

Special

CRYPTO-ASSETS

The rapid expansion of crypto-assets (digital representations of value and rights based on distributed ledger technology (DLT)¹), their potential use, in some cases, as a means of payment and the virtual absence of regulation of these activities pose potential risks to financial stability that call for analysis and close monitoring of these assets.

Crypto-asset technology is creating new financial assets and new forms of intermediation. The underlying technologies could potentially improve the financial system's efficiency and resilience via lower transaction costs, greater interoperability in the payment system or increased competition between the different players. However, these benefits can only be achieved if crypto-assets are developed securely, in conjunction with regulatory frameworks that mitigate risk and maintain confidence in the financial system.

Market and liquidity risks associated with crypto-assets may be high, particularly for those not backed by traditional financial assets. Additionally, these instruments may be used for illicit activities, particularly money laundering. Their reliance on innovative technologies also poses operational risks, including in the legal and reputational dimension, and raises questions as to their operational transparency and the high energy consumption they entail, with a possible impact on climate risk. If crypto-asset markets and their interconnectedness with traditional financial assets and institutions were to scale up, these risks could become systemic.

In this setting, crypto-asset activities in Spain are not currently regulated, except for certain disclosure requirements set by the CNMV, and are therefore not subject to vetted access. In particular, the Banco de España has no regulatory powers, or powers to authorise or supervise crypto-asset service providers, although it monitors developments in this market as part of its financial stability-related responsibilities. A number of jurisdictions are addressing different regulatory aspects of these assets. However, given the global dimension of these activities, it seems urgent to develop international – and particularly European – initiatives, to establish uniform rules to avoid regulatory arbitrage between jurisdictions and correct the shortcomings in the information available on this market, which are significant and need to be rapidly remedied. This will provide legal certainty in crypto-asset operations and will enable appropriate prudential regulation and supervision, allowing the technological possibilities associated with these instruments to be harnessed while avoiding an excessive build-up of risk.

¹ The term DLT is broad and refers to decentralised databases that are managed by several users and employ various technical resources (e.g. cryptography) to implement the desired features, such as levels of transparency and security. Crypto-assets rely on distributed ledger technology or others with analogous functions.

S.1 Crypto-assets, technology and the financial system

The digitalisation of society is being reflected in the emergence of many far-reaching innovations in the provision of financial services, which include most notably crypto-assets and, more generally, innovations affecting payment services. This is probably because that is where there are relatively more immediate gains yet to be exploited (gross fees and commissions for payment services account for approximately one-third of Spanish banks' fee income from their business in Spain) and where network economies² have the greatest potential. In this respect, empirical evidence shows that, in the past, innovations in the financial sector have generally boosted the economy's potential growth. However, they have also entailed processes of financial fragility and increased the risks to the financial system, particularly in the adoption phase, even leading in some cases to banking crises.³ This suggests the need to assess the risk that these innovations may pose and to put in place appropriate regulatory policies to steer their adoption and functioning.

Money fulfils three basic functions, acting as a unit of account, a medium of exchange and a store of value. It comes mainly in two forms: physical cash and electronic balances (see Table S.1). One of the differences between them is that, while cash does not require advanced payment technology to act as a medium of exchange, electronic balances do, through an intensive use of IT and telecommunications networks. For example, to be able to use the balance on a current account or a prepaid card to buy a product, the buyer uses an instrument (e.g. a card) that interacts, via a payment network, with the vendor's point of sale terminal (e.g. a dataphone). After conducting the appropriate checks, the network puts the banks that provided the respective payment and collection instruments in contact with each other for them to settle the transaction via the central bank.⁴ The transaction needs to be verified and recorded owing to what is dubbed the "double-spending" problem. Unlike cash, the transfer of electronic balances does not in itself prevent their original holder from using such balances again in another transaction, by duplicating or manipulating them. Trust in the intermediary operating the payment infrastructure in a centralised manner⁵ and in its regulation makes it possible for all the participants to reach a consensus as to the authenticity of that transaction, thus preventing double spending.⁶

2 Network economies increase the value of a product or service as more people use it. The most common example are platforms for exchanging products or information.

3 See, for example, T. Beck (2013), "Financial Innovation: The Bright and the Dark Sides".

4 See, for example, A. Fatas (2021), "Market Structure, Regulation and the Fintech Revolution".

5 The functions of the intermediary that contribute to building trust in it include verification of the identity of the agents operating in the infrastructure and adoption of measures to prevent fraud and ensure compliance with regulations.

6 See J. Abadi and M. Brunnermeier (2021), *Blockchain Economics*.

Table S.1

CHARACTERISTICS OF TRADITIONAL MONETARY INSTRUMENTS AND CRYPTO-ASSETS (a)

	Cash	Bank deposits	Unbacked crypto-assets	Stablecoins
Electronic format	✗	✓	✓	✓
Programmable	✗	✓	✓	✓
Means of payment	✓	✓	✓	✓
Unit of account	✓	✓	✓	✓
Store of value	✓	✓	✓	✓
Peer-to-peer use (b)	✓	✗	✓	✓
Backed by a central bank	✓	✓	✗	✗
Backed by a deposit guarantee scheme	✗	✓	✗	✗
Backed by collateral (c)	✓	✓	✗	✓
No price volatility (d)	✓	✓	✗	✓

SOURCE: Banco de España.

- a The extent to which a traditional monetary instrument or crypto-asset (columns) has a certain characteristic or function (rows) is denoted by the following signs and colours: red cross (not a significant characteristic), orange tick (not a generally applicable characteristic or function, but one that it may potentially possess) and green tick (a generally applicable characteristic or function).
- b Can be used in transactions without the need for involvement of a traditional financial intermediary.
- c In general, the collateral may include other financial instruments, physical assets or, in the case of legal tender money (for example, cash), the right to use it as a means of payment to acquire any good or service.
- d Low short-term market risk, but not excluding the existence of other financial risks (liquidity credit, etc.).

Crypto-assets rely on a technology that allows for decentralised (peer-to-peer) trading, potentially eliminating the need for intermediation. This chapter focuses on those crypto-assets that aspire to perform the basic functions of money by applying this technology. Crypto-assets are digital representations of value and rights that may be stored and transferred electronically using distributed ledger (DLT) or similar technology. Validation is performed using systems akin to a collective decision-making process, implemented through incentive mechanisms and the use of cryptography, and other permissioned systems, which seek to prevent double spending. The two most widely used incentive-based mechanisms are proof of work (PoW) and proof of stake (PoS).⁷ In the case of PoW, validators check and determine the transaction sequence whose validation⁸ entailed the most computational effort, making the high cost in terms of computational capacity and energy to run the computers key to preventing fraudulent transactions. In PoS protocols, validators are selected in proportion to their holdings in the associated crypto-asset. Thus, to be able to perform a double-spending transaction, it would be necessary to acquire a high percentage

7 These consensus incentive-based mechanisms are primarily applied in public networks, which are the focus of this chapter. There are also private networks which are often permissioned, where the validation is managed by the network owners. In this case, consensus mechanisms are either simpler or absent, and decentralisation is, naturally, much lower or even non-existent.

8 Validators compete to solve a mathematical problem using algorithms, making it computationally costly. The first to solve the problem shares it on the network and the rest verify that it is correct.

of the holdings beforehand.⁹ Blockchain, which is a specific type of DLT, is the ledger technology used by most crypto-assets. This innovation, applicable to many other fields, broadly consists of recording sets of crypto-asset transactions by blocks.¹⁰ These blocks have a header and a marker pointing to the preceding block. This makes it possible, at any point in time, to trace the entire trajectory followed by each crypto-asset unit since its creation.

Crypto-assets have another technological advantage over traditional monetary instruments: they are programmable. Indeed, some of these digital assets may include sets of instructions in the form of computer code. This allows them to support so-called “smart contracts” that make it possible to automatically run specific operations under certain previously specified circumstances.¹¹ Applying such programs to a specific crypto-asset would change its overall financial characteristics, effectively generating new classes of crypto-assets (e.g. a stablecoin-denominated loan to be used as a means of payment), which may have various purposes (e.g. monetary, covering investment and savings needs, etc.) different from those of the original crypto-asset.

Although crypto-assets designed to be used as means of payment are developing and some of their characteristics closely resemble those of money there is still a long way to go. An essential feature of money is the principle of universal acceptance, also referred to as the “no questions asked” (NQA) principle,¹² whereby it must be accepted in any economic or financial transaction without any party questioning whether its face value coincides with its real value. This depends primarily on its backing. In the case of cash and bank deposits, the main factors underpinning their acceptance are their status as legal tender,¹³ the backing of the central bank (which is committed to keeping the value of the currency stable and acts as lender of last resort) and the existence of a deposit guarantee scheme.¹⁴ Crypto-assets are classified economically precisely according to their different degree of backing.

