer requirements for severely adverse scenarios
- **Enhanced liquidity and overall risk management precautions**, including rules related to corporate governance set by the Financial Stability Oversight Council
- **Resolution and recovery plan** to overcome financial distress and remain capitalized in case of an adverse event
- **Orderly liquidation authority** granted to the US FDIC and Federal Reserve to adequately impose losses on shareholders and creditors

Deposit tokens are in early stages of development, hence there is limited data available to show their behavior. However, they are designed to be extensions of traditional deposits on blockchain, as they represent a deposit claim against an issuing bank. Historical analysis of traditional deposits shows that deposits have been a steady and reliable source of funding for commercial banks throughout economic cycles, despite low and sometimes negative interest rate environments, and in spite of innovations that sped up payments such as real-time gross settlement and faster payment systems.

Exhibit 6: Total US and EU Bank Deposits

Bank deposits have been resilient throughout economic and technological changes over the last 20 years. US deposits grew steadily, EU deposits slowed after the Global Financial and Eurozone crises but kept growing in recent years¹.

\$ trillion and € trillion

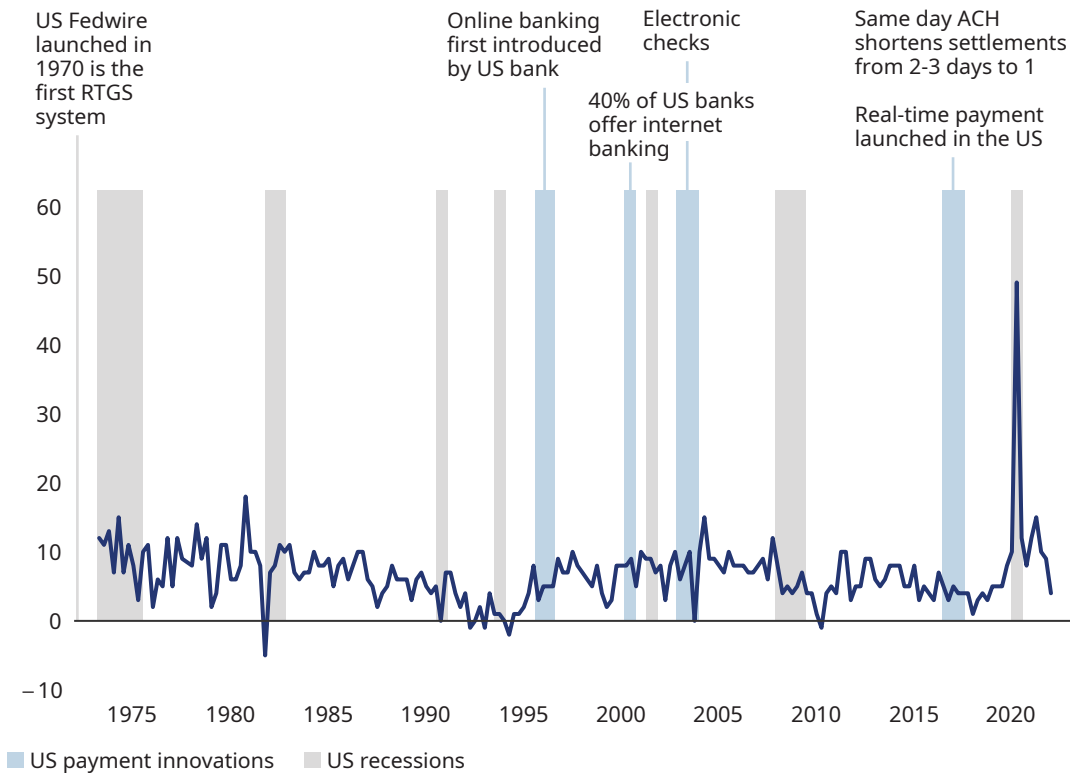


1. US deposits exclude large time deposits and other deposits; EU deposits include all deposits vis-a-vis euro area MFI and non-MFI, reported by MFI and excluding ESCB in the Euro area
Source: FED, ECB

Exhibit 7: Change in US Commercial Bank Deposits

Changes in commercial bank deposits have remained relatively stable in the past 50 years despite economic events and changes in payment technology.

