DANMARKS NATIONALBANK

DIGITALISATION

ANALYSIS | Financial stability and financial risks
7 November 2023 | No. 16

Crypto-assets: Risks, regulation and usage in Denmark

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Interest in crypto-assets has increased significantly in recent years, and the focus on blockchain technology entails both new opportunities and risks. Only a small share of the Danish population has so far used crypto-assets for payments and investments, and the interconnections between the traditional financial sector and the crypto-assets market is limited. Thus, at present, crypto-assets do not pose any significant threat to financial stability in Denmark. However, this may change in the future. Therefore, the coming European regulation that is currently being implemented is an important step towards addressing risks that may threaten financial stability.

Unbacked crypto-assets are speculative assets that exposes investors to high risk

The use of crypto-assets comes with significant risks for investors. Unbacked crypto-assets are not backed by real, productive assets or payment flows, resulting in large price fluctuations. Further, these assets are traded on trading platforms characterised by high complexity and low transparency.

At present, crypto-assets do not pose a threat to financial stability, but the situation might change in the future

Crypto-assets are not widely held by households or financial institutions in Denmark. A survey from Danmarks Nationalbank shows that less than 4 per cent of Danish households own crypto-assets. If the market growth of crypto-assets continues, it could potentially impact financial stability in Denmark in the future.

Coming EU regulation addresses a number of risks and supports financial innovation

The new EU Markets in Crypto-Assets Regulation addresses a number of significant risks that crypto-assets may pose to financial stability. The regulation also supports financial innovation by creating level playing field for financial service providers, regardless of the underlying technology.

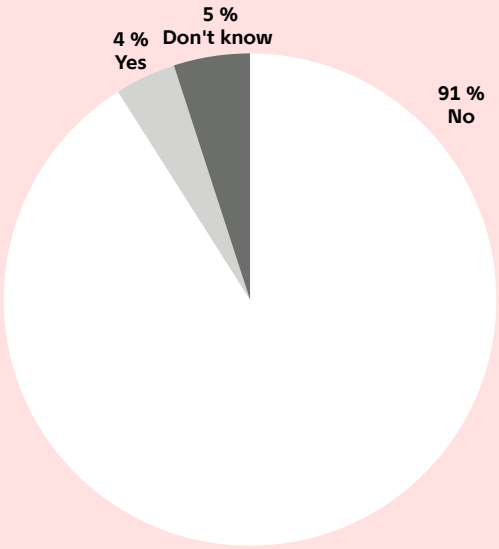
Why is this important?

In recent years, crypto-assets have seen a significant increase in both interest and market value. However, the assets contain several vulnerabilities that expose investors to large and sudden losses. New regulation in the EU is an important step towards addressing risks that may threaten financial stability in the long term.

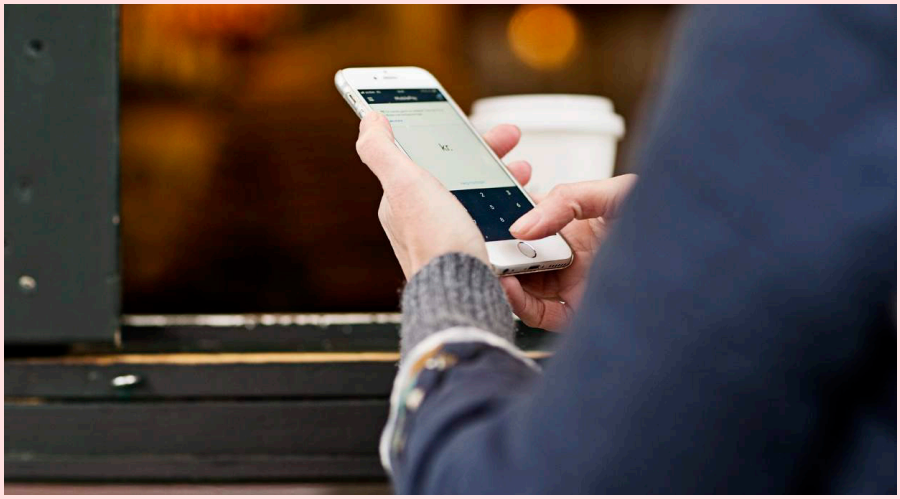
At present, crypto-assets do not pose a threat to financial stability in Denmark.

Main chart: Danmarks Nationalbank's household survey indicates that few Danes use crypto-assets

Share of Danes indicating that they own crypto-assets



Note: Danmarks Nationalbank's household survey from 2023 included questions regarding household ownership of crypto-assets. In the survey, the respondents were asked to indicate whether they had savings/holdings of crypto-assets and to estimate the total value of their holdings.
Source: Danmarks Nationalbank.



Topics

Financial stability | Digitalisation

01
Introduction and summary

Technological advances have paved the way for new financial products and new ways of providing financial services. One of the driving elements in this development is distributed ledger technology (DLT), including blockchain, which has supported the emergence of crypto-assets. The use of blockchain technology has the potential to increase efficiency and reduce costs of financial services, and to foster financial innovation.[1]

However, the new technologies and crypto-assets are associated with a number of risks. Some types of crypto-assets, namely unbacked crypto-assets and stablecoins, are used for financial activities and this report examines how associated risks can have an impact on the traditional financial system.

Hence, the objective of this report is to identify vulnerabilities which are associated with crypto-assets and to assess if these vulnerabilities affect financial stability in Denmark.

Unbacked crypto-assets are not anchored by any underlying assets and are subject to large price fluctuations, which expose investors to significant market risks. The lack of a clear economic anchor makes them particularly vulnerable to shifts in market sentiment. These market risks may spill over to the traditional financial sector in the form of both direct and indirect losses.

Stablecoins are crypto-assets, which are typically anchored to economic or financial assets and aim to maintain a stable value towards these. Stablecoins are also subject to vulnerabilities that may impact the financial system. Stablecoins hold traditional, financial assets, e.g. government bonds, in their reserves. A run on a stablecoin issuer may trigger a fire sale of these assets, which can result in losses for the issuer and spill-overs to other investors in the form of losses on their holdings.

There is a significant risk of fraud and market abuse in crypto-asset trading, which hampers market integrity. Opaque markets and limited access to high quality data makes it difficult for investors to distinguish between high- and low-quality service providers. New European regulation targeting crypto-assets will provide regulatory requirements to increase resilience of crypto-asset service providers and increase market transparency.

The identified risks associated with crypto-assets do not currently pose a threat to financial stability in Denmark, as crypto-asset holdings among Danish households and businesses are still limited. In addition, the Danish financial sector has so far taken a cautious approach to crypto-assets, resulting in very limited interlinkages between the financial sector and the crypto-asset markets. This might change in the future, if there is an increasing use of crypto-assets or a rising interconnectedness between crypto-assets and the traditional financial sector.

In Europe, new regulation will help safeguard financial stability against several identified risks stemming from crypto-assets. The EU Markets in Crypto-Assets Regulation (MiCA) regulation provides a comprehensive regulatory framework for issuers of crypto-assets and providers of crypto-related services aimed at

[1] See Danmarks Nationalbank (2022) for a thorough description of blockchain technology and its potential.

minimising potential risks. Additionally, the implementation of the so-called Basel standards, which set requirements for the banks' prudential treatment of crypto-asset exposures, will increase the banks' resilience to sudden drops in crypto-assets market value.

There is a need for a recurrent evaluation of the impact of the new regulation as well as further analysis of vulnerabilities in some areas that are currently not covered by the forthcoming regulatory measures. This includes risks linked to decentralised financial (DeFi) services as well as centralised crypto-asset service providers with complex business models, that supplies several of financial activities within the same entity.

02
Developments in the crypto-assets markets

In recent years, investors, financial institutions and central banks have increased their interest in new digital assets based on new technology. One of the inventions that has received most attention is crypto-assets.[2] The spark in interest has been supported by a sharp increase in market value and their usage for financial services similar to those provided by the traditional financial system. Crypto-assets are supported by blockchain technology, which can provide benefits for society, see box 1.

Crypto-assets[3] can be defined as a digital representation of a value or a right that that can be stored and transferred electronically using DLT or similar technology.[4] In this report, the term crypto-assets is used as a broad term covering both unbacked crypto-assets and stablecoins. Unbacked crypto-assets (e.g. bitcoin) are crypto-assets that are not supported by other assets. In contrast, stablecoins aims at maintaining a peg to one or several reference assets. Other types of digital assets that are not used for financial purposes[5], as well as digital central bank money (CBDC), are out of scope of this report.

BOX 1

Blockchain technology can have real economic benefits

Crypto-assets rely on blockchain technology, which offers numerous applications. It may prove suitable for financial services as it enables decentralised, programmable and composable digital assets. This may lead to benefits for society, as it can potentially result in lower costs, more efficient processes and innovation.

Blockchain technology can potentially reduce costs by making intermediaries superfluous. Through cryptography, blockchains enable decentralised registration and validation of transactions, i.e. without the need for a trusted third party to ensure integrity of the system. The lack of trusted third parties reduces the number of intermediaries and may lead to reduced costs in the provision of financial services, especially in services currently characterised by a large number of intermediaries, such as cross-border payments.

Processes can be streamlined using blockchain technology through so-called smart contracts that can execute actions automatically according to predetermined terms in a contract. Smart contracts make crypto-assets programmable and can thus facilitate financial services, such as secured loans, where both the disposal of the asset and the service itself are based on a set of predetermined criteria and without a trusted third party handling the processes.

Further, blockchain technology can foster innovation, as many blockchains are open networks. Developers can code new applications that freely use and links with elements in other existing applications. This entails composability in the applications, where new products are created. This is particularly widespread among decentralised financial services (DeFi-services), often referred to as financial LEGO blocks.[1] This can be seen in so-called DeFi aggregators, a type of trading platform that links to several trading protocols and automatically executes trades at the best available prices.

[1] Schär (2021).

[2] See Danmarks Nationalbank (2022) for a detailed review of crypto-assets and stablecoins.
[3] Crypto-assets are often referred to as cryptocurrencies. However, not all crypto-assets have the characteristic features of money, and they consequently cannot be equated with currencies. For this reason, these assets are referred to as crypto-assets in this report.
[4] European Commission (2023), *Markets in crypto-assets*
[5] This includes, among other things, non-fungible tokens (NFTs) and tokens that are solely used to provide access to a good or service, so-called utility tokens.

The market for crypto-assets have seen large fluctuations in recent years

The market for crypto-assets has developed dramatically in recent years, see chart 1. The aggregate value of the crypto-asset market has seen a nearly eightfold increase since 2019, but the market has been characterised by high volatility during this period. Most recently, several major players collapsed in 2022, causing a widespread market downturn, see box 2.

