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democratised finance

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introduction

Our financial system has long ceased to be an engine for social mobility or the enrichment of ordinary people. Banks and other traditional financial institutions rely on archaic infrastructure and governance processes that are captured by a wealthy elite. Structural inequalities pervade the financial system in developed economies and developing economies alike, leaving huge groups of people disenfranchised and without sufficient access to finance.

The nascent world of decentralised finance (**DeFi**) offers an alternative path. DeFi protocols, built on blockchain infrastructure like Ethereum, enable radically accessible and efficient financial services. Most importantly, these DeFi protocols upend traditional models of financial services by empowering the end user. This paradigm shift in finance, powered by technological advances in smart contracts, is well underway.

My view is that the most important impact of a DeFi paradigm shift may be as a democratising force for the financial system. In this report I set out exactly what this means in practice. The promise of DeFi is twofold:

1. Democratising how financial systems work by making them cheaper and more efficient, globally accessible, and resistant to discrimination.
2. Democratising the way financial systems are governed by empowering communities of stakeholders instead of an elite minority of shareholders.

My report will expand on these ideas in depth.[1] Throughout this report, I intend to analyse the substantive case for DeFi in terms of equity and financial inclusion. Before then, however, it may be helpful to provide some context about the state of DeFi and how these systems work.

[1] I am very grateful to the DeFi Education Fund for providing a grant to fund my research and the production of this report.

an overview of decentralised finance

Before we explore the case for DeFi as a force for democratising finance, it is worth taking some time to set the scene about what exactly we are talking about when it comes to DeFi.

You may have noticed that we have yet to mention Bitcoin in this report and are unlikely to do as we explore DeFi further. While many outside the cryptocurrency sphere equate crypto finance to Bitcoin (and unfortunately probably Dogecoin at this stage), this is a poor reflection of what DeFi actually is. DeFi is a network of financial protocols and products, largely built on the second-largest blockchain, Ethereum. The Bitcoin blockchain lacks the flexibility or expressiveness required to make these financial protocols work. As the Economist phrased it in its September 2021 issue, Bitcoin is "now a distraction", compared to Ethereum and its DeFi economy reaching "critical mass".[2]

What does this critical mass look like? Suppose you are new to the world of DeFi. In that case, it is perhaps easiest to think of DeFi as a virtual economy, built on blockchain infrastructure and offering an array of financial services with a decentralised twist. DeFi is often used as a catch-all term for the array of protocols built on Ethereum blockchain infrastructure. A Cambrian explosion of innovation in protocol design has seen hundreds of DeFi applications and protocols launch in the last few years, competing in different verticals to deliver the best financial services to blockchain users. Ethereum users can access secure lending and borrowing services for cryptocurrency, exchange digital assets with ease, and increasingly have access to more sophisticated services like options and structured products as well. Other smart contract platforms like Solana and Terra are developing similar ecosystems.

As this report will go on to detail, while this DeFi ecosystem appears at first to simply mirror the financial services generally available in developed economies,

[2] https://www.economist.com/leaders/2021/09/18/the-beguiling-promise-of-decentralised-finance.

there are some distinct advantages associated with building financial systems and protocols on a public blockchain like Ethereum. In addition, DeFi developers are increasingly producing completely new kinds of financial instruments that could not be built in the traditional financial system.

First, however, I will take some time to explain how DeFi protocols work, what DAOs are, and give a brief history of this technological boom.

how DeFi protocols work

DeFi protocols, as the name suggests, are designed to work without the central intermediaries like banks or lenders that rest at the heart of the legacy financial system. This means that DeFi protocols are characterised by peer-to-peer economic activity, usually involving virtual assets like cryptocurrency or stablecoins (a virtual asset usually pegged to a certain denomination, like the USD or Euro)[3]. While protocols can vary widely in terms of what they do and how exactly they work, what they have in common is the ability for a user to access financial services online through interacting with a smart contract.