% change in US commercial bank deposits, 1973—2022



Source: FRED

Deposit tokens may show different behavioral characteristics than traditional deposits as they bring new features and may be adopted by a certain subset of users. For instance, the technical features of deposit tokens such as their programmability and instant settlement will likely increase velocity of deposit tokens compared to traditional deposits²⁰.

However, this increased velocity does not necessarily alter liquidity demands for the issuing banks. In a world with a rich ecosystem of use-cases for tokenized commercial bank money, enhanced by technological efficiencies, deposit tokens may become a de-facto means of payment, store of value, and working capital. They may fuel an on-chain economy by frequently changing wallets with minimal redemptions back into fiat.

Similar to traditional deposits, and other bank liabilities, the existing liquidity, capital, and risk management frameworks already require banks to engage in robust analysis of potential deposit token redemption behavior under stress conditions and hold prudentially safe levels of financial resources. Additionally, banks that are assessed to be globally systemically important banks or “G-SIBS” through the standardized methodology of the Basel Committee on Banking Supervision²¹, are required to maintain additional capital in order to absorb losses. The view that existing bank regulations can appropriately encompass deposit token issuance is echoed in a recent MAS consultation²², which proposed that no additional reserve backing and prudential requirements should be imposed on banks that issue deposit tokens, arguing that existing requirements for capital, liquidity, money laundering and terrorism financing, technology risk management, and other risk factors are enough to protect banks and their customers. Additionally, the Japanese legislature passed a bill to set a legal framework for stablecoins in June 2022. Japan’s Financial Services Authority²³ is considering detailed rules promulgated under the new stablecoin legislation that would allow banks to issue stablecoins as deposits, noting they are already subject to prudential regulations and that stablecoin holders would be protected by deposit insurance in the same manner as conventional bank deposits.

Lastly, staff of the New York Federal Reserve recently posited that in the US, tokenized deposits may be an attractive form of digital money as they would take advantage of the benefits of the existing, well-functioning banking and payment systems²⁴.

Comparing these practices to stablecoins, we observe that large US\$-pegged stablecoin issuers mostly keep short term high quality liquid collateral as reserve assets, such as cash and short-term Treasuries. Liao²⁵ analyzed run risks and the redemption behaviors of USDC and concluded that liquidity would exceed the Basel III Liquidity Coverage Ratio requirement under different stress scenarios, based on historical data. However, it should be noted that these practices on reserve maintenance are self-enforced in many instances and that most stablecoin issuers are not subject to the same minimum capital, liquidity, supervision, and reporting requirements as regulated banks.

Currently, there are no global standards on the composition of stablecoin reserves, on the frequency with which information about reserves is published, or on redemption rights for holders²⁶. Practices therefore vary by stablecoin provider and by regions that impose varying levels of requirements, and may not be sufficient to address a stablecoin which reaches a systemically important scale and has a broad geographic impact. When best practices are applied, they will need to be maintained, particularly during times of stress when liquidity is most needed, or as stablecoin volumes grow.

Despite the current lack of generally accepted regulatory standards, reserves are increasingly being audited on a regular but voluntary basis. Regulatory standards for stablecoins are also emerging in some markets, such as internationally through the Financial Stability Board's recently proposed

stablecoin guidelines²⁷, in Singapore through MAS' recent consultation²⁸, in Japan through the proposed Stablecoin Act by the Financial Services Authority²⁹, and in Europe through ongoing work on Markets in Crypto Assets (MiCA)³⁰.

CONTAGION RISK

A run on stablecoin issuers or deposit tokens could disrupt traditional markets if the issuers hold insufficient cash to meet the demands on their liquidity, resulting in a large-scale sale of assets to obtain cash.

Global systemically important banking institutions that issue deposit tokens should be less susceptible to run-like threats that would cause such a fire sale on its assets than non-bank actors, in part due to their substantial and diversified balance sheets, access to central bank contingency funding (e.g., discount window provided by the Federal Reserve in the US), and in certain jurisdictions, insurance guarantee schemes. If a deposit token issuing bank were to face sudden and large demand for liquidity, these buffers decrease the likelihood that a bank would have to resort to emergency measures with knock-on market impacts to handle redemptions.

Disruptions to the shared ledgers on which digital money operates may also raise considerations for broader financial stability. Any digital money issuer will need to implement controls to interact with blockchain environments, including public blockchains and other shared ledgers, to prevent risks that emerge from the use of these new platforms to disrupt financial systems.