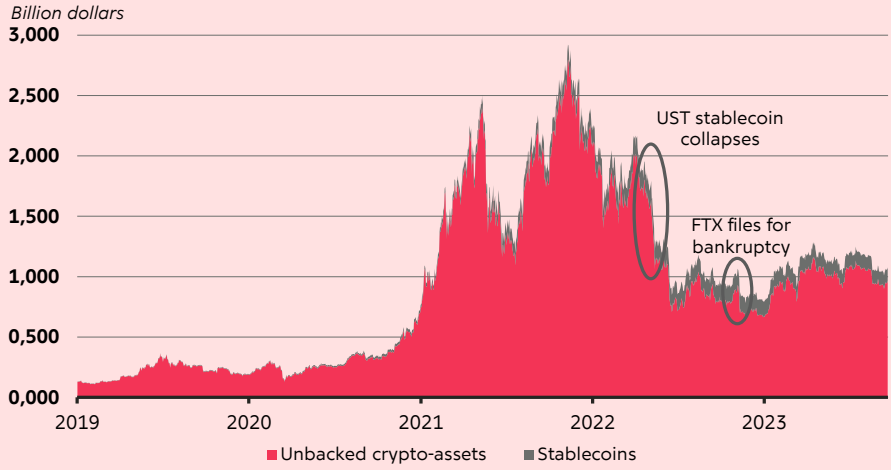
The market value peaked in November 2021 at more than 2,500 billion dollars. Since then, it has declined to below 1,000 billion dollars in September 2023. This measure excludes crypto-related derivative products, which enable increased exposure and speculation in the crypto-asset market. Some factors indicate a growing trading volume among crypto-derivatives, but the size of the market is unknown because of data limitations.[6]

The market has seen a large growth in market value since 2019, which has been driven by the large price increases in dominant crypto-assets, e.g. bitcoin. However, growth in aggregate market value has also been driven by an increase in the amount of issued crypto-assets that has grown rapidly in correspondence with the increasing interest in crypto-assets. In October 2023, there were around 9,000 unique crypto-assets.[7]

Despite the large increase, the crypto-asset market remains small relative to the traditional financial markets. When the total market value of crypto-assets peaked in November 2021, it accounted for less than 1 per cent of the global share and bond markets.[8]

CHART 1

The market value of crypto-assets has grown substantially since 2019



Note: The chart shows the total market capitalisation of unbacked crypto-assets and stablecoins. Unbacked crypto-assets are stated as the market value of all crypto-assets less the market value of the three largest stablecoins in terms of market capitalisation, in particular Tether, USDC and BUSD.
Source: Macrobond

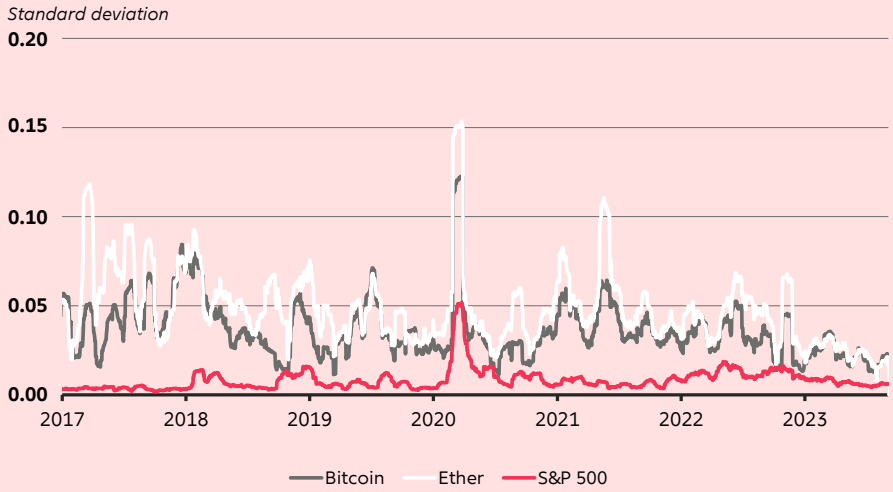
[6] See European Central Bank (2022a).
[7] See Coinmarketcap.com (link)
[8] See European Systemic Risk Council (2023).

The prices of crypto-assets are characterised by high volatility and recurrent price corrections. Bitcoin and ether prices dropped by 39 per cent and 51 per cent, respectively, from April to May 2022 due to the uncertainty following the collapse of the terraUSD stablecoin, see box 2.

Volatility is higher among crypto-assets than other, traditional asset classes. Compared to the US S&P 500 index, price volatility has been higher for crypto-assets in virtually every period since 2017, see chart 2. Likewise, the volatility of crypto-assets is higher than for most real or financial assets, including gold, oil and high-yield bonds.[9]

CHART 2

Crypto-assets are more volatile than traditional stock indices



Note: The volatility is computed as 30-day rolling standard deviations.
Source: Macrobond and own calculations.

[9] See Financial Stability Oversight Council (2022).

BOX 2

Several crypto-asset actors collapsed in 2022

A number of events in 2022 caused risks to materialise in the crypto-asset markets. The collapse of the algorithmic stablecoin terraUSD (UST) and the bankruptcy proceedings involving the FTX trading platform illustrates how vulnerabilities in one or a few players can have severe impact on the entire crypto-asset market.

UST stablecoin lost its peg to the US dollar
UST was a stablecoin that applied an algorithm to maintain price stability, a so-called algorithmic stablecoin. UST lost its peg to the dollar in May 2022, implying that the value of a UST went from 1 to 0.1 dollar in just a few days. Until its collapse, UST was the third largest stablecoin with a market value of more than 18 billion dollars, corresponding to a market share of 10 per cent[1] in the market for stablecoins.

The breakdown of UST had implications for other crypto-assets and crypto-asset service providers. The collapse caused Tether, the most widely used stablecoin, to briefly break its peg to the dollar, as uncertainty surrounding UST led to redemptions of more than 7 billion dollars in Tether.[2] Tether did not have UST in its reserve, but a lack of transparency and credibility regarding the reserve composition resulted in increased market uncertainty. The UST collapse led to problems for crypto-asset service providers, with providers such as BlockFi and Genesis filing for bankruptcy. The lending platform Celsius and the crypto-asset investment company Three Arrows Capital also incurred significant losses on their investments in UST.

The trading platform FTX went bankrupt
FTX was one of the leading crypto-asset trading platforms, with a market share of around 10 per cent, prior to filing for bankruptcy on 11 November 2022, following revelations of fraud with client funds. The bankruptcy was filed following revelations of FTX's close ties to the investment company Alameda Research. Among the revelations were that most of Alameda Research's balance sheet total consisted of a crypto-asset called FTT issued by FTX itself.[3] These tokens could be freely issued by FTX and were used by Alameda Research as collateral for so-called margin trades[4] on FTX's trading platform.

The uncertainty surrounding the link between FTX and Alameda Research's activities and the solvency of both companies caused a run on FTX and large sell-offs – with resulting price declines – in FTT, which further weakened the balance sheet of FTX and Alameda Research. A series of allegations of mismanagement were subsequently made, including the allegation that FTX had transferred client funds to Alameda Research to cover liabilities and as additional collateral on margin trading in connection with capital losses. The collapse of FTX also led to price declines in other crypto-assets and losses among other investors with FTT exposures.

[1] Macrobond.
[2] See OECD (2022a).
[3] FTT is a token issued by FTX on the Ethereum blockchain. FTT is an unbacked crypto-asset and is therefore not pegged to the value of a reserve or anchored in another asset.
[4] A margin trade is a trade in which an investor buys assets with borrowed money while providing collateral to the lender to hedge the latter's credit risk.

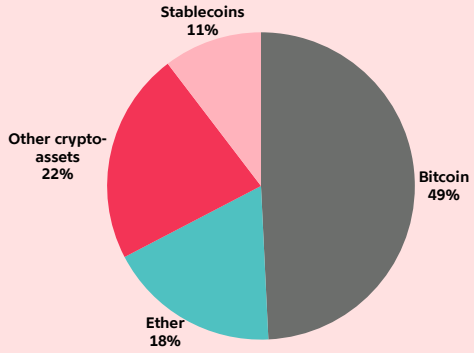
Few crypto-assets and players dominate the crypto-asset market

The concentration in the crypto-asset market is high, see chart 3, left. Two crypto-assets, bitcoin and ether, make up around two-thirds of the total market capitalisation of crypto-assets.

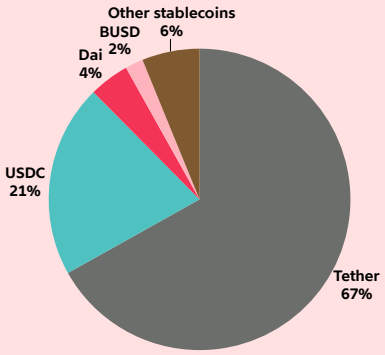
CHART 3

High concentration on the market for crypto-assets

Crypto-assets, percentage share of market value



Stablecoins, percentage share of market value



Note: The charts show the market shares of unbacked crypto-assets and stablecoins in terms of market value. The market value is computed as the market price multiplied by the volume in circulation on 20 September 2023.
Source: Macrobond.

Likewise, the market for stablecoins is dominated by a few major issuers. The high concentration creates a risk that bankruptcy or stress among one or a few large players may have systemic consequences. The two largest stablecoins, Tether and USD Coin, account for almost 90 per cent of the total market value of stablecoins in circulation, see chart 3, right. Other stablecoins with significant market shares include Binance USD, True USD and the algorithmic stablecoin Dai.

Although stablecoins have a relatively low market value, they are traded in significant volumes as they form one leg of many transactions with unbacked crypto-assets. For example, Tether formed part of more than 60 per cent of the total trading volume in September 2023.[10] In the same month, Tether also had an average daily trading volume of around 21 billion dollars, which is significantly higher than bitcoin's trading volume of slightly more than 11 billion dollars.[11]

The concentration is also seen among trading platforms, see chart 4. Financial services related to crypto-assets are primarily provided on a small number of platforms. Binance, a trading platform providing a wide range of financial

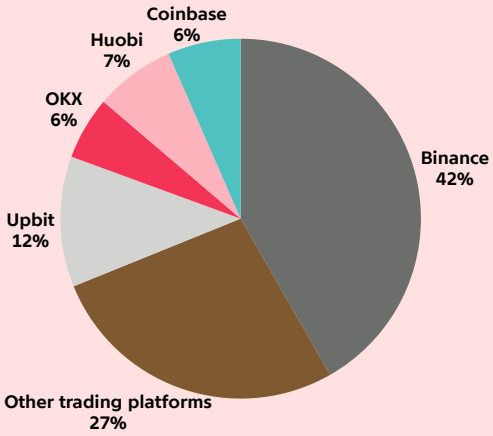
[10] See www.theblock.co (link).
[11] See www.coinmarketcap.com (link) and (link).

services related to crypto-assets, accounted for more than 42 per cent of the total trading volume of crypto-assets in September 2023.

