Stablecoins and Central Bank Digital Currencies (CBDCs)

ECOM215

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Summary

This lecture overviews stablecoins and CBDCs and their potential impact on financial markets. We also discuss CBDCs' design and implementation challenges and the current state of stablecoin development (types, uses, and controversies).

Contents

What are Stablecoins?

The case for Stablecoins

The emergence of blockchain technology and rapid advancements in traditional payment systems have spurred innovations to bridge the gap between digital and fiat currencies.

While Bitcoin and other cryptocurrencies have not evolved into major alternatives to sovereign monetary systems, stablecoins have raised new challenges for regulators and policymakers.

Stablecoins are a subcategory of cryptoassets that aim (or claim) to maintain a stable value relative to a specified peg.

↪ Given their claim to provide a stable alternative to highly volatile cryptocurrencies, stablecoins have the potential to become a widely used method of payment and unit of account.

The case for Stablecoins

In a decentralised financial system without intermediaries and trusted third parties, a stable unit of account becomes crucial for implementing smart contracts.

The massive volatility of cryptocurrencies, such as Bitcoin and Ether, has been a major barrier to settlement.

↪ This has spurred the desire for a sustainable means to link digital transactions with fiat currencies.

Stablecoins intends to offer a solution to cryptocurrencies' price volatility, potentially making blockchain-based payments and settlements more attractive.

The case for Stablecoins

Stablecoins initially evolved as a valid alternative to address the failure of cryptocurrencies as an effective monetary and payment instrument.

This reflected the preference of main market participants to base transactions and payments on sovereign fiat currencies.

↪ It also reflected the weaknesses of Bitcoin as a viable method of payment and/or unit of account.

↪ High volatility makes cryptocurrencies less useful as a payment method and more of an investment, speculative or otherwise.

Despite being supposedly stable, there has been some price volatility in practice for all stablecoins.

↪ Nonetheless, volatility is substantially lower than other major cryptocurrencies (more on this later in the lecture).

Stablecoins as pegged assets

Stablecoin issuers claim that these assets can be redeemed at par with the value of a relevant peg. The latter can be one specific asset or a basket of assets.

To date, the majority of stablecoins are pegged to a single asset, most typically sovereign currencies, such as the US dollar and the Euro, but also commodities such as gold or other cryptocurrencies.

Stablecoins may use various approaches to keep parity with their peg.

- ↪ At a high level, a first distinction can be made between stablecoins if whether or not they claim to hold a pool of assets to back their value (whether a stablecoin is collateralised or not).
- ↪ A more granular distinction can be based on the type of reserve assets held as collateral.

Collateralisation

To a first approximation, we can distinguish three types of collateralised stablecoins:

(i) **Fiat-backed**: stablecoins that claim to be backed by liquid assets denominated in a fiat currency. Examples include Tether USD (USDT) and USD Coin (USDC).

(ii) **Crypto-backed**: stablecoins that claim to be backed by other cryptocurrencies. Examples include Dai and Frax.

(iii) **Commodity-backed**: stablecoins that claim to be backed by commodities. Examples include PAX Gold and Tether Gold.

Notice that fiat and commodity collateralised stablecoins are referred to as "off-chain collateralised" whereas crypto collateralised stablecoins are referred to as "on-chain collateralised" stablecoins.

Collateralisation

The type of reserves are generally of the same denomination as the peg.

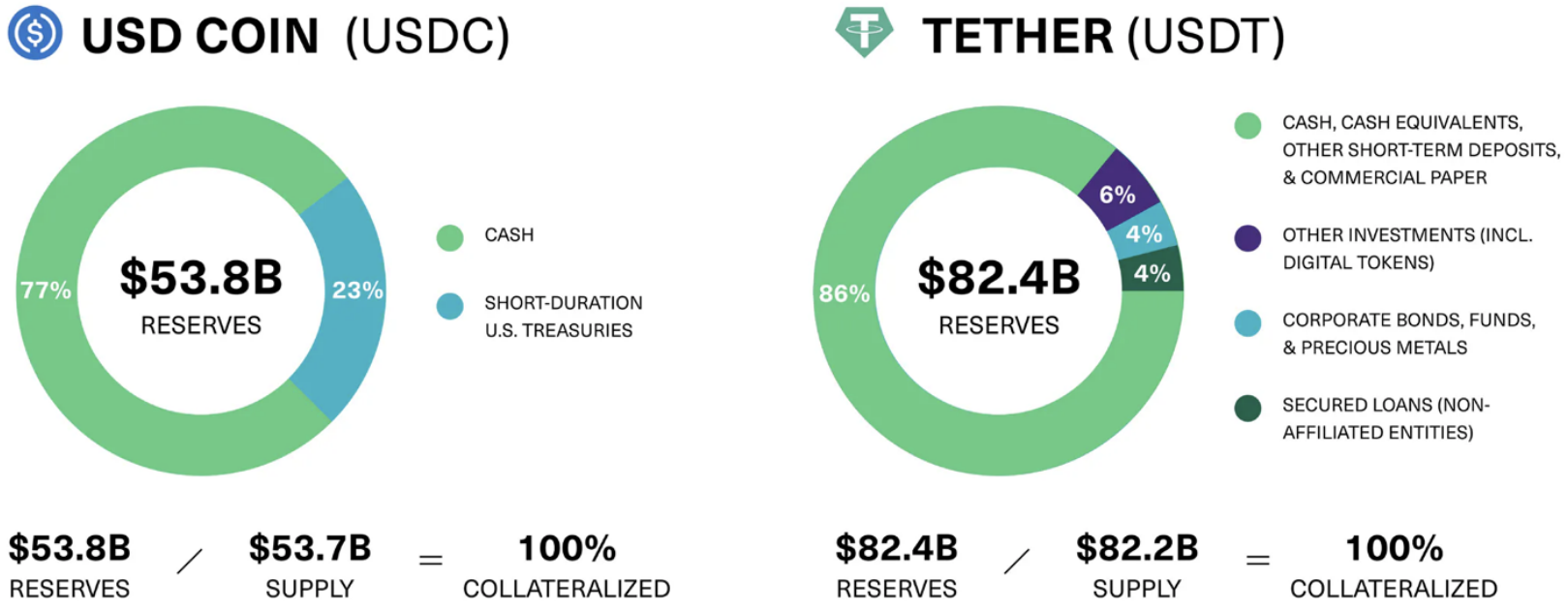

Figure: Reserves Held by the Issuers. USD Coin (USDC) data from Circle (`https://www.circle.com/en/usdc`) as of June 5, 2022. Tether (USDT) data from Tether (`https://tether.to/en/transparency`) as of March 31, 2022.