In this analysis, a distinction must be drawn between unbacked crypto-assets and those that are backed by some kind of asset or mechanism, such as stablecoins. Bitcoin, which was the first cryptocurrency to be put in circulation

9 In the world of crypto-assets a democratic mechanism where each person has a vote is not feasible, as these systems do not identify people but rather the IP addresses of participants, and it is impossible to monitor how many addresses a single person has.

10 See C. Conesa (2019) “[Bitcoin: a solution for payment systems or a solution in search of a problem?](#)” for further details on the technological characteristics of crypto-assets.

11 See A. Lee (2021), “[Programmable Money](#)”.

12 See G. B. Gorton and J. Y. Zhang (2021), “[Taming Wildcat Stablecoins](#)”.

13 Crypto-assets are currently not generally considered legal tender, except in some countries (e.g. El Salvador).

14 Various central banks have considered the possibility of issuing their own central bank digital currency. These digital currencies are generally still under discussion, or in preliminary pilot programmes, focused on ensuring that financial stability will not be compromised by their introduction. For the specific case of Europe, see Box 2.3, “[An initial analysis of the possible introduction of a digital euro](#)”, FSR Spring 2021, and ECB (2020), “[Report on a digital euro](#)”.

(in 2009),¹⁵ is the most well-known example of an unbacked crypto-asset. Although the exact determinants of these unbacked assets' market value are uncertain, it is mainly based on a collective consensus, which can be fragile, regarding the services they can provide to their holders and the value the technological innovation they represent can bring to some users.¹⁶ Thus, their price tends to fluctuate considerably over time, since the swings in demand, which largely depend on the expectations of agents who tend to behave very gregariously, cannot be accommodated by a supply which is generally inflexible. This has largely prevented them from being used as a means of payment or unit of account, and they are currently more akin to an investment product. Conversely, stablecoins (among which tether currently has the largest market share) are backed by assets and have automatic value stabilisation mechanisms.¹⁷ The underlying assets can be traditional assets or unbacked crypto-assets. In practice, the stablecoins with less price volatility and that have gained greater market share are those backed by traditional assets, particularly by highly liquid and secure ones. The latter are the focus of this chapter's analysis of these instruments.

To keep the value of stablecoins steady, issuers and other holders of cryptocurrencies must adapt supply to fluctuations in demand. In some cases this requires their primary issuer¹⁸ to actively intervene in the markets for this instrument and for its underlying assets. Thus, ideally, if their price rises above par, issuers would react by supplying more stablecoins, which would be sold in the market, thus reducing their relative price, and the proceeds would be used to increase their holdings of the underlying assets. Conversely, if their price falls below par, issuers would buy stablecoins with the proceeds obtained from the sale of underlying assets, taking them out of circulation and thus increasing their relative price. Empirical evidence shows that the arbitrage mechanisms that would be triggered when the primary issuer announces that it is always willing to buy stablecoins at par would have great stabilisation potential. This could eventually confer on stablecoins characteristics more similar to those of bank deposits, reinforcing their potential role as a means of payment and store of value and increasing their interconnectedness with, and impact on, the financial system. However, for the time being, stablecoins cannot yet be used in all types of transactions across the entire financial system and pose specific risks analysed in detail in Section 2 of this chapter. Stablecoins are currently being used mainly as a means of payment in purchases and sales of

15 See S. Nakamoto (2009), "Bitcoin: a peer-to-peer electronic cash system".

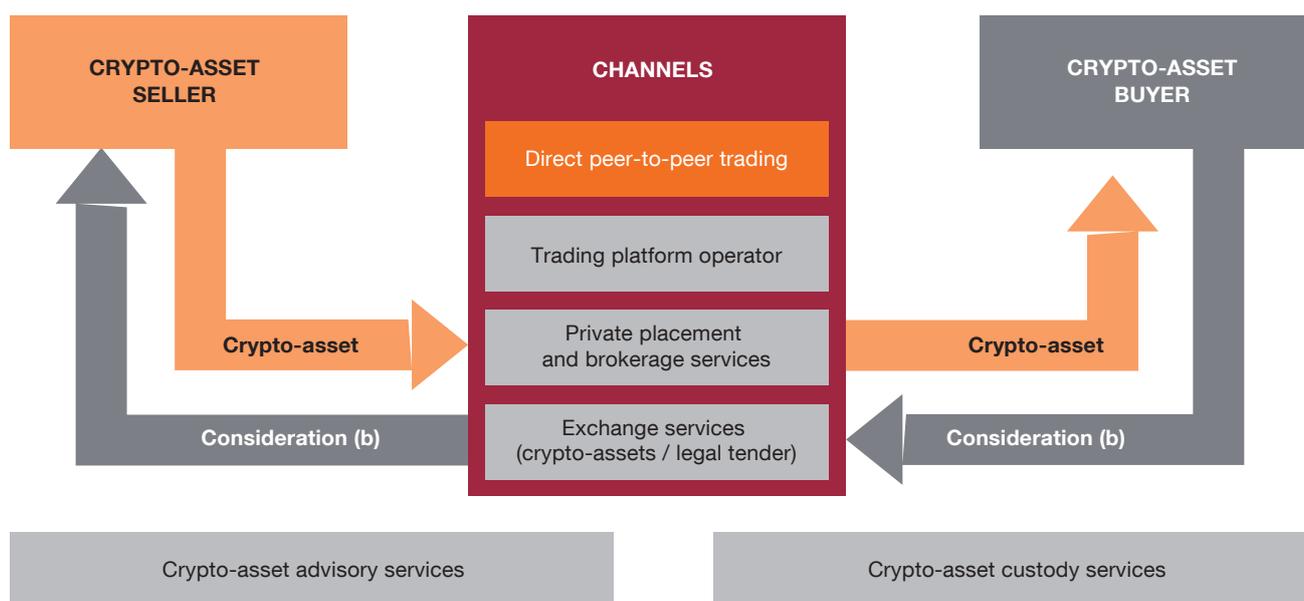
16 More generally, empirical research identifies multiple factors that affect the valuation of such instruments in complex ways. See J. M. Carbó and S. Gorjón (2021), "Application of machine learning models and interpretability techniques to identify the determinants of the price of bitcoin", forthcoming in the Banco de España Working Paper series.

17 See C. Catalini and A. de Gortari (2021), "On the Economic Design of Stablecoins".

18 A crypto-asset issuer is, broadly speaking, a legal person that offers to the public a certain amount of such assets. The primary issuer of stablecoins is the issuer that first places a new quantity of this crypto-asset on the market and that operates the mechanism for stabilising its value.

Figure S.1

AGENTS PARTICIPATING IN CRYPTO-ASSET MARKETS (a)



SOURCE: Devised by authors.

- a Drawing on the classification of crypto-asset service providers in Article 3 of the European Commission’s Proposal for a Regulation on Markets in Crypto-assets (MiCA). Service providers in the grey boxes, direct trading in the orange box.
- b Consideration for the purchase of crypto-assets may be legal tender, other traditional financial assets, or other types of securities or rights established by the counterparties, including other types of crypto-assets (for instance, exchange of a stablecoin for an unbacked crypto-asset). This last example would strictly be an exchange between two sellers of crypto-assets. In the MiCA terminology, legal persons who offer crypto-assets to the public are formally designated issuers of crypto-assets. Sellers of crypto-assets include issuers and other agents offering these assets for sale.

unbacked crypto-assets and there is evidence they could be considered a safe-haven asset in crypto-asset transactions.¹⁹

Technological and financial characteristics associated with crypto-assets can lead to their being considered legal tender to a certain degree by some states. So far, only El Salvador has decided to adopt a crypto-asset – specifically bitcoin – as legal tender, even though it is not backed by traditional financial assets and is beyond the control of the national authorities. To facilitate this payment system, the government of El Salvador has developed its own wallet app and has invested funds and technology in encouraging widespread adoption of the instrument.²⁰ The main motives behind this initiative are to encourage financial inclusion in this emerging economy and to cut bank charges on foreign currency remittances received from Salvadorans working abroad. This novel initiative has attracted considerable attention, but there may be some reluctance to use bitcoin among some of the country’s firms and households²¹ and the technical implementation

19 See R. K. Lyons and G. Viswanath-Natraj (2020), “What Keeps Stablecoins Stable?”.

20 See the news report “Why Bitcoin Is Losing Its Shine in El Salvador”.

21 See press release of the Salvadoran Chamber of Commerce, “Dudas y preocupación entre empresarios y consumidores ante circulación del Bitcoin en el país” (Spanish version only).

continues to pose challenges, such as the need to overcome knowledge barriers in certain segments of the population. There is also concern regarding its impact on financial stability, and in fact the IMF has urged El Salvador to remove bitcoin's legal tender status, based on considerations that include risks for financial stability.²²

Although crypto-assets do not require traditional financial intermediaries in basic transactions, their expansion has led to the appearance of a series of agents, in addition to the issuers, that provide financial services related to these instruments.

