

Bitcoin is so Last Decade – How Decentralized Finance (DeFi) could Shape the Digital Economy

Irina MNOHOGHITNEI*

*Bucharest University of Economic Studies, Romania
mnohoghitneiirina20@stud.ase.ro*

Alexandra HOROBET

*Bucharest University of Economic Studies, Romania
alexandra.horobet@rei.ase.ro*

Lucian BELAȘCU

*University of Sibiu Lucian Blaga, Romania
lucian.belascu@ulbsibiu.ro*

Abstract

Ever since the Global Financial Crisis, the financial system has seen an accelerated level of innovation. Bitcoin offered a decentralized alternative to money, with thousands of other cryptoassets quickly emerging. Most recently, Decentralized Finance (DeFi) promises to offer a new digital economy, with smart contracts replacing the need for financial intermediaries. This new market aims to reinvent traditional financial products in a more transparent and interoperable way. In this paper we aim to undertake an extensive literature review of the financial stability risks posed by the fast-growing DeFi market and assess these using the Financial Stability Board's fintech framework. We find that DeFi could pose several challenges to traditional financial infrastructure, primarily by increasing interlinkages between cryptoassets and traditional financial markets. However, if DeFi evolves in a safe way, it could increase competition and financial inclusion with overall positive implications for financial stability.

Keywords: DeFi; financial stability; fintech; cryptoassets; cryptocurrencies;

JEL Classification: O30; E44; G29; C88;

DOI: <http://doi.org/10.24818/ejis.2022.06>

1. Introduction

Ever since the Global Financial Crisis, the financial system has seen an accelerated level of innovation. Fintech started unbundling traditional financial services, reducing the ability of banks to cross-sell financial products and increasing competition in the market. Furthermore, Bitcoin offered a decentralized alternative to money with thousands of other cryptoassets following its lead. Most recently, Decentralized Finance (DeFi) promises to offer a new digital economy, with smart contracts replacing the need for intermediaries such as banks or exchanges. New technology replicates the functionality of existing financial products (e.g. loans, derivatives) without their inherent design flaws, thus reinventing them in a more transparent and interoperable way.

* *Affiliation disclaimer:* The paper was produced when the author worked at the Bank of England. However, any views expressed in this paper are solely of the author's and cannot be taken to represent those of the Bank of England or to state Bank of England policy. This paper should therefore not be reported as representing the views of the Bank of England.

Received: 12 March 2022; Revised: 7 April 2022; Accepted: 15 May 2022

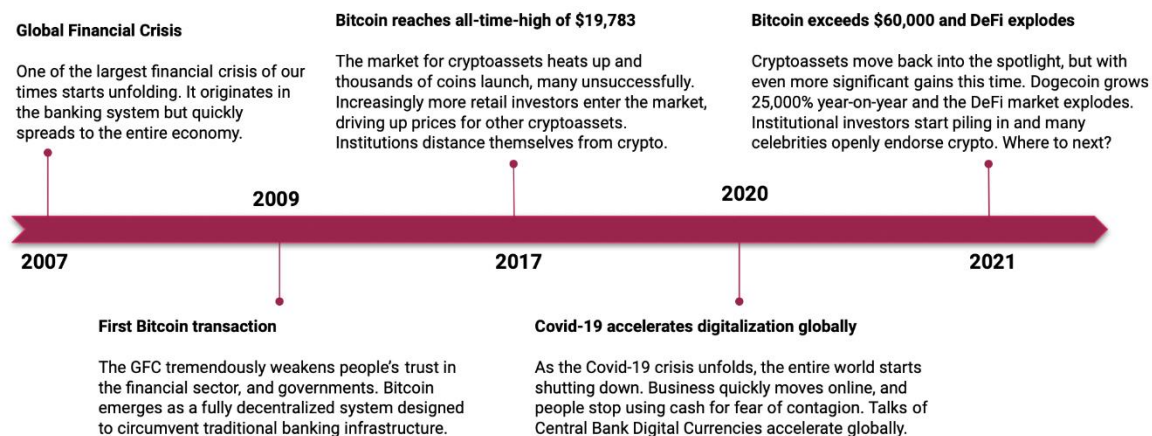
We apply the Financial Stability Board’s fintech framework to assess how the rise of DeFi could impact global financial stability. We observe that the financial products offered by DeFi providers are becoming increasingly complex. While DeFi providers aim to replicate traditional financial services products, many times these are not accompanied by the same levels of robust regulation, or strong customer protection.