Here, we note that banks have historically had to evolve and adopt major new technologies safely, minimizing the novel operational risks these technologies introduced for the institution and the broader systems they operate in.

Given the radical impact of previous technological shifts, banks are well-equipped to continue modernizing as new technologies emerge. The internet and the shift to open banking are notable and relevant examples of how banks adapted to technologies that profoundly impacted their business models and operations. The internet ushered in a new means of connectivity and communication for the clearing and settlement of payments. It resulted in the development of online banking and the continuous evolution of digital payments, a trend that was accelerated by the recent COVID-19 pandemic. More recently, financial institutions have also had to adapt to new information sharing paradigms in connection with open banking, particularly in Europe as required by PSD-2 (Payment Services Directive).

Since the first wave of internet adoption, and the departure away from slower and more rigid means of communication, banks and their supervisors have developed increasingly sophisticated expertise on the implications for innovation and risk management of new technologies, and banks have been adapting, maturing and securing their infrastructures as digital technologies have become synonymous with modern banking. The adoption of blockchain technology is a natural next chapter in how banks apply internet-driven innovation to the exchange of information, including tokens, which are merely another way to express information that evidences the ownership and exchange of value.

Using a decentralized blockchain ledger as a payment infrastructure may also require industry innovation to address challenges around protocol governance. Both at the infrastructure and application layers, decentralized protocols are intended to integrate changes based on majority consensus. Certain decisions on public protocols that are accepted by a majority may therefore go against the preferences of a particular institution, possibly impacting other assets, protocols and users. Here again, banks have shown a track record of developing and operating governance critical infrastructures — SWIFT, for instance, a critical infrastructure for cross-border payments, is a cooperative with internal governance driven by its financial institution members.

As another example, the Real Time Payments (RTP) Network in the United States was established in 2017 by The Clearing House (TCH), a banking association and payments company.

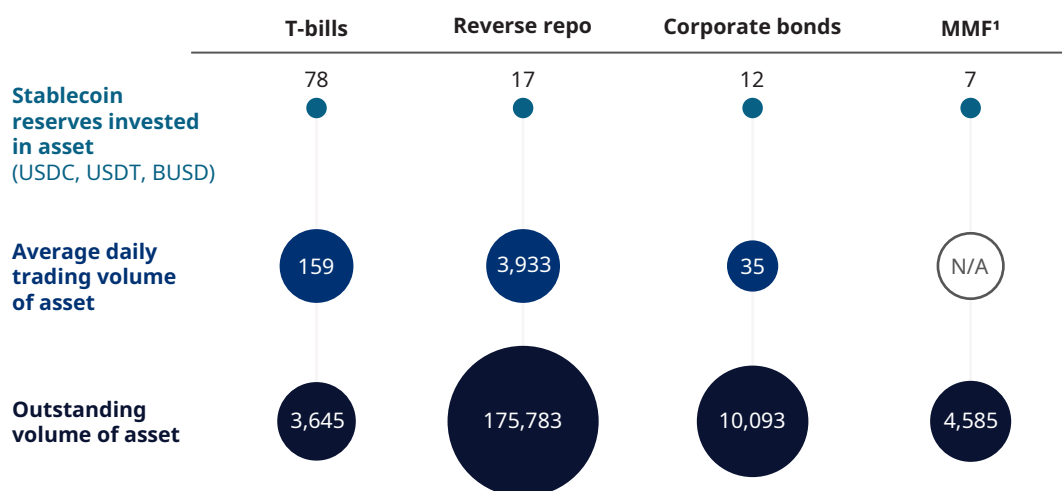
RTP is a significant infrastructure processing 45 million transactions in Q3 2022³¹ and it is the first new core payments infrastructure in the US in more than 40 years. Its development and build were driven by the banking industry through the collaborative efforts of TCH's 25 owner banks and it is open to all US depository banks³².

Comparing these practices to non-bank stablecoins, we observe that current large US\$ pegged stablecoins generally rely solely on the reserve assets to accommodate run risks. At times of stress and large redemptions, they will rely on liquidation of their reserve assets as the only means to meet the requirements, potentially putting stress on the broader markets. Even though they are not yet at a scale to trigger such contagion effects, as illustrated by Exhibit 8 below, their growth may pressure the limited number of assets they currently rely on as the stablecoin scales, if stablecoin reserves remain concentrated in a few select safe assets. The European Central Bank had estimated that Libra, the now discontinued stablecoin initiative of Meta, could have grown to require more short-term government debt from A+ Euro area countries than was available on the market³³.