According to the European regulation on crypto-assets, MiCA,²³ approval of which is currently under way, there may be up to eight types of different crypto-asset activities (see Figure S.1). One of them would be the placing of these assets on behalf of the issuers. In addition, potential buyers and sellers of these assets could require advisory, custodial, portfolio management and brokerage services for the transmission and execution of orders. Lastly, these holders can also operate on trading platforms for crypto-assets and use services for exchanging crypto-assets for other crypto-assets or for fiat currency that is legal tender. From a regulatory standpoint, these crypto-asset service providers may have a very important role to play, since, as is well known, crypto-assets can be generated without an identified issuer (a legal or natural person) to which the regulation can be applied, which can be supervised or on which sanctions can be imposed in the event of non-compliance.

Crypto-asset service providers have expanded, as have decentralised finance systems related to these instruments. In general, the Decentralised Finance (DeFi) framework is an alternative financial infrastructure to the banking system, based on the use of smart contracts in decentralised networks, primarily using the unbacked crypto-asset ethereum, with the aim of replicating the functioning of financial products such as debt contracts, derivatives and asset management without the formal contractual framework of traditional finance.²⁴

S.2 Financial risks associated with crypto-assets

S.2.1 Inherent risks

The dependence of the current value of crypto-assets on the expectations of buyers and sellers as to their value in future transactions creates significant market and liquidity risks. These risks are more marked in the case of unbacked

22 See IMF (2022), "Press release No. 22/13".

23 See Regulation of the European Parliament and of the Council on Markets in Crypto-assets and amending Directive (EU) 2019/1937.

24 See F. Schär (2021), "Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets" for a positive assessment of DeFi's potential to increase efficiency and transparency in financial markets. In contrast, S. Aramonte et al. (2021), "DeFi risks and the decentralisation illusion" focuses on the risks to financial stability stemming from the leverage, liquidity mismatches and interconnectedness associated with DeFi.

crypto-assets, where fluctuations in expectations quickly pass through to their market value in the absence of a stabilisation mechanism. However, these risks are not completely absent in stablecoins, since a deterioration in the trust in their issuers' capacity to convert these instruments into their underlying asset at par may likewise generate liquidity crises or abrupt corrections in their market value. Indeed, such risks have already materialised in their most radical form in episodes related to stablecoins backed by crypto-assets or based purely on price stabilisation algorithms.²⁵ They have also affected stablecoins backed by traditional assets, particularly when the information on the composition of the portfolio backing them was considered insufficient.²⁶

The opacity and lack of user protection in broad segments of the crypto-asset markets, the absence of regulation and technological uncertainty may also generate credit and fraud risk in crypto-asset transactions. In particular, participation in increasingly complex financial contracts through DeFi may step up agents' leverage and increase the probability of default.

The innovative technologies on which crypto-assets are based also pose operational risks that may undermine trust in them in future transactions, and may thus be closely associated with market risks. The underlying decentralised ledger technology has certain intrinsic operational risks (forgotten or stolen access codes, programming failures, use of its decentralised nature for fraudulent purposes, etc.). It also relies on the general telecommunications structure, with the potential for cyber attacks to hinder or prevent transactions. Cyber risks also affect the traditional financial system, but it has a number of safety nets, such as the possibility in an extreme case of operating, at least partially, through physical channels and closed networks. This technology involves a trade-off between security and transaction speed, which could limit its scope in the absence of additional technological developments. Should agents' expectations about the technological possibilities of expanding the market turn pessimistic, the ensuing valuation adjustment could exacerbate market risks.

Operational risks associated with crypto-assets also have legal, regulatory and market design dimensions. Despite their decentralised nature and a certain degree of anonymity built into certain technological developments, they are not fully

25 The most recent example of a crypto-asset-backed stablecoin collapsing was on 16 June 2021. A stablecoin called IRON, which was partially backed by the crypto-asset TITAN, had to suspend its convertibility after TITAN crashed, losing 100% of its value within 24 hours. For a more comprehensive description, see, for example, Chapter 2 "The Crypto Ecosystem and Financial Stability Challenges" of the IMF's October 2021 Global Financial Stability Report.

26 On 11 October 2018 tether was the target of a speculative attack that made it lose much of its value after the Bitfinex exchange announced the temporary suspension of its convertibility to dollar deposits. Bitfinex is responsible for investing most of the dollar deposits of tether's underlying assets. This raised doubts as to the level of collateralisation of this stablecoin.

anonymous. The question therefore arises as to the management of the information flow generated in crypto-asset markets and the protection of participants' data, especially in the case of retail investors. The participation of agents with illicit intentions (particularly money laundering) may create legal risks for other participants in these markets. There is also uncertainty over the potentially high costs and the complexity of the interoperability of transactions with different crypto-asset and traditional financial asset ecosystems. The absence of regulations and the possible ban on the use of crypto-assets in certain jurisdictions are also important and limit the participation of some agents in these markets.

Crypto-assets also pose physical and transition climate-related risks due to the high energy consumption of certain operations. The computational cost of certain verification protocols entails a high energy cost,²⁷ which could contribute to climate change (physical risk) if the use of these instruments becomes more widespread, or could limit this expansion due to the imposition of fiscal or regulatory measures (transition risk).

S.2.2 Risks to financial stability

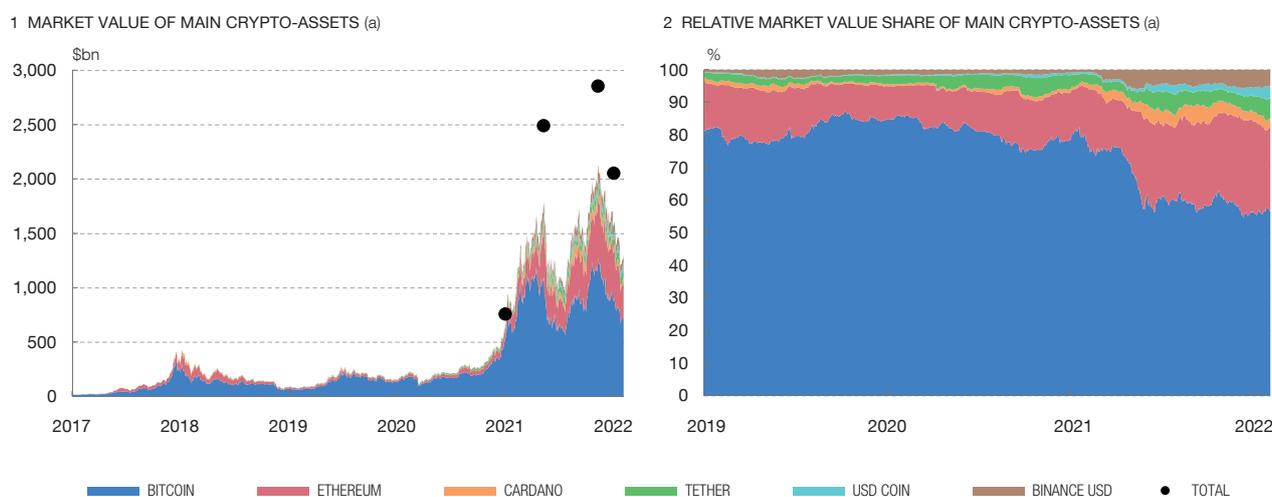
The global market value of crypto-assets is still limited, but it has risen exponentially since late 2020 and most of the trading is concentrated in unbacked crypto-assets, signalling a growing risk to financial stability. However, the risks taken by individual crypto-asset holders, while potentially very high, do not necessarily represent a systemic risk. This would require these markets to gain critical mass in terms of volume or number of interconnections which could, in the event of difficulties, destabilise the financial system. The high growth of trading in the main crypto-assets, whose market value increased by a factor of 13.4 from the beginning of 2020 to its peak in November 2021, and by a factor of 7.8 to February 2022, points to their growing systemic importance (see Chart S.1.1). This is also underlined by the significant correlation between the various crypto-assets, as the chart shows, and suggests that a correction in the value of one such asset could spread to the others in a scenario where there is little differentiation between these assets by most market participants. Moreover, crypto-assets that are not backed by traditional financial instruments, such as bitcoin or ethereum, accounted for more than 80% of the market value of the main crypto-assets at the beginning of 2022, although lately the share by value of stablecoins has grown (see Chart S.1.2). The market capitalisation of the crypto-asset market overall peaked in 2021 at \$2.8 trillion, approximately 1% of global financial

27 In particular, the PoW protocol is computationally and resource intensive. The development of protocols with less energy consumption, such as PoS, opens the door to mitigating these climate risks. For more details, see [Box 1](#) of FSB (2022).

