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DeFi lending: intermediation without information?

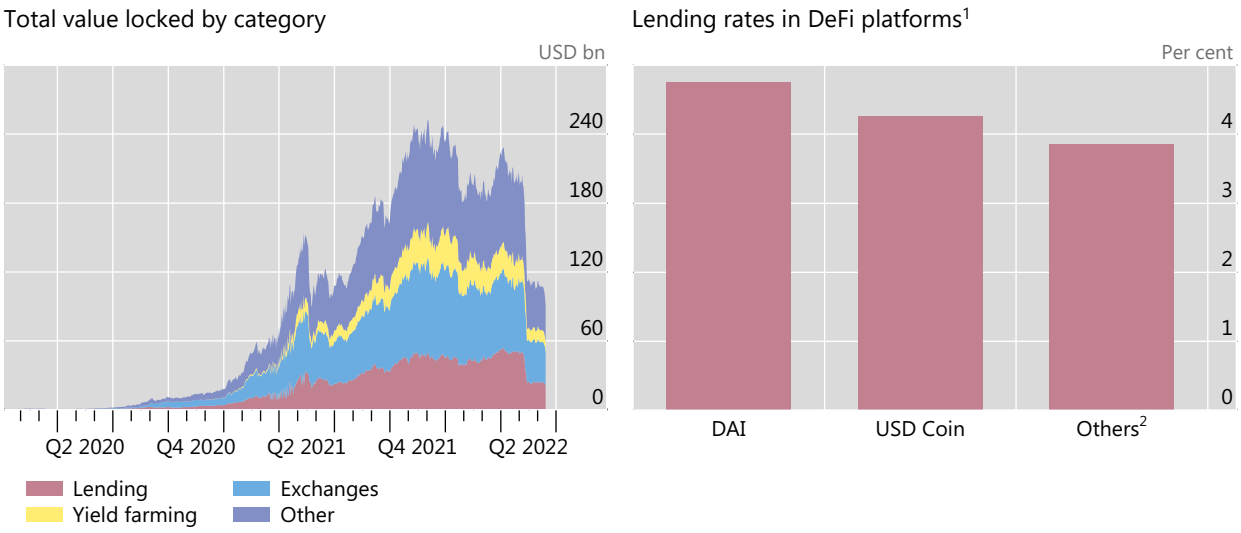
Key takeaways

- *Lending platforms are a key part of the decentralised finance (DeFi) ecosystem, but their institutional features mostly facilitate speculation in cryptoassets rather than real economy lending.*
- *Due to the anonymity of borrowers, overcollateralisation is pervasive in DeFi lending, which generates procyclicality. Reliance on collateral also limits access to credit to borrowers who are already asset-rich, negating financial inclusion benefits.*
- *For DeFi lending to make inroads into the real economy, it needs to tokenise real assets and rely less on collateral by developing its ability to gather information about borrowers; as such, the system is likely to gravitate towards greater centralisation.*

Lending platforms – a key element of decentralised finance (DeFi) – stand at the centre of the recent crypto turmoil. Total value locked in DeFi lending protocols peaked at $50 billion in early 2022, up from nearly zero at end-2020 (Graph 1, left-hand panel). Lenders are attracted by high interest rates that often far exceed those on bank deposits or money market funds (right-hand panel). Borrowers, in turn, use DeFi lending to gain leveraged exposure to cryptoassets or adjust portfolios. However, the recent collapse of Anchor on the Terra blockchain and Celsius' restrictions on withdrawals have shaken confidence and put a stop to the rapid ascent of crypto lending.

The crucial feature of DeFi lending is that it relies heavily on crypto collateral. This is because, unlike in traditional finance, market participants in DeFi are anonymous. Assessing the risk of borrowers through time-tested methods – from banks' screening to reliance on reputation in informal networks – is therefore not possible. Whereas financial intermediaries have, throughout history, focused on improving information

DeFi lending has grown rapidly, as high returns attract investors — Graph 1



[1] Data accessed on 19 April 2022. [2] Simple average of 65 tokens (subject to data availability).