These risks may be addressed over time through regulation and industry practice that enables the diversification of stablecoin reserves into other assets, including into bank deposits, and requiring stablecoin issuers to hold additional capital in excess of the value of reserves. However, there may be tradeoffs as to broad diversification of asset reserves and the stability of such reserves, which may have undesired effects.

Exhibit 8: US Stablecoin Reserve Assets and Their Underlying Markets

Stablecoin HQLA demands are low relative to supply on the underlying markets, but could become a significant share of outstanding and trading volume if they became widely adopted. Stablecoin reserves include reserves of USDC, USDT and BUSD, US\$ billion, 2022



1. Includes Government, Prime and Tax-exempt money market funds

Source: SIFMA, Investment Company Institute

CREDIT INTERMEDIATION AND MONETARY POLICY

The impact of different forms of digital money on credit intermediation and monetary policy are key factors that require careful consideration, especially as these innovations reach a large scale. The impact on credit creation depends critically on two factors: (i) the sources of inflow into these new forms of money and (ii) the composition of assets in which the inflows are invested. If a form of digital money and its applications were to become widely adopted, major inflows could come from three sources: physical currency (banknotes), commercial bank deposits, and other cash-equivalents.

The amount of these inflows will depend on how digital money applications are seen as substitutes, or better alternatives, for the current objectives these sources serve. For example, digital money applications will likely replace some portion of banknotes in circulation, especially as the economy becomes more digital.

The composition of assets in which issuers invest the underlying reserves is another key consideration to gauge the effects of digital money on credit intermediation and monetary policy.

Reserve assets can take different forms based on their liquidity, credit, and duration profile. These range from central bank reserves and very short-term high-quality liquid assets (e.g., Treasury bills), to longer term high-quality liquid assets and longer term bonds and loans.

As extensions of traditional deposits, deposit tokens are not backed by specific assets, but are rather supported by the fractional reserves generally maintained by a bank to support its liquidity needs in accordance with risk management frameworks that reflect an optimal mix of liquidity, credit, and duration characteristics between redemption risk and credit intermediation. Inflows from the conversion of non-tokenized commercial bank deposits into deposit tokens by an issuer are then simply a redistribution of deposit liabilities on the bank's balance sheet, with no changes in the bank's composition of assets³⁴.

As banks would be expected to maintain the same appropriate levels of liquid assets to account for deposit liabilities, they will also continue to provide funding for longer term investments to the public sector, private sector, and consumer needs. This, in turn, continues to provide benefits to the wider economy by bridging the gap between borrowers and savers, funding economic growth and transmitting monetary policy. Caramichael and Liao³⁵ also suggest that inflows into tokenized deposits issued by banks who engage in fractional reserve lending would have a neutral to positive effect on credit provision.

The impact on credit intermediation of non-bank stablecoins may differ from deposit tokens due to the varied reserve backing.

We observe a range of practices by reserve-backed stablecoins, but the largest stablecoins have allocation to cash-like instruments and very short-term government bills. In this framework, redemption run risk is minimized at the risk of credit disintermediation. Non-bank issued stablecoins would result in a neutral to possibly negative effect on credit intermediation if they attract inflows from deposits, by moving funding from the private sector and consumer investment to only short-term government funding³⁶. If done on a large scale, this could increase borrowing costs for longer term government investments and private investments in general³⁷.

Given the above, we believe deposit tokens offer an attractive alternative to non-bank stablecoins for use-cases that commercial bank deposits fulfill today, due to their natural integration with broader banking and financial services. Deposit tokens would tend to augment rather than disrupt the existing payments infrastructure, and may complement existing faster payment and real-time gross settlement systems that utilize central bank money. Banks could use these systems to settle off-chain obligations that arise when holding tokens from other issuers³⁸ and drive more efficient use of dormant central bank reserves³⁹.

In the context of CBDCs, the relatively faster development of deposit tokens could also help inform CBDC design choices, provide an improvement over existing payment systems while CBDCs are developed, and help create efficient pathways for interoperability with the greater digital money ecosystem for future CBDCs.