Chart S.1

THE MARKET VALUE OF CRYPTO-ASSETS HAS INCREASED MARKEDLY SINCE 2020 H1, WITH HIGH FLUCTUATIONS

From early 2020 to November 2021, the market value of the main crypto-assets increased more than thirteenfold, although it has recently suffered sharp corrections leading to a 41% decline from peak levels. The preponderance of crypto-assets not backed by traditional financial assets (which account for around 84% of the main crypto-assets' market value, according to the available data) contributes to this high volatility.



SOURCES: CoinMarketCap, CryptoCompare and FSB.

a Bitcoin, ethereum and cardano are unbacked crypto-assets, while the others are stablecoins. The total corresponds to the market value of all crypto-assets, not just those included in the chart.

assets. This represents growth to a higher order of magnitude compared with a date as recent as end-2018, when the market accounted for just 0.02% of global financial assets.²⁸

The growth and volatility of the global market value of crypto-assets are mainly explained by the prices of unbacked instruments, and are evidence of the relevance and scale of the market risk inherent to these instruments. The supply (number of units) of the main unbacked crypto-assets (bitcoin and ethereum) has held relatively stable since 2017. In particular, from end-2020 to February 2022, supply increased by around just 5%, compared with high growth and volatility in market value (see Chart S.2.1). By contrast, the main stablecoins (tether and USD coin) have based their market value growth on the issuance of new units (see Chart S.2.2), with their unit price holding relatively stable, in keeping with their design and the absence of any widespread crises of confidence in the period.

Unbacked crypto-asset markets have higher volatility than equity markets, but the correlation with the latter has risen since 2020. This could potentially increase market risk beyond the crypto-asset sub-segment. The dispersion of crypto-assets' market returns is significantly higher than that of the S&P 500 index; outliers, both positive and negative, are also more frequent (see Chart S.3.1). There

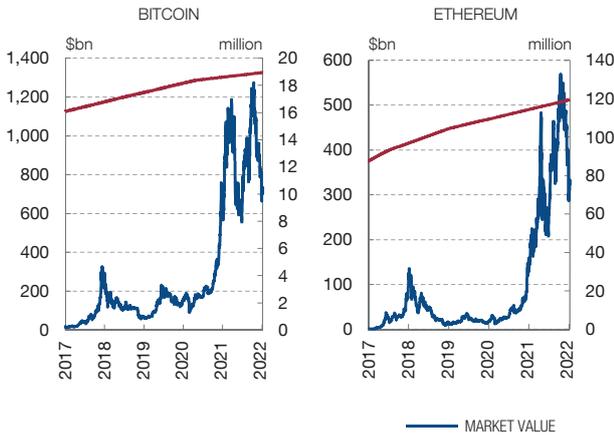
28 See FSB (2020), "Global Monitoring Report on Non-Bank Financial Intermediation 2019" and FSB (2022), "Assessment of Risks to Financial Stability from Crypto-assets".

Chart S.2

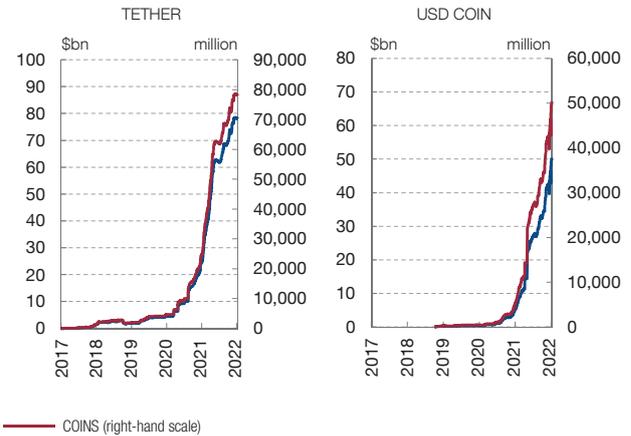
THE GROWTH IN THE MARKET VALUE OF UNBACKED CRYPTO-ASSETS HAS BEEN DRIVEN BY INCREASES IN THEIR UNIT PRICE, WHILE IN THE CASE OF STABLECOINS IT HAS BEEN MAINLY AS A RESULT OF THE GROWTH IN SUPPLY

The number of units of the two main unbacked crypto-assets (bitcoin and ethereum) has risen by approximately 3% and 7%, respectively, since mid-2020, while their trading volume has grown sevenfold and twentyfold, respectively, reaching all-time highs in November 2021. This confirms the significance of the price effect. In the case of the two main stablecoins (tether and USD coin), whose price is stable by design, their market value has risen as a result of the increased supply.

1 SUPPLY AND MARKET VALUE OF MAIN CRYPTO-ASSETS NOT BACKED BY TRADITIONAL FINANCIAL ASSETS



2 SUPPLY AND MARKET VALUE OF MAIN STABLECOINS



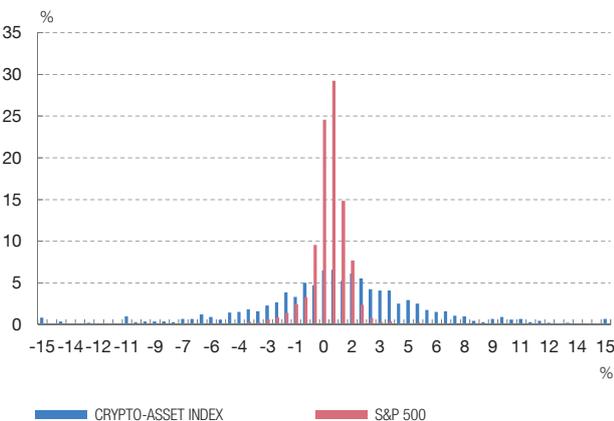
SOURCES: CoinMarketCap and CryptoCompare.

Chart S.3

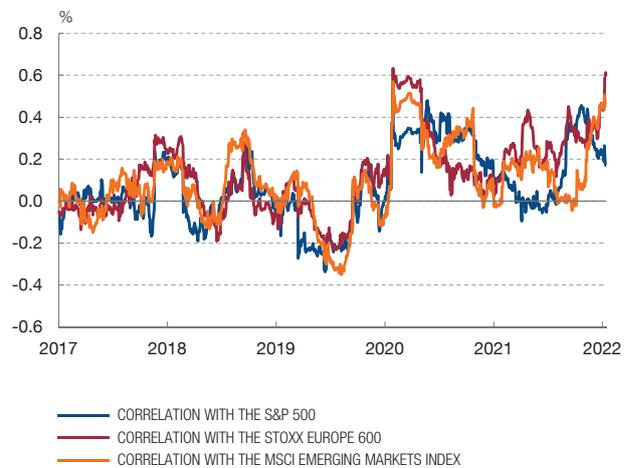
CRYPTO-ASSET MARKET RETURNS ARE MORE VOLATILE THAN EQUITY MARKET RETURNS, WITH WHICH THERE HAS BEEN A GROWING CORRELATION SINCE 2020

The upper and lower tails of the distribution of the market returns on crypto-assets are substantially higher than the returns on the main equity market indices such as the US S&P 500. The correlation between crypto-asset and equity market returns has turned more positive and has risen since 2020, in both advanced and emerging economies, where it was particularly high in 2021.

1 DAILY RETURNS ON A CRYPTO-ASSET INDEX AND THE US S&P 500 INDEX (a)



2 CORRELATION BETWEEN DAILY RETURNS ON A CRYPTO-ASSET INDEX AND EQUITY MARKET INDICES (EUROPE, UNITED STATES AND EMERGING ECONOMIES) (a)



SOURCES: Refinitiv and MVIS Investable Indices.