We find that DeFi could pose a number of challenges to traditional financial infrastructure, primarily by increasing interlinkages between cryptoassets and traditional financial markets. This is particularly concerning as cryptoassets have been gaining legitimacy in recent years, driven by price rallies and celebrity endorsements, resulting in a renewed interest from institutional and retail investors alike. At the same time, there are concerns regarding the use of cryptoassets for money laundering and financing of terrorist activities. Nevertheless, if DeFi develops in a safe way, it could increase competition and financial inclusion with overall positive implications for financial stability.

2. Short History of Cryptoassets

Cryptoassets emerged as a direct response to the Global Financial Crisis of 2007-2008, which tremendously weakened people’s trust in the financial sector and governments (*Figure 1*). Bitcoin emerged as a fully decentralized system designed to circumvent traditional banking infrastructure (Nakamoto, 2008). The first Bitcoin transaction took place in 2009 and thousands of cryptoassets emerged since.

Figure 1. Timeframe of cryptoassets’ growth



Source: Authors’ analysis.

In 2017 the crypto market reached impressive all-time highs. Increasingly, more retail investors entered the market in search for a new Bitcoin, while most institutions distanced themselves from the market (Coinmarketcap, 2022). In 2020 Covid accelerated global digitalization as businesses quickly moved online, and customers stopped using cash for fear of contagion (Caswell et. al., 2020).

In 2021 we have been witnessing a new peak of the cryptoassets market. Dogecoin price grew 25,000% year-on-year (Coindesk, 2022). Institutional investors started entering the market (Phillips et. al., 2021) and many celebrities openly endorsed crypto (Wright, 2022). Alongside the record-breaking growth in the crypto market, Decentralized Finance

(DeFi) took off growing from \$10bn at the start of 2020 to around \$112bn at the end of 2021 (DeFiPulse, 2022). In this paper we will explore the potential implications for financial stability from DeFi.

3. Decentralized Finance (DeFi)

DeFi is a brand-new crypto market primarily based on Ethereum’s Smart Contracts. DeFi promises to replicate the functionality of the entire financial system in an open, decentralized, permissionless and autonomous way. In 2021 DeFi grew very quickly, exceeding \$100bn Total Value Locked (TVL) in November, up from \$10bn in 2020 (DeFiPulse, 2022).

DeFi aims to fully replicate financial services products in a fully decentralized way with the aim to remove intermediaries from transactions and enabling users to trade peer-to-peer. DeFi applications are non-custodial in nature, and are composable, meaning that individual features can be combined like Lego into a brand-new product, thus greatly increasing the complexity of the crypto market. By definition, DeFi also introduces additional layers of decentralization in financial services, which could further accelerate risks associated with traditional cryptoassets.

Throughout 2021 lending and decentralized exchanges applications alone represented the largest part of DeFi market, together accounting for over 70% of TVL (*Table 1*). However, many of the payments and digital assets applications have the primary aim to increase interoperability between various blockchains which, in the longer-term, could significantly increase adoption.

Table 1. Summary of the DeFi market

Products	Lending	DEXes	Asset Management	Derivatives	Payments
Description	Users can lend or borrow crypto, subject to a “collateral factor”. Some platforms automatically set interest rates, by taking into account overall demand and liquidity. Uncollateralized “flash loans” are also possible.	Decentralized Exchanges (DEXes) enable non-custodial exchange of crypto tokens. They also provide automated liquidity pools that users can contribute to in exchange for fees.	Most projects offer a suite of yield-generating crypto products by automatically routing crypto deposits to highest-yield opportunities depending on users’ risk-tolerance.	Products range from synthetic assets, perpetuals, leveraged tokens to margin trading.	Many applications focus on increasing interoperability of payments done between blockchains.
Purpose	Allowing crypto investors to earn interest on their assets and democratizing access to lending.	Removing the need for custodians when trading.	Accelerating the use of cryptoassets as viable collateral.	Speculative, with leverage up to 100x possible.	Improving transactional throughput on public blockchains.
TVL – Feb’21	\$39bn	\$27bn	\$14.4bn	\$2.1bn	\$1.8bn

Source: Authors’ analysis, TVL numbers obtained from DeFiPulse (2022)

4. Research Questions

Our research focused on two main questions, namely (1) whether cryptoassets pose risks to global financial stability and (2) whether Decentralized Finance poses risks to global financial stability. In order to answer these questions, we qualitatively surveyed the scant extant literature on DeFi and used FSB (2017) fintech framework for assessing financial stability risks.