CHART 4

High concentration on the market for trading platforms

Trading platforms, percentage share of trading volume for trading platforms.



Note.: The chart shows the market share of trading platforms measured in terms of trading volume. Computed for September 2023.
Source: www.theblock.co (link)

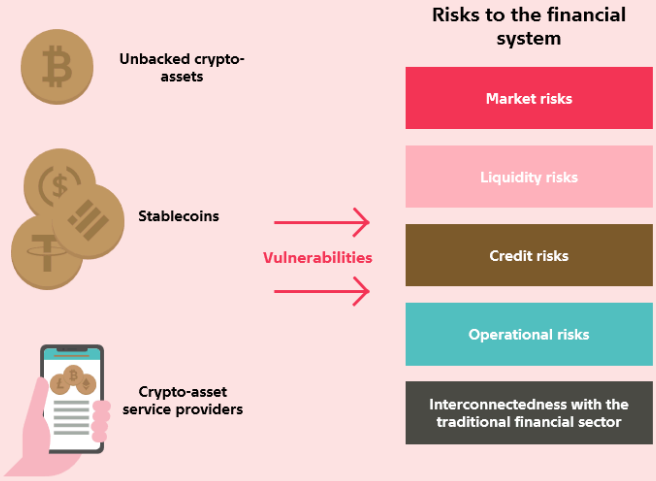
03
Crypto-assets entail risks that may affect financial stability

The crypto-asset market is associated with a number of vulnerabilities that can pose risks to the financial system. One reason being the highly volatile nature of the crypto-asset market, but also its high market concentration and the internal interconnectedness of the market players.

This report makes a distinction between vulnerabilities arising from the use of unbacked crypto-assets, stablecoins and crypto-asset service providers, respectively. The vulnerabilities in the crypto-asset market may lead to types of risks that are well-known to the traditional financial sector, see chart 5.

CHART 5

Vulnerabilities in the market for crypto-assets may pose risks to the financial system



This chapter describes the specific vulnerabilities for unbacked crypto-assets, stablecoins and crypto-asset service providers, respectively, and how these vulnerabilities may affect financial stability.

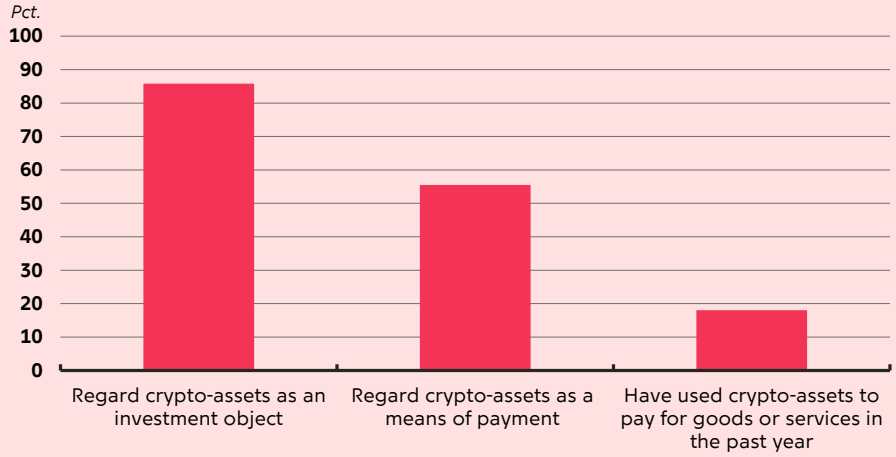
Risks of unbacked crypto-assets as investment objects

Only few Danish households hold crypto-assets and owners of crypto-assets primarily regard them as investment objects.[12] Danmarks Nationalbank's household survey from 2023 shows that only 4 per cent of the respondents hold crypto-assets. Of those 4 per cent, 86 per cent regard crypto-assets as investment objects, while 56 per cent regard crypto-assets as a means of payment, see chart 6. 18 per cent of the respondents who hold crypto-assets indicate that they have used crypto-assets to pay for goods or services in the past year.

According to the survey, few citizens in Denmark regard crypto-assets as a means of payment or money. Danmarks Nationalbank's assessment is that unbacked crypto-assets do not function well as money due to their sharp price fluctuations and associated risks, among other reasons.[13] Whether stablecoins can function well as a means of payment depends on trust and stability, including the impact of the implementation of MiCA.

CHART 6

The 4 per cent of Danish households that own crypto-assets predominantly regard them as investment objects



Note: Danmarks Nationalbank's household survey from 2023 included questions about household ownership of crypto-assets. Here, the respondents were asked to state whether they had savings/holdings of crypto-assets and to answer the questions "Do you regard crypto-assets as an investment object?", "Do you regard crypto-assets as a means of payment?" and "Have you paid for a product or service with crypto-assets in the past year?". The chart shows the answers from the respondents who stated that they had savings/holdings of crypto-assets.
Source: Danmarks Nationalbank.

Results from surveys conducted in other countries show similar trends. In the euro area, almost 90 per cent of crypto-asset owners regard them as investment objects.[14] Among Dutch households with crypto-assets, 54 per cent state that they own them for the purpose of gambling[15], and US studies[16] also indicate that households owning crypto-assets are looking for a speculative investment

[12] See Box 3 for a description of Danmarks Nationalbank's Household Survey
[13] See Nationalbanken (2022).
[14] See European Central Bank (2022b).
[15] See De Nederlandsche Bank (2022).
[16] See Auer and Tercero-Lucas (2022).

object rather than an alternative to money or services provided by traditional financial players. In addition, investors who trade in crypto-assets typically have a higher risk appetite than other investors and are more likely to use leveraged investments, see Hackethal et al. (2022).

BOX 3

Danmarks Nationalbank surveys Danish households' ownership and use of crypto-assets

As a result of the growing interest in crypto-assets, Danmarks Nationalbank has looked into Danish households' ownership and use of crypto-assets as part of the assessment of potential risks to financial stability in Denmark.

Every other year since 2017, Danmarks Nationalbank has conducted a survey on the payment habits and preferences of Danish households, including their use of cash. In 2023, the survey was conducted by the research firm Epinion and included questions about crypto-assets. Respondents answered questions on, for example, household ownership of crypto-assets, how they regard the usage of crypto-assets and the size of potential holdings.

The analysis is based on responses from a representative selection of 2,737 citizens aged 15+ years. The invitations to participate in the survey were sent by digital and regular mail to ensure representativeness across the whole population.[1]

[1] The survey is associated with a +/- 1.9 percentage point uncertainty for questions covering the entire group of respondents. The uncertainty is greater in connection with breakdowns by, for example, age groups and sub-questions.

In the following, risks from unbacked crypto-assets are thus discussed through their role as investment objects.

The price of unbacked crypto-assets is not supported by real or financial assets

Unbacked crypto-assets are speculative assets characterised by large market price fluctuations. Unlike many other types of assets, their value is not anchored to an underlying payment flow or a physically productive value. Hence, the value of unbacked crypto-assets is thus not supported by any assets, liquidity or capital. The absence of a clear financial anchor to support the price of crypto-assets also means that it is not possible to use conventional analytical methods to value the assets, e.g. determining the present value of a crypto-asset.

The market price of an asset that lack a clear financial anchor may be greatly influenced by market expectations of future price movements. These expectations are closely linked to the general discourse of the asset, i.e. market sentiment. Changes in the perception of how the market is developing or in the general market confidence may therefore lead to significant revaluations of crypto-asset prices.

Lack of a clear anchor leads to market risks

Large fluctuations expose investor to market risks and may result in large and sudden losses. For this reason, Danish and European financial authorities have warned private investors on the risks of investing in crypto-assets.[17]

Solely, these market risks pose only a limited threat to financial stability as long as the crypto-asset market is not of a systemic size, i.e. large enough to influence the traditional financial system. However, in combination with other vulnerabilities in the crypto-asset market, such as use of leverage and high

[17] See Finanstilsynet, Advarsel – Markedet for kryptovaluta er et Eldorado for svindlerne, March 2022 (link); The European Banking Authority, EU financial regulators warn consumers on the risks of cryptoassets, March 2022 (link); The European Central Bank, Decrypting financial stabililty risks in crypto-asset markets, May 2022 (link).

interconnectedness, the large fluctuations in market value may pose risks, especially if demand for crypto-assets continues to grow in the future.

There is a close correlation between investor interest in crypto-assets and the development in market price. BIS (2022) shows that rising market prices have self-reinforcing effects, as more investors enter the market, supporting further price increases.

Market risks are amplified by access to leveraged investments

The fluctuations in crypto-asset prices are amplified by an easy access to leverage in the crypto-asset market. There are currently no restrictions on the possibility of using leverage to increase investor exposure. The lack of restrictions increases investors' vulnerability to adverse market developments, thus reinforcing the market risks. Investors increase their exposure up to 125 times on certain trading platforms.[18] The actual prevalence of leverage is not known, but the ECB estimates that the use of leverage in the crypto-asset market has increased since 2020.[19]

Price movements in the crypto-asset market are closely linked. An increase or a decrease in the price of one crypto-asset will consequently do lead to similar movements in the price of other crypto-assets. The close interconnectedness increases the risk that a sharp devaluation in one crypto-assets will result in contagion and create uncertainty in large parts of the market. Ferroni (2022) shows that most of the fluctuations in crypto-asset market prices can be attributed to the general development in the crypto-asset market rather than the special characteristics, ie. use cases, of individual crypto-assets.

Single events may weaken confidence in the crypto-asset market

The lack of a clear anchor increases the risk that single events may weaken confidence in the market and lead to large, sudden devaluations of crypto-assets. A decline in market confidence may be triggered by operational failures, manipulation and fraud or by generally declining confidence in the future prospects of the market.

The use of new technology poses risk of operational challenges

The crypto-asset market is operationally dependent on blockchain technology as infrastructure for registration and validation of transactions, and even though blockchain technology may provide operational gains, market participants will be exposed to risks related to the use of this technology.