We separately note that digital money that is interoperable with central bank payments systems may also enhance the effects of monetary policy that seeks to introduce liquidity into the system, as digital money can increase the velocity of money, i.e., the number of times that a unit

of currency is used to purchase goods or services within a given period of time⁴⁰. Inefficiencies in the existing wholesale payment systems that delay clearing of central bank funds means that money is not available for a bank's end client during the interbank settlement period.

ECONOMIC FUNGIBILITY

The benefits of deposit tokens can be optimized by design choices that enhance their fungibility with other bank-issued deposit tokens and non-tokenized forms of money. A "singleness of currency"⁴¹ that lets users treat currency from different forms of money as equivalent is desirable for a stable and widely accepted money — users should be able to treat physical cash, non-tokenized forms of digital money, and various money-like tokenized assets of the same currency as interchangeable assets with equal monetary worth and different technological properties. Economic fungibility is facilitated in the current banking system by having central banks act as trusted settlement institutions for private money issued by commercial banks⁴².

The German Banking Industry Committee describes one model for achieving fungibility among deposit tokens in which commercial banks grant each other credit lines and settle payments with central bank money⁴³, which could also create fungibility between the deposit tokens of one issuer with non-tokenized deposits of another bank.

We believe this may be one acceptable approach with respect to banks that operate within the same domestic clearing systems. An alternative would be for correspondent banking-like networks to develop, whereby banks are willing to redeem tokens of another institution insofar as they accept exposure against such institution as part of a correspondent relationship.

Both systems have precedent within existing practices today, and in each case, the risks of being exposed to another institution can be mitigated through extensions of existing risk management practices that already manage credit and operational risks in non-blockchain interbank activity. We further note that in cases where institutions are seeking to settle their exposure with central bank money, wholesale CBDCs, particularly tokenized CBDCs, can play an important and desirable role in adoption. Such a CBDC could offer a faster, more transparent and technologically interoperable solution as compared to traditional off-chain operations.

The ability for banks to settle their deposit token exposure to other banks in central bank money can also help minimize divergent pricing for deposit tokens from different institutions which holders may perceive to bear different levels of credit risk. This, alongside a clear path to interoperability with existing payment infrastructures when redeeming these deposit tokens, should support the singleness of the currency⁴⁴.

Such a two-tiered system has the added benefit of preserving the important role that central banks play in wholesale settlement today. Real time methods to settle central bank funds, such as by using a blockchain-based CBDC, may actually strengthen the current system, as using methods that are not real-time may diminish the benefits realized in the availability of central bank funds for settlement.

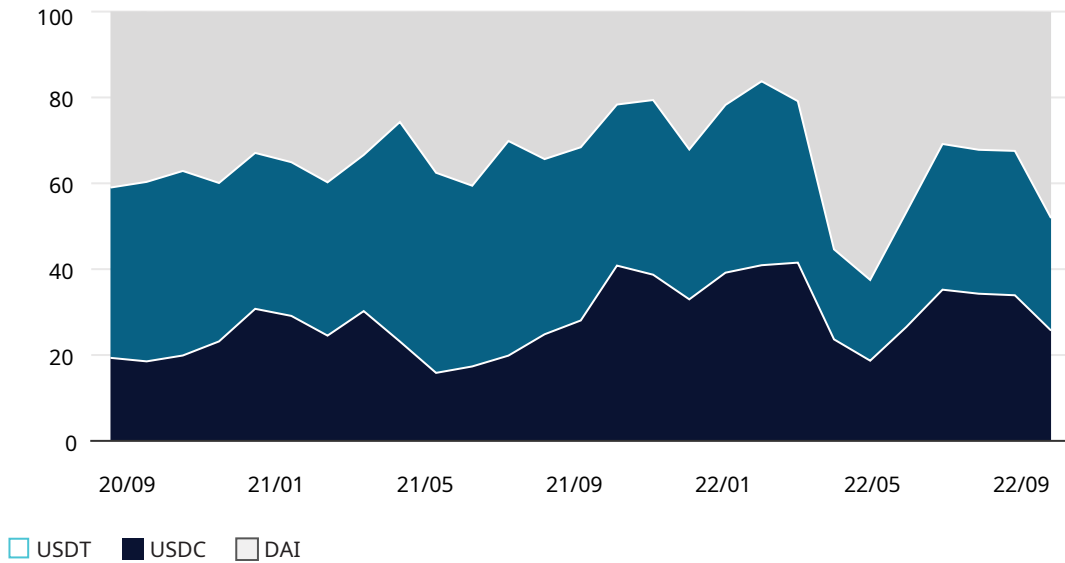
Deposit tokens will also de-facto be fungible with non-tokenized deposits at the same bank, as they represent a claim on the same institution. By redeeming deposit tokens for non-tokenized deposits, the funds become available to interact with the traditional banking system in the ordinary course.