Given the DeFi market only started emerging in earnest in 2021, extant literature is very limited and, where available (Schar, 2021; Qin et.al., 2021), focused on technical characteristics of DeFi products. Werner et.al. (2021) provides an overview of the DeFi market and explores key technological and economical risks from DeFi and Carter (2021) provides an initial assessment of financial stability risks from DeFi protocols.

However, we believe ours to be the first paper that systematically assesses potential global financial stability risks from cryptoassets and DeFi using the established fintech framework proposed by FSB (2017).

5. Methodology

The framework proposed by FSB (2017) assesses implications to global financial stability from three main perspectives: (i) **macro-financial risks**, such as risks to systemic important entities, or markets, potential contagion, and excess volatility; (ii) **micro-financial risks**, that could stem either from financial sources such as leverage or maturity mismatch, or from operational sources, such as cyber risk or reliance on third parties and (iii) **benefits**, that could support sustainable economic growth, dampen the effects of financial shocks, or provide a diversification of exposure to investment risk.

In our analysis we focused on the first two categories, as we believe potential benefits from cryptoassets and DeFi are still to be proven whilst risks could crystalize very quickly.

6. Discussion

During the crypto peak of 2017-2018 international authorities judged that cryptoassets did not pose threats to global financial stability (Cryptoassets Taskforce, 2018; FSB, 2021a). This was in part due to the limited size of the crypto market, but also due to the limited links between crypto and traditional markets.

Our findings suggest that risks to global financial stability have increased during the 2021 bull market. This is because a number of large payment service providers announced plans to start supporting a limited number of cryptoassets on their platforms (FSB, 2022). Furthermore, there has been an increased interest in crypto assets from institutional investors (FSB, 2022), which could greatly accentuate the links between the crypto and traditional markets. Finally, the crypto market has become increasingly complex, with a number of derivative financial products emerging, for example Bitcoin and Ether future contracts traded at the CME (FSB, 2022).

We also find that, should DeFi continue to grow, it could further accelerate risks to global financial stability. This is primarily due to the increased complexity stemming from DeFi's fully decentralized nature. This could also pose unique challenges to supervision and regulatory oversight. *Table 2* shows a summary of our analysis, which we will now cover in turn.

Table 2. Stylized summary of the financial stability assessment of risks from DeFi and crypto

Type of risk	Potential risk	Cryptoassets	DeFi
Macro-financial risks	Contagion: distress experienced by a single financial institution, or sector, can be transmitted to others	Medium	Medium
	Procyclicality: market participants could accentuate potential distress in the markets	Low	Low
	Excess volatility: overreaction to news that could lead to adverse outcomes creating solvency or liquidity issues	Low	Medium
	Systemic importance: entities that are viewed as being systemically important may amplify risks through moral hazard	Low	Low
Micro-financial risks	Financial sources: maturity mismatch, liquidity mismatch, leverage	Medium	High
	Operational sources: Cyber risks, third-party reliance, legal or regulatory risk	Low	Medium
Benefits	Increase in efficiency, transparency, access to, and convenience of, financial services	Still to be realized	Still to be realized

Source: Authors' analysis

6.1. Macro-financial risks

6.1.1. Contagion

We judge contagion risks to be medium for both cryptoassets and DeFi.

Institutional investors' interest in crypto has been growing in 2021, especially compared to previous crypto rallies. Hedge funds have been allocating increasing amounts of their investment to cryptoassets (PWC, 2021; Boston Consulting Group, 2021). However, traditional asset managers remain minimally interested in cryptoassets owing to volatility and regulatory uncertainty (Oliver Wyman, 2021).

There has also been an increased number of traditional financial service providers offering cryptoasset custodial and trading services. Several firms also began holding Bitcoin in 2020 as an alternative to holding cash on balance sheet (Phillips et. al., 2021; FSB, 2022).

If financial institutions continue to invest in cryptoassets in a significant way, this could have material implications for financial stability as their balance sheets could become more volatile and thus riskier. Distress experienced by a single financial institution could be transmitted to other institutions, or sectors, owing to direct exposures between them.

Furthermore, a shift from bank deposits to stablecoins could disintermediate the banking sector by impacting bank funding and the cost and availability of loans (Bank of England, 2021). Fitch Ratings (2021) warned that stablecoins using fractional reserves, or whose collateral is invested in short term credit markets, could represent contagion risks in the event of forced liquidation of stablecoin reserve holdings (e.g. if stablecoins would be

forced to sell securities with a very shallow secondary market). These findings are supported by Aramonte et. al. (2021), in that stablecoins are inherently fragile because their arrangement gives rise to mismatches between the risk profile of the underlying backing assets and the liabilities of the stablecoins.