A smart contract is essentially a set of encoded instructions programmed into a blockchain like Ethereum. You can think of a DeFi smart contract as a series of 'if, then' statements that executes some kind of financial transaction. For instance, take an example where you might want to sell a digital asset, like some cryptocurrency or an NFT. You set a price for your asset, and put it up for sale (for instance, an NFT on a digital marketplace like OpenSea). If someone wants to buy your asset, they can click through to agree to purchase for the price you have set. At this point, the smart contract automatically executes the trade through the Ethereum blockchain – your asset is transferred to the purchaser at the same time as their payment transfers to your wallet. You have taken part in a peer-to-peer transaction, but there was no need to know who the purchaser was or ascertain whether they could be trusted. In this way, smart contracts in DeFi

[3] Stablecoins come in all sorts of forms – some are backed by collateral (assets), whereas some rely on an algorithm to remain pegged to a denomination.

provide the trust and assurance that were previously the sole domain of financial intermediaries like banks.

DeFi protocols are, at their heart, a combination of different smart contracts to perform some kind of financial service. Examples of this include exchanges, lending, borrowing, and insurance. In each case, smart contracts provide an infrastructure for peer-to-peer economic activity that is tremendously efficient, with near-instantaneous execution and without counterparty risk. This is why the acting US Comptroller of Currency, Brian Brooks approvingly described DeFi protocols as 'self-driving banks'.[4] Much as self-driving cars need no human operator in order to drive, self-driving DeFi protocols are designed to work without any human involvement. Instead, they use smart contracts to do the heavy lifting, in the place of a centralised middleman.

A key feature of these smart contracts and protocols is their transparency. The code of each smart contract is accessible to anyone – which means anyone can check and verify what every smart contract does. While non-programmers might struggle to parse the code of a smart contract, there is a strong practice in DeFi of open-sourced code reviews and audits, meaning anyone can read an audit of a DeFi smart contract's terms in plain English.[5] Established DeFi protocols have battle-tested smart contracts that remain open to anyone to scrutinise. These contracts are also transparent in the sense that you can 'follow' your digital assets through the blockchain as they are deposited in a smart contract. You can use tools like Etherscan to see the progress of a token swap on Uniswap or verify that your funds are safely housed on a lending protocol like Aave.

Building financial protocols with smart contracts has wider implications than just their native transparency. For instance, smart contracts are inherently composable, which means that they can easily be built to integrate with each other. This allows new smart contracts to tap into existing financial protocols on Ethereum, and offer new kinds of sophisticated services to users. For instance, a new protocol looking to aggregate different lending protocols can write a smart

[4] https://www.ft.com/content/c1caca5b-01f7-41be-85a4-3ecb883f2417.
[5] As an example: https://blog.openzeppelin.com/barnbridge-smart-yield-bonds-audit/.

contract that 'reads' the smart contracts that underpin different lending protocols. While this capacity for composability creates new structural risks for DeFi as protocols increasingly build and rely on each other, it also opens the door to endless iteration and competition for the benefit of the end user – some examples of these cascading innovations are covered later in this report.

Finally, one last distinguishing feature of DeFi protocols is that they are generally decentralised not just in function but in terms of governance. In practice, this means that true DeFi protocols are governed not by a company, but by a decentralised autonomous organisation – a DAO. DAOs aim to ensure that DeFi protocols are governed and managed by a community of stakeholders and users, rather than a centralised body like a company.

ok, what actually is a DAO?

While the term 'decentralised autonomous organisation' unhelpfully conjures images of some kind of AI supermind pulling the strings of an organisation automatically, the reality is somewhat different. The easiest way to think about DAOs in the DeFi context is as a kind of digital cooperative, charged with managing a DeFi protocol.

The cooperative is made up of stakeholders of that protocol, usually a mix of active users and developers who have worked on or continue to contribute to the protocol. DeFi protocols are seldom governed by companies (that wouldn't be very decentralised) and so DAOs emerged as a blockchain-native way to coordinate community members around governing a DeFi protocol.