Market size and growth

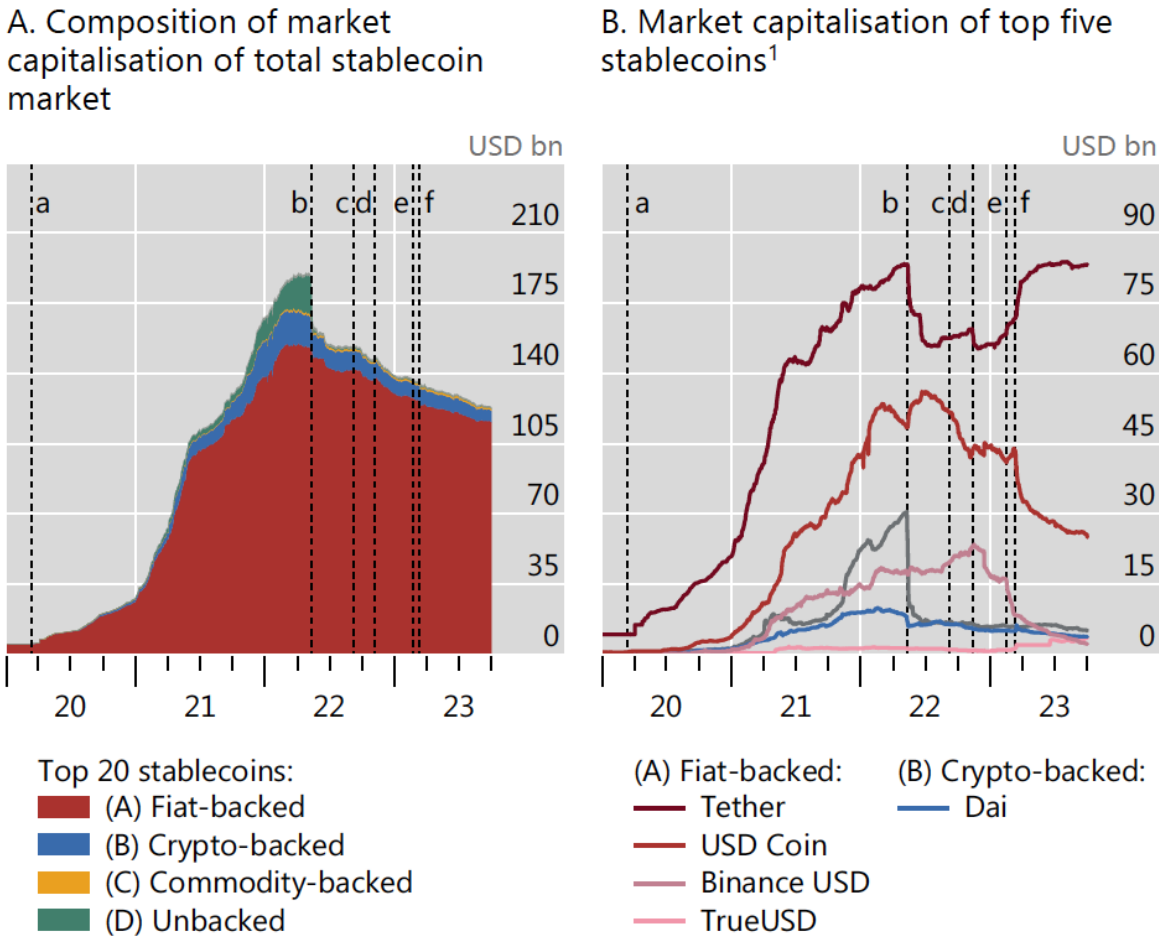

Figure: Stablecoin market developments as of 2023. Source: Kosse et al. (2023) "Will the real stablecoin please stand up?" [BIS Working Paper N.141].

Market size and growth

The market capitalization of stablecoins grew exponentially in a relatively short period.

↪ The market is dominated by fiat-backed stablecoins.

↪ Within the fiat-backed sector, the market is dominated by USDC and USDT, i.e., a highly concentrated market.

Stablecoin growth stopped after major crashes, such as Terra's uncollateralised stable coin (TerraUSD).

↪ TerraUSD was an uncollateralised stablecoin that did not claim to be backed by reserves but sought to peg through, for instance, algorithms or protocols.

↪ TerraUSD's collapse was caused by its inability to redeem users' holdings at par. The collateral lost all of its value.

Market concentration

The stablecoin market has become progressively less concentrated since early 2020. This decline ended in June 2022, as the collapse of the TerraUSD marked the start of a steady increase in concentration.

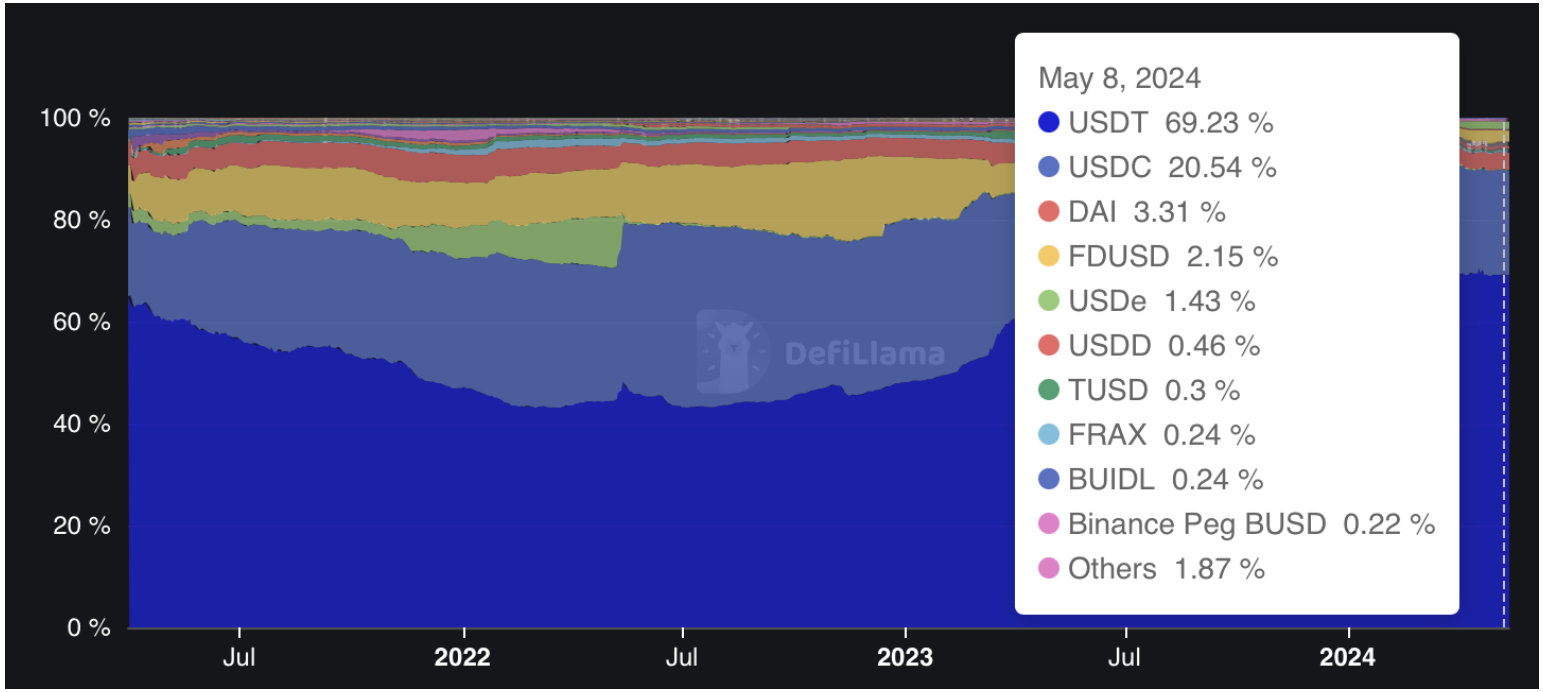

Figure: Market dominance of different stablecoins. Source" `https://defillama.com`.