Gudgeon et. al. (2020b) explores how design weaknesses in DeFi protocols, particularly around governance, could lead to a DeFi crisis and finds that overcollateralized DeFi protocols are vulnerable to exogenous price shocks and could lead to contagion of the broader crypto market.

6.1.2. Procyclicality

There has been an increase in correlations between Bitcoin and the S&P 500 and Gold in 2020, but 2021 has seen those correlations revert to pre-pandemic levels (FSB, 2022). Furthermore, given stablecoins represent only a small subset of cryptoassets (Coinmarketcap, 2022), their potential for procyclicality remains limited. Corbet et. al. (2021) finds that DeFi bubbles are mainly self-generated and that DeFi can be broadly considered as its own asset class, with some linkages to Bitcoin and Ether only. Therefore, we judge the impact from this transmission channel to be low for both crypto and DeFi.

Should the correlations between the crypto market and traditional markets continue to increase, and given the built-in interconnectedness within DeFi applications, this could amplify market distress (Aramonte et.al., 2021).

Furthermore, several DeFi non-custodial asset management solutions emerged, which are primarily used for portfolio diversification. They allow users to invest in a basket of cryptoassets and employ a variety of strategies without having to handle the tokens individually (Schar et.al., 2021). Should the DeFi market continue to grow at an accelerated pace, it could increase procyclicality in the underlying traditional financial markets.

6.1.3. Excess volatility

The crypto market is renowned for its excess volatility and has long been compared to the Dutch tulip mania which arguably similarly ignored market fundamentals whilst artificially driving up prices (Taskinsoy, 2019). Many authorities have issued warnings for consumers that their funds invested in crypto could disappear. However, spillovers to other financial markets remained limited leading to our overall assessment that risks related to this transmission channel are low.

However, during 2021 there have been signs of increased institutional investor interest in crypto, including using leverage. This could greatly increase future volatility of the market. In this sense, DeFi has only been adding to the overall volatility of the crypto market as many DeFi products are highly automated versions of existing crypto leveraged products. For this reason we assess risks from DeFi related to this channel to be medium.

6.1.4. Systemic importance

In order to determine the systemic importance of cryptoassets, we look at their provision of critical services (e.g. payments, lending). We judge stablecoins to be the type of cryptoassets best placed to function as means of payments because their value is linked to fiat and thus intrinsically less volatile. No stablecoins have been deemed to be of systemic importance to date, but upcoming projects such as Diem have the potential to become

systemic from launch (Bank of England, 2021). However, given that no crypto entities have to date been deemed as having systemic importance, we estimate risks related to this transmission channel to be low.

While cryptoassets have not been widely used as means of payment, in 2021 an increasing number of retailers announced plans to start accepting payments in cryptoassets (Euronews, 2021). Further, large payment services providers, announced plans to support processing of crypto payments, which could lead to increased adoption (Dhamodharan, 2021).

Finally, many DeFi payment platforms aim to increase interoperability between blockchains and improve speed and seamlessness (Schar, 2021). If these DeFi projects are successful, more retailers could be swayed to accept payments in crypto thus increase the overall systemic importance of the crypto sector. Moreover, lending is one of the fastest-growing sectors of DeFi and this could increase the provision of critical services by the DeFi sector and thus its overall systemic importance.

6.2. Micro-financial risks

6.2.1. Financial

6.2.1.1. Maturity or liquidity mismatch

We judge the overall risks to be medium because the crypto sector is not providing critical financial services.

According to Schar et. al. (2021), DeFi lending platforms are innovative because they don't require lenders or borrowers to identify themselves, without necessarily increasing credit risk. They achieve this by either over-collateralizing the loans, or by requiring borrowers to repay the loan within a single transaction on the underlying blockchain.

The crypto derivatives market has grown rapidly in 2021 but remains small overall (FSB, 2022). Derivative crypto products arguably present a higher level of maturity and liquidity mismatch. These products track the value of underlying tokenized assets, including versions of stocks, commodities or other cryptoassets. If the underlying tokenized assets are highly volatile, there is an increased risk of the derivative falling below the collateralization ratio. This can be mitigated to some extent by tracking multiple data sources independently (Schar et.al., 2021).

Another channel of transmission could be from fire sales of assets backing stablecoins potentially disrupting other financial markets. Fitch Ratings (2021) warned that stablecoins that use fractional reserves, or whose collateral is invested in short-term credit markets, may pose risks to short-term credit markets should they be forced to liquidate their reserve holdings in a very shallow secondary market. Stablecoins are increasingly integral to the DeFi sector, which might suggest that any distress could further accentuate risks in the broader crypto market.