In practice, DAOs are an interesting combination of self-executing technological functions and collective governance by humans. The different parts of the DAO acronym offer a straightforward breakdown of what makes DAOs distinctive, particularly compared to traditional organisations like companies:

- **Decentralised**: a cooperative of stakeholders that make governance decisions about the protocol – there is no central leader or CEO

- **Autonomous**: some parts of the protocol operate autonomously due to self-executing smart contracts

- **Organisation**: the community of stakeholders makes collective decisions about functions not covered by the protocol's smart contracts

In all DAOs, smart contracts act as a sort of constitution setting the rules for how the protocol is governed. Once this constitution is live as a smart contract on Ethereum, nobody can change the rules except by a vote. If anyone tries to do something on the protocol that isn't specifically enabled by the rules in the smart contract, it will fail. This protects users, who can trust that a protocol will do what the smart contract says it will.

However, while certain parts of a DAO (ie, the operation of the protocol's smart contracts) are 'autonomous' as the name suggests, the broader governance of the protocol lies in the hands of DAO members. This can include a range of different functions depending on the protocol. Some examples of this include deciding whether to approve new classes of assets on lending protocols like Aave or Compound, or the compensation package for contributors to the DAO.

One of the most common examples of DAO responsibility is over a protocol's treasury. The DAO's smart contract will define the bounds of the treasury and ensure that nobody can spend the protocol's money without the DAO's approval. Treasury management is a great illustration of the decentralised structure of power in a DAO.[6] A common activity for a DAO is to make decisions about managing the treasury, similar to how many cooperatives manage shared funds. For instance, if a DAO wanted to spend part of the treasury on providing grants to contributors who propose to fix some bugs with the protocol's interface, they would organise a vote in line with the rules required by the DAO's smart contract. If the DAO achieve the required quorum and majority, the smart contract will automatically process the payment from the treasury to the contributors. In this way, the very structure of a DAO favours collective discussion and decision-

[6] See further: https://ethereum.org/en/dao/.

making between stakeholders. There is no central authority or CEO to make decisions or process payment of a protocol's funds. While this tends to make DAOs slower-moving compared to traditional hierarchical organisations, a cohesive DAO is a much more democratic and inclusive form of coordination. I will discuss more of these advantages and disadvantages later in the report.

Much like existing cooperatives, DAOs come in all shapes and sizes, and new forms of DAOs are constantly being created – DeFi is just one sector within the broader cryptocurrency and blockchain world that is embracing the potential of decentralised governance. A fascinating aspect of this iteration is that different protocols have developed their own internal political systems to resolve the direction of the protocol. A well-established DeFi protocol and DAO, Synthetix, has steered away from a standard DAO model where DAO members vote on all protocol decisions, with voting weight proportionate to how many governance tokens they hold. Instead, Synthetix has a 'Spartan Council' of seven community representatives, appointed after a competitive election between candidates for Synthetix leadership.[7] Candidates try to persuade members of the Synthetix DAO of their vision for the protocol, and skills to execute on that vision. The seven elected Spartan Council members then make critical decisions for the protocol for a three-month epoch, before another election commences.

However, while the intricacies of different DAOs within DeFi can sometimes seem overwhelming, they all essentially boil down to an organisation of community stakeholders working together to shepherd a DeFi protocol. All DAOs share common features, like performing functions within the ambit of the protocol's smart contracts, and ensuring governance decisions are executed when required. As the below history indicates, DAOs are a recent invention within the cryptocurrency space, but quickly emerged as the de facto way of governing DeFi protocols.

[7] https://blog.synthetix.io/the-spartan-council-election/.

a (very) brief history of DeFi

The invention of Bitcoin in 2009 by Satoshi Nakamoto enabled peer-to-peer transfers of digital money, the first stepping stone towards decentralised finance.[8] However, as previously mentioned, the Bitcoin blockchain was only designed to facilitate the transfer of Bitcoin, the cryptocurrency – it cannot support complicated logic or effective smart contracts.