Stablecoins face similar fungibility questions. Their activity reflects their credit risk and supply and demand dynamics, as evidenced by the different weightings of stablecoins in liquidity pools on decentralized finance protocols. For instance, the Curve protocol on Ethereum, a popular exchange protocol for stablecoin swaps, hosts a liquidity pool which carries different amounts of USDC, USDT and DAI. These uneven weightings of stablecoins supplied to the liquidity pool reflect differences in supply and demand, driven by the popularity of each coin with other DeFi protocols, the perceived riskiness of the stablecoin and other factors. For instance, a given stablecoin will become overweighted in the pool when users supply the token in exchange for another stablecoin that they consider safer. Nevertheless, large liquidity pools on protocols such as Curve enable users to easily swap between stablecoins, creating fungibility between stablecoins through market exchange rates. This particular USDC/USDT/DAI Curve liquidity pool carried over US\$760 million in assets and traded US\$60 million per day⁴⁵ in October 2022.

Exhibit 9: Weights of USDC, USDT, and DAI in the Curve Liquidity Pool

The weights of USDT, USDC, and DAI in the liquidity pool show how supply and demand varies over time.

% Share of liquidity pool



Source: Dune Analytics

Like on-chain decentralized finance protocols that manage liquidity between different stablecoins, liquidity pools for deposit tokens may appear. To the extent that on-chain liquidity pools for deposit tokens are created by token holders who provide their deposit tokens as liquidity on decentralized exchange platforms, and to

the extent that such liquidity pools persist because they serve a useful purpose such as creating market-based fungibility between deposit tokens, the tokenization process should not introduce a pricing differential. Rather, the liquidity pools should reflect the fungibility of the deposit tokens as financial assets.

TECHNICAL INTEROPERABILITY

Achieving economic fungibility among deposit tokens and/or off-chain deposits is not meaningful without sufficient technical interoperability to make actual exchange between different forms of money possible.

Technical interoperability will most likely occur between the issuing bank's deposit tokens and its non-tokenized deposits, as a bank would naturally integrate its redemption process with its core banking system. This interoperability then extends to cash and other payment rails available through non-tokenized deposits. The challenges of interoperability will be most pronounced in the exchange of tokens with different issuers, or the redemption of tokens for non-tokenized money by a bank that is not the original issuer.

And while universal ledgers offer the greatest degree of interoperability between banking systems and the benefits that result from it, simpler shared ledgers introduce fewer challenges to adoption for regulated institutions and offer significant upgrades over the current systems. The shared ledgers under development aim to accelerate the clearing and settlement of payments, in an environment with clear governance and established identity of all banks in the system.

The development of industry token standards and thoughtful consideration as to the appropriate chain for issuance and means of bridging between chains are needed. These would foster greater technical interoperability across different banking systems by implementing industry-wide standards and promoting best practices.

Banks will need to become familiar with deposit tokens and their underlying technology to issue or offer related services and should examine where efficient linkages can be created between traditional and novel blockchain-based services.

Stablecoins and deposit tokens will likely face similar challenges when operating across different blockchains and, stablecoins have already experienced these challenges firsthand.

Stablecoins are often bridged between different blockchains⁴⁶, or wrapped when the networks are not interoperable⁴⁷, because issuers typically do not natively support all the blockchains on which their products are demanded or provide bridging protocols. Bridging and wrapping stablecoins has typically been carried out by smart contracts written by third parties, which introduces additional operational and technical risk due to the complexities involved⁴⁸.

The success of deposit tokens will hinge on the network effects outside of their own ecosystems. This will require interoperability between traditional finance systems and blockchains, across different chains and with other assets on a given blockchain. Responsible and informed innovation must be at the core of any advancement in this space, rooted in the high technological and operational risk management standards such as those applicable to banks today.