Although blockchains are generally considered to be decentralised, they typically rely on actors that validate transactions and maintain the blockchain, so-called miners. On public blockchains, all market participants can participate in the validation, but the process is often concentrated among a specialised few. This exposes the infrastructure to concentration risks, for example if these players periodically choose to cease their activities or to benefit systematically from their ability to determine the order in which transactions in the new blocks are executed, so-called front-running.

In addition, transactions on blockchains are irreversible and cannot be changed or cancelled if operational errors, such as keying errors, have occurred.

Software developers play a key role in maintaining and developing the blockchain and in implementing changes to the software. Changes must typically be adopted by voting among the actors validating the blockchain. The efficient

[18] For example, Binance offers so-called *leveraged tokens* with leverage of up to 125 times. Leveraged tokens are a type of futures contract without a fixed settlement date (*link*).
[19] See European Central Bank (2022a).

functioning of the infrastructure thus requires that these actors have an incentive to vote in favour of important changes, that the proposed adjustments contribute positively to the infrastructure and that the software developers correctly implement the changes accepted.

The crypto-asset market is vulnerable to manipulative behaviour and fraud

Lack of regulation makes crypto-asset markets vulnerable to market manipulation. Manipulative behaviour inhibits the integrity of the market, as the market participants make trading decisions based on market information that does not accurately reflect the state of the market. By artificially raising the price or liquidity for a period of time, manipulators can signal to other markets participants that demand is greater than what is actually the case.[20] The risk of manipulation is further increased by market complexity and the pseudonymity of market participants are. Combined with the absence of a trusted third party to ensure market security and integrity, manipulation may create a risk that less sophisticated market participants trade based on manipulated market information.[21]

The risk of experiencing fraud in the crypto-asset market is high. It is estimated that theft of and fraud amounted to more than 10 billion dollars in 2022, corresponding to approx. 0.1 per cent of the total transaction volume in 2022.[22] There are currently no or few safeguards against fraud in the crypto-asset market unlike in the traditional financial markets.

Correlation indicates interconnectedness with the traditional financial sector

Until recently, crypto-asset returns have been uncorrelated with traditional assets, but the correlation has increased in recent years.[23] A correlation between traditional assets and crypto-assets may provide an indication of the interconnectedness of the two markets. A high correlation can express that the assets respond to the same underlying factors or that the participants in both markets share a common risk premium.[24] The higher correlation may be due to a number of factors, including that the crypto-asset market has matured and increasing interest from professional investors.[25]

Other things being equal, a high correlation between crypto-assets and other securities reduces the potential diversification gains that investors can achieve by adding crypto-assets to a portfolio consisting of a broad market index. This also reduces the usefulness of crypto-assets as an instrument for hedging the development in other assets.

Risks of stablecoins

Stablecoins are backed crypto-assets, with a purpose of maintaining a stable value against one or several other assets, for example a currency. The stability is typically ensured by the issuer by managing a reserve of assets linked to the reference asset.[26] Several stablecoins have faced challenges maintaining a stable value, especially the so-called algorithmic stablecoins. This was illustrated by the collapse of the stablecoin terraUSD in early May 2022, see box 2. Stablecoins also share several risks with unbacked crypto-assets, especially in terms of operational risks.

[20] See Eigelshoven et al. (2021).
[21] See De Nederlandsche Bank (2022).
[22] See Chainalysis (2023).
[23] See Roshan (2022).
[24] See Financial Stability Oversight Council (2022).
[25] See OECD (2022b).
[26] See Danmarks Nationalbank (2022) for a further description of blockchain technology and its applications.

Stablecoins play a prominent role in digital asset trading as they seek to solve the issue of high price volatility associated with unbacked crypto-assets. Stablecoins are used as a secure investment of funds for investors in the digital ecosystem when they temporarily want to reduce their exposure against unbacked crypto-assets. It allows investors to stay within the blockchain-based systems, saving them expensive on/off ramping between bank deposits and crypto-assets.

Reserve-based stablecoins are connected to the traditional financial sector

The inclusion of traditional assets in the reserve holdings of stablecoin issuers creates a clear link between reserve-based stablecoins and the traditional financial markets. The funds generated through issuance are placed in a reserve to support the peg against that asset. The composition of the reserve may affect traditional financial markets by contributing to changes in the demand for the reserve assets. Furthermore, reserve-based stablecoins require a central actor, such as a commercial company or a bank, to manage their reserve.

A well-functioning peg will ensure stablecoins owners are able to always redeem their stablecoins and to a price close to the price of the reference asset.[27] For stablecoin owners to be able to redeem that stablecoin into the pegged currency at any time, the reserve must be sufficiently liquid. Reserve assets often consist of highly liquid assets such as cash or money market instruments, but other less liquid assets, such as corporate bonds or other crypto-assets, are also used in some stablecoin reserves. There are currently no requirements for the composition or management of reserve assets, but the MiCA Regulation will change this for stablecoins that are issued in the EU or that are directed at citizens in the EU (see also Chapter 5, *New regulation of crypto-assets in the EU).*

Liquidity mismatch exposes investors to liquidity risks

A so-called liquidity mismatch occurs because stablecoins, which are a direct claim against the issuer, are typically more liquid than the assets in the reserve. The liquidity mismatch on the issuer's balance sheet implies the issuer may risk being unable to meet its obligations of redemption. This issue is well-known from the financial sector and applies also to, for example, banks and money market funds.

In the traditional system, these risks are addressed through financial regulation, including adequate capitalisation and liquidity management requirements. Until MiCA enters into force, corresponding legislation does not apply to stablecoins issued in Europe.

A large volume of sudden redemptions may trigger a fire sale of reserve assets

Reserve-based stablecoins are vulnerable to a situation where many customers want to redeem their holdings of stablecoins at the same time. A large volume of sudden redemptions may trigger a fire sale of the reserve assets. This may result in large losses for the issuer and spill over to other investors through losses on their holdings. The implications for the traditional financial sector will e.g. depend on the volume and liquidity of the assets that are being sold off.

In less liquid markets, a fire sale risks causing significant market movements. For example, issuances among dominant stablecoins may have contributed to boosting demand for and reducing yields on short-term US corporate bonds.[28]

[27] Many stablecoins are associated with limited redemption rights for investors. For example, Tether imposes a lower redemption limit of 100,000 dollars. Investors with smaller holdings must sell their USDT on market terms. See Gorton & Zhang (2023) for an overview of redemption rights for a number of stablecoins.
[28] See Kim (2022).

Low transparency may create uncertainty and increase risks of sudden redemptions

A secure and well-managed reserve is essential for creating trust among holders of a stablecoin. However, many stablecoins are characterised by low transparency, e.g. in relation to the composition of their reserve. Uncertainty about whether a stablecoin issuer can meet its obligations, especially during periods of stress, may lead to a self-reinforcing process in which the sale of reserve assets, potentially with a discount, will worsen the outlook of the issuer and lead to further redemption requests.

Information on the composition and liquidity of the reserve is key for the public, including the owners, to assess the risk connected with owning a stablecoin.

A well-managed reserve is necessary to maintain confidence in the stability of the stablecoin and will reduce the risk of sudden redemptions. However, there are differences in how the dominant stablecoins manage the reserve. Available data for the two dominant stablecoins, Tether and USD Coin, shows that the majority of their reserves consist of market-based instruments, in particular short-term US Treasury bonds. However, Tether states that a significant fraction of its reserve is placed in other assets, including gold, other crypto-assets and secured loans. Tether does not specify what type of collateral that support the value of the secured loans.[29]

Stablecoin issuers are currently not subject to disclosure, auditing or reserve requirements. Hence, financial authorities have no insight into the quality and composition of the issuers' reserves and no possibility of validating the information provided. There are some examples of misleading information being provided by stablecoin issuers.[30] In addition, the lack of common disclosure standards reduces the possibility for investors of comparing risks across issuers.

Widespread use of stablecoins may affect credit supply

If the use of stablecoins becomes widespread, this may affect the supply of credit by traditional banks, as some of the funds placed in stablecoins stem from traditional bank deposits. However, it is not clear to what extent such an exchange will affect the credit supply.

The reserve composition plays a key role in the potential impact of increased use of stablecoins on credit supply. Different types of reserve assets will imply a trade-off between lower risk of a stablecoin run and greater risk of a reduction in credit supply. A scenario where bank deposits are being substituted for stablecoins will reduce deposit funding under the assumption that the stablecoin issuers do not replace their reserves as deposits in the banks. A reduced access to financing through deposits will, all things equal, increase financing costs and reduce credit supply. A reduction in credit supply may affect the banks' earnings capacity and have real economic consequences, as households and businesses could face tighter credit standards. For this to have a significant effect on credit supply, there must be a significant substitution from bank deposits to stablecoins and stablecoin issuers' reserves must consist of significant holdings in other assets than bank deposits.

[29] See www.tether.io (link)
[30] In 2021, Tether was ordered by the US Commodity Futures Trading Commission to pay fines of 41 million dollars for misleading clients about the composition of their reserve (*link*).

Risks posed by crypto-asset service providers

Crypto-asset service providers provide a wide range of financial services to clients. For the vast majority, trading services are the primary activity, but they also offer other services including custody and lending. At the same time, crypto-asset service providers play a vital role for the functioning of the market through market making, clearing and settlement of transactions. Finally, a large number of service providers issue their own tokens to support liquidity on their trading platforms.

The supply of many financial services under one entity makes it difficult to assess risk. In combination with high concentration and interconnectedness, this makes the crypto-asset market vulnerable, and it may increase the implications of a crypto-asset service provider running into financial or operational issues.

Crypto-asset service providers are currently not subject to the same kind of regulation as traditional financial institutions providing corresponding services. The fact that similar activities can be carried out under different regulatory frameworks allows for so-called regulatory arbitrage, which have several implications.

First, regulatory arbitrage gives crypto-asset service providers a competitive advantage compared to traditional financial institutions when they have to comply to less stringent rules. One cannot rule out that this has supported the rise in activity among crypto-asset service providers.

Secondly, financial stability risks are left unaddressed. The objective of financial regulation is, among others, to safeguard the financial system by mitigating the effects of a financial institute facing financial or operational challenges. The of sound regulation increases counterparty risks to investors. for instance, there have been several cases in which crypto-asset service providers have frozen clients' funds in connection with financial challenges. However, from the end of 2023, crypto-asset service providers in Europe will be covered by the MiCA Regulation (see also Chapter 5, *New regulation of crypto-assets in the EU)*.