Ethereum changed the game when Vitalik Buterin released it in 2015. Ethereum had a Turing-complete programming language called Solidity, which allowed for a theoretically endless array of possibilities in terms of what could be programmed onto the Ethereum blockchain. Ethereum quickly built significant mindshare among developers, eager to see what these 'smart contracts' could deliver. Buterin proved to be a prescient founder, highlighting the opportunity for specific decentralised finance applications even in Ethereum's 2013 white paper.[9]

The first major DeFi protocol developed on Ethereum is generally considered MakerDAO, a protocol that created a decentralised stablecoin called DAI (each DAI being pegged to the value of the USD) through users 'minting' DAI through locking up ETH. MakerDAO launched in 2017 and remains one of the most important projects in DeFi, due to the sheer number of protocols integrating DAI. MakerDAO met the need from early DeFi users to access a virtual currency that would remain stable, counterbalancing the infamous volatility of cryptocurrencies like Bitcoin and Ether. The protocol was 'permisionless' to boot – MakerDAO's developers have no control over who minted DAI or what they did with it. In this way, MakerDAO was one of the first building blocks of a decentralised DeFi economy.

After MakerDAO, further DeFi protocols sprung up to offer new financial applications to users on Ethereum. Compound Finance launched in 2018 and created the first open market for lenders to lend out their virtual assets for interest, and borrowers who would take out loans after putting up some of their

[8] https://bitcoin.org/en/bitcoin-paper.
[9] https://ethereum.org/en/whitepaper/.

own assets as collateral. This way, Compound enabled trustless lending and borrowing – lenders did not need to worry that borrowers would fail to pay back their loan, as in the event of nonpayment Compound's smart contracts would liquidate the borrower's collateral to pay the lender what they are due. Uniswap also launched in 2018, allowing users to 'trustlessly' swap any digital asset or token on Ethereum – again, without knowing anyone else's identity on the exchange. This emerging DeFi economy is captured well by this data visualisation in November 2018:

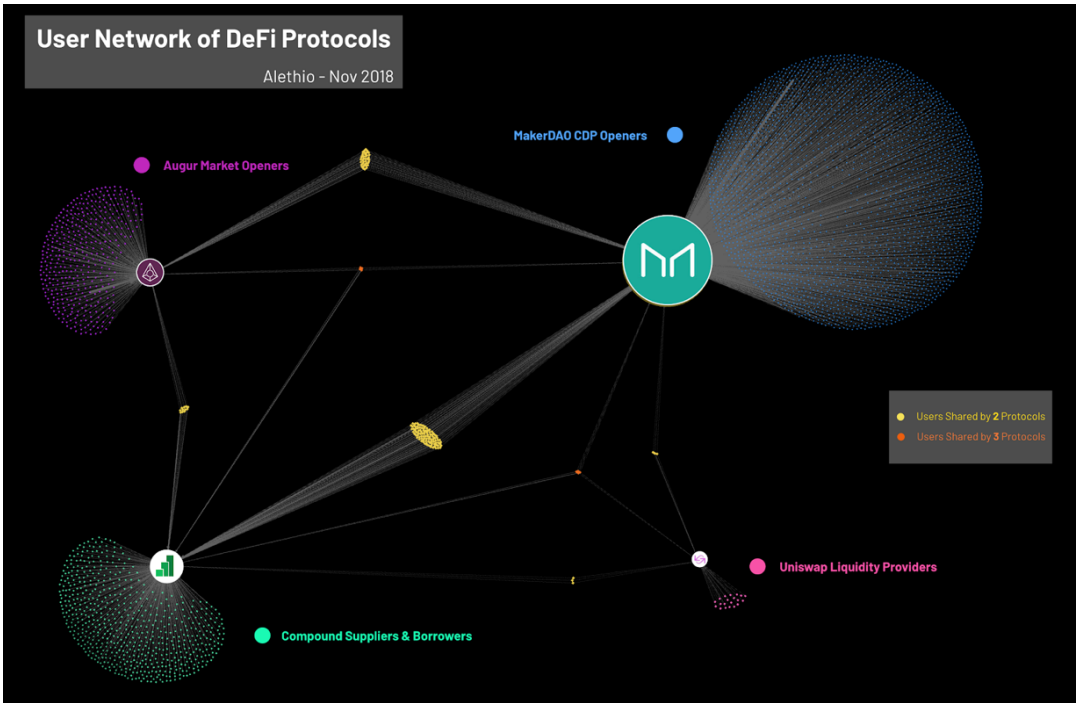

Figure 1: Alethio chart of DeFi users in November 2018

By comparison, a year later the DeFi ecosystem was beginning to pick up momentum. There was a range of DeFi applications, including ambitious projects like Synthetix that were experimenting with more sophisticated smart contracts and financial services around derivatives. In addition, these DeFi protocols were increasingly integrating with each other, as demonstrated by a comparative data visualisation in August 2019:

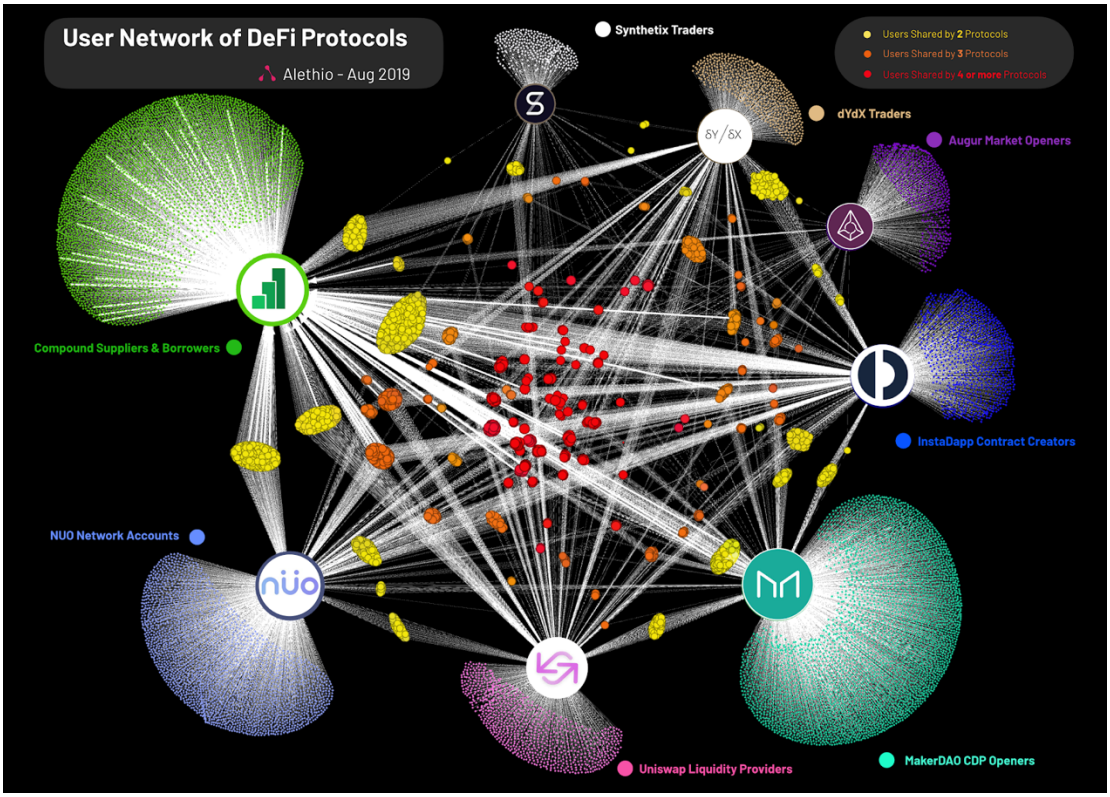

Figure 2: Alethio chart of DeFi users in August 2019

2020 was a breakthrough year for the growing DeFi landscape, particularly in terms of protocol governance. Compound set off a period known as 'DeFi Summer' in May 2020 when it released its own token, COMP, representing governance power over the Compound protocol. The team that initially developed Compound signaled that they were transferring power to manage the Compound protocol over to the community through dispersing the COMP token. DeFi users who were borrowing or lending on Compound began receiving rewards in COMP in a process termed 'liquidity mining'.