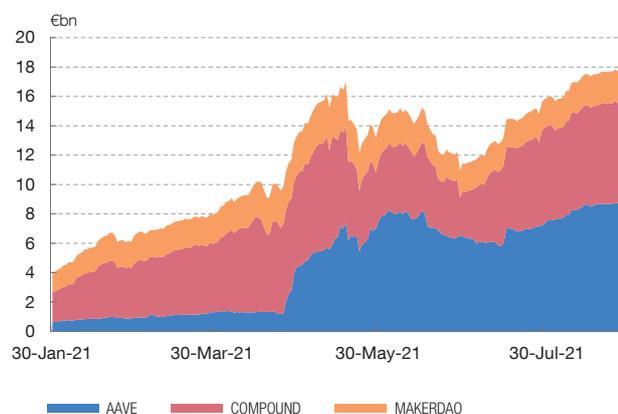
a The MVIS CryptoCompare Digital Assets 100 Index comprises the largest 100 crypto-assets (asset-backed and unbacked) by market value.

Chart S.4

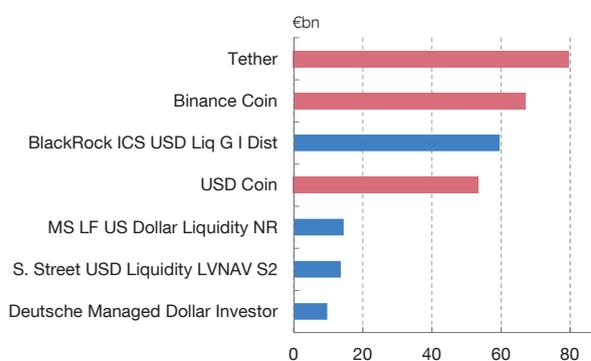
THE GROWTH OF DeFi, WHICH COULD FACILITATE LEVERAGING WITH CRYPTO-ASSETS, AND THE INCREASE IN THE VOLUME OF STABLECOINS TRADED, COULD POSE RISKS TO FINANCIAL STABILITY

The volume of loans on the main DeFi platforms has increased fourfold since the start of 2021; if this trend continues, the systemic importance of this infrastructure will rapidly increase. Some stablecoins are already larger in size than some major European money market funds, evidencing their strong growth and their capacity to affect financing conditions on the traditional money markets.

1 LOANS ON DeFi PLATFORMS



2 COMPARISON BETWEEN MMFs AND STABLECOINS (a)



SOURCES: BIS and Refinitiv.

a The blue bars denote funds and the red bars stablecoins.

is ample evidence in the economic literature of how shocks resulting in a reduction in agents' income and wealth can increase their risk aversion, leading them to shed other financial assets whose value would also experience a correction, negatively affecting consumption and investment.²⁹ The high volatility of crypto-assets may contribute to these dynamics, with corrections in these assets driving a more general correction in financial asset prices. In this respect, the growing correlation between this market and that of other risky assets, such as equities, both in advanced and emerging economies (see Chart S.3.2) increases this risk of indirect contagion.³⁰ It should also be borne in mind that an albeit small but high-risk segment can give rise to widespread market corrections, particularly if highly leveraged agents are exposed to it.³¹ The growing volume of crypto-asset loan agreements could make it easier for traders in this sub-segment to become more leveraged and drive up these correction risks (see Chart S.4.1). The fact that these instruments are available to retail investors

29 See for example J. Y. Campbell and J. H. Cochrane (1999), "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior", and J. H. Cochrane (2017), "Macro-Finance".
 30 T. Adrian et al. (2022), "Crypto Prices Move More in Sync With Stocks, Posing New Risks" highlights the importance of this growing positive correlation.
 31 E. Pinto (2008), "Sizing Total Exposure to Subprime and Alt-A Loans in U.S. First Mortgage Market" documents that in 2008 the US subprime mortgage market was worth \$1.2 trillion, less than the current global crypto-asset market even after adjusting for inflation.

with limited understanding of their financial characteristics³² could also exacerbate this accelerating expansion and the risk of abrupt price corrections, as they are unable to properly assess the positive and negative news flow.

Meanwhile, the growth in the supply of stablecoins implies that issuers must also increase their holdings of the underlying assets, thus increasing interconnectedness with the traditional financial market. For their value to hold stable, stablecoins often need to be backed by liquid assets, such as highly rated commercial paper and sovereign debt with short maturities or bank deposits, which increases demand for these assets and affects their price. This implies that stablecoins drive up demand for safe assets. When such assets are scarce, this may put additional downward pressure on equilibrium real interest rates.³³ Moreover, increased pressure to convert stablecoin holdings into legal tender could lead to a hasty sell-off of positions in these products and generate liquidity stress.³⁴ The larger the stablecoin segment, the greater the liquidity risks would be. In this respect, there is already evidence that the main stablecoins are now comparable in size to some major European money market funds (see Chart S.4.2). In addition, the role that stablecoins currently play in making it easier to trade in unbacked crypto-assets creates substantial interconnectedness that increases these instruments' risk profile. The volatility of unbacked assets can feed through to all crypto-asset trading and increase the above-mentioned liquidity and market risks, putting pressure on the issuer's ability to convert them at par value at times of stress, since they act as a safe-haven asset within crypto-asset trading. Retail and institutional investors that have become more reliant on these instruments would be more affected by these volatility episodes (see Figure S.2).

Lastly, a more widespread use of stablecoins could entail medium-term structural risks to financial stability through the erosion of the banking sector's deposit-taking capacity. This could potentially alter the effects of monetary policy and affect capital flows. The possible substitution of stablecoins for bank deposits would reduce the banking sector's ability to raise low-cost funding, as well as its engagement with and knowledge of traditional segments of bank customers. This would result, all else being equal, in a lower financial intermediation capacity. This could lead the banking sector to seek alternative sources of financing which would possibly require a greater use of collateral in secured transactions, thus increasing the banking sector's demand for certain classes of liquid assets. The net effect of these dynamics on banks' financing costs would plausibly also feed through to the interest rates charged on bank loans and to banks' risk-taking, which could

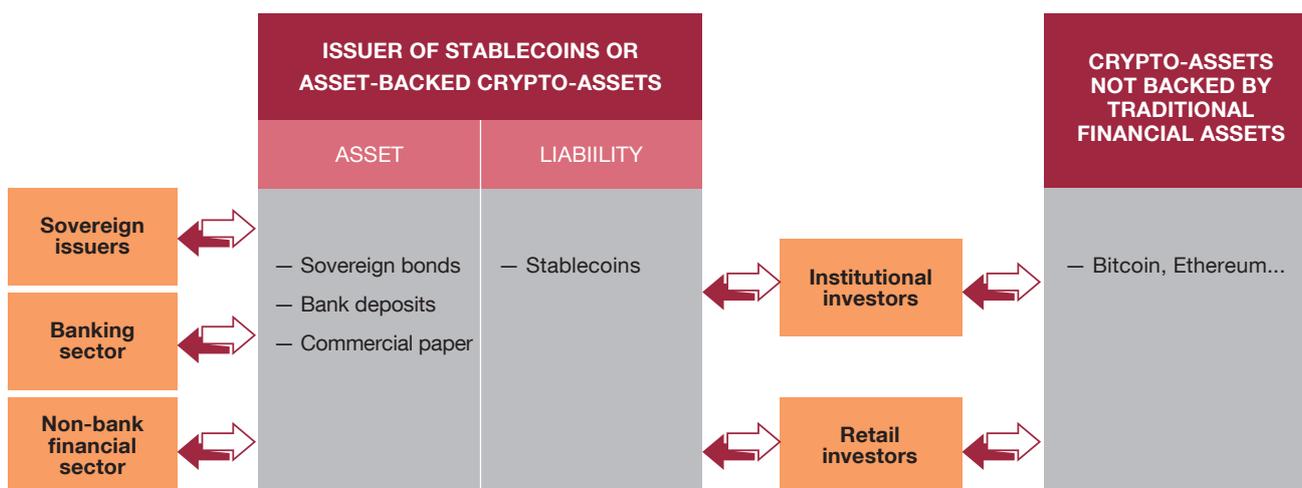
32 See the address given by the Governor of the Banco de España, "Financial Stability and Crypto-assets", on 21 February 2022 at the "Observatorio de las Finanzas" symposium organised by the newspaper El Español.

33 See, for example, R. Caballero et al. (2016), "Safe Asset Scarcity and Aggregate Demand".

34 See, for example, J. Barthélemy et al. (2021), "Crypto-assets and financial stability: are there any contagion risks?".