Sources: DefiLlama; DeFi Rate; authors' calculations.

processing, DeFi lending in its current form has reversed this trend and tries to perform intermediation *without* gathering information. Instead, it requires borrowers to post collateral.

A model of intermediation fully built around collateral undermines benefits for financial inclusion, as borrowers already need to own assets. In addition, as collateral values, and hence risk-taking capacity, tend to increase in booms and decline in busts, reliance on collateral generates procyclicality in lending volumes and prices. Importantly, anonymity and dependence on collateral are incompatible with DeFi's aspiration to democratise finance: collateral-based lending only serves those with sufficient assets, excluding those with little wealth. The dependence on crypto collateral also prevents real-world use cases.

Looking ahead, the ability of DeFi lending to serve the real economy appears tied to better representation of real-world assets on the blockchain (tokenisation) and to improved information processing. Tokenisation will be essential to overcome DeFi's self-referential nature and requires both technological improvements and updated legal frameworks. Enhanced information processing hinges on identity verification that allows for credit scoring and reputation building. These advances are likely to push the system towards more centralisation, blurring the distinction between DeFi and traditional finance.

How does DeFi lending compare with traditional lending?

A core function of the financial sector is to channel savings towards productive investment opportunities. Traditionally, uninformed savers deposit their money with banks to earn interest; banks, in turn, lend out the funds to borrowers, including firms and households. Crucially, as lenders, banks screen borrowers to assess their creditworthiness, thereby ensuring that scarce capital is allocated to its best uses. In screening, banks combine hard information, such as borrowers' credit scores, income or educational background, with soft information often acquired through the broader relationship with the borrower.

Seen in this light, the history of financial intermediation is a quest for improving information processing. Indeed, a major purpose of institutions in the lending sector is to collect, distil and transmit information (Holmström and Tirole (1997)). For borrowers that are difficult to screen, lenders may require collateral to secure the loan, thereby mitigating information asymmetry and aligning incentives. For example, entrepreneurs often have to pledge their home equity when applying for a loan. In case of default, lenders can seize the collateral and sell it to recoup losses. For centuries, collateral has played a pervasive role in lending, with the Temple of Apollo in ancient Rome reportedly already issuing loans backed by real estate (Temin (2012)).

DeFi lending platforms also bring together savers and prospective borrowers, but without a central intermediary such as a bank. Activity takes place on platforms – or collections of smart contracts – that administer loans following pre-specified rules. On one side are individual depositors (also known as lenders), who deposit (or "stake") their cryptoassets into so-called liquidity pools, earning a deposit rate. On the other side are the borrowers, who receive cryptoassets and pay a borrowing rate. The two rates vary by cryptoasset and are determined by the demand for loans and the size of the liquidity pool, which represents the supply of funds. For their services, platforms usually charge fees paid by the borrower. As the process is automated, loan disbursement is nearly instantaneous and associated costs are modest.

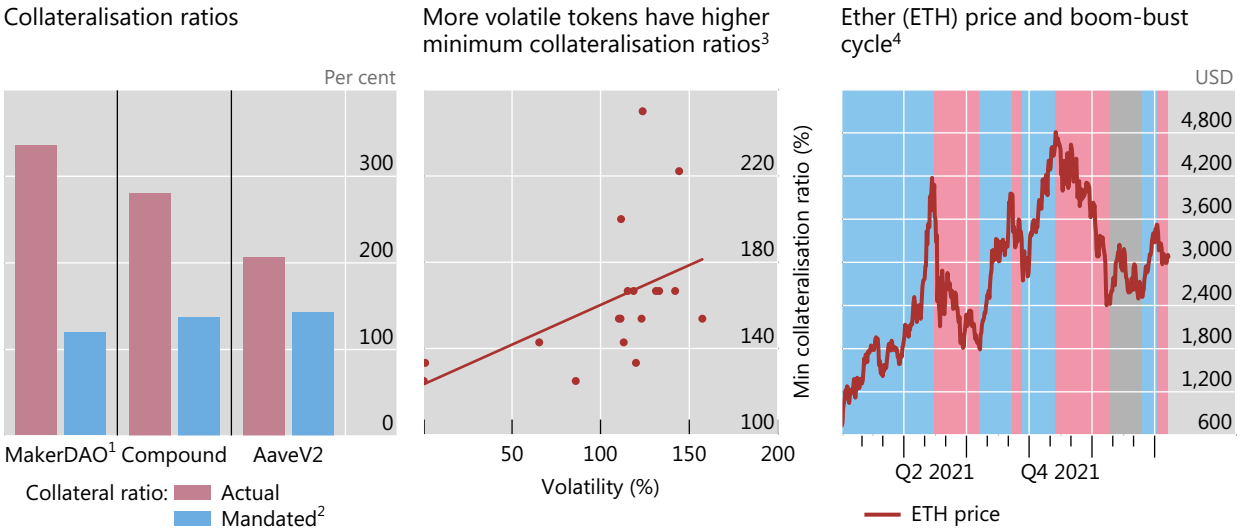
A key difference between lending in DeFi and in traditional finance is the limited ability to screen borrowers. The identity of borrowers and lenders is hidden behind cryptographic digital signatures. Lenders thus cannot access information such as borrowers' credit scores or income statements.