Stabilisation mechanisms

Stabilization mechanisms in stablecoins

As the name suggests, stablecoins attempt to provide a stable value relative to other crypto assets by pegging their value to a real-world asset, known as the reference asset, such as the US dollar.

This is done through a stablecoin's "stabilization mechanism". Two types of mechanism:

- ↪ Off-chain stabilization based on bank deposits or other cash-like assets traded in the traditional financial system. The collateral assets require a custodian to keep them safe until the user redeems the stablecoins.
- ↪ On-chain stabilization is based on tokens on a blockchain so that the collateral can be held in smart contracts.

Off-chain stabilisation

The stabilization mechanism for off-chain collateralized stablecoins works through arbitrage.

Any difference between the market price and the 1:1 redemption guarantee by the issuer offers a profit opportunity to current or potential holders.

- ↪ If the market price is above 1:1, potential holders can profit by converting USD to stablecoins with the issuer, then selling the stablecoins for USD on the secondary market and ending up with more USD than they started with.
- ↪ If the market price is below 1:1, holders can profit by redeeming their current holdings at the issuer and taking the proceeds to the market to buy more stablecoin than they had originally.

In either case, the actions of stablecoin holders to take advantage of the arbitrage opportunity work to drive the market price toward 1:1.

Off-chain stabilisation

However, this arbitrage mechanism breaks down when the market loses faith in its ability to maintain the peg.

↪ Expecting the stablecoin to lose value, stablecoin holders have the incentive to request redemption of their stablecoins in an attempt to recover the collateral.

The incentives of stablecoin holders are similar to those of depositors who withdraw their money from an uninsured bank if they suspect it might fail.

↪ Once redemptions are underway, the value of the collateral assets might decrease further if such assets are sold to be converted into currency in a fire sale.

↪ This mechanism would amplify the run and potentially increase its speed as stablecoin holders have an incentive to front-run each other.

Off-chain stabilisation

A wide range of events might trigger a loss of confidence in the stablecoin's ability to maintain the peg.

- ↪ A drop in the price of the collateral assets or a lack of trust in the custodian of those assets could trigger a run.
- ↪ The trigger for a run can be merely a sudden lack of confidence in the stablecoin, which could be self-fulfilling and might result from a speculative or short sellers' attack on the stablecoin.

It is worth emphasizing that the risk of a run driven purely by a change in market sentiment can be mitigated when the collateral asset is the same as the peg. For example, a dollar of stablecoin is fully backed by a reserve.

Off-chain stabilisation

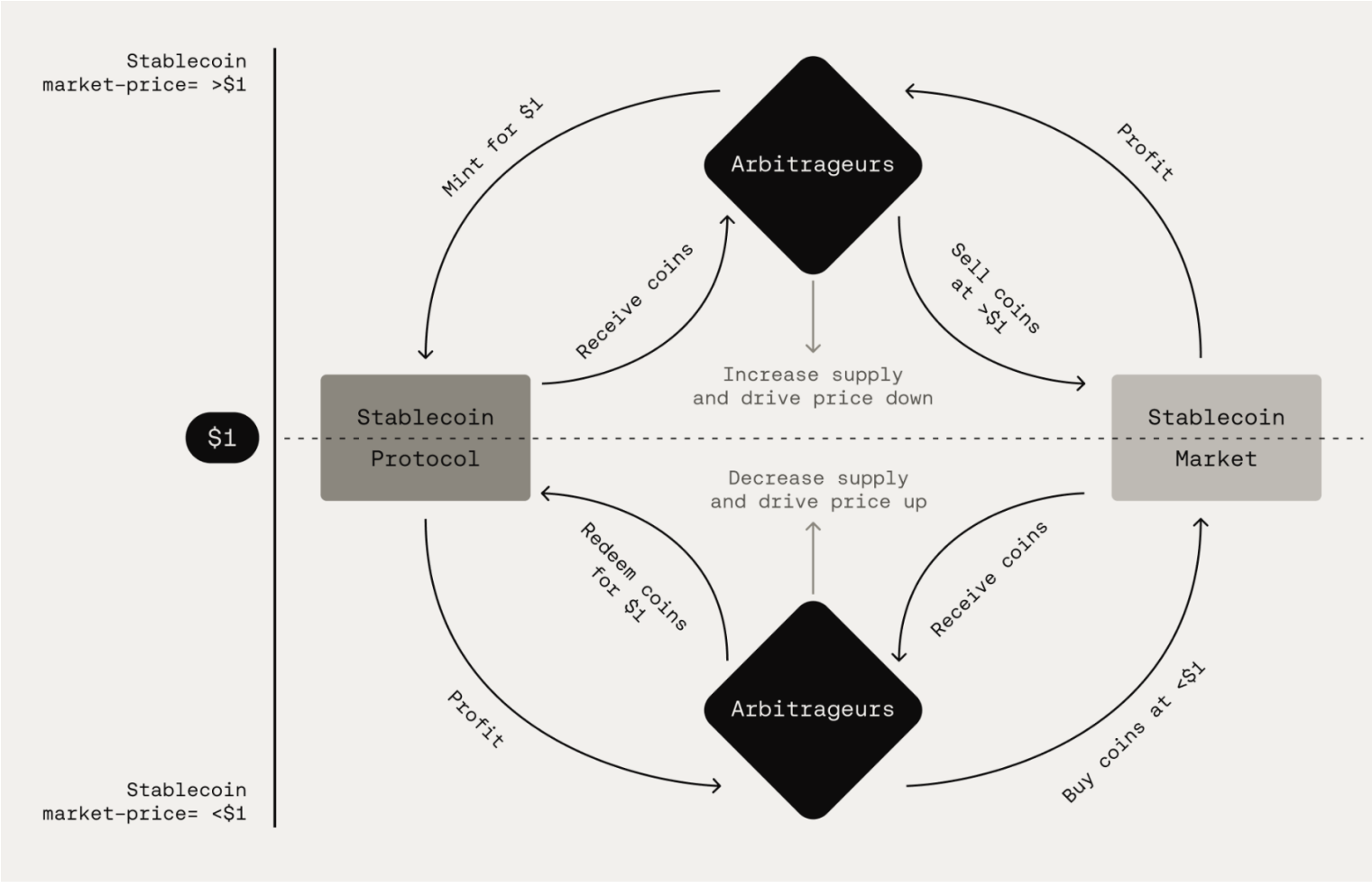

Figure: A sketch of off-chain stabilisation based on arbitrage. Source: `hiro.so`.