Figure S.2

INTERCONNECTIONS GENERATED THROUGH STABLECOIN HOLDINGS



SOURCE: Banco de España.

increase. These different impacts (bank loans and deposits, higher demand for liquid assets, possible increased recourse to central banks or wholesale markets) would affect both monetary policy interest rate and bank lending channels. In emerging countries, crypto-assets may allow residents to access a store of value that affords them greater protection from domestic inflation. This would have significant implications for capital flows and would also reduce the effectiveness of both monetary and macroprudential policy, leaving these countries more exposed to the global financial cycle.³⁵

S.3 Regulation of crypto-assets

S.3.1 Challenges posed by the regulation of crypto-asset markets worldwide and in Spain

Regulating crypto-assets poses novel challenges just as crypto-assets entail novel risks. Moreover, international coordination is essential in a market segment such as this one, susceptible to regulatory arbitrage. However, applying the principle of “same activity, same risk, same regulation” to crypto-assets is less straightforward than for other financial activities subject to digitalisation processes, since their novel features hamper comparisons with traditional services. In addition, the diversity of agents that make up the ecosystem of crypto-asset

35 See IMF (2021), *The Crypto Ecosystem and Financial Stability Challenges*.

issuers and service providers complicates the regulatory approach to be followed and, in any event, advises adopting a sufficiently broad approach to enable all the relevant aspects of these ecosystems to be captured. This is an urgent task, considering the speed at which crypto-assets are expanding and the current almost total lack of regulation of crypto-asset-related activities.

There are no specific Spanish regulations on crypto-assets, and only recently has the CNMV issued a circular on advertising of crypto-assets intended for financial investment. The circular aims to ensure that the advertising content is accurate, easily understandable and not misleading, and that it clearly includes mention of the associated risks. To that end, the circular lays down rules on the content and format of crypto-asset advertising campaign messages. It also envisages a procedure for prior notification to the CNMV of mass advertising campaigns targeting 100,000 persons or more. The circular establishes the tools and procedures for effective supervision of crypto-asset advertising, but it does not regulate either crypto-assets, their issuance or crypto-asset-related services.

In this setting, with no specific national crypto-asset regulations, the Banco de España does not currently have the power to regulate, authorise or supervise the functioning of crypto-asset markets or their participants. At present, it is only responsible for managing the register of providers engaged in exchange services between virtual currency and fiat currencies and custodian wallet providers, but it has no regulatory or supervisory powers over crypto-asset markets. In particular, the Banco de España does not have the power to regulate authorisation of the provision of crypto-asset services. Naturally, however, despite the scant information available, it does analyse and monitor these services, as in this report, in view of the potential relevance of crypto-assets for the stability of the financial system and their impact on economic activity.

Various supranational initiatives are under way for the regulation and supervision of crypto-assets, which are key given the possibilities these instruments offer for international transactions. The European Union has developed a comprehensive response to the challenge of regulating crypto-assets in a new regulatory framework, rather than simply adapting existing structures, developing the Markets in Crypto-assets Regulation (MiCA) mentioned earlier. In the international sphere, several initiatives are under way – in particular at the FSB, the Committee on Payments and Market Infrastructures and the International Organization of Securities Commissions (CPMI-IOSCO), the Basel Committee on Banking Supervision (BCBS) and the Financial Action Task Force (FATF) – that will introduce regulations on different aspects of operations with crypto-assets, in particular relating to prudential requirements at banks.

The regulatory initiatives largely stem from a growing consensus among regulators as to the scale of the potential risks associated with this market

segment. At the European Union level, the European Banking Authority (EBA), European Securities and Markets Authority (ESMA) and European Insurance and Occupational Pensions Authority (EIOPA) recently issued a joint warning to consumers of the financial risks of crypto-assets.³⁶ In Spain, the Banco de España, the CNMV and the Directorate General of Insurance and Pension Funds (DGSFP) subsequently issued a joint message of caution,³⁷ also warning that the regulations in place to date cover only a very limited part of activity in crypto-assets and are, therefore, insufficient to adequately contain the associated risks.

S.3.2 Proposed EU Markets in Crypto-assets Regulation (MiCA)

The European institutions are currently negotiating a proposal for a regulation on crypto-asset markets (Markets in Crypto-assets, MiCA). The proposal was submitted by the European Commission in September 2020. The Council of the European Union reached an agreement on the text in late November 2021 and negotiations are now ongoing between the European Parliament and the Council to secure a final agreement. In February 2022, the Economic and Monetary Affairs Committee of the European Parliament adopted its negotiating position on the new rules on crypto-assets (MiCA).³⁸

The proposed MiCA regulation considers a set of common rules within the European Union, focused on providing crypto-asset users with legal certainty and adequate legal protection and applicable to both crypto-asset issuers and service providers.³⁹ This framework will replace all national crypto-asset regulations other than those covered by European Union financial services legislation. Among the largest European countries, Germany, France and Italy already have crypto-asset legislation, albeit with varied scope. The proposal does not apply to non-fungible crypto-assets,⁴⁰ or to crypto-assets that may be classed as financial instruments, deposits, funds, securitisation positions or pension products, inter alia, which will be governed by the existing legislation for each corresponding type of financial instrument. But the proposal does apply to stablecoins, understood as those crypto-assets that aim to preserve a stable value relative to an official currency or other securities or rights, or a combination of

36 See the joint EBA, ESMA and EIOPA document, “EU financial regulators warn consumers on the risks of crypto-assets”.

37 See the joint Banco de España, CNMV and DGSFP document, “Joint press statement by the Banco de España, CNMV and DG de Seguros on the warning by European financial regulators regarding the risks of crypto-assets”.

38 See the European Parliament press release of 14 March 2022, “Cryptocurrencies in the EU: new rules to boost benefits and curb threats”. A priori, this position does not impose a ban on the use of PoW protocols, despite their environmental impact.

39 Crypto-asset issuers and service providers are defined in the first section of this chapter.

40 Essentially, crypto-assets with unique characteristics or functions that cannot be immediately exchanged with other crypto-assets and whose value cannot be determined relative to an existing market or other equivalent assets.

both. As explained below, if stablecoins satisfy certain conditions they will also be considered electronic money.

The proposal distinguishes between the following classes of crypto-assets: first, those classifiable as stablecoins, identified as electronic money (emoney) tokens and asset-referenced tokens, and second, all other crypto-assets. Specifically:

- **Electronic money tokens** are a kind of crypto-asset that may be used as a medium of exchange and that aim to preserve a stable value relative to a country's official currency. They are considered electronic money.⁴¹ The issuers of these tokens must be credit institutions or electronic money institutions.
- **Asset-referenced tokens** are a different kind of crypto-asset that aim to preserve a stable value relative to any other securities or rights, or a combination of both, including one or several official currencies of a country. Issuers of asset-referenced tokens must constitute and maintain a reserve of assets at all times. This reserve is created in the interest of the holders of these tokens and must, therefore, be segregated from the issuers' own assets. The reserve assets may only be invested in highly liquid financial instruments with minimal concentration, credit and market risk. Lastly, the proposed MiCA regulation requires that the reserve be managed in such a manner as to ensure that the liquidity risks associated with holders redeeming their tokens can be met, and that the risks associated with the assets to which the tokens are referenced are covered.
- All **crypto-assets** other than those described above, included in the sphere of the proposal.
- Electronic money tokens and asset-referenced tokens may, in addition, be **significant** if they satisfy certain criteria or cross certain thresholds, as to the client base, the value of the tokens issued or the number and value of the transactions concerned.

The proposal regulates other aspects of crypto-asset issuers' and service providers' activities. For crypto-asset issuers, it introduces rules on their authorisation, on how to draft the "white paper", which is an informative document on the issuance of crypto-assets, and on their organisation, governance and supervision. Crypto-asset service providers may provide a range of services (see

⁴¹ Electronic money is a financial instrument that may be used to make payments and transfers by means of an electronic device that stores a country's official currency.

Figure S.1 in Section 1) and the proposal includes rules for each such service, relating to organisational and prudential (own funds, insurance policies) aspects, customer information, safeguarding of funds, conflicts of interest and outsourcing. Credit institutions may be both crypto-asset issuers and service providers. In neither case will they need to obtain authorisation to pursue this activity. However, they may be subject to other provisions of the proposed MiCA regulation.

Regulation of crypto-asset service providers may ensure that this market expands at an appropriate pace and prevent an excessive build-up of risk.

Despite the possibilities of peer-to-peer crypto-asset transactions, the role of intermediaries may be important to scale up the crypto-asset market, harnessing efficiency gains and reducing data asymmetry. If the regulations ensure an appropriate degree of transparency and prudence in intermediaries' operations, the build-up of risks associated with crypto-assets could be effectively controlled, in particular as regards the information required by the regulator and the number of agents whose compliance with the regulations would need to be supervised. In any event, the supervisory challenges are considerable, not least in view of the technological complexity involved.