As a consequence, DeFi platforms rely on collateral to align the incentives of borrowers and lenders. Only assets recorded on blockchains can be borrowed or pledged, making the system largely self-referential. The typical DeFi loan is disbursed in stablecoins, while the collateral consists of riskier unbacked cryptoasset (IMF (2022)). Smart contracts assign each collateral type a haircut, or margin, that determines the minimum collateral borrowers must pledge to receive a loan of a given amount. The high price volatility of cryptoassets means that there is overcollateralisation: the collateral required tends to be much higher than the loan size. Minimum collateralisation rates typically range between 120% and 150% on major lending platforms (Graph 2, left-hand panel), and depend on the expected price appreciation and volatility

of the cryptoassets serving as collateral (centre panel). As DeFi loans are disbursed in cryptoassets and secured by crypto collateral, they do not currently finance real economy activities.

Overcollateralisation due to pseudo-anonymity and high price volatility

Graph 2



[1] Based on non-stablecoin collateral. [2] Weighted average with weights proportional to the token supply. [3] Each dot represents a token on Aave V2. The minimum collateralisation ratio is obtained from Aave risk parameters, accessed on 18 May 2022. Volatility is defined as the annualised standard deviation of a token's log returns from January 2021 to April 2022. [4] Blue (red) denotes booms (busts), defined as the period between the previous low (high) point and next high (low) during which the price increases (decreases) more than 30%. Grey denotes price changes of 30% or less.

Sources: Aave V2; Aavewatch; Compound; CryptoCompare; DeFi explore; MakerDAO; authors' calculations.

To ensure lender protection, platforms also set a "liquidation ratio" relative to the borrowed amount. For instance, a 120% collateralisation rate could be accompanied by a 110% liquidation ratio, and if collateral depreciates below this threshold, the contract stipulates that anyone can act as liquidator and seize the collateral, repay the lender and pocket a share of the residual collateral.[1] The prospect of earning a profit ensures a sufficient supply of liquidators, mitigating potential credit losses for lenders.[2] To avoid forced liquidation, borrowers normally post more cryptoassets than the minimum required, leading to a higher effective collateralisation ratio than the prescribed minimum (Graph 2, left-hand panel). Considering the boom-bust cycles of crypto (right-hand panel), overcollateralisation and liquidation ratios do not eliminate the risk of credit losses. In several instances, collateral values dropped quickly and there was no time to unwind the loans before they became impaired, leading to losses for lenders.[3]

Collateral – a double-edged sword

Collateral mitigates information asymmetries but leads to an inefficient use of capital and fosters procyclicality in DeFi lending. The main reason is that the amount of lending that can take place depends on the total value of assets eligible as collateral. In booms, appreciating prices mean that collateral values increase, while collateralisation ratios fall. In turn, borrowing constraints relax and loan volumes expand, feeding into further price appreciation and boosting volumes (Graph 3, left-hand panel). In busts, however, loans are liquidated as prices – and hence collateral values – decline sharply, suppressing lending activity (centre panel). This mechanism is further amplified when borrowed cryptoassets are used as collateral for additional loans (akin to rehypothecation), giving rise to "collateral chains". For example, a borrower can

