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# Can Crypto-Assets Play a Role in Foreign Reserve Portfolios? Not Today, and Likely Not in the Near Future

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Prepared jointly by the Finance, Competitiveness and Innovation Global Practice and the World Bank Treasury

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# Introduction

Notwithstanding the substantial volatility experienced by crypto-assets and several high-profile failures, the market capitalization and liquidity of crypto-assets has increased significantly in recent years as many new players have entered the market and new exchanges, instruments, and service providers have continued to mature. Citing crypto-assets' growing market capitalization and footprint and evolving market structure, institutional investors, including central banks, have been exploring exposures to crypto-assets and reviewing whether including these instruments in their portfolios is reasonable. Some institutions, typically those with a long investment horizon and higher risk tolerance, have started to invest in the crypto-asset space, but investment by this group accounts for only 5 percent of the total issued Bitcoin supply (Bridgewater 2022), and individual allocations are in the low-single digits of these institutions' total assets.

We discuss the potential role of crypto-assets in central bank reserve portfolios and argue that these instruments do not at present meet the eligibility criteria for inclusion. Crypto-assets are currently incompatible with the traditional objectives of safety, liquidity, and return; their value can be highly volatile, undermining their reliability as a store of value; and despite some guidance from policy makers and standard-setting bodies, they still face an uncertain regulatory environment. Considering the rapid evolution of the technological and regulatory landscape, however, a small chance exists that in the future crypto-assets could be included as an eligible central bank investment instrument, and we discuss what would be required before that could happen. (We will not cover central bank digital currencies (CBDCs), as they are very distinct from crypto-assets. For more on CBDCs, see Box 1.)

While terminology differs across regulatory authorities and standard-setting bodies, crypto-assets can be broadly defined as private digital representations of value that can be used for payment or investment purposes or to access a good or service and that rely on distributed ledger or similar technology (see Financial Stability Board 2018a; Financial Action Task Force 2021; and Basel Committee on Banking Supervision 2021).<sup>2</sup> Crypto-assets typically operate on open, decentralized computer networks. Some decentralized networks aim to maintain an immutable distributed ledger that enables users to store funds with global reach and relatively fast settlement in a purely peer-to-peer fashion without the need for intermediaries (i.e., “permissionless” operation) or the potential for third-party interference (i.e., providing “censorship resistance”).<sup>3</sup>

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2. The definition of crypto-assets typically excludes e-money, central bank digital currencies (CBDCs), and digital representations of traditional financial instruments.  
3. The open-source software protocols enforced by these decentralized networks allow for consensus formation about the “state of the world” in low-trust environments without requiring a trusted third party and seek to imbue crypto-assets with certain characteristics such as scarcity, verifiability, and, more broadly, programmability (e.g., Nakamoto (2008) and Buterin (2013)). The benefits of decentralization come at a cost, typically by posing tradeoffs with throughput capacity and/or security. See Feyen, Kawashima, and Mittal (2022) for further details.

As outlined by the Financial Stability Board (2022a), crypto-assets can be broadly divided into three main categories: (i) unbacked crypto-assets, which do not constitute a claim on any party (e.g., Bitcoin); (ii) stablecoins, which aim to maintain a stable value relative to a specified asset, most often the US dollar and usually through collateralization (e.g., USDC); and (iii) decentralized finance (DeFi), an experimental ecosystem built on top of distributed ledger or similar technology and consisting of projects or decentralized apps (dapps) that aim to provide a range of interoperable financial services (e.g., exchange, asset management, and lending). Dapps often issue their own crypto-asset, and in practice many suffer from the “illusion of decentralization,” since the need for governance makes some degree of centralization necessary (Bank for International Settlements 2021). (See the Appendix for a more detailed description of the main types of crypto-assets.)

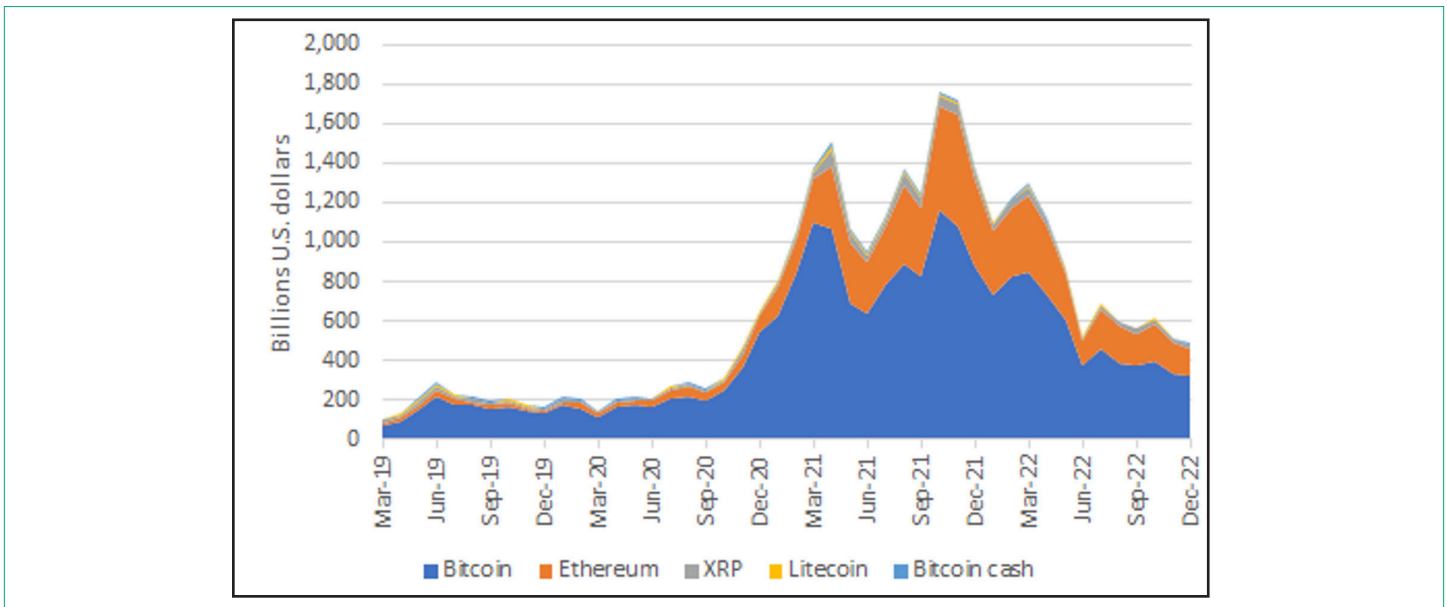
Since Bitcoin’s genesis in 2009, crypto-assets have gained momentum and captured media attention, notably after prices rose dramatically in 2013 and 2017. The combined market value of crypto-assets grew significantly in the past few years

(Figure 1). It reached an all-time high of almost \$2 trillion in 2021, after which market capitalization dropped precipitously to around \$1 trillion in the second quarter of 2022. The fall in market capitalization coincided with a tightening of global monetary and financial conditions, but it was also driven by sector-specific adverse developments such as the failure of TerraLuna, a large stablecoin project, and the demise of several crypto-asset services and investment firms, notably FTX, that came under pressure due to, inter alia, large price drawdowns and financial interlinkages and, in the case of FTX, allegations of fraud and material weaknesses in governance, risk management, and other corporate controls.<sup>4</sup>

Given the open nature of distributed ledger technology, anyone can create a crypto-asset. As a result, worldwide over 10,000 crypto-assets are available for trading today, although the overwhelming majority are small, illiquid, and have doubtful economic use cases and valuations. Bitcoin tops the ranking by far in terms of market capitalization, followed by Ether, the native crypto-asset of “smart contract” platform Ethereum.



**Figure 1. Market Capitalization of the Top Five Crypto-Assets**



Source: Bloomberg.  
 Note: Latest data as of December 2022.

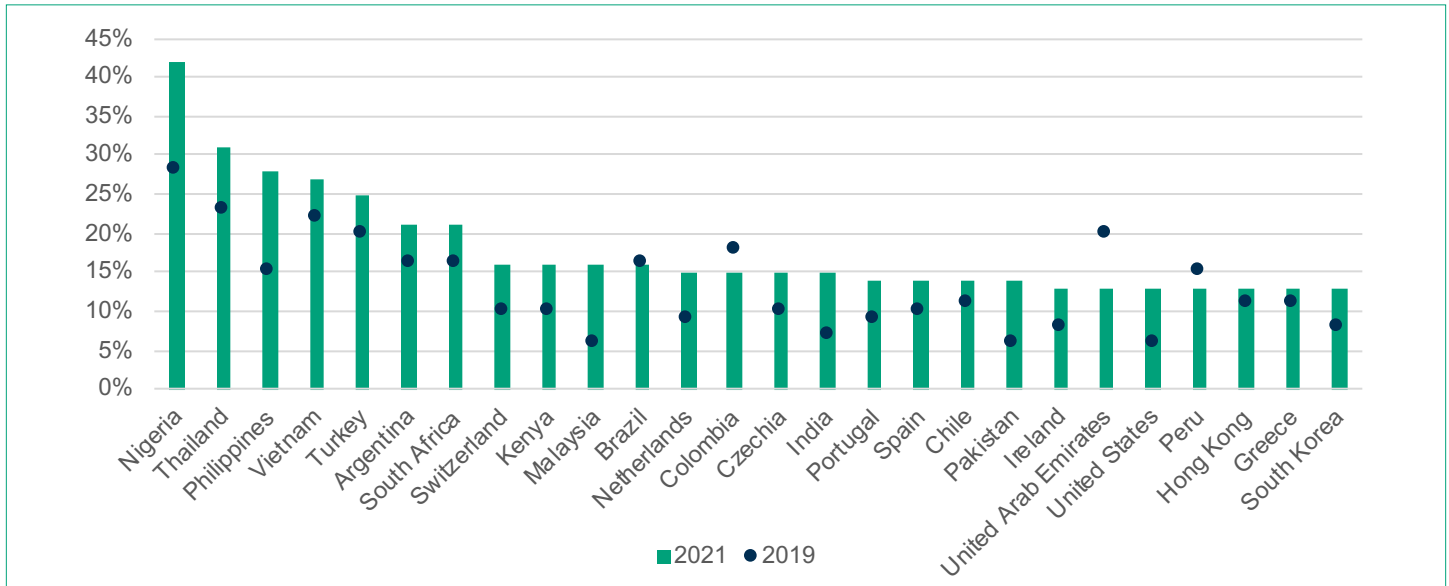
4. See for example the testimony of Mr. John J. Ray III, CEO of FTX Debtors (2022), <https://docs.house.gov/meetings/BA/BA00/20221213/115246/HHRG-117-BA00-Wstate-RayJ-20221213.pdf>.

Crypto-asset activity has witnessed significant growth in recent years, particularly among retail investors in emerging market and developing economies (Figure 2). According to a Statista survey held in over 50 countries for the years 2019 and 2021, the average share of respondents using or owning crypto-assets rose on average by 3 percentage points to 14

percent. At the same time, adoption by long-term investors such as pension funds and endowments remains very low; and although high net-worth individuals and family offices have created exposure to this type of asset (Figure 3), their overall allocation to crypto-assets as a percent of capital tends to be very small.