On-chain stabilisation

The stabilization mechanism for on-chain collateralized stablecoins relies on the holder's ability to redeem the stablecoins for the collateral assets on demand.

At the time of writing, most traditional financial assets are not tokenized. As a result, all on-chain stablecoins are largely collateralized by crypto assets or other stablecoins.

Due to the high volatility of such assets, on-chain stablecoins are typically over-collateralized, and their stabilisation mechanisms rely on continuous valuation of the collateral.

↪ Stablecoin protocols typically contain provisions for the re-valuation of collateral to ensure that the ratio of the market value of collateral to issued stablecoin is always greater than a given collateralization ratio set by the stablecoin issuer.

On-chain stabilisation

If the value of the collateral drops below the given threshold, the protocol demands that the users either provide additional collateral or reduce the amount of stablecoins held to meet the minimum requirement.

↪ The protocol relies on smart contracts and the economic incentives of users to guarantee that all circulating stablecoins are collateralized.

The stabilization mechanisms for on-chain collateralized stablecoins rely on market participants' beliefs in the stablecoins' long-run pegs, as do the ones for off-chain collateralized stablecoins.

However, on-chain collateralized stablecoin introduces an additional weakness, as the collateral is another cryptocurrency whose value can fluctuate significantly relative to the USD.

↪ On-chain collateralized stablecoins might experience more frequent and pronounced runs.

Uncollateralised stablecoins

Uncollateralized (or algorithmic) stablecoins aim to maintain pegging by dynamically matching the stablecoin supply with user demand.

↪ In contrast with collateralized stablecoins, few or no assets are held in reserve to support the stablecoin's exchange rate.

Suppose, for example, that the peg to the USD is 1:1. Similar to expansion and contraction of the money supply for central banks:

↪ If the price of the coin goes above \$1, new coins are issued to devalue each existing token.

↪ If the price of the coin goes below \$1, coins are removed from circulation to increase the value of each token.

However, while increasing the supply can be implemented by simply distributing new coins, decreasing the supply can be more challenging.

Uncollateralised stablecoins

Algorithmic stablecoins can be divided into two subgroups according to the stabilization mechanism they adopt: the *rebase* model and the *coupon* model.

- ↪ The *rebase* model operates by automatically adjusting the supply of stablecoins based on its prevailing market price, typically with a tolerance band above and below the peg.
- ↪ The *coupon* model operates by incentivising stablecoin owners to change their holdings deliberately. Incentive mechanisms are typically based on rewards, whose features differ according to the direction of deviation from the peg.

Terra Classic USD (UST) (formerly Terra USD) is an example of an algorithmic stablecoin adopting the coupon model.

Challenges and risks

Are stablecoins stable?

Collateralised stablecoins fulfil, at least partly, the commitment to be less volatile than traditional cryptocurrencies.

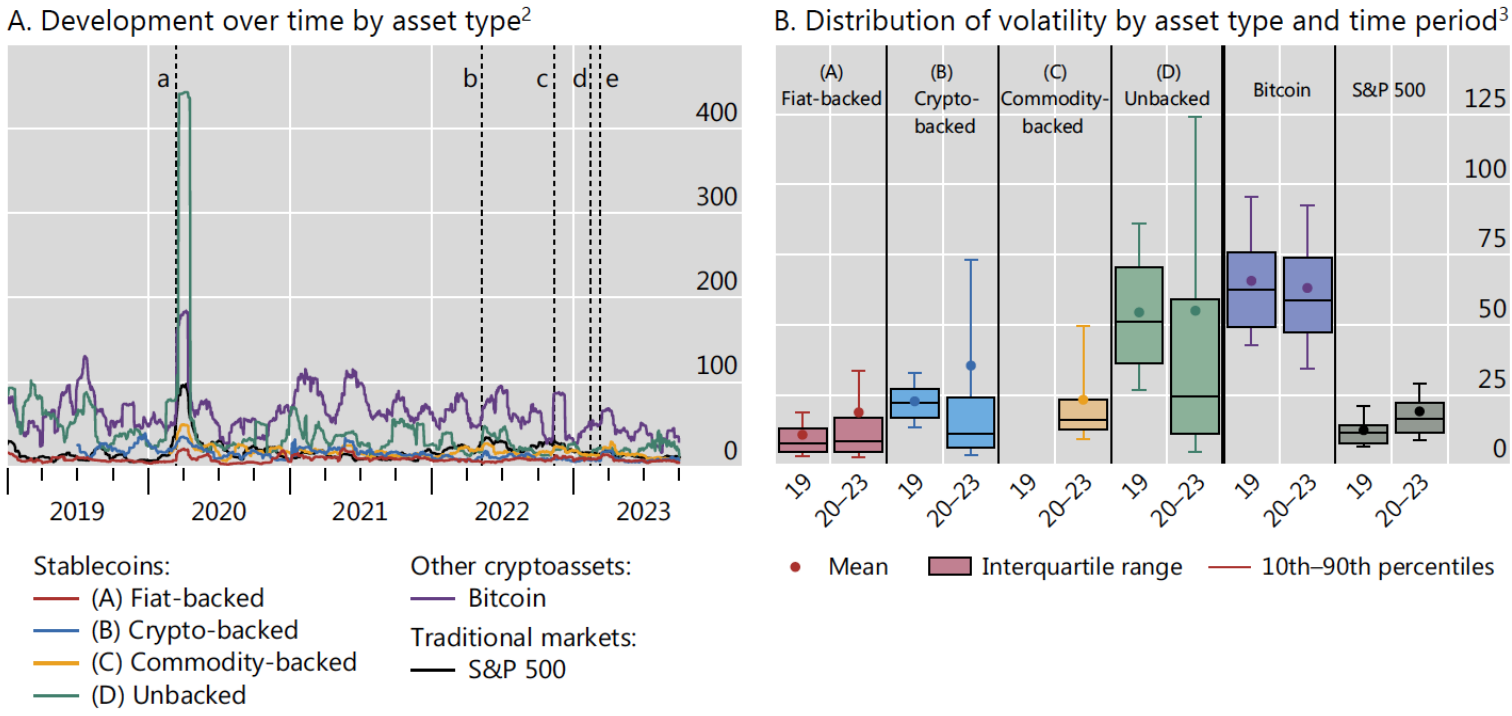

Figure: Closing price volatility of stablecoins. Source: Kosse et al. (2023) "Will the real stablecoin please stand up?" [BIS Working Paper N.141].

Are stablecoins stable?

Stablecoins with less stability of the peg are generally newer and smaller.