Other protocols quickly followed suit, with almost every major DeFi protocol releasing a governance token, distributing it through liquidity mining, and providing a roadmap to transfer governance of the protocol to the community of new tokenholders. Uniswap's token was especially notable – in a single release (or 'airdrop'), Uniswap distributed a share of its new token UNI to every single user who had previously interacted with its smart contracts. This amounted to an immediate transfer of 400 UNI (value at the time of writing: $9,400) to all of the

protocol's users; 220,000 different Ethereum accounts. In my view Uniswap's retroactive distribution was a breakthrough step for DeFi governance, setting a standard for broad distribution of governance power. As the below chart from Finematics indicates, 2020 saw Uniswap's activity explode as trading volumes boomed in April 2020 from $169m to $15bn in September 2020. The amount of total $USD value locked in DeFi, similarly increased by an order of magnitude.

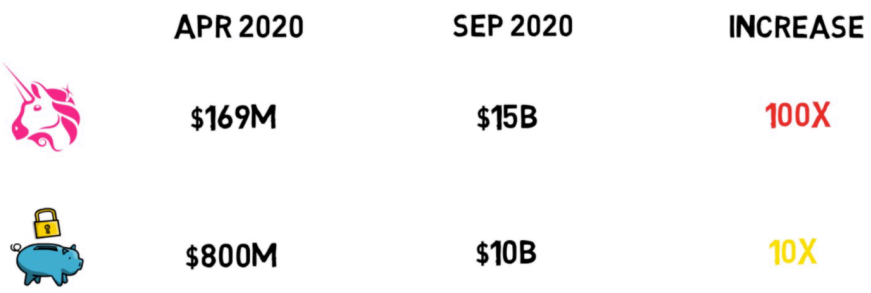

Figure 3: Graph by Finematics[10]

Since the heady days of 2020, DeFi has continued to grow at remarkable speed. While the limelight through 2021 has largely been monopolised by the explosive growth of NFTs (non-fungible tokens), DeFi has continued to escalate on all metrics, notwithstanding high transaction costs due to bottlenecks. At the time of writing, a technological solution called 'optimistic roll-ups' are set to come online and reduce transaction costs by an order of magnitude.[11] This should curtail high transaction costs for DeFi users and continue the ecosystem's expansion to a much larger cohort of users. 2021 may come to be seen as the tipping point for DeFi, as its user-centric financial protocols, and decentralised governance structures provide a blueprint for what a 'democratised' financial system might look like.

[10] https://finematics.com/.
[11] https://developer.offchainlabs.com/docs/rollup_basics.

democratising financial systems

As we have seen, it is easiest to think about DeFi as a virtual economy, with an array of different financial services that each operate without need for centralised intermediaries like banks and payday lenders. While it is still early days for this ecosystem, there is enough evidence to get a sense of how DeFi can revolutionise the financial system as we know it.

While a DeFi-powered economy still has rough edges to iron out, the opportunities offered by on-chain financial applications abound. DeFi protocols upend the lacklustre standards of care evident in the traditional financial system, passing on benefits of efficiency and cost to users. These new platforms remove the explicit gendered and ethnic discrimination that plagues the financial world, and open the door to further technological innovations that will drive social mobility and financial inclusion. These changes are sorely needed.

our existing financial system is failing everyday people

The starting point for any discussion about financial inclusion and the prospects of a new financial paradigm has to acknowledge deep, systemic failure in the financial system to date. President Biden's campaign in 2020 cited the "structural weaknesses and inequalities" built into the American economy and financial system.[12] Senator Warren's statements have been even more trenchant about the consistent failures of the financial system:

"The truth is that Washington has it backwards. For a long time now, Wall Street's success hasn't helped the broader economy — it's come at the expense of the rest of the economy. Wall Street is looting the economy and Washington is helping them do it." [13]

[12] https://joebiden.com/build-back-better/.
[13] https://www.politico.com/story/2019/07/18/elizabeth-warren-wall-street-2020-1421826.