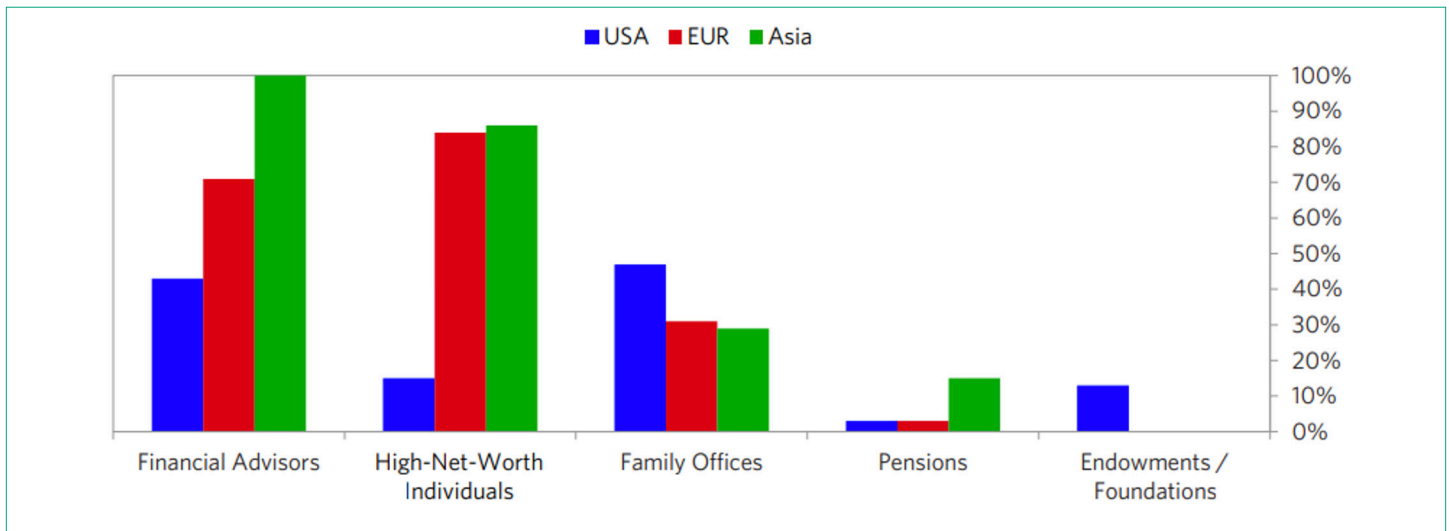
**Figure 2. Share of Respondents Indicating They Either Owned or Used Crypto-Assets**



Source: Statista.



**Figure 3. Adoption of Crypto-Assets by Type of Investor**



Source: Fidelity International Digital Asset Survey (2022).



This paper is organized into two substantive sections, followed by a conclusion. The first main section assesses the suitability of crypto-assets for central bank reserve managers' purposes. In this context, we review the objectives of reserve management and discuss the currency composition and characteristics of crypto-assets versus those of gold, a long-term reserve asset. The second substantive section analyzes the fundamental changes required if crypto-assets are to become eligible instruments for reserve portfolios. Among the

necessary changes discussed are the need for significantly enhanced liquidity and decline in the volatility in crypto-assets' valuation; reduced specific operational risk for the instrument; crypto-assets' adoption as globally accepted medium of exchange and store of value; abatement of concerns about crypto-assets' potential adverse impact on financial stability; and clarification of the still uncertain regulatory treatment of crypto-assets. The conclusion summarizes our findings from this analysis.

### **BOX 1: FUNDAMENTAL DIFFERENCES BETWEEN CRYPTO-ASSETS AND CENTRAL BANK DIGITAL CURRENCIES**

While Bitcoin and similar block-chain-based cryptocurrencies, to some extent, inspired the concept of central bank digital currencies (CBDCs), the two currencies fundamentally differ. CBDCs are issued by and have a direct claim on a central bank; they are denominated in the national currency; and they are fully convertible to other forms of money. Depending on the objectives, a CBDC can be made accessible to all domestic users as a substitute for cash (retail CBDC) or to select financial institutions to help improve financial market efficiency (wholesale CBDC). Launched in October 2020, the Bahamas' sand dollar is a fully operational CBDC and is considered retail. Numerous countries and central banks have studied issuing their own CBDCs, and many have completed proofs of concept or pilots (Bank for International Settlements 2020). It is still early days for CBDCs, but it is safe to assume that reserve managers would adopt them quickly because they are backed by central banks and governments.

Adoption of CBDCs for reserve management could potentially improve operational efficiency—their main potential advantage—by improving the speed of transactions and reducing settlement windows. The current Swift infrastructure is secure, but it has room to improve in efficiency. Electronic transfers are not instantaneous: participants must send Swift messages to their banks, which may take some time, even days, to process the instructions. Similarly, trading in most securities takes a few days to settle. Blockchain technology, including distributed ledgers, offers a potential mechanism for speeding up those transactions and reducing operational costs. Central banks could leverage this technology to improve efficiency in financial markets.

Although reserve managers would welcome CBDCs as options, their added value would be minimal from a portfolio investment and diversification perspective. Central banks already invest in digital versions of fiat currencies by investing in commercial bank deposits. Since any CBDC would trade at parity with the existing fiat currency, investing in CBDCs would not bring any diversification benefit.<sup>5</sup>

5. Despite this, the possible impact of CBDCs on reserves management, and more generally on central banks' need to hold reserves in anticipation of future developments, continues to be discussed (see Dong et al).





# Central Bank Reserve Management and Crypto-Assets as an Investable Asset Class

The International Monetary Fund (IMF) defines reserve assets as “those external assets that are readily available to and controlled by monetary authorities for meeting the balance of payments financing needs, for intervention in exchange markets to affect the currency exchange rate” (IMF 2010). The IMF defines as reserve assets monetary gold, special drawing rights holdings, reserve position in the IMF, and currency, as well as deposits, securities (including debt and equity securities), financial derivatives, and other claims (loans and other financial instruments). Crypto-assets do not currently fit into these conditions, and it is difficult to assess if and when they will, given their low relevance as an internationally accepted medium of exchange and store of value.

## Suitability of Investing in Crypto-Assets Given the Objectives and Principles of Reserve Management

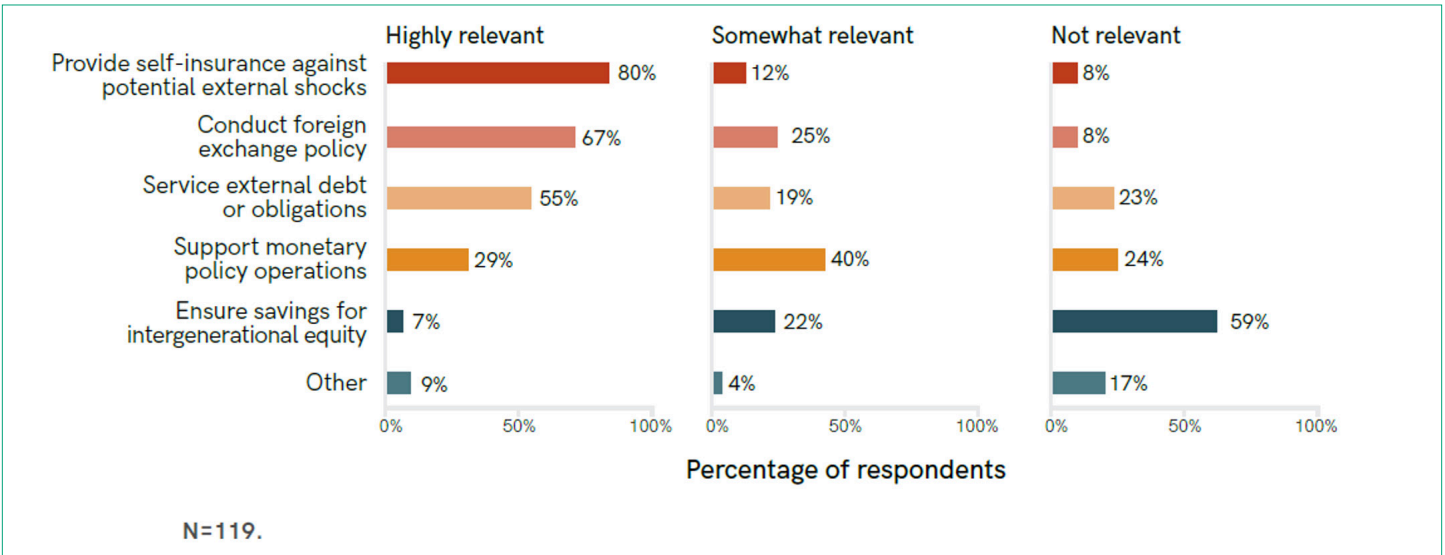
To assess the suitability of crypto-assets for reserve management purposes, we review the objectives and reserve management principles that drive reserve management activities. We also review the factors underlying the specific currency composition of reserves to analyze the circumstances under which crypto-assets could be included in reserves.

### RESERVE MANAGEMENT DIMENSIONS AND CRYPTO-ASSETS

**Reserve management objectives.** Figure 4 shows that central banks invest reserves to meet macroeconomic objectives such as providing self-insurance against external shocks, conducting foreign exchange policy, and servicing external debt or obligations. Achieving or maximizing long-term returns (“to ensure savings for intergenerational equity”) is less relevant for most central banks.



**Figure 4. Reserve Management Objectives**



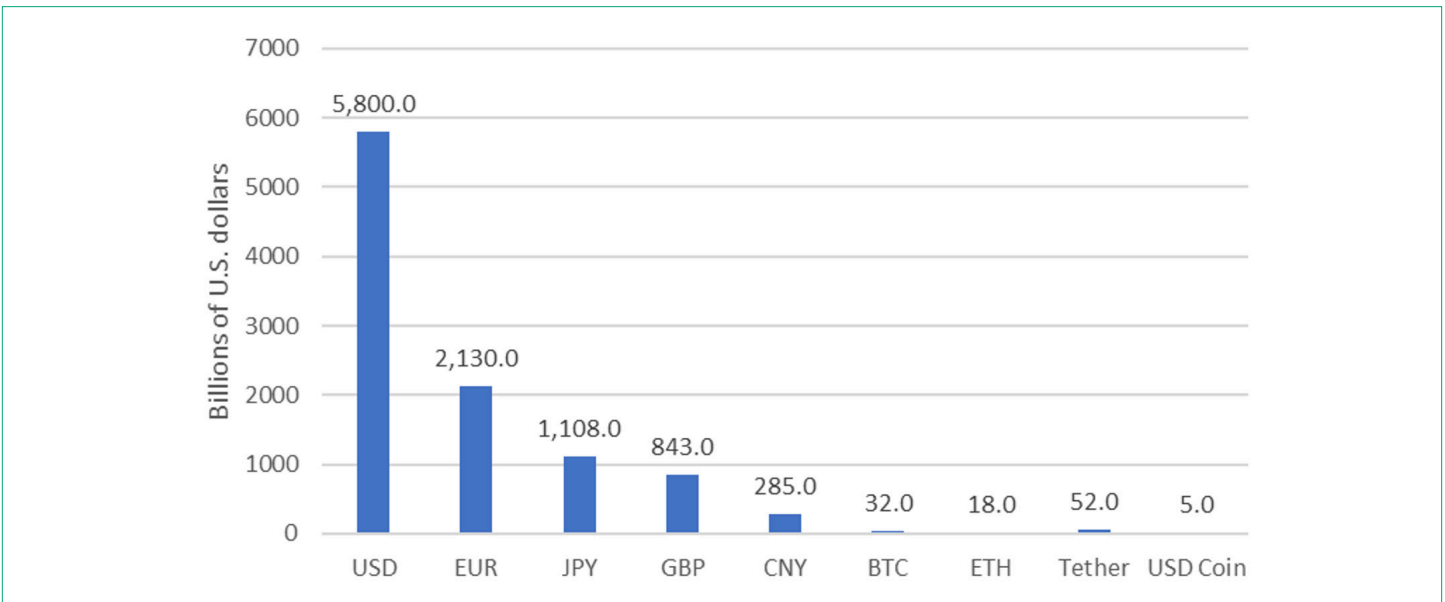
Source: Third RAMP survey on the Reserve Management Practices of Central Banks (2021).