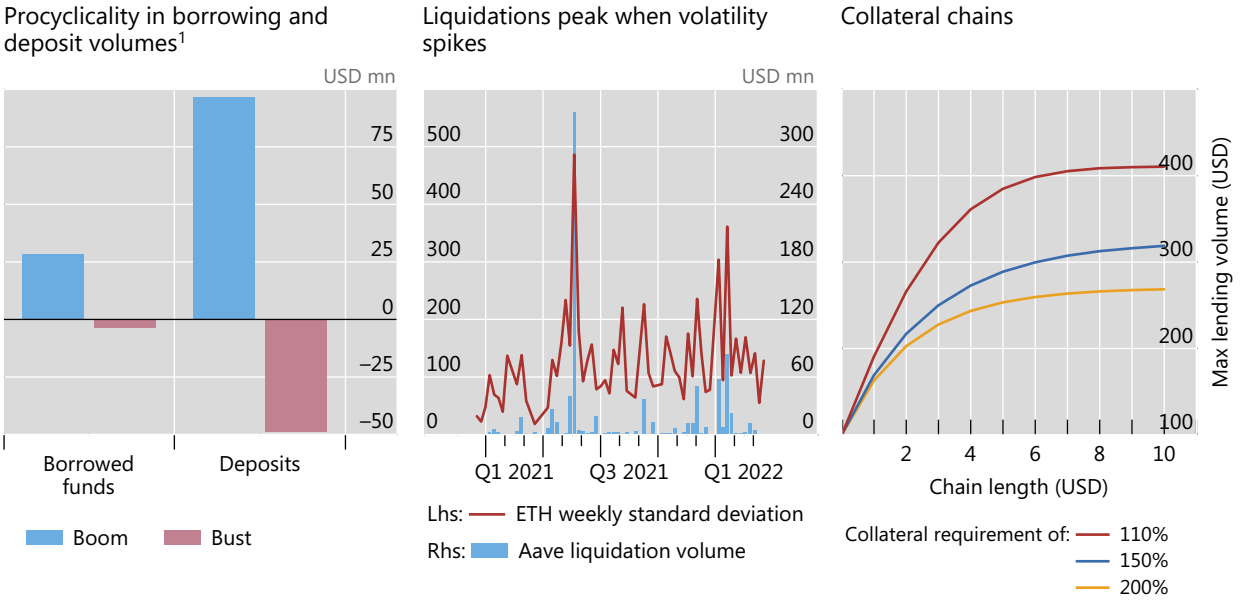
[1] As a result, the decision to terminate a loan is not taken by the lender, meaning that lending relationships have little value in DeFi lending and are trumped by the value of collateral.

[2] High price volatility can make liquidators hesitant because the collateral value they retain could decline rapidly below 100% of the borrower amount before they can sell it, implying a loss for liquidators.

[3] The Venus protocol, a once-popular lending platform on the Binance Smart Chain, suffered a price manipulation attack, which led to liquidations of more than $200 million in value and more than $100 million in value of credit losses.

post $100 in crypto collateral to borrow $80 of stablecoins, and then use the stablecoins to borrow $60 of another cryptoasset when a trading opportunity arises. For a given stock of collateral, the total amount of lending that can occur is inversely related to collateralisation rates (right-hand panel), so lower collateralisation rates increase the "monetary multiplier".

DeFi lending is procyclical, amplifying boom-bust cycles — Graph 3



[1] Average daily borrow (deposit) volume is average of the daily change in the outstanding borrow (deposit) amount. Data include Aave V2, Compound and MakerDAO.

Sources: CryptoCompare; Dune, @echolon166; @zkmark; authors' calculations.