Lastly, the proposal regulates the crypto-asset supervisory architecture.

Essentially, authorisation of the issuer, the white paper which the latter must present and the authorisation to provide crypto-asset services fall within the remit of the national competent authorities (NCAs). These authorities are also responsible for supervising the issuers, unless the e-money and asset-referenced tokens issued are significant, in which case this responsibility will be assumed by a European-level supervisor in conjunction with a college of supervisors. Supervision of crypto-asset service providers falls within the remit of the NCAs.

S.3.3 Advances at the global level

At the global level, the main regulatory challenge is to formulate consistent rules across the different frameworks, preventing gaps or overlaps between the different approaches. The main international coordination efforts as regards regulation of crypto-asset-related activities and banking sector exposure are concentrated at the FSB, BCBS, CPMI-IOSCO and FATF.

The FSB operates as a forum for cross-border and cross-sectoral coordination.

Initially, it agreed to regularly monitor and report to the G20 developments in these markets, to identify possible global systemic risks. The FSB also agreed to establish a series of high-level recommendations⁴² to address the regulatory and supervisory

42 FSB (2020), "Regulation, Supervision and Oversight of "Global Stablecoin" Arrangements".

challenges posed by global stablecoins. These recommendations establish minimum criteria for the regulation and supervision of global stablecoins, from a flexible, international and multi-sectoral approach. The FSB is currently working to identify possible gaps and overlaps in the regulatory standards for which other international bodies – the standard-setting bodies – are responsible. Moreover, and as a result of this analysis and monitoring of the development of crypto-assets, the FSB has concluded that, parallel to the above-mentioned work on stablecoins, regulatory and supervisory questions relating to unbacked crypto-assets must begin to be examined, warranted by the growth and potential risks to financial stability (albeit contained to date) of these assets and by the FSB's own analysis.

In recent years the BCBS, as the body responsible for international prudential standards for banks, has worked on the development of the prudential treatment for banking exposures to crypto-assets.⁴³ Specifically it has analysed whether the prudential regulatory framework, which links the risk of different exposures to a defined level of bank capital requirements, should be modified in any way to correctly capture the risks associated with crypto-assets. Thus, in June 2021 the BCBS published a first consultative document (to be followed in 2022 by a second one).⁴⁴ The proposed approach classifies crypto-assets into two groups, according to the specific classification conditions they fulfil:⁴⁵

- **Group 1 includes stablecoins** that have effective stabilisation mechanisms at all times.⁴⁶ These conditions would be set in accordance with the risk of fluctuation or loss of value of the underlying assets and the risk that the redeemer may not honour its commitments.⁴⁷
- **Group 2 includes unbacked cryptocurrencies and stablecoins that do not have a stabilisation mechanism that complies with the test established.** It also includes other crypto-assets whose technology does not satisfy the conditions, or traditional tokenised assets that do not satisfy the conditions, for classification in Group 1. The prudential treatment proposed for Group 2 crypto-assets establishes a 1250% risk weight of exposure to these crypto-assets, irrespective of whether they are classified

43 BCBS (2021), “Prudential treatment of cryptoasset exposures”, consultative document.

44 The document includes all kind of crypto-assets, with the exception of central bank digital currencies (CBDCs).

45 A value stabilisation mechanism, clearly defined and legally enforceable legal rights that ensure that the crypto-assets may be redeemed at any time, secure networks and regulation of network agents delivering critical functions.

46 The initially proposed mechanism consists of monitoring daily the difference between the value of the crypto-asset and the underlying assets. The difference in value must not exceed 10 bp of the value of the underlying asset more than three times over a one-year period.

47 In any event, Group 1 is broader, as it also includes tokenised traditional assets, i.e. assets which confer the same legal rights as their traditional version and which, therefore, will receive the same prudential treatment. In this case, the technology permits a more efficient transfer of traditional assets, but these maintain their financial characteristics and are not specified as a new instrument.

in the banking or the trading book. Crypto-asset exposures cannot be part of any hedging set.

- **The prudential treatment differences between the two groups** are confined, so far, to the credit and market risk frameworks. All other requirements would be applied in the same way to both groups. In any event, the possibility of including a capital add-on for technological reasons for all crypto-assets is to be assessed, should it be considered that their operational characteristics entail additional risks.

CPMI-IOSCO has concentrated on the operational side of crypto-assets. It has published a consultation report, confirming that the Principles for Financial Market Infrastructures (PFMI) apply to systemically important stablecoin arrangements and proposing additional guidance on how certain aspects of the PFMI may affect the features of these arrangements.

The potential illicit uses of crypto-assets have also prompted a global regulatory response. In October 2021 the FATF, the global money laundering and terrorist financing watchdog, updated its 2019 Guidance for a risk-based approach to virtual assets and virtual asset service providers (VASPs) which provides, inter alia, additional guidance for the public and private sectors on implementation of the “travel rule”⁴⁸ envisaged in its Recommendation 16. Precisely to include the “travel rule” in European legislation, the European Commission has revised its Regulation (EU) 2015/847, extending the obligation on payment service providers to accompany transfers of funds with information on the payer and the payee to include crypto-asset service providers.

S.4 Exploratory analysis of crypto-assets in Spain and Europe

In 2021 Spain was the fifth economy by crypto-asset transaction volume in Europe, which is the region that receives the largest volume of crypto-assets worldwide.⁴⁹ Over the last year, crypto-asset transaction volume in Europe amounted to almost €845 billion⁵⁰ (4.9% of GDP, 0.9% of total financial assets), 25% of the global total, ahead of North America which accounted for 18% and which is also its main counterparty in crypto-asset transactions. Within Europe, Spain ranked fifth in terms of transaction volume in 2021, with almost €60 billion (4.8% of GDP,

48 In general, the “travel rule” refers to the need to record identification and transactional data on transactions over certain minimum thresholds.

49 This section mainly draws on data from Chainalysis (2021), “The 2021 Geography of Cryptocurrency Report”. When assessing these data it must be borne in mind that they are not official statistics (there are none currently available), but are based on the data processing capacity of this private data provider.

50 The original dollar estimates have been converted to euro at the average 2021 exchange rate. The ratios to GDP and total financial assets are based on 2019 values, to obtain a comparison not affected by the impact of the pandemic.

2.7% of total financial assets), behind the United Kingdom, France, Germany and the Netherlands and ahead of Switzerland and Italy.

Analysis by geographical area can be broken down by type of crypto-asset, investor and service associated with the transaction; even the incidence of illicit activity can be proxied. Information on the transaction volume and service type associated with each transaction can be obtained from on-chain data,⁵¹ while the investor type can be proxied by the transaction amount, and the incidence of illicit activity thanks to collaboration with government authorities.

Over the last year the volume of trading in crypto-assets in Europe increased, with institutional investors playing a larger role, although there is no evidence of a significant degree of banks' involvement in this segment. On Chainalysis data, crypto-asset transaction volume in 2021 H1 (the latest data available) was more than ten times the volume traded during the same period of 2020 (see Chart S.5.1.A). In principle, this increase is due to the greater number of transactions, but also to the appreciation of the main unbacked crypto-assets (such as bitcoin), and to the higher supply of stablecoins (such as tether) in the period considered. By transaction type, larger transactions (over \$10 million) have gained prominence over time, which suggests an increased involvement of institutional investors in crypto-asset transactions.⁵² Certain data constraints hamper measurement of the banking sector's exposure to crypto-assets, but the preliminary studies available do not detect a significant volume of exposure, either for Spanish banks or at a global level.⁵³

Within the euro area, Spain's share of trading in crypto-assets by volume is commensurate with its GDP. Thus, Spain accounted for some 10% of total euro area transactions between July 2020 and June 2021 (see Chart S.5.1.B), similar to its relative economic weight in the region. In general, the larger a country's economy, the greater its involvement, although some countries (for example, the Netherlands and Portugal) have a somewhat higher volume of transactions than their GDP would warrant.

Transactions in unbacked crypto-assets account for the bulk of the total and are mainly non-intermediated transactions. In the period considered, most trading (see Chart S.5.2) was in unbacked crypto-assets (approximately 75% of the total in Spain and in the rest of the euro area) whose prices are more volatile. Transactions in Ethereum network currencies (including ether and all other tokens on

51 On-chain data are data that can be extracted from the public ledgers of crypto-assets backed by blockchain technology.