Because reserve assets are held for self-insurance purposes, they must be highly liquid in the face of external shocks. Crypto-assets are not liquid enough to include in reserve portfolios. The daily trading volume of crypto-assets is extremely low compared to any of the currencies in the special drawing rights (SDR) basket (Figure 5).<sup>6</sup> The daily trading volume of

Bitcoin and Ethereum, currently the dominant crypto-assets, is a fraction of the daily trading volume of the foremost reserve currencies. Tether, the largest stablecoin, has a greater daily trading volume than Bitcoin and Ethereum, but it is well below that of any SDR currency.



**Figure 5. Daily Trading Volume of Major Crypto-Assets and Currencies in Special Drawing Rights Basket**



Source: BIS Triennial FX Survey (2019) and CoinMarketCap.  
 Note: BTC and ETH volume as of August 2022.

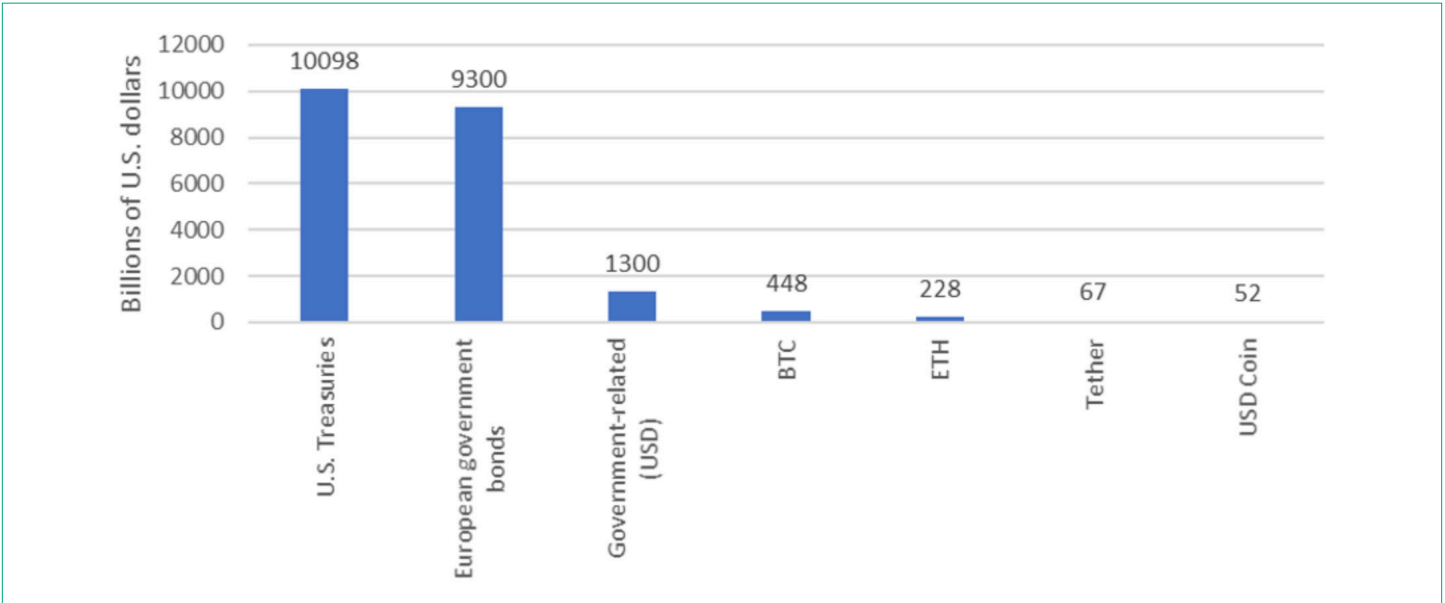
6. Yahoo Finance as of April 2022.

An asset's liquidity can also be gauged using the prism of trading costs. Crypto-assets are difficult and costly to trade. Permissionless blockchains work by providing monetary incentives to decentralized validators, which can lead to congestion and high fees (see Boissay et al. 2022 for further details).

Despite its impressive growth, the market capitalization of Bitcoin and Ethereum, which together account for 66 percent of crypto-assets' market capitalization, is much lower than that of traditional reserve assets (see Figure 6). The largest stablecoins, Tether and USD Coin, have even lower market capitalization.



**Figure 6. Market Capitalization of Major Crypto-Assets and Traditional Reserve Asset Classes**

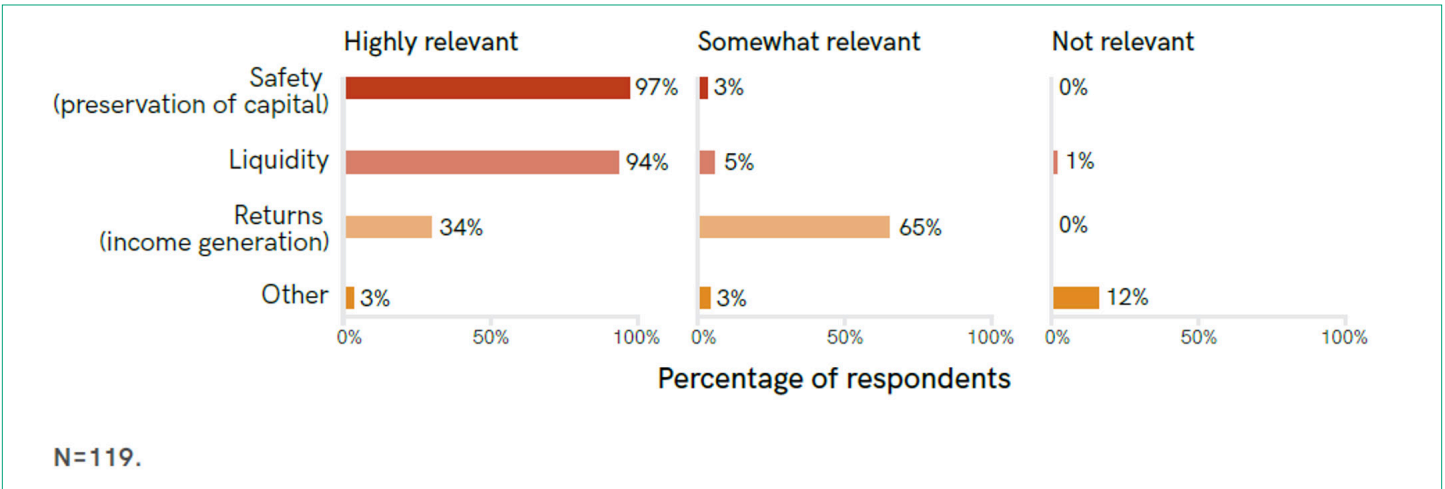


Source: Bloomberg indices and CoinMarketCap.  
 Note: Latest data as of August 2022.

**Reserve management principles.** According to the 2021 RAMP survey, safety is the most critical reserve management principle, followed closely by liquidity (Figure 7). Capital preservation is essential in reserve management activities to meet the objectives shown in Figure 4. Reserves, most needed during stress episodes, must retain value when inherently unpredictable shocks hit and markets' ability to price assets, including crypto-assets, may break down. Central banks have interpreted this principle as a mandate to invest in low-risk instruments, a universe encompassing instruments that have low volatility and high credit quality and that are easy to safeguard, including from cybersecurity risk.



Figure 7. Reserve Management Principles (2021)



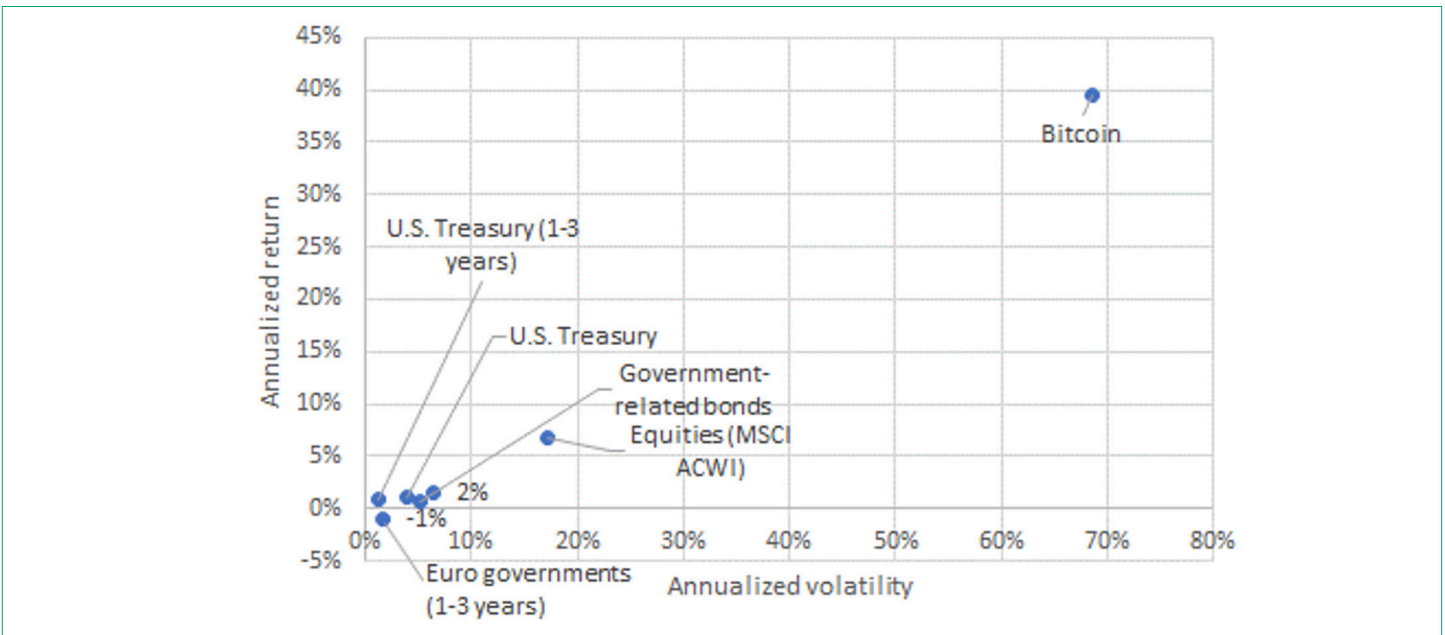
Source: Third RAMP survey on the Reserve Management Practices of Central Banks (2021).