Crypto-asset service providers have complex risk profiles

Some crypto-asset service providers supply a wide range of financial services alongside their primary function as a trading platform. The large number of financial functions for an individual provider implies that the provider's risk profile becomes complex and difficult to assess. This may raise concerns related to the providers' ability to manage risk and in potential implications for financial stability. Inadequate risk management may mean that losses on parts of a crypto-asset service provider's business spill-over to the crypto-asset service provider's other activities.

If, for instance, a trading platform also issues a crypto-asset to support other business activities within the entity, e.g. as collateral in margin trading, it entails a risk that issues in one part of the business can rapidly spread to the others. This was the case during the collapse of FTX, and it illustrates the vulnerabilities that arise when a crypto-asset service provider provides multiple financial services. Therefore, international organisations, including the Financial Stability Board (FSB) and the European Systemic Risk Council (ESRB), have special focus on the largest crypto-asset service providers, which they refer to as *financial conglomerates*.[31]

When crypto-asset service providers offer a range of activities, it can also give rise to potential conflicts of interest that may hamper the market integrity and the investor protection. Crypto-asset service providers can exploit their position

[31] See Financial Stability Board (2022).

in the ecosystem to achieve benefits in transactions that, in turn, can negatively impact their clients. A platform that acts in a combined role of exchange, credit provider, broker, custodian and investment company may, for example, can benefit from assigning the most advantageous trades to its investment business or using disproportionately large debt financing.

High interconnectedness and concentration among crypto-asset service providers

There is great interdependence and high interconnectedness between crypto-asset service providers. Many crypto-asset service providers have significant holdings of crypto-assets issued by other crypto-asset service providers. For example, the trading platform Binance owned just under 14 per cent of the FTX-issued token, FTT, when FTX went bankrupt in November 2022. Others are dependent on credit or direct investments from other crypto-asset service providers.[32] The two companies Voyager and Celsius, both of which went bankrupt in 2022, were involved in credit intermediation to other crypto-asset service providers and left their counterparties with large financial outstanding amounts. Celsius had 1.7 million clients at the time of its bankruptcy.[33]

Challenges faced by individual actors may also have a negative impact on market liquidity. If a crypto-asset service provider has a supporting market liquidity role as a market-maker or in facilitating margin trading, its discontinuation of such support will have negative liquidity and market consequences.

The concentration in the crypto-asset market is also high among trading platforms, where a limited number of actors account for the vast majority of the total trading volume (see also Chapter 2, *Development in the crypto-asset market)*. The high concentration among the trading platforms implies that the market is exposed to concentration risks. Problems among crypto-asset service providers of a significant size may impact other crypto-asset service providers and their ability to service users of crypto-assets.

Lack of regulation and supervision increases credit risks for crypto-asset service providers

At present, there is neither a regulatory framework nor a supervisory authority laying down requirements and overseeing the financial resilience of the crypto-asset service providers. In combination with a low level of information from crypto-asset service providers, it exposes users to credit risk, i.e. the risk that the service provider as a counterparty does not meet the agreed obligations related to the use of their services. There have been examples of crypto companies having placed clients' assets in their own accounts or having frozen assets in case of uncertainty about the provider's operations. This happened to both clients with assets placed with FTX and with Celsius in connection with their respective bankruptcies, see box 2.

Fragmented markets can lead to low liquidity

A large number of trading platforms contributes to fragmenting the crypto-asset market, which may affect market liquidity and lead to adverse market outcomes. When liquidity is low, market depth is poor, and only few investors want to engage in a trade. Low market liquidity thus leads to price slippage, due to a spread between buying and selling prices and higher volatility. It may become challenging to execute trades if they are made during periods of high uncertainty and stress. Here, investors wishing to sell may be forced to sell at a significantly lower price than would be the case in a liquid market.

[32] See Financial Stability Oversight Council (2022) for a review of FTX's corporate structure.
[33] See www.reuters.com (link)

Market fragmentation also means that the platforms will generally be characterised by a more sluggish price formation process, as price signals come from few transactions between few market participants. As a result, the participants take longer to form a consensus on the actual value of the traded asset, known as *price discovery*, and this provides arbitrage opportunities for investors willing to exploit them.[34]

The market fragmentation creates a tendency for investors to utilise the platforms with the better liquidity conditions. On the one hand, these network effects contribute to better liquidity, and thus trading outcomes, for the individual investor. In turn, it can tend to increase market concentration, with the vulnerabilities that this entails.

Limited data access and quality

On public blockchains, there is public access to transaction data of the crypto-market, but, despite this, access to data on crypto-asset market actors is scarce. This complicates the identification and assessment of risks and their potential implications for financial stability. Data on prices, trades and market depth are reported by the crypto-asset service providers without having public authorities validating the credibility of these data. ESRB (2023) stresses that there is great uncertainty about the quality of available market data and that so-called *wash-trading* is widespread. Wash-trading is the practice of engaging in transactions that have the sole purpose to increase the available measures of liquidity in the crypto-asset market. On some platforms, it is estimated that more than half of the total transaction volume is wash-trading.[35]

The absence of a regulatory framework for the crypto-asset market means that insufficient information is provided about the crypto-asset service providers' activities and management of risks. Additionally, it prevents verification of the correctness of the available information and its comparability across crypto-asset service providers.

[34] See Makarov & Schoar (2020)
[35] See Cong, Li, Tang and Yang (2022)

04
Usage of crypto-assets in Denmark

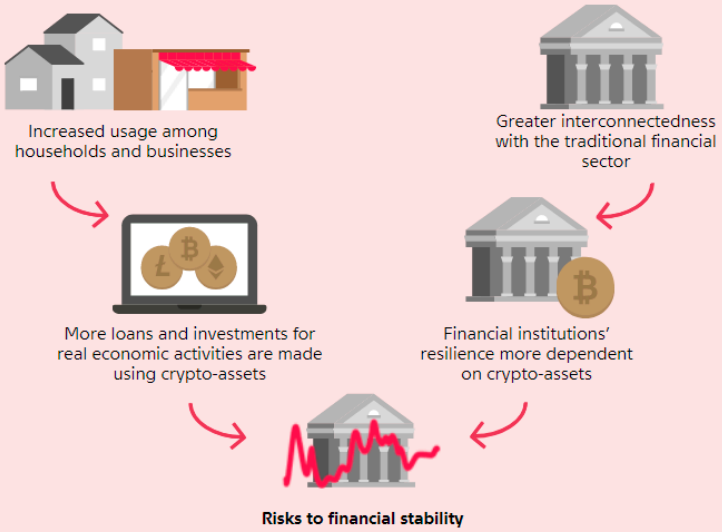
There are currently no indications that financial stability in Denmark is threatened by the risks associated with crypto-assets. The reason is that Danish households and businesses only have limited exposure to crypto-assets.

However, risks from the use of crypto-assets can be channelled through international financial markets. For example, crypto-assets had on impact on the liquidation of some American banks in spring 2023. These risks are assessed as a more pronounced, but still limited, threat to financial stability in Denmark.[36]

Should crypto-assets become a potential threat to financial stability in Denmark in the future, this may occur through two channels: increased use of crypto-assets among households and businesses and greater interconnectedness between crypto-assets and the traditional financial sector, see chart 7.

CHART 7

Risks associated with crypto-assets can be transmitted to financial stability through two channels



Source: Danmarks Nationalbank.

An increase in the use of crypto-assets to a significant level could increase several of the risks identified in Chapter 3. If more investments in crypto-assets by households and businesses lead to more financial services being provided through crypto-assets, this may, impact financial sector earnings and the

[36] However, this assessment is subject to reservations for insufficient data on the geographical distribution of ownership on public blockchains. Pseudonymisation of market participants means that their physical identity cannot be determined. Therefore, there is no clear view of how widespread the use of crypto-assets is among Danish households and businesses.

monetary transmission mechanism. However, the potential risk for financial stability will also be impacted by the coming regulatory framework and its mitigating effects.

Usage of crypto-assets by households in Denmark

In 2023, Danish households had very little exposure to crypto-assets, and there are currently no indications that crypto-assets are of systemic importance in Denmark. However, the supply of investments products that tracks the development of crypto-assets and blockchain-based companies is growing and may provide households and investors with easier access to crypto-assets.

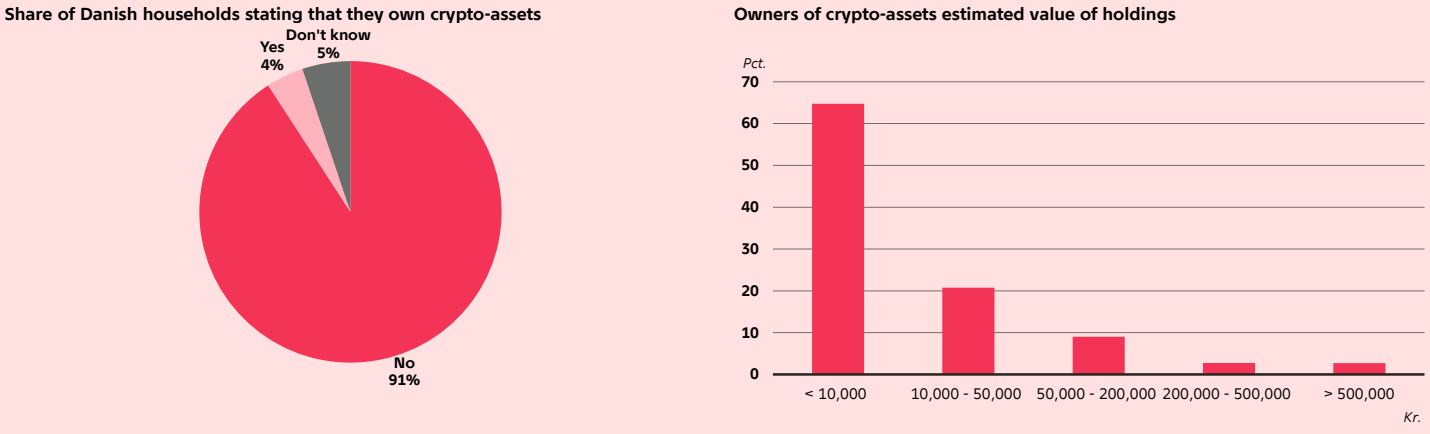
Only few Danish households own crypto-assets

Danmarks Nationalbank's household survey shows that the uptake of crypto-assets among Danish households is low. In the survey, 4 per cent of households in Denmark respond that they own at least one type of crypto-asset, see chart 8, left.