52 On the assumption that retail investors' transactions are smaller than those of institutional investors.

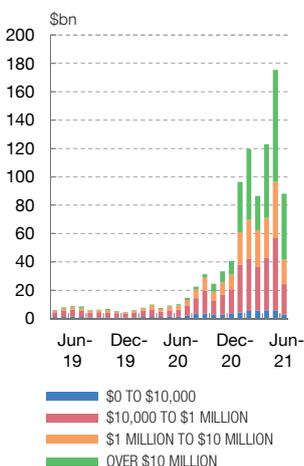
53 Investment in crypto-assets amounts to less than 1% of CET1 capital for the vast majority of the international banks that have most focus on these kind of assets; see BIS (2021) "International banking and financial market developments".

Chart S.5

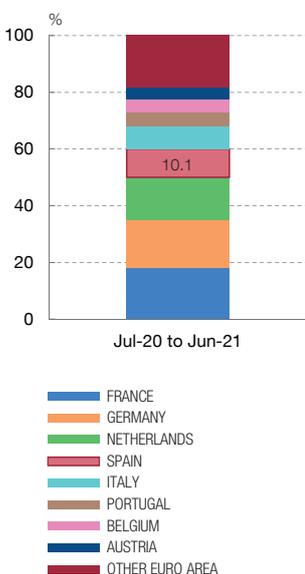
TRADING IN CRYPTO-ASSETS INCREASED IN 2021 IN SPAIN AND IN THE REST OF EUROPE, MAINLY WITH UNBACKED ASSETS AND THROUGH DECENTRALISED TRANSACTIONS

During the first half of 2021 (the latest data available), trading in crypto-assets increased, essentially driven by large transactions. The bulk of the transactions were in unbacked crypto-assets and decentralised services. Among the illicit activities with crypto-assets, on the data available from police investigations, the majority are scams and stolen funds.

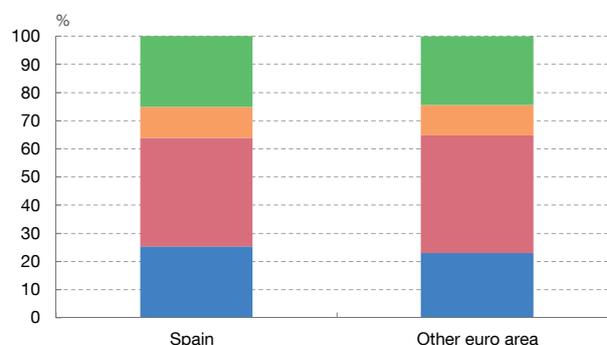
1.A CRYPTO-ASSET TRANSACTION VOLUME IN EUROPE, BY SIZE (a) (b)



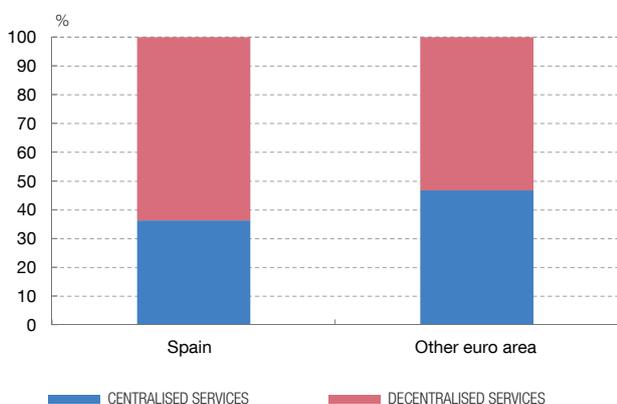
1.B SHARE OF EURO AREA TRANSACTIONS BY COUNTRY (c)



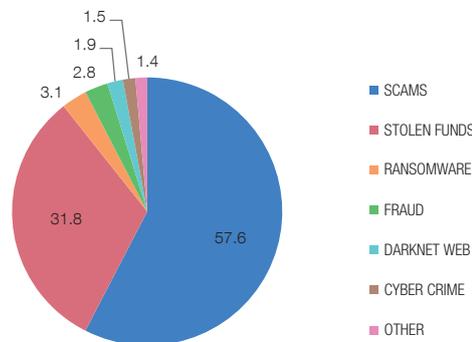
2 TRADING IN DIFFERENT CRYPTO-ASSETS (c)



3 TRADING IN CRYPTO-ASSETS BY SERVICE TYPE (d)



4 BREAKDOWN OF ILLICIT ACTIVITIES ASSOCIATED WITH CRYPTO-ASSET TRANSACTIONS IN EUROPE (AS %) (b) (e)



SOURCES: Banco de España and Chainalysis.

- a Monthly transactions, expressed in US dollars.
- b Includes all European countries according to the Chainalysis classification, both euro area and non-euro area countries. The latter include the United Kingdom, Switzerland, Norway, Sweden, Denmark, Hungary, Croatia, Albania, North Macedonia, Bosnia and Herzegovina, Monaco, Montenegro and Iceland.
- c Stablecoins or asset-backed crypto-assets, such as tether, enjoy some kind of guarantee associated with their value. Bitcoin and ethereum are two of the most important unbacked crypto-assets.
- d Centralised services imply the existence of a trading intermediary (such as a cryptocurrency exchange), while decentralised protocols operate without intermediaries.

that network) were particularly significant (39% of the total in Spain, 42% in the other euro area countries). By protocol type, decentralised services account for a higher share (64% of the total in Spain, 53% in the other euro area economies) than centralised alternatives or those requiring trading intermediaries, such as cryptocurrency exchanges (see Chart S.5.3). However, in some countries⁵⁴ intermediation services are growing rapidly, possibly in response to various factors, such as fewer formal requirements for execution of transactions and the inclusion of liquidity requirements for participation in centralised platforms.⁵⁵

A certain proportion of cryptocurrency transactions are for illicit activities, and only an estimate of the lower bound of their share of the total is available.

In Spain, it is estimated that they accounted for approximately 1% between July 2020 and June 2021. This percentage is low but it could be the lower bound, as agents involved in illicit activity, by its own nature, seek to hide it.⁵⁶ Chart S.5.4 provides a breakdown of the main categories of illicit activity associated with crypto-assets for Europe overall (for where such a breakdown is possible). It shows that scams (57.6% of the total) and stolen funds (31.8%) account for the bulk of illicit crypto-asset transactions detected in Europe.

The surveys available on holdings of crypto-assets confirm that their adoption in Spain is fairly high.

Finder, which conducts a regular survey on cryptocurrency adoption rates in 27 countries,⁵⁷ estimates that 12% of adults in Spain hold crypto-assets, with a slight difference between men (13%) and women (10%) and a higher proportion among young people (highest among the 18 to 24 age group). Likewise, according to a similar survey conducted by Statista, 10% of respondents in Spain declared that they used or owned crypto-assets.⁵⁸ These figures are close to, and in some cases higher than, those observed in the same surveys for other developed countries.

The – albeit limited – information available points to a significant presence of crypto-assets in both Spain and Europe.

The growth in the use and holding of crypto-assets in Spain, and the possible associated risks, advise that they be considered and monitored from a financial stability standpoint. Accordingly, more and better information is needed on the crypto-assets traded and held by different economic agents. In addition to the possibilities offered by on-chain approximations, other sources such as future official statistics or surveys on usage habits may also

54 See, for example, J. Cunliffe (2021), “Is ‘crypto’ a financial stability risk?”.

55 For instance, the presence of agents or operators providing liquidity in liquidity pools in exchange for a consideration, or the development of “smart contracts” for transactions.

56 In S. Foley et al. (2019), “Sex, Drugs, and Bitcoin: How Much Illegal Activity Is Financed through Cryptocurrencies?”, it is estimated that almost half of all bitcoin transactions are financing illegal activity.

57 The [Finder Crypto Report on Cryptocurrency adoption rates](#), whose results were published on 23 August 2021, draws on 42,000 surveys of internet users across 27 countries, including 1,511 respondents in Spain.

58 The [Statista Global Consumer Survey](#), an online survey conducted from January to June 2021 with samples of between 1,000 and 5,000 adults (18 to 64 years of age) by country.

be helpful, especially to identify factors that could determine a higher or lower level of adoption⁵⁹ (for instance, level of education, age, risk aversion, familiarity with technology and even gender). These characteristics are also essential to determine the level of risk crypto-assets pose for the population, especially from the conduct standpoint and for the financial system overall.

59 Surveys of this kind can be found, for example, in the United States ([Survey of Consumer Payment Choice](#)), Canada (the Bank of Canada's [Bitcoin Omnibus Survey \(BTCOS\)](#)) and [Austria](#).