Crypto-assets are inconsistent with the investment principle of safety, even from a portfolio concept perspective. The volatility of crypto-assets is too high and their valuations are uncertain, making them risky for central banks focused on capital preservation. The standard deviation of Bitcoin is much higher than that of any other asset class in which central banks invest (Figure 8). Between August 2020 and August

2022, Bitcoin experienced seven episodes of price decreases exceeding 20 percent; in three of these instances, its value dropped by more than 40 percent. This high level of volatility is undesirable for central banks that may need to provide their economies with foreign currency liquidity at any moment and thus crypto-assets cannot be considered safe from a reserve management perspective.<sup>7</sup>



Figure 8. Volatility of Bitcoin, Fixed Income, and Equities



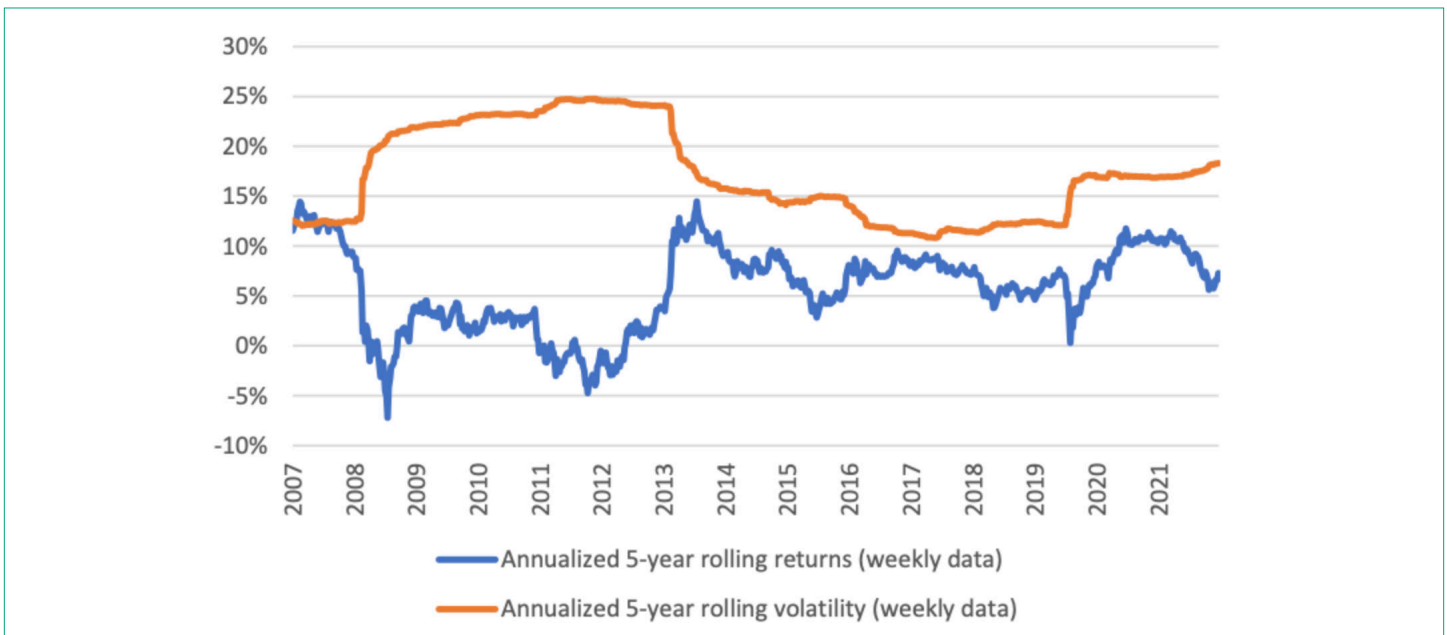
Source: Bloomberg.  
Note: Latest data as of January 2023.

Although some market participants suggest that reserve managers invest in crypto-assets to enhance investment return, the reality is that this is a secondary objective for most central bank reserve managers (see Figure 7). For instance, allocation to “riskier” asset classes, such as equity, that also require a longer investment horizon is low in many central bank reserve portfolios, accounting for only an average of 1.7 percent (see RAMP 2021). The low average allocation to equities illustrates that even broadly accepted asset classes

struggle as reserve assets if their volatility is high (see Figure 9). Additionally, contrary to equities, for example, the valuation of crypto-assets is uncertain in the absence of (expected) cash flows and limited utility, making it highly challenging to establish reasonable return expectations. It can be assumed, then, that central banks are unlikely to move into crypto-assets any time soon, given their even more volatile return streams (see Figures 1 and 8).



**Figure 9. Equity Returns and Volatility**



Source: Bloomberg.  
Note: Latest data as of August 2022.

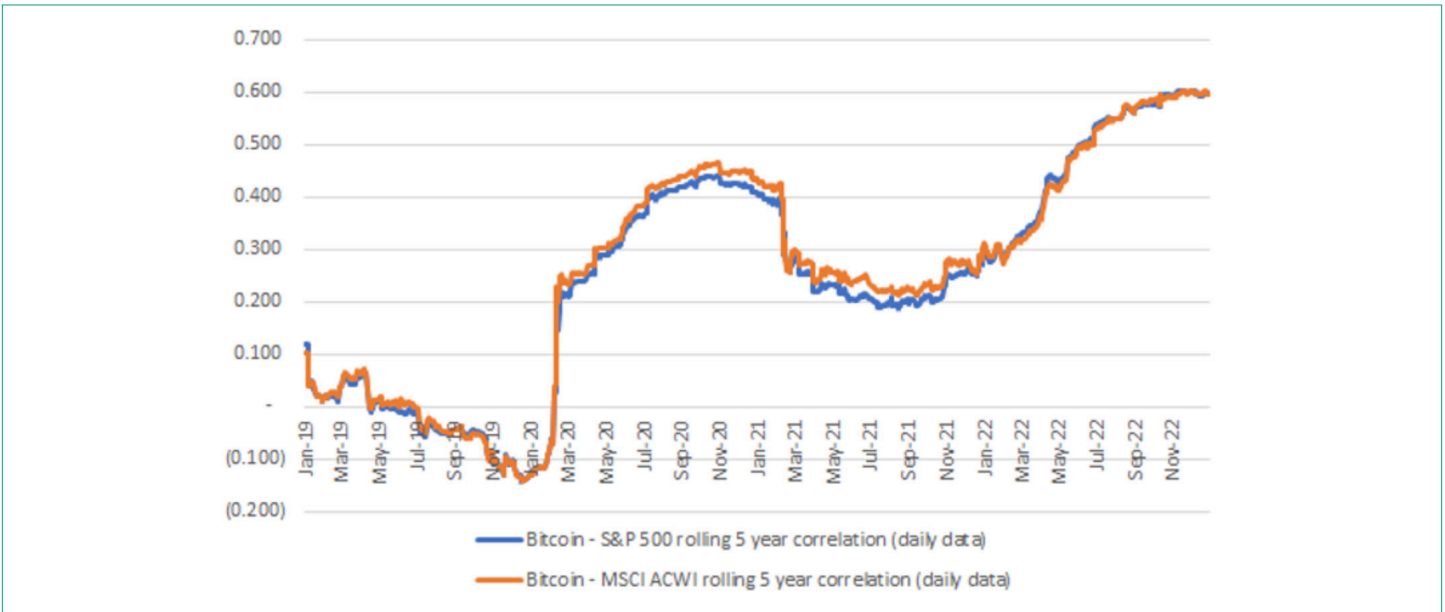
Finally, crypto-assets are not good portfolio diversifiers, as their correlation with risk assets is volatile and recently stood above 0.5 (see Figure 10). As with any statistical analysis involving crypto-assets, however, one must recall that historical data is limited and that they are continuously

evolving.<sup>8</sup> In addition, in contrast to U.S. Treasuries, Bitcoin exhibits a negligible correlation with emerging market CDS, suggesting crypto-assets do not increase in value exactly at the moment when central banks may need to use foreign reserves to stabilize markets.

8. Even for Bitcoin, with just over a decade in existence, it is difficult to draw firm conclusions. Other crypto-assets have even less data history, hindering effective analysis. In addition, the Bloomberg performance benchmark to reflect the return of available crypto-assets is even less helpful for the analysis, as its composition changes regularly, creating structural breaks in the data. Using the Bloomberg benchmark to reflect the risk and return available for crypto-assets is therefore of limited use. For the rest of this paper, we focus our technical analysis on Bitcoin, as it has at least ten years of data.



**Figure 10. Bitcoin's Correlation with Equities**



Source: Bloomberg.  
Note: Latest data as of January 2023.

Beyond crypto-assets' high volatility of return and relative illiquidity, they also carry specific operational risks distinct from those of typical reserve assets. For example, cryptocurrency exchanges and other players in the space have observed fraud (Prasad 2021). Moreover, smaller blockchain projects are vulnerable to manipulation, leading to erosion of trust if a single player or group of players collude to form a domineering presence. While those risks appear smaller for large, well-established networks such as Bitcoin and Ethereum, they are not negligible. (See BIS 2022 for a discussion of additional problems that Bitcoin investors face.)

In addition, server or other outages can result in significant downtime, with failures and disruptions preventing the use of services and perhaps even resulting in substantial losses of customer funds. Such operational risks have coincided with periods of high transaction activity and may be due to poorly designed system controls.

Crypto-assets are also subject to cyber risks. The crypto-asset space has seen some high-profile cases of hacking-related thefts of customer funds and compromised wallet keys

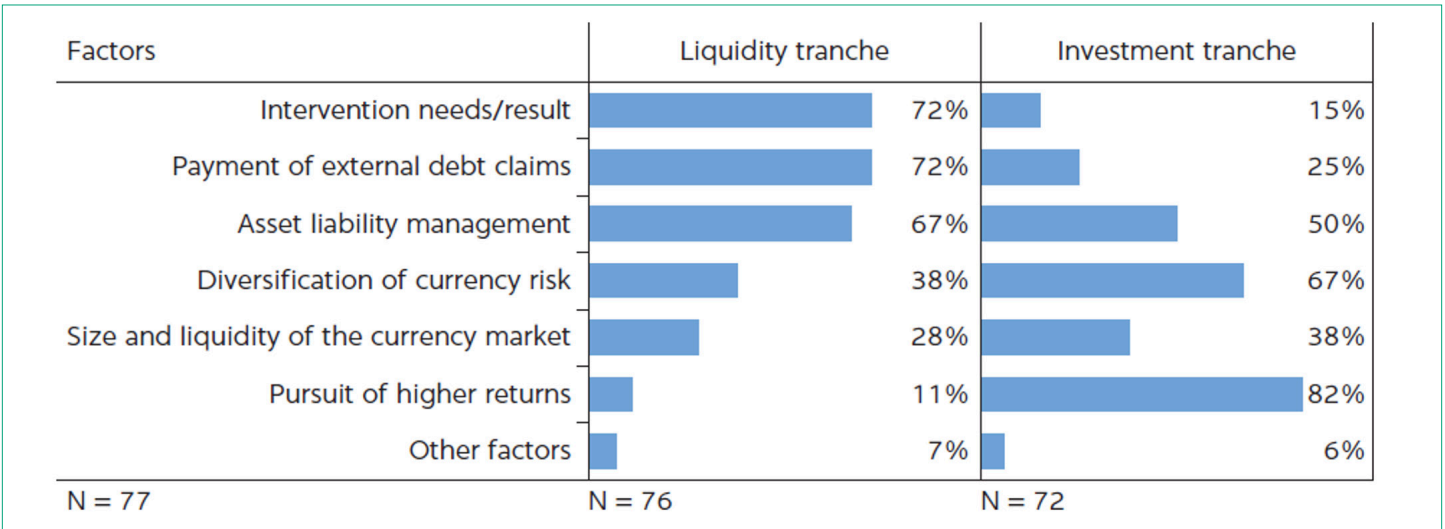
on centralized exchanges, revealing vulnerabilities in software codes. Such attacks can occur on centralized elements of the ecosystem (for example, wallets and exchanges), but they can also arise on the consensus algorithms that underpin blockchain operations, particularly for smaller platforms. Crypto-assets are also at risk of being used for illicit activities.

Taken together, these risks give pause to the highly conservative community of central banks, which are deeply concerned with meeting their mission goals and preserving their reputations.

**Determinants of currency composition.** Several factors shape the currency composition of foreign exchange reserves (Figure 11). The potential uses intended for the reserves significantly impact the currency composition of the liquidity tranche (RAMP 2019). Intervention needs, payment of external debt claims, and asset liability management require reserve portfolio liquidity tranches composed of highly liquid currencies. Financial factors such as risk diversification and return play a more critical role in the investment tranche, which has a longer investment horizon (see RAMP 2021).



**Figure 11. Factors Shaping Currency Composition**



Source: Third RAMP survey on the Reserve Management Practices of Central Banks (2021).

The factors that affect the currency composition of reserves shown in Figure 11, such as intervention needs, payment of external liabilities, and asset-liability management, help explain why the US dollar and the euro are the currencies with the highest allocations in central bank portfolios. On average, central banks allocate 62 percent of their reserves to the US dollar and 21 percent to the euro; the allocations to other currencies are small (see RAMP 2021). Since over 80 percent of global exports are invoiced in those currencies (Boz et al. 2022), and the dollar is the dominant funding and investment currency (Committee on the Global Financial System 2021), crypto-assets are currently not relevant for trade and capital flows and cannot play a significant role in the currency composition of reserves.