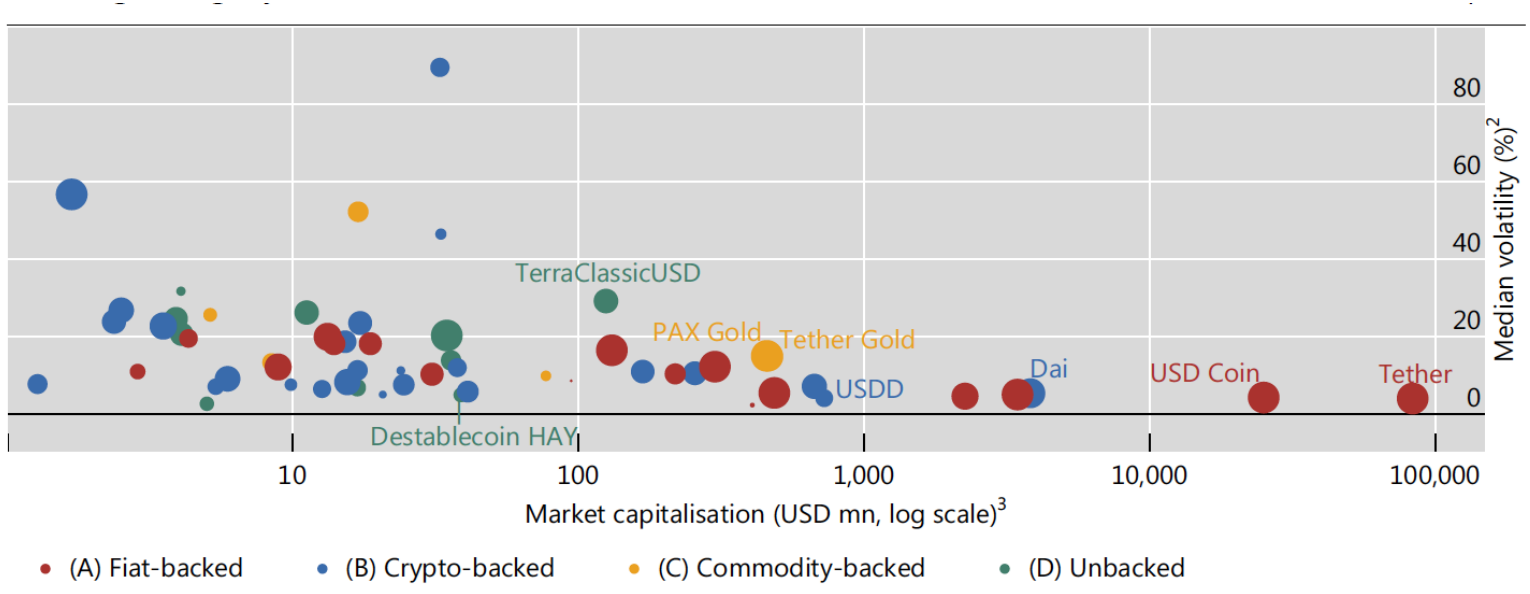

Figure: Stablecoins volatility to market capitalisation and number of active days. Source: Kosse et al. (2023) "Will the real stablecoin please stand up?" [BIS Working Paper N.141].

Are stablecoins stable?

Peg stability differs across stablecoins, even within the same collateralisation category. Not all stablecoins are equally stable.

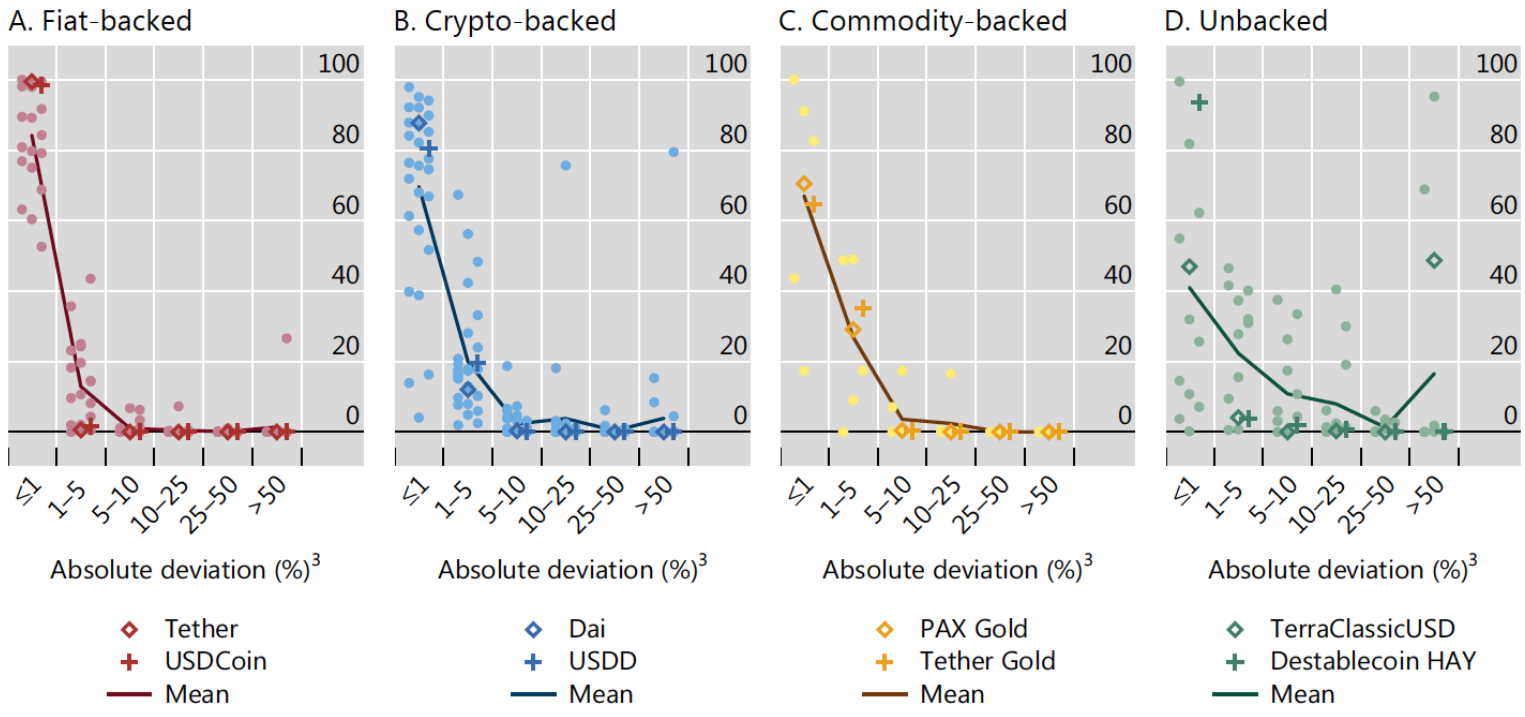

Figure: Frequency of deviations from the peg by intensity and stablecoins type. Source: Kosse et al. (2023) "Will the real stablecoin please stand up?" [BIS Working Paper N.141].