6.2.1.2. Leverage

DeFi further increases the complexity of the crypto market and allows for automatically taking highly leveraged positions. As such, we deem risks from DeFi to be high, despite the small market size, and from crypto more broadly to be medium.

Crypto leverage trading allows potential profits (and conversely, losses) to be amplified by giving customers control of up to 125 the amount needed to open a trade (TheMargin, 2021).

Most of the trading in crypto futures happens on unregulated exchanges, with some positions held on very high leverage. High leverage implies less equity available to absorb any potential losses materializing from the realization of market, credit, or other risks and as such, we deem risks from crypto to be medium.

6.2.2. Operational

We judge the overall financial stability risk stemming from operational sources to be low for cryptoassets and medium for DeFi. The latter is primarily driven by the unclear legal structure of DeFi which greatly increases regulatory risks.

6.2.2.1. Governance and process control

The crypto market is developed on decentralized ledger, or blockchain, technology. This innovative set-up fundamentally changes the way in which governance and processes are controlled by sharing the responsibility across all participating entities. Therefore, any governance decisions are made according to the consensus algorithm of each crypto project, but frequently relying on the majority rule. We argue that this decreases potential governance risks, compared to that of traditional set-ups, because the responsibility for overseeing the network is shared which implicitly increases the number of checks and balances.

DeFi arguably takes decentralized governance to a new level, through the issuance of governance tokens which grant their owners voting rights over the future of the respective protocol (Schar et. al., 2021). Whilst this design reduces the reliance on any centralized entities, any high concentration in the ownership of governance tokens can lead to power imbalances resulting in potential collusion and erosion of trust.

6.2.2.2. Cyber

Similar to governance, because of their decentralized nature, cryptoassets encounter a different type of cyber-risk compared to traditional markets. In this sense, decentralization mandates that each participating node in the crypto system must hold the entire network's information. This greatly increases the number of entities that can be attacked. However, for the entire crypto system to be vulnerable to cyber-threats, attackers must first get hold of the majority of the participating nodes before they are able to influence any decisions.

In a traditional system, information is highly guarded by a centralized entity. While it might be harder for cyber-threats to materialize, we argue they might have a bigger impact on the overall functioning of the system.

However, most centralized crypto exchanges take custody of the private keys that control customers' funds, meaning that anyone holding cryptoassets through crypto exchanges are reliant on their security standards (Schueffel et.al., 2019). This arguably reduces potential benefits to be realized from the decentralization of cryptoassets and instead increases the risk that customers lose all their funds should a successful cyber-attack take control of private keys held by exchanges. However, DeFi is decentralizing the exchange process thus lessening the risk of exchanges needing to taking custody of the private keys that control customers' funds.

For these reasons, we evaluate the overall cyber risk to be limited for both cryptoassets and DeFi.

6.2.2.3. Third-party reliance

As discussed, many customers are dependent on crypto exchanges with the custody of their private keys. In the case of the notable hack of crypto exchange Mt Gox in 2013, it took 7 years for 90% of the lost funds to be identified and recovered (Bloomberg, 2021). Should systemically important crypto exchanges collapse, this could have direct and severe impacts on customers, which could lead to a broader loss of confidence in the market.

Another notable third-party reliance in the crypto space is represented by access of crypto projects to traditional financial services. For example, in the US, there is a very limited number of banks that provide services to crypto firms (Carter and Jeng, 2021). Should one of the banks collapse, this would have a potentially severe impact on the broader US crypto market. The risk is further exacerbated in the case of stablecoins, as their reserves need to be constantly managed and are tied into traditional markets.

6.2.2.4. Legal or regulatory

Legal and regulatory risk regarding cryptoassets has long been debated, with many authorities launching initiatives to bring cryptoassets within their regulatory perimeter or ban activities in cryptoassets (WEF, 2021).

Uncertainty around liability for losses may be particularly damaging to confidence in the system, especially if customers may be unaware of the risks of the crypto products they are investing in. Many authorities have launched stark consumer warnings and stepped up regulatory action against crypto firms that could pose heightened risks (WEF, 2021).

DeFi takes cryptoassets a step further by implementing fully decentralized financial products. So far, regulation of financial services is predicated upon identifying the financial activities undertaken by financial entities and applying proportionate regulation to the relevant entities. Within DeFi, platforms are software providers of smart contracts and financial activity is undertaken directly by customers using smart contracts.