Democrats are on the money (so to speak). The traditional financial system has systematically failed to drive the social mobility and financial inclusion that most citizens in developed economies could reasonably expect. Not only have the largest banks and other financial institutions escaped culpability for their role for causing the 2007-2008 global financial crisis (**GFC**), but they have set record profits in the years since. Notwithstanding the recession brought on by COVID-19 last year, JP Morgan managed to post a revenue record halfway through 2020.[14]

Meanwhile, 22% of American adults are either unbanked or underbanked, according to a study by the Federal Reserve.[15] The details of those statistics are saddening and damning in equal measure. Two-fifths of unbanked adults were forced to use some form of alternative financial service, such as a pawnshop loan, payday loan or paycheck advance in order to make ends meet.[16] 'Underbanked' adults had a bank account but similarly needed to use one of these alternative financial services at points.

It should go without saying that these alternative financial services are pernicious and predatory, preying on vulnerable people in their time of need. The unbanked and underbanked have lower incomes, less education, and disproportionately belong to a racial or ethnic minority group. 14% of blacks and 11% of Hispanics are unbanked, versus 4% of white Americans.[17] These problems are a sore blight on the richest country in the history of the world – and they are going nowhere fast. Newer, seemingly more inclusive financial providers like Robinhood have turned out just as inequitable as the large banks before them. Robinhood prioritises profits through dubious business practices and sells its users' data to financial institutions at the expense of retail investors.

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[14] https://www.cnbc.com/2020/07/14/despite-recession-jpmorgan-chase-just-posted-record-revenue-heres-how-they-did-it.html.
[15] https://www.federalreserve.gov/publications/2019-economic-well-being-of-us-households-in-2018-banking-and-credit.htm.
[16] https://www.federalreserve.gov/publications/2019-economic-well-being-of-us-households-in-2018-banking-and-credit.htm.
[17] https://www.federalreserve.gov/publications/2019-economic-well-being-of-us-households-in-2018-banking-and-credit.htm.

Though Democrats and other progressive politicians might not think so at present, they are on the same side as DeFi stakeholders in wanting to see the end of the concentrated power in legacy finance, with its irreparable incentive structures and track record of failing those in greatest need. Of course, developed economies are still much better off in terms of banking and financial services compared to other economies around the world. 1.7 billion of the world's adults are unbanked, including over half of the adults in countries as populous as Indonesia, Nigeria and Bangladesh.[18] Without access to finance and its associated prospects for social mobility, these families are left bereft of safe options.