In summary, crypto-assets currently do not exhibit features sufficiently aligned with central banks’ main motivations for holding foreign reserves, even with small allocations. They are illiquid and expensive to trade; their value is highly volatile; and they offer limited diversification benefits relative to other assets, as their correlation with risky assets is very high. Moreover, crypto-assets have not yet increased in value during periods of financial market stress, making them impractical for self-insurance. Additionally, international trade and capital flows are usually denominated in US dollars and euros, making crypto-assets unsuitable for foreign exchange

policies or for servicing external debt obligations. These factors all suggest that crypto-assets are not currently suitable investment vehicles through which central banks can achieve any of their reserve management objectives.

## Crypto-Assets versus Gold

Market participants often compare crypto-assets to gold (Pfeffer 2017). This analogy may be relevant for reserve managers, because they have an average allocation of 13 percent to this precious metal (RAMP 2021). The most compelling reason for this apparent similarity may be that the supply of gold and of some crypto-assets, such as Bitcoin, is relatively fixed, making them less vulnerable than fiat currencies to debasement. Additionally, both are secure, privately held, durable, and transferable outside the traditional international payment networks. More recently, in a context of rising geopolitical tensions, gold and some crypto-assets have been touted as alternatives to the main reserve currencies.

Although crypto-assets do not have any industrial or ornamental value, as gold does, some market proponents argue that crypto-assets are superior to gold in other ways. For example, unlike crypto-assets, gold is difficult to store, verify, transport,



and divide into smaller parts. For central banks, however, gold differs fundamentally from crypto-assets. Gold played a critical part in the history of the international monetary system, and it is explicitly recognized and classified as a reserve asset. Throughout this history, gold has supported high-value transactions. Indeed, modern central banking started in the late 19th and early 20th century when national central banks pegged their currency explicitly to gold and the gold standard was developed.<sup>9</sup> Although the gold standard collapsed at the beginning of World War I and was not fully operational during the interwar period, it was the basis of the Bretton Woods agreement, which lasted from 1944 to 1971.

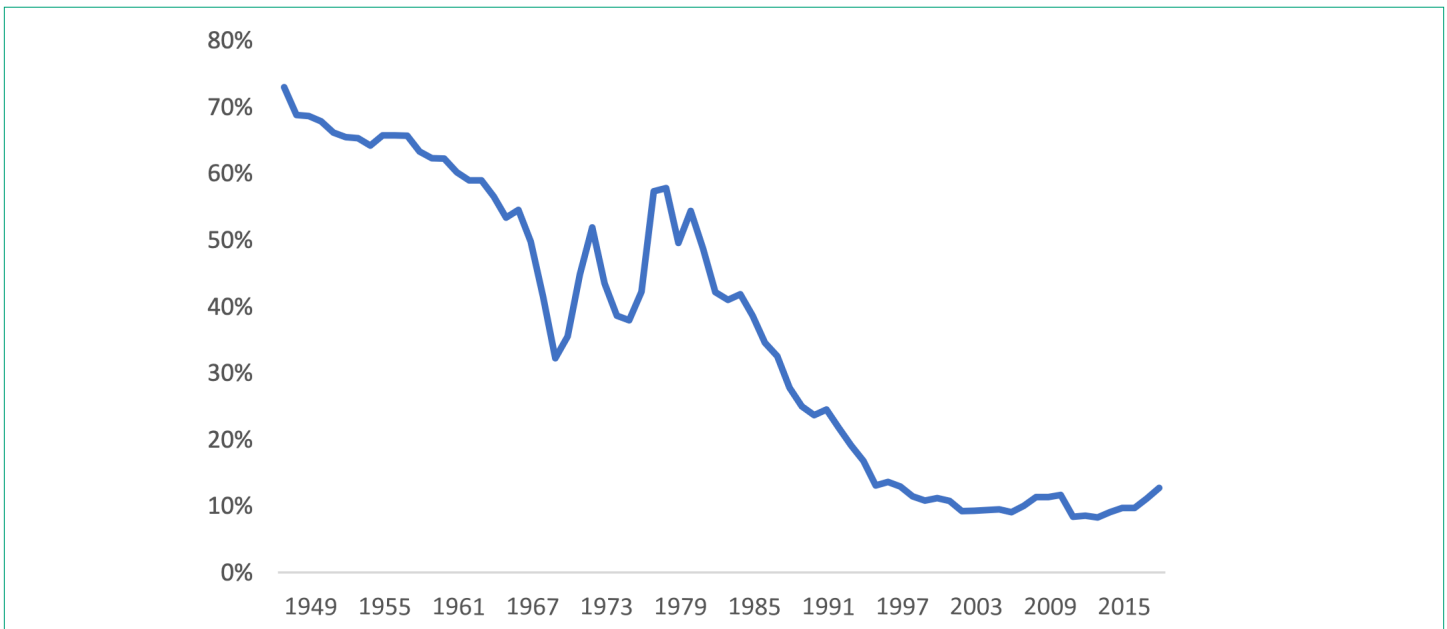
Under the Bretton Woods agreement, the price of gold was fixed to the US dollar, with a guarantee from the US government that foreign central banks could exchange US dollars for gold at any time. Other countries fixed their exchange rates against the US dollar, making gold the cornerstone of most currency

values. Central banks invested their reserves mostly in gold, but they also held US dollars or other major currencies, as they were considered fundamentally equivalent. Only when the United States ran out of gold reserves to back the Bretton Woods agreement and suspended gold conversion in 1971 did the current period of floating exchange rates begin, reducing the international monetary system's reliance on gold (Eichengreen 2019). As a result, the past 70 years has seen the role of gold in foreign exchange reserves decrease, especially after the end of Bretton Woods (Figure 12).<sup>10</sup>

These historical precedents explain why central banks rarely hold gold for risk-return considerations and why these institutions are unlikely to replace their gold holdings for crypto-assets. Although 76 percent of central banks have gold in their foreign reserve portfolio, only 20 percent of those institutions include these assets in the traditional risk and return optimization framework (RAMP 2021).



**Figure 12. Share of Gold in Foreign Exchange Reserves (% of total)**



Source: International Monetary Fund, authors' calculations.

9. The Sveriges Risksbank was founded in 1668 and the Bank of England in 1694, but their functions differed from those of modern central banks.

10. Although central banks' gold holdings are at levels similar to those of the early 1970s (1.1 billion ounces), they have increased their fiat currency holdings significantly.

Furthermore, crypto-assets still do not—and may never—have some of the key characteristics of gold as a store of value. Bitcoin, for instance, like gold, has a limited supply, but currently Bitcoin also has lower liquidity and higher volatility. Notably, Bitcoin does not operate in the same regulatory ecosystem as gold (Bridgewater 2021). These differences are true for any investor, but they are even more critical for central banks. Another factor favoring gold is that central banks already have the operational infrastructure to hold and trade it, which is not the case for crypto-assets. Once central banks hold gold bars that meet Good Delivery standards<sup>11</sup> and have a reliable custodian (like the Federal Reserve or the Bank of England) and approved counterparties, gold is secure and easy to trade at a minimal cost. This system has an extremely low risk of fraud and forgery. Finally, while Bitcoin has a limited issuance quantity, it may need to compete with other crypto-assets: it could be displaced as the space evolves, and even driven out of business (see Bridgewater 2021).

In summary, gold has specific properties as a reserve asset that crypto-assets currently lack. Consequently, central banks are unlikely in the near term to replace gold with crypto-assets.

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11. The London Bullion Market Association (LBMA) sets the Good Delivery standards, including fine ounce weight, purity, and physical appearance; <https://www.lbma.org.uk/good-delivery/about-good-delivery>.



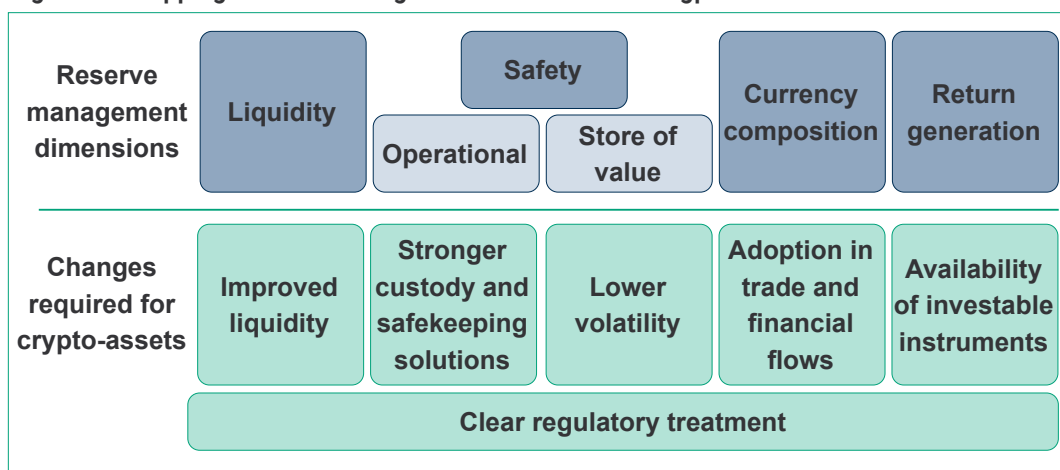
# The Fundamental Changes Required for Crypto-Assets to Become Suitable for Central Bank Reserve Portfolios

Although crypto-assets are currently not appropriate for central bank reserve portfolios, this may change over time given the remarkable development of the space and the pace of technological change. Illustrating just how far crypto-assets have come, institutional investors are carefully thinking through the case for investment in crypto-assets after dismissing them out of hand for years.

Many knowledgeable observers also believe that private and public digital currencies and other technologies could significantly disrupt the financial services industry (Harvey, Ramachandran, and Santoro 2021). This section will review the characteristics reserve managers require to consider crypto-assets an eligible financial instrument (Figure 13).



Figure 13. Mapping Reserve Management Dimensions to Crypto-Assets



## Improved Liquidity and Larger Market Cap

Along with issues of market manipulation, insider trading, and fraud, liquidity and depth of crypto-asset markets would need to improve significantly before central banks can consider them as eligible reserve assets. The cost to trade these assets would also need to decrease significantly. As discussed above, the liquidity of crypto-assets is much lower than that of traditional currencies and asset classes; except for the largest crypto-assets, such as Bitcoin and Ether, most crypto-assets are highly illiquid, making it unfeasible at present to allocate a significant share of reserves to crypto-assets.

At a minimum, crypto-assets would need to be similar in liquidity to high-grade investment assets denominated in currencies such as the Canadian dollar, the British pound, the Japanese yen, or the Chinese yuan renminbi, which typically have low single-digit allocations in reserve portfolios. Here, the liquidity of the Canadian dollar may be a good benchmark in terms of liquidity required before central banks can adopt crypto-assets as an eligible investment instrument. According to the 2021 RAMP survey, central banks hold an average of one percent of their portfolios in Canadian dollars. According to the BIS triennial foreign exchange survey,<sup>12</sup> the average daily trading volume of the Canadian dollar is 465 billion, compared to 328 million for Bitcoin and 158 million for Ether.

Also pronounced is the gap in market capitalization of crypto-assets as compared to other asset classes with single-digit allocations in reserve portfolios. The market capitalization of equities (MSCI ACWI) is US\$62 trillion, that of mortgage-backed securities is US\$7 trillion, and that of covered bonds is over US\$1 trillion. As of August 2022, Bitcoin and Ethereum, the two largest crypto-assets in the space, have a combined market cap of US\$676 billion.

## Reduced Price Volatility

The volatility of crypto-assets must decrease to align with the low-risk tolerance of most central banks. Again, as highlighted above, reserve portfolios concentrate heavily in asset classes

with low volatility, like government bonds, commercial bank deposits, and money market products (RAMP 2021).

As discussed earlier, reserve managers do not broadly invest in equities due to their risk characteristics, including high volatility of returns. Only 18 percent of central banks invest in this asset class (RAMP 2021), with an average allocation of two percent. Investing in crypto-assets, a much more volatile instrument, is clearly inconsistent with these institutions' low-risk tolerance (Figure 8).