Risks for financial stability

As the introduction of stablecoins approaches its tenth anniversary, one thing is certain: a stablecoin that never breaks its peg has yet to emerge.

The evidence suggests that, to date, no stablecoin has been able to assure full price stability.

↪ This applies to all types of stablecoin, irrespective of their size or type of reserve assets.

More importantly, there is a lack of transparency on the issuers having assets required to redeem the coins at all times.

↪ This may undermine trust in stablecoins' credibility and ability to maintain their peg.

Risks for financial stability

While stablecoins are by nature less susceptible to speculative bubbles of the type that Bitcoin and other cryptocurrencies have experienced, their market capitalisation may nonetheless rise and fall rapidly with purchases and redemptions by investors.

Without additional private or public backstops, stablecoins can be subject to severe price discounts or self-fulfilling runs, especially when backed by risky or opaque assets and in market turmoil.

If stablecoins are to gain significant usage, runs on stablecoins could provoke fire sales of the assets used to back their value.

$\hookrightarrow$ This could have negative spillovers on the rest of the financial system.

Regulatory challenges

Appropriate regulation and supervision are essential to prevent stablecoins from compromising financial stability and the financial system more broadly.

The Bank for International Settlements' Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) have been engaged in standard-setting work to regulate, supervise, and oversee stablecoin arrangements.

↪ July 2022 their guidance on how to apply the CPMI-IOSCO Principles for financial market infrastructures (PFMI) to systemically important stablecoin arrangements.

↪ July 2023, the Financial Stability Board (FSB) published revised high-level recommendations on the regulation, supervision and oversight of "global stablecoin" arrangements.

Regulatory challenges

However, to address the challenges related to stablecoins, regulation alone may not be sufficient to mitigate the impact of stablecoins on financial systems.

Policymakers and commentators argue that improvements in existing payment infrastructures and exploration or the development of central bank digital currency (CBDC) may help to offer the legitimate benefits in payments and financial services that the public seeks.

↪ For example, if demand for cheaper cross-border payments mainly drives the use of stablecoins, similar benefits may be offered by interlinking today's fast payment systems.

Further analytical work on the market structure of stablecoins, their stabilisation mechanisms and the critical drivers for their adoption will provide a basis for robust policy work.

Central Bank Digital Currencies (CBDC)

Central bank digital currencies (CBDC)

If widely used for payments, crypto-assets, including stablecoins, may threaten financial stability.

International policymaking institutions published updated or new guidance and standards for stablecoins or crypto activities, and markets to strengthen and coordinate regulatory approaches to contain their risks to the financial system.

Most central banks said that the emergence of stablecoins and other crypto-assets had accelerated their work on CBDCs.[a]

↪ CBDC work is often driven more by financial stability and payment efficiency.

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[a] See Kosse and Mattei (2023) "Making headway – Results of the 2022 BIS survey on central bank digital currencies and crypto" [BIS WP No. 135].

Central bank digital currencies (CBDC)

If stablecoins are used for reasons of programmability and instant settlement, then Central Bank Digital Currencies (CBDCs) could satisfy this demand while offering the safety of central bank money.

A CBDC is a digital payment instrument denominated in the national unit of account, which is a direct liability of the central bank.

Unlike cryptocurrencies such as Bitcoin or Ethereum, which are decentralized and not controlled by any single entity, a CBDC is backed by the full faith and credit of the issuing government.

Central bank digital currencies (CBDC)

Key characteristics of a CBDC include:

(i) **Official Currency Status**: The government recognises it as a legal tender and can be used for all types of transactions.

(ii) **Digital Nature**: Unlike physical cash, a CBDC exists only in electronic form, which can facilitate more efficient transactions.

(iii) **Central Bank Issuance and Regulation**: The central bank is responsible for issuing, regulating, and maintaining the supply of the CBDC, ensuring stability and trust.

(iv) **Programmability**: CBDCs can be programmed for specific uses or conditions, enabling new financial services and products.

The introduction of a CBDC aims to modernize the financial system, enhance payment efficiency, improve financial inclusion, and provide a stable alternative to private digital currencies.

Retail vs wholesale CBDC

If the CBDC is intended for use by households and firms for everyday transactions, it is referred to as a **retail** CBDC.

A retail CBDC differs from existing forms of cashless payment instruments (i.e., credit transfers, direct debits, card payments and e-money), as it represents a direct claim on a central bank rather than the liability of a private financial institution.

$\hookrightarrow$ CBDCs are a direct liability of the central bank, offering the same level of trust and security as physical cash.

A retail CBDC should be available to all citizens and residents and have legal tender, which means it is recognized by the government as an official means of payment.

Retail vs wholesale CBDC

Examples of retail CBDCs:

The Sand Dollar (Bahamas): Launched in October 2020, the Sand Dollar is the first fully operational retail CBDC. It aims to improve financial inclusion and payment efficiency across the archipelago, where many islands have limited banking infrastructure.

eNaira (Nigeria): Introduced in October 2021, the eNaira is designed to enhance financial inclusion, reduce the cost of transactions, and improve the efficiency of payments in Nigeria.

Digital Yuan (China): Currently in various stages of pilot testing across multiple cities and aims to modernize the payment system, enhance financial inclusion, and reduce reliance on physical cash.

e-Krona (Sweden): The e-Krona aims to ensure that the general public continues to have access to a state-guaranteed means of payment given the declining use of cash in Sweden.

Retail vs wholesale CBDC

A **wholesale** CBDC targets a different group of end users.

↪ Only accessible to financial institutions, such as banks and other entities holding central bank accounts.

Wholesale CBDCs streamline interbank settlements, reducing the time and cost associated with large-value transactions.

↪ They would serve a similar role as today's reserves or settlement balances held at central banks.

It also allows central bank institutions to access new functionalities enabled by tokenisation, such as composability and programmability.

Retail vs wholesale CBDC

Examples of wholesale CBDC:

Project Jasper (Canada): A collaboration between the BoC and several financial institutions, Project Jasper explores the use of a wholesale CBDC to improve the efficiency of interbank payments.

Project Ubin (Singapore): Led by the Monetary Authority of Singapore (MAS), Project Ubin is a multi-phase initiative to explore the use of distributed ledger technology (DLT) for clearing and settlement of payments and securities.

Project Stella (ECB and Bank of Japan): A joint research project exploring the potential of DLT for improving the efficiency and safety of financial market infrastructure.

Project Helvetia (Switzerland): A collaboration between the Swiss National Bank, the BIS, and SIX Group, Project Helvetia explores the integration of tokenized assets and wholesale CBDCs into existing financial market infrastructures.

The state of development in CBDCs

The state of development in CBDCs

CBDC experiments and pilots are well underway.