For example, DeFi lending entails taking crypto-deposits and issuing crypto-loans, with interest rates being set automatically depending on overall demand and liquidity. It could thus be argued that DeFi lending is akin to banking, and that it should be regulated accordingly. In practice, there is no entity that acts as a bank in this set-up, instead the smart contracts enable users to build pools of deposits and loans, and vote on the suitable levels of remuneration and cryptocurrency creation.

Given the remaining uncertainties around the legal and regulatory status of cryptoassets, we deem the overall legal risk from cryptoassets to be medium. However, given the unique challenges posed by DeFi, we deem this risk to be high.

6.3. Benefits

While cryptoassets and DeFi promise several potential benefits, we are of the opinion that these are still to be proven.

6.3.1. Decentralization and diversification

Decentralization has been the main driving factor behind the emergence of the crypto market, and we argue one of the most promising benefits from the crypto and DeFi markets alike.

Indeed, Bitcoin emerged in the aftermath of the Global Financial Crisis as an alternative to the financial system, which Bitcoin's whitepaper (Nakamoto, 2008) argued could no

longer be trusted. Such diversification in financial services could dampen the effects of financial shocks. Furthermore, should other types of financial providers be available, the failure of a single institution would make it less likely for the wider market to need to shut down.

DeFi brings with it composability, namely incremental pieces of functionality can be implemented independently and then combined with each other. This flexibility opens the door for an ever-expanding range of applications that could fundamentally improve the diversification of financial services (OECD, 2022).

6.3.2. Efficiency

Traditional financial markets rely on centralized institutions to provide trust. Cryptoassets promise to replace intermediaries in financial services thus increasing the overall efficiency of the provision of financial services with significant efficiency benefits. Smart contracts can undertake the role of custodians, CCPs, escrow agents as well as other intermediaries (OECD, 2022). Furthermore, transactions done on blockchain can be settled atomically, which could significantly reduce counterparty risk (Schar et. al., 2021).

However, in practice, while crypto projects have been able to demonstrate how an alternative intermediaries-free financial infrastructure could operate, the results have not necessarily been unequivocally more efficient. For example, Bitcoin supports up to 7 transactions per second, compared to up to 45,000 for Visa or no upper limit for cash (Poon et.al., 2015).

There are many projects, including DeFi, that focus on increasing the scalability of blockchains, but the current throughput has arguably been an important reason for relatively low uptake of cryptoassets. However, traditional cross-border transactions do currently take days to settle, so whilst Bitcoin is fairing better, the cost remains very high (FSB, 2021b).

6.3.3. Transparency

Through their very nature, many cryptoassets use a public blockchain, which means that pseudonymous information is publicly available for anyone to analyze. Furthermore, the underlying code which implements smart contracts on public blockchains is public and open to anyone to audit. In case of an incident, all the (historical) data inscribed on the blockchain will continue to be available to be analyzed, which is an improvement over traditional financial data management, which is scattered across multiple centralized databases (Schar, 2021). This embedded transparency would suggest that many incidents could be prevented before they occur because both the code and the data on public blockchains can be more easily and openly scrutinized.

However, it is hard to make a judgement as to whether benefits from increased transparency have been realized. Furthermore, stablecoins and many private crypto projects are moving away from fully open systems, which means transparency is likely to be reduced in the future.

6.3.4. Access to, and convenience of, financial services

Cryptoassets have primarily been used as an alternative investment tool, albeit in highly risky assets. However, it is likely any benefits from cryptoassets in terms of access to, and convenience of, financial services are more prevalent in emerging economies, where existing financial services may either be harder to access or not yet available. For example, cryptoassets may be an attractive alternative to cash as means for payments in

regions where local currencies are more volatile than cryptocurrencies, and where electronic means of payments may not be viable or available.

The use of DeFi has arguably been broader than investments, with lending a key and growing part of the market. DeFi loans are overcollateralized and, as such, remove the need for credit checks. This could allow customers with no, or poor, credit scores to access financial services. However, because of how novel the DeFi market still is, interest rates on loans have been varying wildly and, as such, they might not be attractive as alternatives to traditional financial products.

7. Conclusion

In this paper we presented evidence that risks from cryptoassets to financial stability have increased since 2018. This is, in part, because a number of large payment service providers (e.g. Visa, MasterCard) announced in 2021 that they are planning to start supporting a limited number of cryptoassets. Furthermore, there has also been an increased interest in cryptoassets from institutional investors. This could be, in part, due to the low interest rate environment in the aftermath of the Covid crisis. Finally, the crypto market has become increasingly complex, with several derivative crypto financial products emerging. This includes, but is not limited to, DeFi.