Nonetheless, given further advances in the safety and transparency of stablecoins and associated legal and regulatory frameworks, these may become appealing to central banks if they offer better operational efficiency than fiat currencies. Since stablecoins are pegged to major currencies, their volatility would resemble that of other traditional central bank investments. Wide adoption of stablecoins must overcome two additional challenges, however. Policy makers are currently concerned with the inherent vulnerabilities of existing stablecoins, for reasons including deficiencies in the price stabilization mechanism, the quality of reserve assets, disclosure, governance, and consumer protections. Moreover, like CBDCs, stablecoins do not provide diversification opportunities; being pegged to reserve fiat currencies reduces their appeal from an investment perspective.

## Improved Availability of Investable Instruments

As explained above, central banks typically choose their reserve currency composition based on macroeconomic factors. Once they have made their currency allocation decision, they invest their currency holdings in liquid instruments such as deposits and bonds. Income (e.g., interest, dividends) is typically more critical from a return perspective because the currency allocation does not often change (see RAMP 2019, 2020, and 2021). Central banks invest in conservative instruments. On average, reserve managers allocate 34 percent to government bonds, 23 percent to bank deposits, 12 percent to sovereigns, supnationals, and agencies, and 10 percent to money market products. The minimum credit rating for those

12. [https://www.bis.org/statistics/rpfx22\\_fx\\_annex.pdf](https://www.bis.org/statistics/rpfx22_fx_annex.pdf)

investments is typically A- or higher. By contrast, the allocation to corporate bonds and equities is below three percent on average (RAMP 2021).

Crypto-assets could be used to generate returns. First, crypto-assets operating with a Proof-of-Stake protocol (e.g., Ethereum) can be used to provide “staking” services to help validate transactions and secure the network. In turn, “staked” crypto-assets provide a return stream. Second, the development of decentralized finance (DeFi) services can also help generate income from crypto-assets since these services can, for example, allow investors to lend their crypto-asset holdings or provide liquidity and make a return (Harvey, Ramachandran, and Santoro 2021). This experimental space is evolving rapidly—the assets stored have grown from \$1 billion at the beginning of 2020 to more than \$200 billion today (Economist 2020). Risks from fraud and other vulnerabilities are still considerable, however, increasing the need for further regulation (Hicks 2021). Third, sovereign, supranational, and agency crypto bonds (e.g., El Salvador’s plan to issue Bitcoin bonds) are an option, at least in theory, but these would need to become widely adopted in developed economies, the likelihood of which currently seems rather remote.

Taken together, operational, investment, and other risks associated with these options for return generation still loom large, while the associated markets remain small, illiquid, and largely unregulated, making crypto-assets or crypto-denominated instruments unattractive to central banks from a return generation perspective.

## Adoption in Trade and Financial Flows

Reserve managers consider adoption of crypto-assets in cross-border trade and investment flows to be a critical

prerequisite for inclusion in their portfolios. These flows remain denominated and executed in fiat currencies, especially the US dollar. Central banks are unlikely to include crypto-assets in their asset mix until such assets play a more substantial role in the global monetary system. Crypto-assets would need to become widely accepted mediums of exchange and stores of value, neither of which appears likely at this point.

Stablecoins, too, are currently not widely used for payments, as they still pose various risks and regulatory uncertainty remains high. Although the original objective of Bitcoin was to become a peer-to-peer electronic cash system, few players use it for international transactions. As discussed, one significant obstacle for such flows is that Bitcoin has relatively low throughput or processing capacity. Crypto-assets such as Ethereum promise changes to improve processing capacity and energy efficiency,<sup>13</sup> but advances in technology alone will be insufficient to spur adoption as a medium of exchange as long as crypto-assets continue to experience high volatility in their valuations.

Additionally, for multiple reasons including concerns about consumer protection and AML/CFT regulations, crypto-assets’ rate of adoption across countries is uneven. Nine jurisdictions, including China, have banned crypto-assets altogether as a means of payment and investment, and 42 have implicit prohibitions (Library of Congress 2021). The Democratic Republic of Congo and El Salvador are the only countries to have adopted Bitcoin as a legal tender. Still, the IMF has urged these governments to reverse this decision because of the “risks to financial and market integrity, financial stability, and consumer protection.”<sup>14</sup> Without broader adoption as a means of payment, crypto-assets are unlikely to be used for international trade and investment.

Even if crypto-assets were to become more important for global trade and external financing, their adoption as reserve assets is likely to be slow. In the past, the move to include

13. The Bitcoin network uses a proof-of-work (PoW) algorithm that is computationally demanding by design (for details see Auer 2019). This mechanism allows the network to come to consensus, preventing users from double spending their coins. Miners must compete to solve a complicated mathematical problem, and the first to finish adds a block to the chain and is rewarded if the transactions included in the block are valid. By contrast, Ethereum is moving to a proof-of-stake (PoS) algorithm that should allow faster transaction processing. With PoS, validators stake their coins and are chosen at random to create blocks, avoiding the demanding validation process of PoW (for details, see <https://ethereum.org/en/developers/docs/consensus-mechanisms/pos/>).

14. <https://www.imf.org/en/News/Articles/2022/01/25/pr2213-el-salvador-imf-executive-board-concludes-2021-article-iv-consultation#:~:text=Since%20September%202021%2C%20the%20government,also%20can%20create%20contingent%20liabilities.>

a new currency in reserve portfolios has taken a significant amount of time. For example, despite the importance of China in the global economy and international trade, central banks have only recently started adding the renminbi to their reserve portfolios. The average allocation of renminbi is close to two percent (RAMP 2021) on average for reserve portfolios, an insignificant amount considering that the currency has been part of the Special Drawing Rights basket since 2016. One significant constraint on the renminbi's adoption that may be relevant for crypto-assets is that institutions must modify their operational frameworks to trade the currency onshore. As discussed above, custody arrangements for crypto-assets are also more complex than for other currencies and are still being developed. Custody may therefore present a continuing additional obstacle to reserve managers' general adoption of crypto-assets.

## Robust Custody and Safekeeping Solutions

Crypto-asset safekeeping and custody crucially differ from those for traditional financial assets and are more akin to bearer instruments. Specifically, crypto-assets require careful management of the private cryptographic keys associated with the wallet containing and allowing access to a user's funds. Mismanagement of access to and storage of this private key can lead to irreversible loss of funds as there is no way to recover the private keys and reverse transactions. As such, accessibility for large institutional investors to obtain outright exposure to crypto-assets will remain constrained by the development of sound services regarding custody, including client asset protection (e.g. proper asset segregation) and insurance. Recent failures of key crypto-asset service providers highlight the problem: investors may encounter large losses if, among others services, proper safekeeping and client asset protection measures are not in place. Recently, however, several large investment managers (e.g., Blackrock, BNY Mellon) have begun to offer such services using a trust structure. The prospect of "atomic" settlement (i.e., exchange of crypto-assets without counterparty risk) is an attractive feature of crypto-assets and can facilitate trade execution.

## Clear Regulatory, Supervisory, and Oversight Treatment

A clear, comprehensive, and globally consistent policy framework would be another necessary—but not sufficient—condition before crypto-assets and crypto-asset activities can overcome reserve managers' hesitation to use these assets. Currently, many crypto-asset activities are unregulated, lack regulatory clarity, or do not comply with existing relevant standards, rules, and regulations. Investment products without such validation are risky and unlikely to attract conservative institutional investors with fiduciary duty. Before considering investing in crypto-assets, most institutional investors—central banks in particular—will require appropriate regulatory treatment and a significant reduction in regulatory uncertainty. The recent SEC approval of Bitcoin ETFs does not address these problems for the underlying instruments.

Regulating the crypto-asset sector could bestow unwarranted credibility on crypto-asset activities and intermediaries. However, given its rapid growth, increasing interconnectedness with the traditional financial sector, and a string of recent high-profile failures impacting thousands of users, broad international recognition has emerged of the need to adequately regulate and supervise the sector. Indeed, international standard setters such as the Financial Action Task Force (FATF), the Basel Committee for Banking Supervision (BCBS), the Financial Stability Board (FSB), and the International Organization of Securities Commissions (IOSCO), as well as domestic policy makers around the world, are increasingly focusing on the crypto-asset space to preserve financial stability, financial integrity, sound market conduct, and consumer and investor protection. Updating and implementing policy frameworks nonetheless remains a work in progress in many countries.

The Financial Stability Board (2022, 2023a) has advocated for regulatory and supervisory frameworks to preserve crypto-asset activities' and service providers' financial stability that use the principle "same activity, same risk, same regulation" at levels commensurate to the risks posed, both domestically and internationally. FSB (2023b, 2023c) has issued final high-level recommendations for regulating, supervising, and overseeing

both crypto-asset activities and markets and global stablecoin arrangements, and BCBS (2022) has also issued its final standard regarding the prudential treatment of crypto-asset exposures. IOSCO has issued various crypto-asset-related reports covering crypto-asset trading platforms (2020) and DeFi (2021); recently it has sought feedback on a set of key recommendations, including regarding conflicts of interest, market manipulation, fraud, and asset safekeeping. In 2019, the Financial Action Task Force issued a globally binding standard for regulating crypto-assets and related service providers to understand, monitor, and mitigate financial integrity risks (see Financial Action Task Force 2021). Implementation of international guidance and new binding rules is in its early stages, however, and remains inconsistent across countries, which may give rise to international regulatory arbitrage, since crypto-activity can easily transcend borders (e.g., Financial Action Task Force 2023).





## Conclusion

Institutional investors, including central bank reserve managers, have been intrigued by the rapid ascent of crypto-assets and assessed their investability. As a result, central banks have started to ask questions about crypto-assets, even if the large majority have no immediate plans to invest in them over the short and medium term.

Central bank digital currencies (CBDCs), although fundamentally distinct from crypto-assets, would be obvious investment choices for reserve managers and could improve efficiency in payments and settlements. From a portfolio diversification perspective, however, CBDCs and stablecoins do not have much to contribute, since their value would be equivalent to currencies central banks already invest in.

Crypto-assets like Bitcoin and Ether currently remain unsuitable instruments for central banks' reserve portfolios as they do not exhibit features consistent with central banks' motivations for holding foreign reserves. To become an eligible instrument for foreign reserve portfolios, crypto-asset markets and players must overcome multiple obstacles. A significant increase in liquidity and a reduction in trading costs would be required, as well as a meaningful reduction in price volatility, strengthened custody and safekeeping solutions, increased availability of suitable investable instruments, and widespread adoption in trade and global financial flows. The foundational requirement is for clear, comprehensive, consistent international and domestic regulatory and supervisory treatment, a precondition that cuts across all reserve management dimensions. Currently, it remains unclear whether crypto-assets will be able to meet all of these criteria in the future, even with the recent regulatory approval of Bitcoin ETFs in the U.S.