CONCLUSION

As digital transactions grow in scale and complexity, deposit tokens can become a strong foundation for digital money and an important part of a broader tokenized asset ecosystem. Their technical features, alignment with well-established bank regulatory frameworks, and their natural integration with financial services via the banking sector positions deposit tokens to be a stabilizing anchor within the digital money landscape, while ushering in a new era of enhancement for commercial bank money, the world's most used form of money.

Importantly, deposit tokens do not need to exist at the exclusion of other innovations. The digital money landscape is still emerging and various types of money will compete to support different use cases. Deposit tokens can play a valuable role within the overall ecosystem. For example, deposit tokens can have a symbiotic relationship with blockchain-based wholesale CBDCs, helping to further the two-tier banking system in place today and providing a natural bridge for the integration of CBDCs into the banking system. Deposit tokens may also help stabilize the broader blockchain digital money space by absorbing some of the increasing global demands on the nascent sector and by supporting different markets. This includes institutional segments where there is demand for traditional financial services that some stablecoin issuers do not seek to offer.

Banks, policy makers and regulators alike should consider each form of digital money separately for its unique risks and benefits. Deposit tokens are rooted in the existing deposit-taking activities of banks and are not the same product as non-bank stablecoins or CBDCs, and the frameworks for innovation and regulation should recognize the distinctions. For deposit tokens to create productive linkages between traditional banking systems and blockchain, they must exist as an extension of those traditional systems, both in design and in regulation.

Deposit tokens are well positioned to help the digital money landscape stabilize and mature. Accordingly, they merit separate consideration by banks looking to innovate, regulators looking to establish appropriate regulation that shape this evolving space, and the broader set of participants in the financial system looking to interact with digital money.

ENDNOTES

- 1 Summerville, M. (2022), [Institutional Investing 2.0 Migration to Digital Assets Accelerates](#), Celent.
- 2 See, for instance, Federal Reserve (2022), [Money Stock Measures – H.6 Release](#) in the US, European Central Bank (2022), [Monetary developments in the euro area: September 2022](#) in the European Union and Monetary Authority of Singapore (2022), [Project Orchid Programmable Digital SGD](#), page 15, in Singapore.
- 3 Monetary Authority of Singapore (2022), [MAS partners the industry to pilot use cases in digital assets](#). SGD deposit tokens are not a generally available live product offering.
- 4 USDF will be a bank-minted alternative to non-bank-issued stablecoins, minted exclusively by US banks and redeemable on a 1:1 basis for cash from a Consortium member bank. See [USDF Consortium](#).
- 5 Partior, an independent company, is the blockchain platform for payments clearing and settlement that grew from the Project Ubin collaboration, and founded by J.P. Morgan, DBS and Temasek, to achieve end-to-end atomic settlements in multiple currencies, and replace the sequential approach to payments settlement.
- 6 Figure sourced from [DefiLlama](#) as of November 2022.
- 7 See President’s Working Group (2021), [Report on Stablecoins](#), Financial Stability Board (2020), [FSB publishes high-level recommendations for regulation, supervision and oversight of “Global stablecoin” arrangements](#), European Commission (2020), [Regulation of the European parliament and of the council on markets in crypto-assets, and amending Directive \(EU\)](#), and Monetary Authority of Singapore (2022), [Proposed regulatory approach for stablecoin-related activities](#).
- 8 Kosse, A. and Mattei, I. (2022), Gaining momentum – [Results of the 2021 BIS survey on central bank digital currencies](#) (BIS Papers No 125), Bank for International Settlements.
- 9 Ekberg, J., Chia, T.Y., Ho, M., and Liu, L. (2021), [Unlocking \\$120 billion value in cross-border payments](#), Oliver Wyman.
- 10 Oliver Wyman, DBS, Onyx by J.P. Morgan, and SBI Digital Asset Holdings (2022), [Institutional DeFi — The Next Generation of Finance?](#)
- 11 Ibid, endnote 9.
- 12 European Investment Bank (2021), [EIB issues its first ever digital bond on a public blockchain](#).
- 13 European Securities and Markets Authority (2022), [ESMA publishes report on the DLT pilot regime](#).