For the majority of households, exposure is low. Around 65 per cent respond that the total value of their investments in crypto-assets amounts to less than kr. 10,000, while 90 per cent estimate that their holdings have a value of less than kr. 50,000, see chart 8, right.

CHART 8

Danmarks Nationalbank's household survey indicates that few Danes use crypto-assets



Note: Danmarks Nationalbank's household survey from 2023 included questions about household ownership of crypto-assets. In the survey, the respondents were asked to state whether they had savings/holdings of crypto-assets and to estimate the total value of their holdings.
Source: Danmarks Nationalbank.

Compared to surveys conducted in other European countries, Danish households are equally or less exposed to crypto-assets. For example, ECB (2022b) finds that 4 per cent of euro area citizens own crypto-assets.[37] Other surveys, including the ECB's Consumer Expectation Survey, national

[37] The data collection for the SPACE survey took place from October to December 2021.

questionnaire surveys and surveys based on web-traffic, indicate lower use in Denmark than in other European countries.[38]

Assets traded on the regulated market increase both direct exposures and interconnectedness

Danish households' *indirect* exposure to crypto-assets is also low. Funds and asset traded on regulated markets may increase interconnectedness with the crypto-asset market. The emergence of exchange-traded investment funds (ETFs) and exchange-traded products (ETPs) that follows the development of crypto-assets and blockchain-based companies is becoming increasingly pronounced and may provide investors with easier access to exposures against crypto-assets as they are traded on traditional and, regulated markets. In this way, investors can expose themselves against crypto-asset market developments without holding crypto-assets.

Especially in the United States, several significant investment funds have applied to the financial authorities for permission to set up funds linked to crypto-assets. These funds will offer traded products that seek to follow the price of single or multiple crypto-assets. The purpose of a bitcoin ETF will thus be to follow the price of bitcoin. It may be, but does not require, that the issuer has an actual holding of bitcoins, as they also can follow the market by using futures or derivatives.

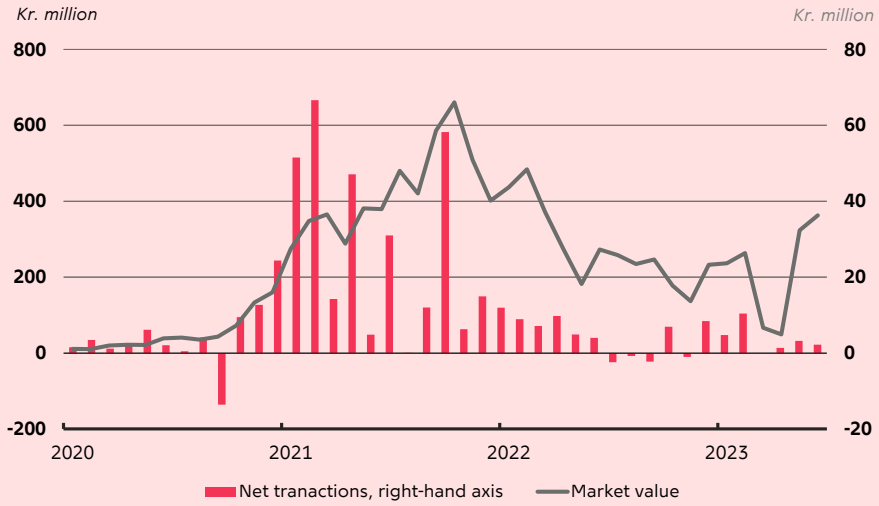
There are also several exchange traded companies that are directly connected to the crypto-asset market, including trading platforms and companies which balance sheet consists mainly of crypto-asset holdings.

Danish households are indirectly exposed to crypto-assets for kr. 360 million in August 2023, see chart 9. This corresponds to just 0.03 per cent of Danish households' total investments in registered securities.

[38] See European Central Bank (2022a) and De Nederlandsche Bank (2022) and Chainalysis (2022), among other surveys.

CHART 9

Danish households are only to a very limited extent exposed to securities that follows the development in crypto-assets



Note: The grey line indicates the market value of Danish households' investments in registered securities linked to crypto-assets, see box 4. The red columns indicate households' net transactions for the same securities.
Source Danmarks Nationalbank.

There is a positive correlation between the interest in crypto-assets and the price development on the assets. The monthly net transactions in chart 9 give an indication of Danish households' interest in crypto-assets. Especially in 2021, which saw sharp price increases, net transactions increased significantly. Interest in investing in crypto-assets has subsequently declined during 2022-2023, resulting in decreases in the prices of crypto-assets. However, only a few months have reported net sales.

The market risk of indirect exposures to the crypto-asset market is not necessarily lower than for direct ownership. Even though the investor does not formally own a crypto-asset, the investor will be equally exposed to the market development.

Danish financial institutions and institutional investors' exposure to crypto-assets

The Danish financial sector has so far been reluctant to invest in crypto-assets and offer related services, which has contributed to financial stability. In addition, banks have low exposure from crypto-assets through Danish households' crypto-asset holdings as they are very low. It reduces their overall exposure to the related risks mentioned in the previous section.

The banks' exposure to crypto-assets will become more transparent. Danish banks are currently not required to report their direct exposures to crypto-assets, but this will change with the implementation of the Basel standards for banks' crypto exposures in EU legislation. Since 2021, the Basel Committee has continuously monitored the exposures of a number of global banks to crypto-assets. At the end of 2022, 17 out of 181 banks reported that they had exposures

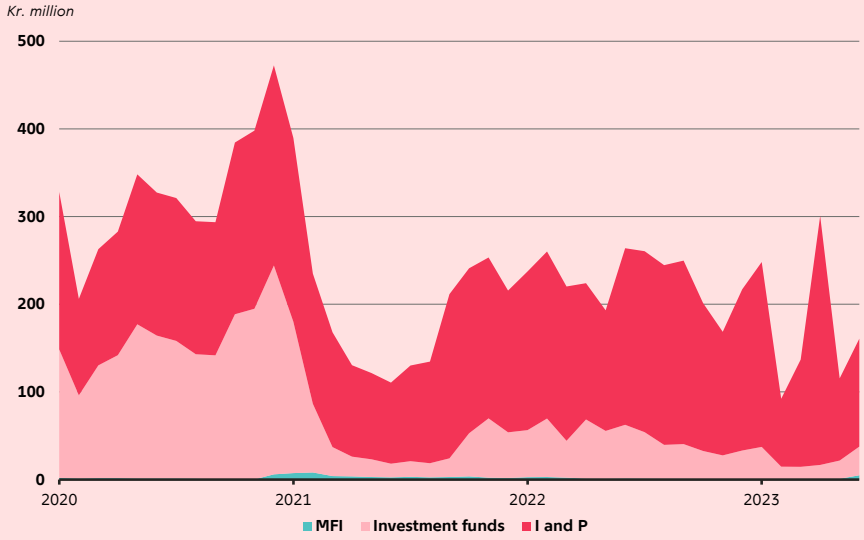
to crypto-assets of just under 3 billion euro, corresponding to a weighted average of 0.013 per cent of the total exposures for the reporting banks.

Danmarks Nationalbank has examined the Danish banking sector's indirect exposure to crypto-assets, see Box 4box 4. The study showed that the Danish MFI sector[39] does not have any significant holdings of financial instruments that expose them to the development in the crypto-asset market. In July 2023, the market value of the MFI sector's holdings of shares, ETFs and ETPs that follows the development of the crypto-asset market was only kr. 5 million, see chart 10 chart 10.

Financial institutions can be exposed through a number of the services that they provide to their customers, see BCBS (2022). These include loans to players exposed to crypto-assets, exchange service between crypto-assets and fiat money, custody services, clearing of crypto-derivatives or the use of crypto-assets for interbank transfers.

CHART 10

Indirect crypto-exposures in the Danish financial sector are very limited



Note.: The investment funds *category also includes holding companies. MFI comprises monetary and financial institutions, including banks, mortgage credit institutions and Danmarks Nationalbank. I and P includes insurance and pension companies as well as investment funds owned by pension companies.*
Source: Danmarks Nationalbank.

Pension and insurance companies, as well as investment funds owned by pension funds (the I and P sector), also have very limited exposure to the market risk through indirect investments in crypto-assets. In August 2023, the I and P sector had holdings of kr. 123 million in securities and financial instruments related to crypto-assets. This corresponds to 0.003 per cent of the I and P sector's total managed investments of more than kr. 4,000 billion.[40]

The I and P sector's reluctancy to invest in crypto-assets is a trend also seen across Europe. A survey conducted by Fidelity in 2021 shows that only 3 per cent

[39] The MFI sector in Denmark consists of banks, mortgage credit institutions and Danmarks Nationalbank.
[40] See Danmarks Nationalbank's StatBank, table DNFPINVL (link)

of European pension funds and insurance companies had included crypto-assets in their portfolio.[41]

BOX 4

Identification of indirect exposures to crypto-assets

Danmarks Nationalbank has examined Danish investors' indirect exposure to crypto-assets. Indirect exposures cover a wide range of securities (shares, ETPs and ETFs) that fully or partially follow the development in a crypto-asset or more generally in the blockchain-based markets. Overall, 109 crypto-related securities have been identified in the securities statistics where Danish ownership has been registered between 2020 and 2023. The list of crypto-related securities has been generated based on securities registered on the Danish central securities depository, Euronext Securities.

For investment funds and ETPs, a search has been made on name or ticker search for the 15 most widely used crypto-assets, such as 'Bitcoin' and 'BTC'. In addition, a number of other crypto and blockchain-related keywords have been used to capture crypto-related ETFs that follows the development in a broader basket of crypto-assets. The securities have then been checked to verify that they actually represent an exposure to one or more crypto-assets or blockchain companies.

Shares are included for companies with business models that depend on the development in the crypto-asset market or blockchain technology. It includes companies with large holdings of crypto-assets, trading platforms and companies specialising in mining of crypto-assets. A total of 23 listed companies are identified.[1]

The statement should be seen as a lower estimate of Danes' indirect exposures to crypto-assets. It is generally difficult to identify crypto-related securities, and the statement is subject to the reservation that not all crypto-related securities have been identified. In addition, new investment funds are continuously being established and new financial products are introduced on the market, which means that the identified list may already be outdated.

[1] See Morgan Stanley (2022).