Figure 14. Summary: Mapping Reserve Management Dimensions to Required Changes for Crypto-Assets

KEY DIMENSIONS	CHANGES REQUIRED	
<b>Safety</b>		
Store of value	Lower volatility. With an annualized volatility of 70 percent—significantly higher than equity and gold—crypto-asset price volatility is currently too high, making crypto-assets an unreliable store of value for helping central banks self-insure against shocks.	
Operational	<p><b>Stronger custody and safekeeping solutions.</b> Crypto-assets are similar to bearer instruments and rely on cryptographic private keys—loss or theft of which can lead to permanent loss of funds. Industry-grade private key management and execution solutions able to withstand fraud or cyber-attacks are essential (e.g., for storage, access, authentication).</p> <p><b>Sufficient decentralization.</b> Insufficiently decentralized crypto-asset projects over which a governing body or central party can exert significant control may pose risks.</p>	
<b>Liquidity</b>	<p><b>Improved liquidity.</b> Crypto-assets’ liquidity and market capitalization are much lower than those of traditional currencies and asset classes, discouraging large investors from taking and managing significant exposures. Liquidity of the largest crypto-assets (e.g., Bitcoin, Ether) has improved significantly, however, and derivatives markets have emerged to manage risks.</p>	
<b>Return generation</b>	<p><b>Availability of investable instruments.</b> Central banks usually invest in very safe assets (e.g., government bonds). Most crypto-assets do not have intrinsic value (e.g., they do not produce an interest or dividend stream). “Staking” can produce an income stream, and DeFi applications could help generate returns on crypto-assets, but various uncertainties and risks remain in this experimental ecosystem.</p>	
<b>Currency composition</b>	<p><b>Adoption in trade and financial flows.</b> Use of crypto-assets for (cross-border) trade and investment flows is necessary if reserve managers are to gain exposure to crypto-assets to support their need for self-insurance against trade and financial shocks. Adoption of crypto-assets in such flows is virtually nonexistent.</p>	
<p><b>Clear regulatory treatment (cross-cutting issue).</b> Crypto-assets should be subject to regulations based on the principles of “same activity, same risk, same regulation” and proportionality to risk. Currently, many crypto-asset activities are unregulated, lack regulatory clarity, or fail to comply with relevant regulations, standards, and rules. Domestic and international regulatory treatment of crypto-assets remains unclear in other critical aspects, including institutional mandates, powers, and tools, although policy makers have made progress (e.g., coping with illicit financial activity).</p>		



# Appendix: The Background of Crypto-Assets

This appendix provides a brief overview of the different types, main characteristics, and market sizes of crypto-assets and notes some of the growing body of theoretical and empirical literature on drivers behind developing and adopting them.<sup>15</sup>

## Types of Crypto-Assets and Their Main Characteristics

A wide range of crypto-assets has evolved to meet varying needs, including speculative investment, store of value, currency conversion, and payments. Investors differentiate between three main types of crypto-asset: (1) **unbacked** crypto-

assets with **limited supply**, such as Bitcoin, conceived as a medium of exchange and a store of value (i.e., “digital gold”); (2) crypto-assets operating on **smart-contract blockchains**, such as Ethereum, with applications in numerous areas including in decentralized finance (DeFi)<sup>16</sup> and non-fungible tokens (NFTs); and (3) **stablecoins**, which aim to maintain a stable value relative to a specified asset or pool of assets (e.g., the US dollar, gold, or another reference asset).

**Bitcoin**,<sup>17</sup> the best-known crypto-asset with limited supply, emerged in 2009. It was the first blockchain-based crypto-asset and is now the most widely held, with the highest single market value (see Table A.1).



Figure 14. Summary: Mapping Reserve Management Dimensions to Required Changes for Crypto-Assets

Cryptocurrency	Release	Current Market Cap (US\$ mn)	Quantity of Tokens Issued (mn)	Maximum Amount of Tokens Issued (mn)
Bitcoin	2009	451,940	19	21
Ethereum	2015	227,741	122	Unlimited
Tether	2015	67,570	67,566	Unlimited
USD Coin	2018	53,441	53,441	Unlimited
Binance Coin	2017	50,185	161	200
XRP	2012	18,528	49,378	100,000
Cardano	2017	18,497	33,739	45,000
Binance USD	2019	17,981	17,979	Unlimited
Solana	2020	14,625	349	Unlimited
Dogecoin	2013	10,999	132,671	Unlimited

Source: CoinMarketCap.

15. See Feyen, Kawashima, and Mittal (2022) for a summary of the theoretical and empirical literature on supply- and demand-side drivers for the adoption of cryptocurrencies. According to the authors, supply-side drivers include profitability and costs of traditional payment services providers and the availability of infrastructures such ICT and agent networks. Demand-side factors include costs and inconvenience, confidence in financial incumbents and the government, and macro-economic conditions. The authors summarize the empirical findings for the US and importantly conclude that crypto-asset adoption in the US is not driven by distrust but rather by speculation and that crypto users tend to be educated, young, and digital natives (Auer and Tercero-Lucas 2021).

16. DeFi is an emerging financial technology based on a secure distributed ledger that removes third parties, such as banks.

17. See Prasad (2021) for an extensive review of Bitcoin technology.

**Is Bitcoin a medium of exchange?** A reliable medium of exchange should have value when compared with the unit of account in which goods and services in an economy are priced (see Prasad 2021). For example, the US dollar serves as a medium of exchange and a unit of account in the United States.<sup>18</sup> The US dollar is not only backed by the US government, it is also a legal tender—merchants and creditors in the United States have a legal obligation to accept the US dollar as a means of payment. This is not the case for any private cryptocurrency.<sup>19</sup> Observers note that crypto-assets are unlikely to be accepted or to take hold in countries with stable inflation and exchange rates and credible institutions. So far, the only countries to adopt Bitcoin as legal tender are the Democratic Republic of Congo and El Salvador. Households and businesses have little incentive to price or save in a crypto-asset—even if it had legal tender or currency status—because of its price volatility. Some analysts also warn that making crypto-assets legal tender has significant implications for macrofinancial stability, consumer protection, and the environment (see Adrian, IMF Blog issued July 26, 2022; Feyen, Kawashima, and Mittal (2022)).

Although new payment technologies, such as the Lightning Network (Poon and Dryja 2016), have built on top of Bitcoin to address bottlenecks, Bitcoin is not currently in wide use as a means of payment for the following reasons: (1) low transaction speed, (2) high transaction costs when transaction demand is high, and (3) high volatility relative to fiat currencies. The Bitcoin network can only process up to seven transactions per second or 600,000 transactions per day. While the comparison has limitations, Visa can handle up to 24,000 transactions per second or more than two billion transactions per day (Deutsche Bank 2021).<sup>20</sup> Depending on demand, transaction fees for Bitcoin ranged from US\$2 to US\$60 per transaction between 2020 and 2021. Finally, Bitcoin's price exhibits high daily volatility, reducing its utility as a medium of exchange. Taken together, these factors make Bitcoin unattractive to merchants as a payment medium.

**Is Bitcoin a store of value?** As noted above, Bitcoin's software protocol fixes the terminal supply of bitcoins to 21 million; as of early 2021, 18.7 million bitcoins had been “minted” and entered circulation. The limited supply and the decline in the issuance rate of Bitcoin have been the main drivers behind the “digital gold” narrative. Like gold, Bitcoin does not pay any yield outright and is not a claim on any entity. At the same time, Bitcoin is globally accessible and easily portable—valuable attributes for a store hold of wealth. While scarcity is insufficient to drive demand for an asset and sustain it as a viable store of value, Bitcoin's relatively long history, much larger relative size, and broader public profile and acceptance have given it a clear advantage.

Further attributes of a store of value are (1) ability to retain its purchasing power over time, (2) easily exchangeable for currency and other liquid assets, and (3) easily accessible. Compared to other traditional stores of value, such as gold, art, and real estate, Bitcoin is much more easily exchangeable, especially for individual holders. Bitcoin also appears to be the most portable potential store of value, much more so than physical cash. Notwithstanding these attributes, since the fundamental purpose of a store of value is to preserve or increase in value over time, many observers still assess Bitcoin as a highly volatile and speculative asset with no intrinsic value.

In addition, compared to established stores of value, Bitcoin is not widely used as a savings vehicle or reserve asset, and governments and the largest institutional investors do not as yet meaningfully participate in it.<sup>21</sup> Furthermore, as seen in Figure A.1, Bitcoin's realized volatility is higher than that of other assets held as a store of value, specifically, gold. While Bitcoin has a limited issuance quantity, it may need to compete with other crypto-assets and could be displaced as the space evolves.

18. This is generally true for most national currencies except in countries facing high inflation or hyperinflation that erodes their currencies' purchasing power.

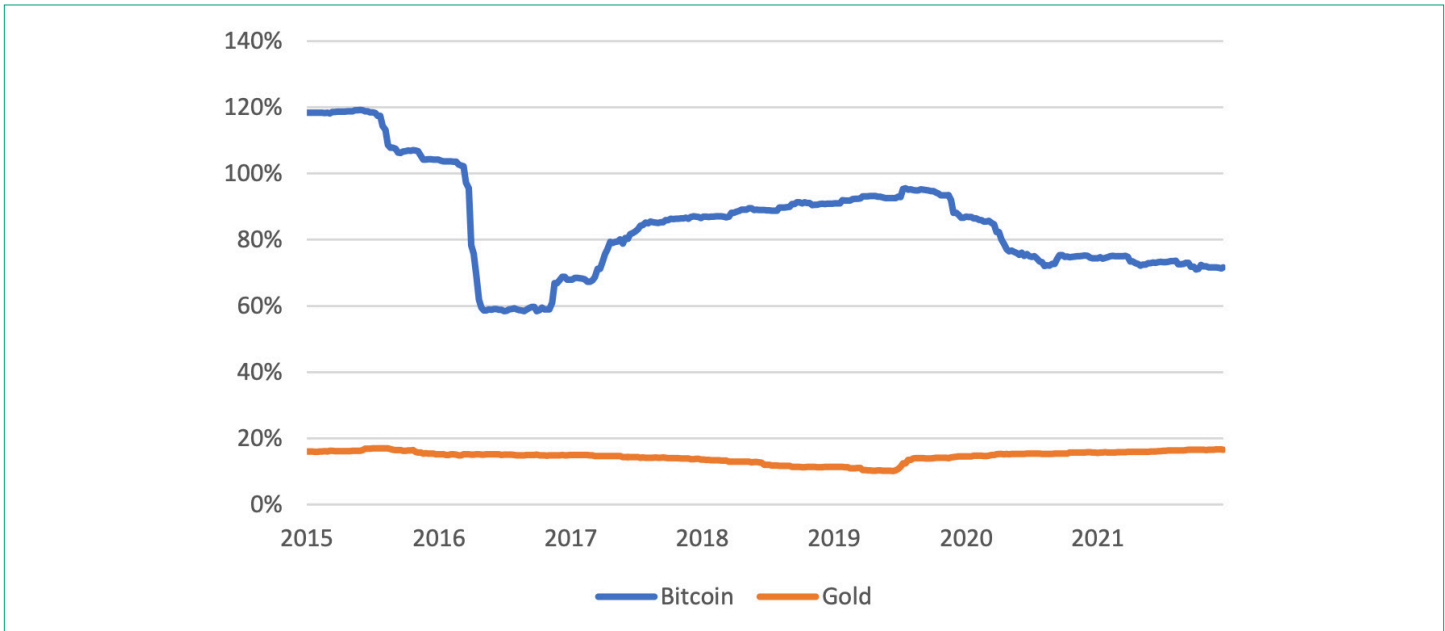
19. Gorton and Zhang (2021) call this the no-questions-asked-principle, which requires that money be accepted in a transaction without due diligence on its value.

20. Each block of bitcoin's digital ledger, i. e., the blockchain, can store only one megabyte of information, and ten minutes are needed to mine a new block. It takes at least as long for the blockchain to confirm a bitcoin payment transaction.

21. To assess the extent to which investors hold Bitcoin to store wealth, Bridgewater is looking at turnover and coin activity, concluding that the cryptocurrency has a high turnover, confirming its speculative nature (see Bridgewater, January 28, 2021).



Figure 12. Share of Gold in Foreign Exchange Reserves (% of total)



Source: Bloomberg.

Note: Three-year rolling using weekly data.