- 14 Atomic settlement refers to simultaneous settlement of assets, whereby assets are linked to ensure the transfer of an asset only occurs if the others are simultaneously transferred (e.g., to achieve delivery versus payment in a securities transaction or payment versus payment in a foreign exchange transaction), see Bank for International Settlements (2020), [BIS Quarterly Review](#).
- 15 For example, the administration of a significant bond offering or syndicated loan.
- 16 The largest stablecoins, for instance, are issued and managed centrally by private institutions.
- 17 Ibid, see endnote 1.
- 18 Sourced from [Cryptocompare](#).
- 19 Stablecoins have also traded above peg in secondary markets during non-stablecoin related market stress as users liquidate speculative assets for stablecoins, as described in Caramichael, J. and Liao, G. (2022), [Stablecoins: Growth Potential and Impact on Banking](#), International Finance Discussion Paper No. 1334.
- 20 Long, C. (2022), [Ten Stablecoin Predictions and Their Monetary Policy Implications](#), CATO Institute.
- 21 Basel Committee on Banking Supervision (2021), [Scope and definitions – Globally systemically important banks](#), Bank for International Settlements. The [Basel Committee on Banking Supervision \(BCBS\)](#) is the primary global standard setter for the prudential regulation of banks and provides a forum for regular cooperation on banking supervisory matters.
- 22 Monetary Authority of Singapore (2022), [Proposed regulatory approach for stablecoin-related activities](#).
- 23 Financial Services Agency, the Japanese Government (2022), [Regulatory Framework for Crypto-assets and Stablecoins](#).
- 24 Garratt, R., Lee, M., Martin, A., and Torregrossa, J. (2022), [The Future of Payments Is Not Stablecoins](#), Federal Reserve Bank of New York Liberty Street Economics.
- 25 Liao, G. (2022) [Macprudential Considerations for Tokenized Cash](#).
- 26 President's Working Group (2021), [Report on Stablecoins](#).
- 27 Financial Stability Board (2022), [Review of the FSB High-level Recommendations of the Regulation, Supervision and Oversight of "Global Stablecoin" Arrangements: Consultative report](#).
- 28 Monetary Authority of Singapore (2022), [Proposed regulatory measures for digital payment token services](#).
- 29 Ibid, see endnote 23.
- 30 European Commission (2020), [Regulation of the European parliament and of the council on markets in crypto-assets, and amending Directive](#).
- 31 The Clearing House (2022), [Real-Time Payments for All Financial Institutions](#).
- 32 The Clearing House (2017), [First New Core Payments System in the US in more than 40 Years Initiates First Live Payments](#).

33 Adachi, M., Cominetta, M., Kaufmann, C., and van der Kraaij, A. (2020), [A regulatory and financial stability perspective on global stablecoins](#), European Central Bank.

34 Armas, A. and Singh, M. (2022), [Digital Money and Central Banks Balance Sheet](#), International Monetary Fund.

35 Ibid, endnote 19.

36 Ibid, endnote 19.

37 A similar point is argued by ibid, endnote 26.

38 Monetary Authority of Singapore (2022), [Project Orchid Programmable Digital SGD](#), page 34.

39 Ibid, endnote 20.

40 Ibid, endnote 20.

41 Bank for International Settlements (2003), [The role of central bank money in payment systems](#).

42 As argued by Cheng, J. and Torregrossa, J., [What is Money? A Lawyers Perspective on US Payment System Evolution and Dollars in the Digital Age](#) (2021) an ibid, endnote 24.

43 German Banking Industry Committee (2021), [Europe needs new money – an ecosystem of CBDC, tokenised commercial bank money and trigger solutions](#).

44 Ibid, endnote 41.

45 Figures from [Curve Finance](#) as of October 2022.

46 Bridges are protocols that connect separate blockchain networks. They are commonly used to transfer tokens between layer 1, layer 2 and sidechain networks, compatible layer 1 networks such as EVM-based blockchains, and non-compatible networks. There exist various approaches to bridging, some of which involve wrapping tokens as defined in endnote 47, that involve different trust assumptions and security guarantees.

47 Wrapping a token involves locking the original token, then minting a new token on the desired blockchain that is compatible with other tokens on that blockchain. The original tokens underlying the “wrapped version” can only be unlocked by burning an equivalent amount of the wrapped token, thereby promising economic fungibility between the two.

48 The four largest crypto hacks since 2021 all exploited a cross-chain bridge in some form: Ronin Network (March 2022, US\$ 624 million), Poly Network (August 2021, US\$ 611 million), BNB Bridge (October 2022, US\$ 586 million) and Wormhole (February 2022, US\$326 million), see [Rekt](#) as of November 2022.

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