The interconnectedness of the various components of DeFi lending can exacerbate procyclicality, as it implies that shocks to part of the DeFi ecosystem can affect the system as a whole – as evidenced by the recent collapse of the algorithmic stablecoin TerraUSD (UST). UST was supposed to keep a one-for-one peg to the US dollar by being convertible into one dollar's worth of LUNA, and vice versa. To ensure sufficient demand for UST, the lending protocol Anchor offered a deposit rate of around 20% on UST. Attracted by high returns, new users bought LUNA to mint UST, leading to a steady increase in the value of LUNA. In such a buoyant market, confidence in the stable value of UST and the appreciation of LUNA meant widespread use of these cryptoassets as collateral.

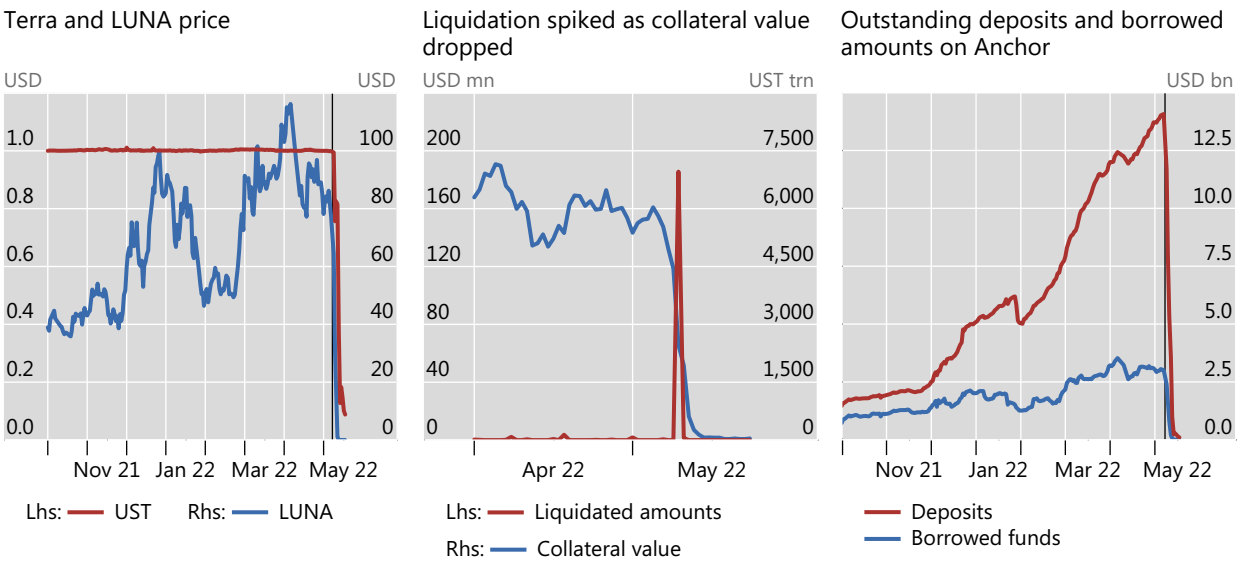
When the value of UST plummeted from $1 to almost zero in a few days (Graph 4, left-hand panel), it sent shockwaves through the system. As UST dropped below its peg, users scrambled to pull their UST out of the Anchor protocol to burn them and mint $1 worth of new LUNA, in the hope of selling LUNA and making a profit. However, given the size and speed of the shock, confidence in the whole system was shaken, meaning that there were not enough parties willing to buy all the newly minted LUNA coins. Consequently, the price of LUNA crashed, too. Collateral values declined and fell below their liquidation ratios, so liquidations of DeFi loans spiked (centre panel). As depositors feared that the collateral could become impaired, they quickly withdrew their funds in a full-fledged "platform run"; loan volumes collapsed (right-hand panel). The run on Terra quickly spread to other cryptocurrencies and has brought to the fore a centuries-old lesson: a financial system is inherently unstable without a lender of last resort.