**Decentralized finance.** The Ethereum blockchain was created in 2015 along with its native crypto-asset, Ether. A key feature of the platform is that it enables developers to build and run distributed applications powered by Ether.<sup>22</sup> These applications can be interoperable, allowing a complex financial ecosystem to emerge, referred to as decentralized finance (DeFi), and offer financial services such as an exchange, loans, derivatives, and insurance.<sup>23</sup> Some of these applications issue their own crypto-assets, often for owners to participate in the future governance of the application (e.g., Uniswap for decentralized exchange services or Aave for decentralized lending and borrowing). Currently, most DeFi applications are built on Ethereum, but competing platforms, such as Solana, have been set up. Market interest has grown in newer blockchains that use smart contracts and aim to solve the challenges of earlier blockchains by introducing new features that improve scalability, interoperability, and sustainability.<sup>24</sup>

**Stablecoins.** Stablecoins aim to offer a medium of exchange and to store value for investors by maintaining a stable value relative to a reference asset (typically the US dollar) or basket of assets. In practice, however, stablecoins are

currently mostly used as a bridge between fiat currencies and crypto-assets, as collateral for smart contracts, and to facilitate trading and exchange in the DeFi space. Stablecoins can be classified across a spectrum depending on the type of collateral and the stabilization mechanism. Fiat-based stablecoins are most common and are backed by traditional financial instruments that may differ in liquidity and risk profile (e.g., ranging from bank deposits and US government bills to corporate bonds and commercial paper) and are redeemable by the issuer at face value. A stablecoin that maintains a peg to a sovereign currency is more likely to be used as a form of digital money. Asset-backed stablecoins are fully backed by non-cash equivalents (e.g., corporate bonds, commercial paper, commodities, and cash) and are often marketed as immediately redeemable at face value, although issuers may be able to defer redemption or offer in-kind redemption during periods of stress. Finally, crypto-asset-based stablecoins are backed by other crypto-assets, while algorithmic stablecoins seek stability through a software protocol that manages the supply of coins to ensure a stable value; the recently failed TerraLuna project is an example of an algorithmic stablecoin. Tether is currently the largest stablecoin, but its market share

22. Market participants also build crypto-tokens (unlike crypto-assets, which are native to a specific network) on the Ethereum network. Crypto-tokens can not only be used as a medium of exchange or store of value but also for governance decisions of the platform (see Goldman Sachs 2021).

23. Also referred to as smart contracts, they are self-executing with the terms of the agreement between parties written directly into lines of code. Ethereum is the most popular blockchain for running smart contracts, which are typically written in the programming language Solidity (see Goldman Sachs 2021).

24. Scalability refers to the ability to handle large transaction volumes. Interoperability is the ability to connect with other blockchains as well as with off-chain data. Sustainability is the ability to scale in an environmentally sustainable way.

has declined sharply due to competition from alternatives such as USDC, issued by Circle, and Binance’s BUSD, issued by crypto exchange Binance. Stablecoin trading volume outpaces that of other crypto-assets primarily because they are usable for settlement of exchange spot and derivatives trades. The price stability for top stablecoins continued to

improve in 2021, when their market capitalization quadrupled to more than \$120 billion, and their relative price stability has shielded users from the volatility common to other crypto-assets.<sup>25</sup> Significant concerns around price stability and consumer protection remain, however.

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**Table A.2. Main Characteristics of Crypto-Assets**

	Crypto-Assets with Fixed Supply	Stablecoins	DeFi
<b>Denomination</b>	Own	The national currency, commodity, or other reference assets	Own
<b>Redemption pledge</b>	None	At face value or market value of reserves	None
<b>Backing</b>	None	Full or partial backing by a variety of (fiat-based) assets	None of the other crypto-assets
<b>Main design functions</b>	<ul style="list-style-type: none"> <li>• Medium of exchange</li> <li>• Store of value/ investment</li> </ul>	<ul style="list-style-type: none"> <li>• Medium of exchange</li> <li>• Store of value</li> </ul>	<ul style="list-style-type: none"> <li>• To operate on smart-contract platforms</li> <li>• Governance of DeFi applications</li> <li>• Non-fungible tokens (NFTs)</li> </ul>
<b>Defining feature</b>	<ul style="list-style-type: none"> <li>• No intrinsic value</li> </ul>	<ul style="list-style-type: none"> <li>• Intrinsic value depends on the stabilization mechanism and reserve assets</li> </ul>	<ul style="list-style-type: none"> <li>• Value depends on the technology platform and issuers’ ability to attract market participants to use the platform or applications built on it</li> <li>• “Staking” rewards produce a crypto-asset cash flow (e.g., Ether)</li> </ul>
<b>Selected current challenges</b>	<ul style="list-style-type: none"> <li>• Of limited value as a medium of exchange because of payment network capacity constraints</li> <li>• Store of value challenged by high volatility</li> </ul>	<ul style="list-style-type: none"> <li>• Of limited value as a medium of exchange because of payment network capacity constraints</li> <li>• Design shortcomings (e.g., stabilization mechanism) have already caused failures or significant deviations from the reference asset</li> </ul>	<ul style="list-style-type: none"> <li>• “Smart contract” and other operational risks</li> <li>• Interconnectedness and leverage</li> </ul>
<b>Examples</b>	<ul style="list-style-type: none"> <li>• Bitcoin</li> <li>• Litecoin</li> <li>• Bitcoin Cash</li> </ul>	<ul style="list-style-type: none"> <li>• Tether</li> <li>• USD Coin</li> <li>• LunaTerra (defunct)</li> </ul>	<ul style="list-style-type: none"> <li>• Ethereum (smart-contract platform)</li> <li>• Uniswap (decentralized exchange)</li> <li>• Aave (lending and borrowing)</li> </ul>

Source: International Monetary Fund (2021) and authors’ assessments.

25. The pricing dynamics of stablecoins have been examined in several studies (see discussions in Lyons and Viswanath Natraj 2020).



## Options for Investors to Obtain Exposure to Crypto-Assets

Investors can create exposure to crypto-assets in three ways: (1) outright exposure; (2) exposure to arbitrage and money-making opportunities; and (3) exposure to technological growth via venture capital or equities. Bridgewater (2021) offers a detailed assessment of these various options.

**Direct exposure to crypto-assets.**<sup>26</sup> The most liquid and most common crypto-asset for outright exposure is spot Bitcoin or Ether (and related derivatives) traded via crypto or commodity exchanges or over the counter (OTC). Some fund products passively track Bitcoin, Ether, or a broader basket of crypto-assets that charge substantial fees and offer limited liquidity. Nonetheless, accessibility for large institutional investors will remain constrained by the development of custody and counterparty services, although several large investment managers have started to offer such services through a trust structure (e.g., Blackrock, BNY Mellon).

**Exposure to crypto-asset trading.** High price volatility and improving liquidity appear to offer some arbitrage opportunities for hedge funds and other investors. With the continued development of the crypto ecosystem, institutional investors are beginning to gain exposure to this type of strategy through their holdings of some hedge funds that have expanded into the crypto space. Emerging new crypto-specific funds specialize in investment strategies primarily intended

to access crypto directly on native platforms and, in some cases, to bridge inefficiencies between crypto-linked assets in traditional finance and their corresponding on-chain product.<sup>27</sup> Crypto hedge funds use two alternative strategies: focusing on higher risk directional strategies or implementing more market-neutral strategies engaging in high-frequency trading, market making, and arbitrage.

**Exposure via venture capital or equities.** The number of new businesses that use blockchain technology has grown rapidly. These range from new crypto-asset exchanges to firms behind DeFi protocols. Other industries are also increasingly adopting blockchain technology; examples include businesses providing digital art, gaming, social networks, or sharing economy platforms. Venture funding for cryptocurrency and blockchain companies quadrupled to over \$25 billion in 2021. Institutional investors are increasingly gaining exposure to these opportunities through venture capital or the few listed public equities in the space. For investors with private or public equity exposure, this form fits neatly into existing mandates and competencies.

### Current Investor Base

Apart from retail investors, institutional participation is still primarily restricted to smaller corporates, hedge funds, and family offices rather than large traditional institutional allocators where the market size in relevant instruments remains relatively small (see Table A.3).<sup>28</sup>



**Table A.3. Institutions' Publicly Disclosed Bitcoin Holdings**

Category	Country	Company Name	BTC Holdings (BTC)	Market Cap (US\$m)	% of BTC in Circulation
Public Company	US	MicroStrategy	129,699	3,066	0.68%
Public Company	US	Galaxy Digital Holdings	40,000	946	0.21%
Public Company	CA	Voyager Digital LTD	12,260	290	0.06%
Public Company	US	Tesla, Inc	10,725	254	0.06%
Public Company	US	Marathon Digital Holdings Inc	10,055	238	0.06%

26. Owning a crypto-asset can be anonymous because ownership and use of crypto-assets relies on having "private keys" stored in "wallets." Depending on how they operate, wallets can be classified as "hot" (connected to the internet) or "cold" (kept offline), as well as "hosted" (hosted by a third-party provider) or "unhosted." "Unhosted" wallets can make it difficult or even impossible to determine who controls the crypto-assets, which in turn can allow concealment of illicit activity (see IMF, Global Stability Report, October 2021, Annex).

27. Many of the largest crypto-native active managers have both hedge funds and VC arms, which often entails both overlaps and synergies.

28. On April 26, 2022, Fidelity announced that it would allow retail investors to put Bitcoin into their 401(k)s, the first major retirement plan provider to do so. This decision allows the 23,000 companies using Fidelity to administer their retirement plans to add Bitcoin to the list of option provided to their employees (Wall Street Journal, April 26, 2022). This announcement by the largest retirement plan provider suggests crypto investing has moved deeper into the mainstream. At the same time, however, Fidelity's announcement came a month after the Labor Department expressed its concern over including cryptocurrencies in retirement planning.



Public Company	US	Coinbase Global, Inc.	9,000	213	0.05%
Public Company	US	Square Inc.	8,027	190	0.04%
Public Company	CA	Hut 8 Mining Corp	7,736	183	0.04%
Public Company	US	Riot Blockchain, Inc.	6,696	158	0.04%
Public Company	DE	Bitcoin Group SE	3,830	91	0.02%
Public Company	CA	Hive Blockchain	3,091	73	0.02%
Public Company	CA	Bitfarms Limited	2,021	48	0.01%
Public Company	US	Core Scientific	1,959	46	0.01%
Public Company	JP	NEXON Co. Ltd	1,717	41	0.01%
Public Company	US	Exodus Movement Inc	1,300	31	0.01%
Public Company	GB	Argo Blockchain PLC	1,295	31	0.01%
Public Company	TH	Brooker Group's BROOK (BKK)	1,150	27	0.01%
Public Company	US/CA	Other Crypto Firms in North America	4,922	116	0.03%
Public Company		Other Crypto Firms in Rest of World	1,564	37	0.01%
Private Company	JP	Mt. Gox	141,686	3,350	0.68%
Private Company	HK	Block.one	140,000	3,310	0.67%
Private Company	CH	The Tezos Foundation	17,500	414	0.08%
Private Company	US	Stone Ridge Holdings Group	10,000	236	0.05%
Private Company	US	Massachusetts Mutual	3,500	83	0.02%
Private Company	CH	Lisk Foundation	1,898	45	0.01%
Private Company	NO	Seetee AS	1,170	28	0.01%
Private Company	SG	Luna Foundation Guard	'313	7	0.00%
Government		Ukraine	46,351	1,096	0.22%
Government		El Salvador	2,381	56	0.01%
Government		Finland	1,981	47	0.01%
Government		Georgia	66	2	0.00%
ETFs	US	Grayscale Bitcoin Trust	643,572	15,215	3.37%
ETFs	CH	CoinShares/XBT Provider	48,466	1,146	0.25%
ETFs	CA	Purpose Bitcoin ETF	25,284	598	0.13%
ETFs	CA	3iQ CoinShares Bitcoin ETF	21,237	502	0.11%
ETFs	DE	ETC Group Bitcoin ETP	17,976	425	0.09%
ETFs	US/CA	Other ETFs in North America	42,061	994	0.22%
ETFs		Other ETFs in Rest of World	10,092	239	0.05%
<b>Total</b>			<b>1,432,581</b>	<b>\$33,868</b>	<b>7.32%</b>

Source: Buy Bitcoin Worldwide, August 2022.

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