No significant stablecoins are pegged to the Danish krone

Danmarks Nationalbank is not aware of any significant stablecoins that follow the value of the Danish krone. There are currently no indications that there may be a fire sale of Danish or European securities caused by a run on a stablecoin, as the market for stablecoins linked to the Danish krone or European currencies is very small. And although more stablecoins pegged to the euro have emerged in recent years, it is also a market that is very limited in size.[42]

Most stablecoins are pegged to the US dollar, one reason being network effects. Therefore, stablecoins which have a large number of users are more attractive as there are more users to interact with. The importance of network effects for stablecoins reduces the likelihood that a sufficiently large scale – and thus business volume – can be achieved in a stablecoin anchored to a smaller currency such as the Danish krone, as the number of users is limited.[43] The spread of global stablecoins pegged to the US dollar also means that Danish users are likely to be more inclined to look to where liquidity is already high.

Risks can be transmitted through global financial markets

Developments in the crypto-asset market may affect the financial system in Denmark through the global financial markets. Denmark is a small open economy with a financial sector that is closely connected to the global financial system. If risks in the crypto-asset market affect the financial sector in one of our trading partner countries or a financial epicentre such as the United States, the Danish financial sector can import risks from the crypto-asset market.

[41] See Fidelity (2021).
[42] See European Systemic Risk Council (2023) for an overview of stablecoins pegged to the euro.
[43] See Danmarks Nationalbank (2022) for a description of why network effects are relevant to players providing services using blockchain technology

In spring 2023, the development in the crypto-asset markets had consequences for two US banks, Signature Bank and Silvergate Bank, both of which specialised in crypto-assets. The banks were wound up and went into voluntary liquidation, respectively, after a rapid decline in deposits triggered by turbulence in the crypto-asset market and the resulting uncertainty about the banks' ability to continue as going concerns. If a similar event occurs for a bank of a significant size, this may have even greater consequences for the US banking market and risk impacting the Danish financial sector.

A fire sale of large stablecoins can, under certain conditions, affect financial stability in Denmark. The vast majority of all stablecoins are pegged to the US dollar and are primarily supported by assets issued in the US financial sector. A fire sale of reserve assets among these issuers can have an impact on the less liquid assets in the reserves, such as corporate bonds and crypto-assets. To the extent that the reserves are placed as deposits with banks and money market funds, sudden redemptions will also give rise to stress. It could potentially create a similar run on the assets held by banks and money market funds.

It is difficult to determine when a stablecoin has reached a size that can cause the above effects, as the increasing risk is a product of many factors. As previously stated, the risk of a run on a stablecoin depends on the composition of reserve assets and general confidence in the market, among other factors. However, the market for stablecoins is, for now, still small relative to traditional markets, and the implications of a fire sale on a stablecoin are likely to be very limited, especially in Denmark.

05
New regulation of crypto-assets in the EU

New regulation will address a number of the vulnerabilities in the crypto-asset market that may threaten financial stability in the long term. Companies that issue crypto-assets or provide financial services connected with them must, like other financial institutions, comply with the rules that support an efficient and secure financial system. It is important that risks are addressed while the use of crypto-assets remains limited and before they can have implications for financial stability in Denmark and Europe.

From 2025, there will be a comprehensive regulatory framework covering crypto-assets in the EU. By then, all provisions in MiCA[44] will be applicable and the Basel Committee's proposed standards for capital treatment of crypto-assets are expected to be implemented in European legislation. EU Member States have previously had to deal with crypto-assets within national legislation, resulting in an absence of regulation in many places.

New regulation fences off risks posed by crypto-assets

The new regulation will, for example, help reduce the risks to financial stability in the EU posed by crypto-assets, see table 1. A significant part of the identified risks that may threaten financial stability will be addressed in the new regulation.

[44] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937

TABLE 1

New European regulation will address a number of risks that crypto-assets pose for financial stability

Financial stability risks	Vulnerability	Regulatory response	Addressed by MiCA	Addressed by Basel
Market risks	Lack of anchoring in tangible assets	-		
	Lack of clarity on reserves for stablecoins	Requirements for the reserve composition	X	
	Low market transparency	Disclosure requirements	X	
	Prone to fraud and scams	Consumer protection requirements	X	
	Regulatory arbitrage	International coordination		
Liquidity risks	Liquidity mismatch in stablecoin reserves	Liquidity management requirements	X	
	High concentration of liquidity on platforms	Disclosure requirements	X	
Credit risks	Financial connections with affiliated entities	Disclosure requirements	X	
	Excessive use of debt in the crypto-asset market	Loan-based tools		
	No control of governance	Management requirements	X	
	Limited information about business models	Disclosure requirements	X	
Operational risks	High technological dependency	Operational requirements	X	
	Cyber security risks	Contingency response plans for critical incidents	X	
Interconnectedness with the traditional financial sector	Direct exposures in banks	Capital and liquidity requirements		X
	Direct exposures among other financial corporations	Capital and liquidity requirements		
	Traditional financial institutions' supply of financial products related to crypto-assets	-		
	Traditional financial services provided to crypto-companies	-		

Source: BIS (2023) and Danmarks Nationalbank

The purpose of the new regulation is multifaceted. The European Commission wants to increase consumer protection and market integrity and continue to ensure financial resilience and stability. Under MiCA, persons and legal entities operating with crypto-assets must comply with standards for, for example, own funds, liquidity management, governance, authorisation for and supervision of the companies operating with crypto-assets, see box 5.

MiCA harmonises reporting of business information across EU member states. This gives supervisory authorities and central banks access to data that enable them to better identify and assess the potential risks to financial stability.

BOX 5

Main elements of MiCA

With the MiCA Regulation, the EU is the first major jurisdiction to adopt a regulatory framework dedicated to markets for crypto-assets. The requirements in the Regulation are based on those contained in the existing financial legislation, including the regulation of financial instruments and capital requirements contained in the Markets in Financial Instruments Directive (MiFID), the Capital Requirements Regulation (CRR) and the Capital Requirements Directive (CRD). However, MiCA does not cover activities with digital assets regulated under MiFID, non-fungible tokens (NFTs), central bank digital currencies (CBDCs) or activities provided by fully decentralised service providers (so-called DeFi services).

MiCA formally entered into force on 30 June 2023, but the provisions of the Regulation concerning issuers of crypto-assets and crypto-asset service providers will become applicable after an implementation period of 12 and 18 months, respectively. For crypto-assets service providers registered within the EU before the implementation of MiCA, a grandfathering period on 18 months applies. The national financial authorities do have the competence the reduce or remove this option.

Regulation of crypto-assets and stablecoins
MiCA distinguishes between three types of digital assets: Asset-referenced tokens (ART), e-money tokens (EMT and other crypto-assets. ARTs and EMTs can both be characterised as stablecoins, as they comprise assets tha seek to maintain a stable value against one or more reference assets. Only credit institutions and e-money institutions registered within the EU will be able to issue EMTs, as these follow the exchange rate of an official currency and are regarded as electronic money, whereas all legal entities will be able to issue an ART.

The Regulation imposes relatively few requirements on issuers of crypto-assets, while there are significantly more provisions for issuers of ARTs and EMTs. Issuers of both ARTs and EMTs must be authorised and supervised by the national competent authorities. If an ART or EMT is assessed to be significant (see the criteria for this described later in this box), the supervisory authority will pass to the European Banking Authority (EBA) in the case of ARTs, or be shared between the national supervisory authority and the EBA in the case of EMTs.

Key elements of MiCA include requirements for own funds, reserve management and redemption rights among holders of issued tokens. Adequate capitalisation among issuers of ARTs and EMTs is to ensure that they are sufficiently resilient to limit any contagion effects on the established financial system. At the same time, issuers of ARTs and EMTs must clearly specify the redemption rights to which holders are entitled and ensure that the reserve in question is sufficient to meet redemption requests. This involves requirements for the composition, management and storage of the reserve. EMTs must always be redeemable at par, while ARTs must be redeemable at the market price of the assets that the price of the issued tokens follows.

In contrast to the regulation of ARTs and EMTs, MiCA imposes few requirements on issuers of crypto-assets that are not asset-referenced tokens or e-money tokens. These requirements primarily concern the preparation of a so-called white paper, i.e. a disclosure document containing information about, for example, the issuer, rights and obligations as well as possible risks of the asset.

Under MiCA, the national central banks have the possibility of limiting the issuance of crypto-assets that may pose a threat to those parts of the financial system that fall under the central banks' mandate. In practice, this means that Danmarks Nationalbank can veto the issuance of an ART that follows the Danish krone in Denmark if it is deemed to pose a risk to payment security, financial stability, monetary policy transmission or monetary sovereignty.

The box continues on the next page

BOX 5 (continued)

Regulation of crypto-asset service providers
MiCA contains three categories of regulation aimed at crypto-asset service providers: A set of general requirements aimed at all crypto-asset service providers, a set of specific requirements targeting providers of specific financial services and, finally, more stringent requirements for so-called significant crypto-asset service providers.

The general requirements include requirements for capitalisation, organisational structure, competence requirements for governance, storage of customer funds and protection of the customers, which contain great similarities with the requirements of the Danish Financial Business Act (*Lov om finansiel virksomhed*). Among other requirements, crypto-asset service providers must be authorised by a competent authority in an EU member state, have clear governance and organisational structures and effective procedures for identification and management of risks. In addition, they are covered by the standards for combating money laundering and terrorist financing.

MiCA sets stricter requirements for so-called significant crypto-asset service providers. A crypto-asset service provider is regarded as significant when it has more than 15 million active users in EU member states. A significant crypto-asset service provider must be authorised and national authorities must share supervisory information with the European Securities and Markets Authority (ESMA) on an ongoing basis.

Source: European Commission (2023), *Markets in crypto-assets*

Financial stability is further supported by the Basel Committee on Banking Supervision (BCBS) having finalised its standards for the treatment of credit institutions' exposures to crypto-assets, see box 6. This includes requirements for the credit institutions' own funds and liquidity management. In practice, this implies that credit institutions must finance investments in crypto-assets exclusively with equity.[45] In addition, the standards impose a cap at maximum 2 per cent of the total Tier 1 capital for credit institutions' possible exposures to crypto-assets, with the aim of limiting the interconnectedness of the traditional financial sector and the crypto-asset market.

Once implemented in European law, the Basel standards will improve the credit institutions' resilience to absorbing losses from materialisation of risks on their exposures to crypto-assets. This applies to both direct investments in crypto-assets and indirect exposures in exchange-traded products that follow the development in the crypto-asset market.

[45] Based on the assumption of a capital requirement of 8 per cent, corresponding to the Pillar I minimum requirement. However, banks will often have a higher capital requirement as a result of additional capital requirements.

BOX 6

Basel standards for treatment of credit institutions' exposures to crypto-assets

In December 2022, the Basel Committee on Banking Supervision (BCBS) presented its proposal for a set of regulatory standards for credit institutions' treatment of exposures to crypto-assets. This includes capital adequacy and liquidity risk management standards designed to ensure that credit institutions holding crypto-assets are resilient and thus capable of absorbing any losses on their holdings.