We find that, should DeFi continue to grow at a similar pace, it could further accentuate the potential risks to financial stability associated with cryptoassets. This is, in part, because DeFi increases the overall complexity of the crypto market allowing for a wide range of products to exist and interact in a fully decentralized ecosystem. Further, due to its decentralized nature, the DeFi market could pose unique challenges to supervision and regulatory oversight.

However, the overall crypto market remains small. Thus, despite identifying a number of potentially significant risks to financial stability, our assessment is that these are small overall.

References:

- Aramonte, S., Huang, W. & Schrimpf, A. (2021). DeFi risks and the decentralisation illusion. *BIS Quarterly Review December 2021*. https://www.bis.org/publ/qtrpdf/r_qt2112b.pdf
- Bank of England. (2021). New forms of digital money. *Bank of England Discussion Papers*. <https://www.bankofengland.co.uk/paper/2021/new-forms-of-digital-money>
- Bloomberg. (2021). Mt. Gox Bitcoin Repayment Plan Gains Final Approval From Trustee. Retrieved from <https://www.bloomberg.com/news/articles/2021-11-16/mt-gox-bitcoin-repayment-plan-gains-final-approval-from-trustee>
- Boston Consulting Group. (2021). When Clients Take the Lead. *BCG Research*. <https://web-assets.bcg.com/d4/47/64895c544486a7411b06ba4099f2/bcg-global-wealth-2021-jun-2021.pdf>
- Carter, N. & Jeng, L. 2021. DeFi Protocol Risks: the Paradox of DeFi. “. *RiskBooks – forthcoming 3Q 2021*. <https://ssrn.com/abstract=3866705>
- Caswell, E., Smith, M.H., Learmonth, D. & Pearce, G. (2020). Cash in time of Covid. *Bank of England Quarterly Bulletin 2020 Q4*. <https://www.bankofengland.co.uk/quarterly-bulletin/2020/2020-q4/cash-in-the-time-of-covid>
- Coindesk. (2022). Daily Cryptoasset Prices. Retrieved from: <https://www.coindesk.com/price>

- Coinmarketcap. (2022). Global Cryptocurrency Charts. <https://coinmarketcap.com/charts/>
- Corbet, S., Goodell, J.W., Gunay, S. & Kaskaloglu, K. (2021). Are DeFi Tokens a Separate Asset Class from Conventional Cryptocurrencies?. *SSRN*. <http://dx.doi.org/10.2139/ssrn.3810599>
- Cryptoassets Taskforce. (2018). UK Cryptoassets Taskforce: Final report. *HM Treasury Publications*.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752070/cryptoassets_taskforce_final_report_final_web.pdf
- DeFiPulse. (2022). Total value (USD) locked in DeFi. <https://www.defipulse.com>
- Dhamodharan, R. (2021). Why MasterCard is bringing crypto onto its network. Retrieved from <https://www.mastercard.com/news/perspectives/2021/why-mastercard-is-bringing-crypto-onto-our-network/>
- Euronews. (2021). Paying with Bitcoin: These are the major companies that accept crypto as payment. Retrieved from <https://www.euronews.com/next/2021/12/04/paying-with-cryptocurrencies-these-are-the-major-companies-that-accept-cryptos-as-payment>
- Financial Stability Board. (2017). Financial Stability Implications from FinTech. Supervisory and Regulatory Issues that Merit Authorities' Attention. *FSB Publications*. <https://www.fsb.org/wp-content/uploads/R270617.pdf>
- Financial Stability Board. (2021a). Crypto-assets and Global Stablecoins. *FSB Publications*. <https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural-change/crypto-assets-and-global-stablecoins/>
- Financial Stability Board. (2021b). G20 Roadmap for Enhancing Cross-border Payments – First consolidated progress report. *FSB Publications*. <https://www.fsb.org/wp-content/uploads/P131021-1.pdf>
- Financial Stability Board. (2022). Assessment of Risks to Financial Stability from Crypto-assets. *FSB Publications*. <https://www.fsb.org/2022/02/assessment-of-risks-to-financial-stability-from-crypto-assets/>
- Fitch Ratings. (2021). Stablecoins Could pose New Short-Term Credit Market Risks. *Fitch Research*. <https://www.fitchratings.com/research/fund-asset-managers/stablecoins-could-pose-new-short-term-credit-market-risks-01-07-2021>
- Gudgeon, L., Perez, D., Werner, S. & Knottenbelt, W.J. (2020a). DeFi Protocols for Loanable Funds: Interest Rates, Liquidity and Market Efficiency. *Proceedings of the 2nd ACM Conference on Advances in Financial Technologies*. <https://arxiv.org/pdf/2006.13922.pdf>
- Gudgeon, L., Perez, D., Harz, D., Gervais, A. & Livshits, B. (2020b). The decentralized financial crisis: Attacking defi. *arXiv preprint arXiv:2002.08099*.
- Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. *Decentralized Business Review (2008)*: 21260. Retrieved from: <https://bitcoin.org/bitcoin.pdf>
- Organisation for Economic Cooperation and Development (OECD). (2022). Why Decentralised Finance (DeFi) Matters and the Policy Implications. *OECD Publications*. <https://www.oecd.org/daf/fin/financial-markets/Why-Decentralised-Finance-DeFi-Matters-and-the-Policy-Implications.pdf>
- Oliver Wyman. (2020). After the Storm. *Oliver Wyman Research*. <https://www.oliverwyman.com/our-expertise/insights/2020/jun/wealth-management-industry-analysis-2020.html>
- Phillips, D. & Graves, S. (2021). The 9 Public Companies With the Biggest Bitcoin Portfolios. <https://decrypt.co/47061/public-companies-biggest-bitcoin-portfolios>
- Poon, J. & Dryja, T. (2015). The bitcoin lightning network. *Scalable o-chain instant payments*. <https://cryptochainuni.com/wp-content/uploads/Bitcoin-lightning-network-paper-DRAFT-0.5.pdf>