Obstacles to financial inclusion

Beyond inducing greater procyclicality, the need for collateral also stands in the way of financial inclusion and "democratising finance" – declared goals of DeFi. Across the world, the asset-rich tend to have better

access to financial services. The financially excluded, on the other hand, often own few to no assets.[4] They remain excluded also in DeFi, which, due to overcollateralisation, actually requires participants to own *more* assets than they wish to borrow. Unless the borrower is wealthy enough – or was lucky enough to benefit from the price rally of cryptocurrency early on – DeFi fails to cater to households and (small) businesses who need capital to fund productive investment. Even if access to credit on DeFi platforms is in principle open to all, DeFi lending, as currently designed, fails to foster financial inclusion.[5]

Depletion of lending platforms in the Terra ecosystem[1] Graph 4



[1] The vertical line indicates 7 May, when Terra and LUNA prices started to fall.

Sources: Anchor; CryptoCompare; Flipside Crypto; author's calculations

This stands in contrast to fintech and big tech lenders, which acquire substantial digital information about their clients and use it for credit scoring through machine learning algorithms. As a result, these lenders can better gauge the riskiness of borrowers and often extend loans without collateral (Gambacorta et al (2020)), enabling significant gains in inclusion (Croxson et al (2022)). The use of real identities also allows for trust and relationship building, which leads to more effective screening, as lenders can combine hard and soft information (Schnabel and Shin (2004)). Moreover, real identities allow reputation to be developed – a key way of promoting economic and financial development through the centuries, as shown by the Hawala network (Schramm and Taube (2003)) and the community of Maghribi traders (Greif (1989)). In this sense, anonymity in DeFi lending is financial development in reverse, as it proscribes established ways of screening borrowers without sufficient collateral.

Possible ways forward for DeFi lending

The limitations of DeFi lending mask elements of genuine innovation. Smart contracts can complement automated underwriting in traditional finance and help to bring down the costs of financial intermediation (IMF (2022)). Composability – the ability of DeFi protocols to interact with one another – allows end users to combine various "money legos" to build customised financial products. This possibility can be particularly relevant in complex chains of transactions such as trade finance.

Harnessing the benefits of these innovative elements will require substantial changes.

[4] For example, in many emerging market and developing economies men are the legal owners of property like cars, houses or farms, which means that women cannot access collateralised loans (WEF (2019)). But also in advanced economies, poorer households are less likely to, for example, own their house, a major type of collateral (OECD (2022)).

[5] Besides the need for collateral, blockchain-based lending platforms can feature high costs, stemming from the need to reward validators (Boissay, Cornelli, Doerr and Frost (2022)), as well as practices such as miner extractable value (Auer et al (2022)).

First, DeFi lending must engage in large-scale tokenisation of real-world assets, unless it wants to remain a self-referential system fuelled by speculation. Representing assets such as buildings or capital equipment on the blockchain, so that it can serve as collateral underpinning loans, would be particularly beneficial for SMEs, which have more limited access to finance. Oracles, ie the mediators that communicate real-world information to blockchain-based DeFi applications, are essential to achieving this objective. But oracles must be reliable and trustworthy, lest they be used to corrupt the system by inducing smart contracts to take action based on manipulated information.[6]

Second, to serve the un- or underbanked, DeFi will need to abandon anonymity and use real names, and ultimately to fall within the regulatory umbrella. Some initial steps towards using real names are already being taken, with one major platform launching a lending pool in which participants are required to disclose their identities. Others seek to create credit scores that embed details available off-chain, potentially including non-traditional items such as social networks. This information is added to the blockchain through trusted oracles. A key challenge in this step will be to preserve users' privacy.

While all these initiatives are in their infancy, they highlight a growing trend in DeFi to rely on forms of centralisation in one way or another. This development suggests that the similarities between DeFi and legacy intermediaries are increasing, which has two important implications. The first is that elements of DeFi, mainly smart contracts and composability, could find their way into traditional finance. The second implication is that, once more, decentralisation proves to be an illusion (Aramonte et al (2021)).

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[6] A shortcoming of smart contracts is that they are tied to a given blockchain, operating in a closed system. They cannot directly access "off-chain" real-world information. Instead, they rely on third parties, known as oracles, to import off-chain data. The so-called "oracle problem" refers to the fact that whoever oversees an oracle can corrupt the on-chain system by misreporting data. Currently, there are no clear rules as to how oracle providers are incentivised or vetted.

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