The regulation must create a level playing field for the treatment of assets. The standards have been prepared on the basis of a principle of 'same activity, same risk, same regulation'. Thus, for example, the capital adequacy requirement for exposures to crypto-assets will be equated with other types of assets if they involve the same risk. The Basel standards are not automatically applicable in Europe but must be implemented in the regulation that lays down capital requirements for credit institutions and systemic investment firms, among other requirements.

Two risk groups
The Basel standards classify crypto-assets into two risk groups, group 1 and group 2, each of which imposes on the banks' different own funds and liquidity requirements.

Group 1 includes both tokenised assets, i.e. digital representations of traditional assets such as equities and bonds issued by means of DLT or similar technology as well as crypto-assets with an effective stabilisation mechanism. Provided they meet a number of classification criteria, these assets will be treated as traditional assets in the existing Basel standards. In order to address observed weaknesses in the DLT infrastructure, it is envisaged that authorities can activate a capital add-on to the risk-weighted assets.

Group 2 includes all crypto-assets that do not meet the classification criteria of group 1. This applies to tokenised assets, stablecoins and unbacked crypto-assets. These assets are associated with higher risks than other assets and are therefore subject to more conservative regulation. Holdings of group 2 assets will be subject to a risk weight of 1250 per cent. This means that banks must fully finance their holdings of crypto-assets with equity. In addition, the standards set an exposure limit of 1 per cent of the bank's core capital, which aims to prevent the spreading of shocks from the crypto-asset market to the banking sector.

Difference between classification of crypto-assets in the Basel standards and MiCA
The classification of crypto-assets is not fully harmonised between the Basel standards and MiCA, and expectations are therefore that we will see an alignment of the standards with European legislation. Asset-referenced tokens can be placed in both group 1 and group 2, depending on the effectiveness of the stabilisation mechanism. E-money tokens will always be classified as group 1, while other crypto-assets will always be classified as group 2.

[1] An effective stabilisation mechanism is defined by the BCBS as one that meets the following five criteria: (1) the asset must be designed to be redeemable at a predefined value against a reference asset, (2) the stabilisation mechanism minimises fluctuations in the market value of the crypto-asset relative to the peg value of the reference asset, (3) the stabilisation mechanism enables risk management similar to the risk management of traditional assets, (4) there must be sufficient information for banks to verify the ownership rights to the reserve assets upon which the crypto-asset is dependent, and (5) the crypto-asset's reserve is sufficient to ensure redemption, even in periods of stress, and the issuer is regulated by a financial authority and subject to capital and liquidity requirements.

Source: BCBS (2022), Prudential treatment of crypto-asset exposures

Regulation of crypto-assets supports financial innovation

The coming regulation will increase the credibility and integrity of the crypto-asset market. MiCA creates clarity about the regulatory landscape, making it easier for businesses to navigate the crypto-asset market. At the same time, MiCA entitles owners of crypto-assets to basic rights. It benefits market integrity when businesses that develop financial solutions based on blockchain technology must meet the same requirements as financial companies that use other technology. This results in competition that is value-based rather than based on the absence of regulatory requirements, which supports financial innovation.

Several examples have been seen of how crypto-asset service providers characterised by a lack of risk management and careless handling of customer

funds have created distrust in the crypto-asset market and increased uncertainty about possible societal gains from blockchain technology.

Regulation of crypto-assets is revised on an ongoing basis

With MiCA and the expected implementation of the Basel standards for treatment of exposure to crypto-assets in European law, there will, for the first time, be a framework covering the use of new technology in the financial area. Therefore, the European Commission is proposing to evaluate the regulatory framework on an ongoing basis. Periodic evaluations have thus been incorporated in the application of the Regulation in MiCA. This will result in two reports to be submitted in mid-2025 and mid-2027, respectively.

The application of MiCA may lead to some activities moving to areas or platforms that are less regulated. MiCA exempts fully decentralised services, so-called DeFi services. The reason being that the services are not offered by a trusted third party, but by automated software through so-called *smart contracts*. The absence of a identifiable legal entity hinders a secure and efficient enforcement since there is not counterparty that can be held accountable for any breaches of the regulation. When MiCA regulates centralised crypto-asset service providers but not DeFi services, this can lead to higher activity levels among decentralised crypto-asset service providers. For this reason, the European Commission will focus on further examining DeFi services in their two evaluations of MiCA.

In addition, international organisations such as the ESRB and FSB recommend an examination of the risks associated with the fact that some crypto-asset service providers offer a combination of many financial services under the same legal entity. This increases the complexity of the providers' business activities, making it difficult to identify risks that are building up. MiCA currently does not contain any rules limiting the possibility that the same business can provide different services. ESRB (2023) recommends that such an analysis be included in the coming evaluations of MiCA in 2025 and 2027.

Access to data is necessary for effective monitoring

Data concerning crypto-assets and the activities of service providers are vital for the financial authorities' ability effectively to oversee and assess potential risks to financial stability. With the new regulation of the crypto-asset market, financial authorities will have access to more and better information about credit institutions' exposures to crypto-assets and the build-up of risks among crypto-asset market players.

In some areas, however, the data available to the authorities will still be limited. The Basel standards lay down requirements for credit institutions, but financial institutions such as investment funds and insurance and pension companies are currently not required to report exposures to crypto-assets. Furthermore, MiCA will primarily impose requirements on the crypto-asset service providers that provide trading services, while no reporting requirements will be imposed on providers of other types of services, for example custody activities.

Global harmonisation can limit regulatory arbitrage

The crypto-asset market is not limited to Europe, but is global, and global harmonisation of rules is therefore an expedient way to regulate the market. There is important ongoing work, including in the FSB, which, since 2018, has issued global policy recommendations for crypto-assets, stablecoins and crypto-asset service providers.[46] This work is to support convergence of the rules across borders, as a higher degree of cross-border harmonisation reduces the risk of regulatory arbitrage. It is therefore important to continue the work

[46] See FSB (2018) and FSB (2020)

internationally to promote global coordination and harmonisation in the regulation of crypto-assets.

Danmarks Nationalbank monitors the development closely and participates actively in international working groups and forums that focus on new technology and on the opportunities, risks and costs associated with crypto-assets.

Bibliography

Auer, Raphael and David Tercero-Lucas (2022), Distrust or speculation? The socioeconomic drivers of U.S. cryptocurrency investments, Journal of Financial Stability, *vol. 62*

The Basel Committee on Banking Supervision (2022), *Prudential treatment of crypto-asset exposures*, December 2022

Bank for International Settlements (2022), Crypto trading and Bitcoin prices: Evidence from a new database of retail adoption, *BIS Working Papers*, no. 1049

Bank for International Settlement (2023), Financial stability risks from crypto-assets in emerging market economies, *BIS Papers*, no. 138, August 2023

Chainalysis (2022), The 2022 Geography of Cryptocurrency Report

Chainalysis (2023), *The 2023 Crypto Crime Report*

Cong, Lin William, Xi Li, Ke Tang and Yang Yang (2022), Crypto Wash Trading, National Bureau of Economic Research, Working Paper no. 30783, December 2022

CoinGecko (2023), *Crypto Industry Report Q1 2023*

Danmarks Nationalbank (2022), New types of digital money, *Danmarks Nationalbank Analysis*, No. 8, June 2022

De Nederlandsche Bank (2022), Crypto-assets: Evolution and policy response, *DNB Occasional Studies, vol. 20/5*

European Central Bank (2022a), Decrypting financial stability risks in crypto-asset markets, *Financial Stability Review*, May 2022

European Central Bank (2022b), Study on the Payment Attitudes of Consumers in the Euro Area (SPACE), *ECB surveys*

European Systemic Risk Council (2023), Systemic implications and policy options*, ESRB Task Force on Crypto-Assets and Decentralised Finance*

Eigelshoven, Felix, André Ullrich and Douglas A. Parry (2021), Cryptocurrency Market Manipulation: A systematic literature review*,* International *Conference on Information Systems*

Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets

Ferroni, Filippo (2022), How interconnected are cryptocurrencies and what does this mean for risk measurement, *Chicago Fed Letter*, no. 466

Fidelity (2021), The Institutional Investor Digital Assets Study

Financial Stability Board (2018), *Crypto-asset markets: Potential channels for future financial stability implications*, October 2018

Financial Stability Board (2020), *Regulation, Supervision and Oversight of 'Global Stablecoin' Arrangements*, October 2020

Financial Stability Board (2022), *Assessment of Risks to Financial Stability from Crypto-Assets,* February 2022

Financial Stability Oversight Council (2022), *Report on Digital Asset Financial Stability Risks and Regulation*

Gorton, Gary B., and Jeffery Y. Zhang (2023), Taming Wildcat Stablecoins, *The University of Chicago Law Review, vol. 90.3*, May 2023

Hackethal, Andreas, Tobin Hanspal, Dominique Lammer and Kevin Rink (2022), The Characteristics and Portfolio Behavior of Bitcoin Investors: Evidence from Indirect Cryptocurrency Investments, *Review of Finance,* vol. 26, issue 4, July 2022

Kim, Sang Rae (2022), How the Cryptocurrency Market is connected to the Financial Market, available on SSRN 4106815

Liao, Gordon Y. and John Caramichael (2022), Stablecoins: Growth Potential and Impact on Banking, *International Finance Discussion Papers 1334. Washington: Board of Governors of the Federal Reserve System*

Liu, Jiageng, Igor Makarov, and Antoinette Schoar (2023), Anatomy of a Run: The Terra Luna Crash, National Bureau of Economic Research, Working Paper no. 31160, April 2023

Makarov, Igor and Antoinette Schoar (2020), Trading and arbitrage in cryptocurrency markets, *Journal of Financial Economics,* vol. 135, no. 2

Morgan Stanley (2022), The growing list of new crypto ETFs and ETPs

OECD (2022a), Lessons from the Crypto Winter: DeFi vs. CeFi*, OECD Business and Finance Policy Papers*, no. 18

OECD (2022b), *Institutionalisation of crypto-assets and DeFi–TradFi interconnectedness, OECD Publishing*

Roshan, Iyer (2022), *New evidence on Spillovers between Crypto Assets and Financial Markets, IMF working paper, no. 213, September 2022*

Schär, Fabian (2021), Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets, *Federal Reserve Bank of St. Louis Review,* vol. 103, no. 2

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Editing completed on 1 October 2023

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