- PWC. (2021). 3rd Annual Global Crypto Hedge Fund Report 2021. *PWC Research*. [https://www.pwc.com/gx/en/financial-services/pdf/3rd-annual-pwc-elwood-aima-crypto-hedge-fund-report-\(may-2021\).pdf](https://www.pwc.com/gx/en/financial-services/pdf/3rd-annual-pwc-elwood-aima-crypto-hedge-fund-report-(may-2021).pdf)
- Qin, K., Zhou, L., Afonin, Y., Lazzaretti, L. & Gervais, A. (2021). CeFi vs. DeFi--Comparing Centralized to Decentralized Finance. *arXiv preprint* arXiv:2106.08157.
- Schar, F. (2021). Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets. *FRB of St. Louis Review*. Second Quarter 2021, 103(2), pp. 153-74. <https://doi.org/10.20955/r.103.153-74>
- Schueffel, P. & Groeneweg, N. (2019). Evaluating Crypto Exchanges in the Absence of Governmental Frameworks - A Multiple Criteria Scoring Model. *SSRN*. <http://dx.doi.org/10.2139/ssrn.3432798>
- Taskinsoy, J. (2019). Bitcoin: The Longest Running Mania–Tulips of the 21st Century?. *SSRN*. <https://dx.doi.org/10.2139/ssrn.3505953>.
- TheMargin. (2021). Best Crypto Trading Platform With High Leverage. Retrieved from <https://themargin.io/crypto-trading-platform-high-leverage/>
- The Wharton School. (2021). DeFi Beyond the Hype. The Emerging World of Decentralized Finance. *Wharton Blockchain and Digital Asset Project*. <https://wifpr.wharton.upenn.edu/wp-content/uploads/2021/05/DeFi-Beyond-the-Hype.pdf>
- Werner, S. M., Perez, D., Gudgeon, L., Klages-Mundt, A., Harz, D. & Knottenbelt, W.J. (2021). Sok: Decentralized finance (defi). *arXiv preprint* arXiv:2101.08778.
- World Economic Forum. (2021). Navigating Cryptocurrency Regulation: An Industry Perspective on the Insights and Tools Needed to Shape Balanced Crypto Regulation. *WEF Community Paper*. https://www3.weforum.org/docs/WEF_Navigating_Cryptocurrency_Regulation_2021.pdf
- Wright, T. (2022). Year of sponsorships: Celebrities who embraced crypto in 2021. *Cointelegraph*. <https://cointelegraph.com/news/year-of-sponsorships-celebrities-who-embraced-crypto-in-2021>
- Xu, J. & Vadgama, N. (2021). From banks to DeFi: the evolution of the lending market. *Enabling the Internet of Value*. Springer, Cham, 2022. 53-66. https://www.researchgate.net/publication/350625378_From_banks_to_DeFi_the_evolution_of_the_lending_market