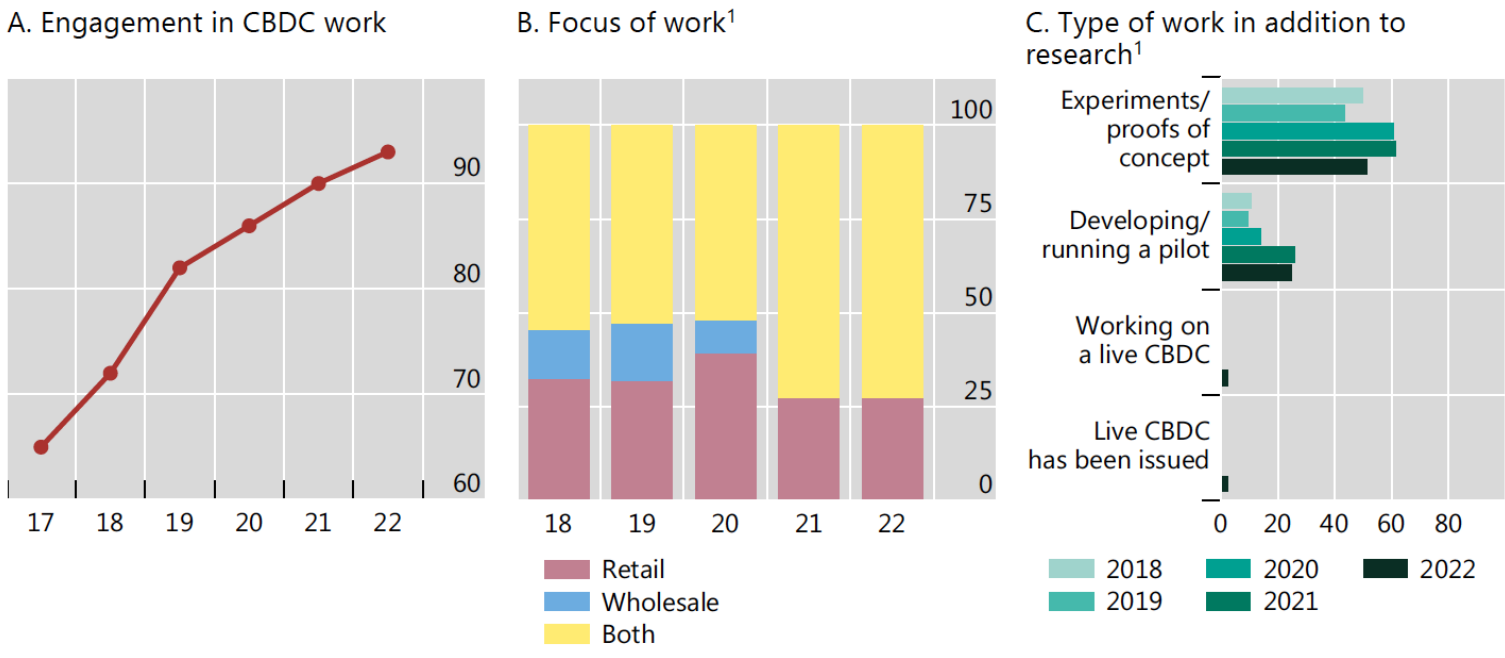

Figure: Share of respondents conducting work on CBDCs. Sources: BIS central bank surveys on CBDCs and crypto, 2017–22.

The state of development in CBDCs

Motivations tend to differ between advanced and emerging economies.

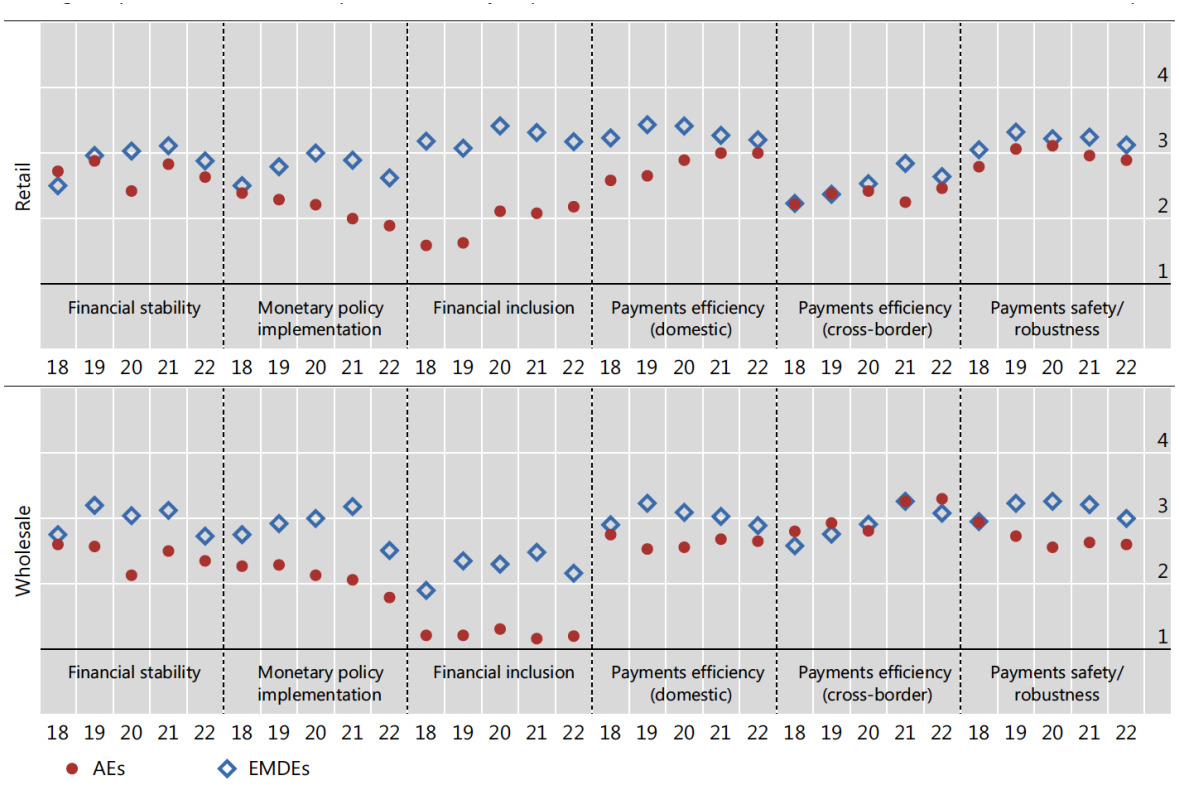

Figure: Motivations for issuing retail and wholesale CBDC between Advanced Economies (AE) and Emerging Economies (EMDE). Average importance, 1 (not so important)–4 (very important) Sources: BIS central bank surveys on CBDCs and crypto, 2017–22.

The state of development in CBDCs

More live CBDCs to be expected in the foreseeable future.

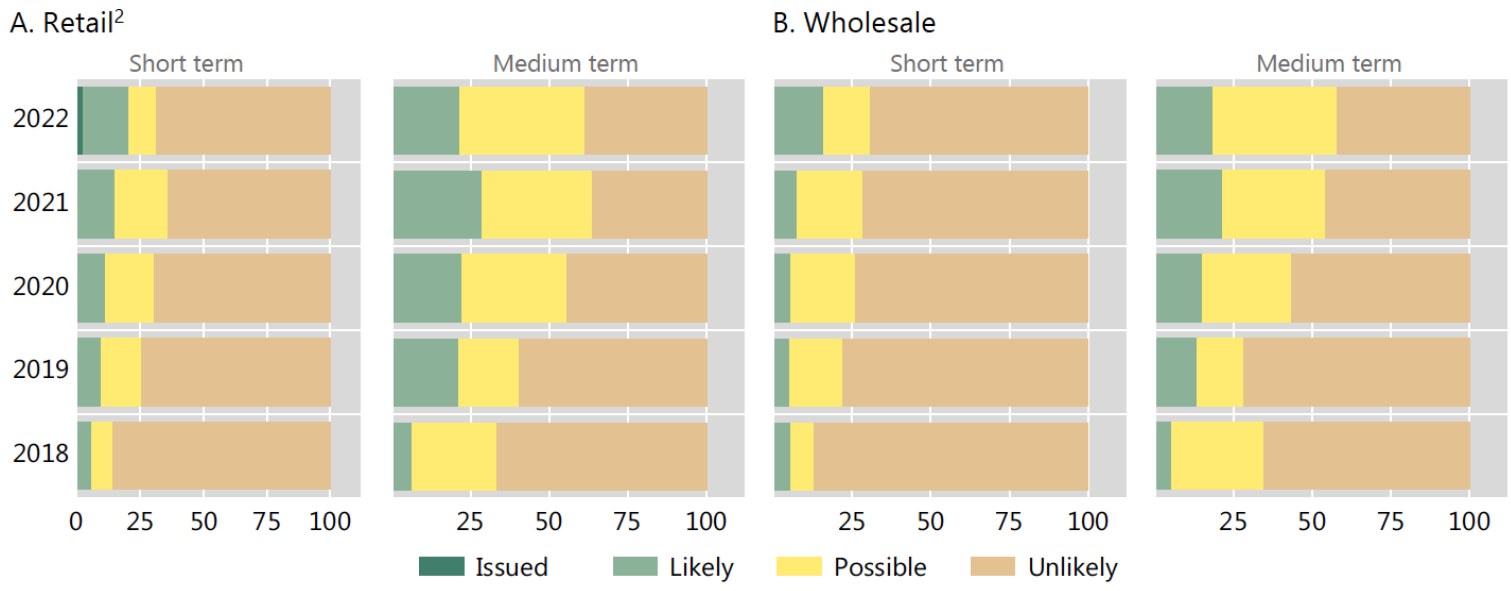

Figure: Likelihood of issuing a CBDC in the foreseeable future (% of respondents). Short term: 1–3 years; Medium term: 1–6 years. "Likely" combines "very likely" and "somewhat likely". "Unlikely" combines "very unlikely" and "somewhat unlikely". Sources: BIS central bank surveys on CBDCs and crypto, 2017–22.

The state of development in CBDCs

Uncertainty about the legal basis for issuing a CBDC.

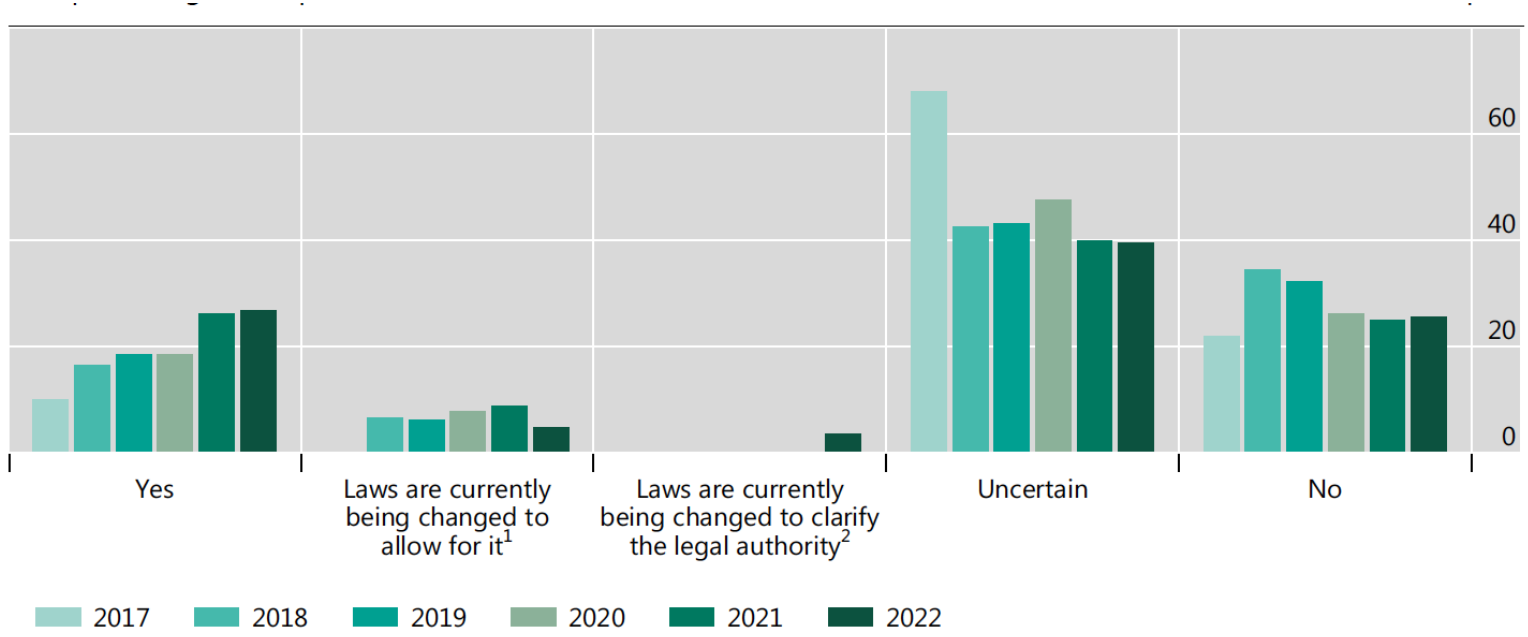

Figure: Legal authority of a central bank issuing a CBDC (% of respondents). Sources: BIS central bank surveys on CBDCs and crypto, 2017–22.

What did we learn?

Stablecoins are a subcategory of cryptocurrencies that aim to maintain a stable value relative to a specified peg.

↪ This could be an individual asset (a fiat currency or a commodity) or a pool of assets.

Stablecoins intend to offer a solution to cryptocurrencies price volatility to make blockchain-based payment systems more attractive.

Collateralisation, i.e., stabilisation mechanisms, and widespread adoption raise risks for financial stability.

↪ If stablecoins are used for payments and settlements, then Central Bank Digital Currencies (CBDC) could satisfy this deman while offering the safety of central bank money.

There is an active interest among major central banks in implementing CBDCs in the foreseeable future.