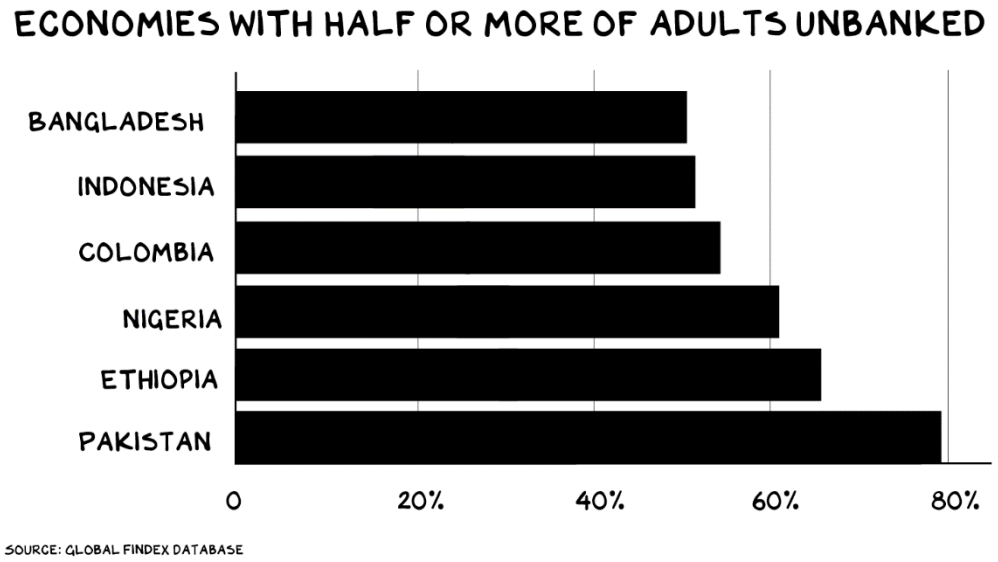

Figure 4: 1.7 billion of the world's adults are unbanked[19]

Taken together, this is a grim but necessary picture of the global financial system and the extent to which it facilitates the social mobility and basic financial inclusion of vulnerable people. DeFi and cryptocurrencies are no panacea for these complicated issues, but at the very least, the sobering reality of contemporary financial failure should make us open-minded towards new technological developments that might be able to address these problems.

[18] https://www.profgalloway.com/bank/.
[19] https://www.profgalloway.com/bank/.

how DeFi reorients finance from the banker to the user

We have established that the existing financial system is not setting the bar particularly high when it comes to providing for the financial needs of users. While the development of the DeFi ecosystem remains at an early stage, there is growing evidence that DeFi protocols can change the processes of financial services for the benefit of end users.

While it should not be mistaken for a silver bullet solution to the myriad tragedies of the existing financial system, the totality of DeFi innovation amounts to a new financial paradigm. Part of the promise of DeFi is in scaling the reach of financial systems across the globe, and simultaneously curtailing discrimination through ensuring that those systems are 'permissionless'. However, at a base level, there is plenty of low hanging fruit that come with operating a financial system on blockchain infrastructure:

- **Abstracting away intermediaries reduces costs for users**.[20] Think of a bank's overheads: thousands of shop fronts, hundreds of thousands of staff and expensive IT systems. Smart contracts, on the other hand, have no overhead. Interactions on a lending protocol like Compound and Aave execute instantly and settle on the blockchain. While protocols do charge nominal fees, these can be (and are) much lower than fees charged in the traditional finance system, as the protocol incurs virtually no costs.

- **Smart contracts are efficient and decrease counterparty risk.** Transactions in DeFi execute 'atomically', meaning that either both transfers occur, or neither of them do. If you are transacting to sell me a digital asset through a smart contract, the transaction will only execute if the terms can be met (ie, the smart contract guarantees that the digital

[20] While it is true that gas fees are incurred by DeFi users when using DeFi processes, these are a) not charged or accrued by the protocols themselves and b) are likely to be minimised in the near future in any case due to technological breakthroughs in roll-up technology: see https://ethereum-magicians.org/t/a-rollup-centric-ethereum-roadmap/4698.

asset will be transferred to me, and that the requisite payment will be transferred to you, or neither will occur). As the St Louis Fed notes, this can result in efficiency gains "for almost every area of financial infrastructure."[21]

- **DeFi infrastructure is internet-native and executes near-instantaneously**. Smart contracts benefit from Ethereum as internet-native digital infrastructure. DeFi transactions can execute instantaneously and settle in a radically shorter time period than a transaction in the legacy financial system, which continues to rely on slow, outdated IT infrastructure developed 60 years ago.[22]

- **Transitional barriers between DeFi protocols are minimal, driving competition and innovation.** It costs almost nothing and takes little time in a DeFi economy to shift your money from one protocol to another, particularly compared to the painful process of changing banks or providers in the traditional financial system. This means that DeFi protocols must compete on the merit of their services, rather than rely on market capture through high transition costs. Consequently, DeFi protocols are continually competing to offer better rates and increased capital efficiency for users.

- **DeFi protocols are immutable**. Any transactions through a DeFi protocol on a public blockchain like Ethereum are tamper-proof and censorship resistant. There is no central actor who can reverse transactions or shut a user out from using a service. Decentralised architecture improves the system's security and helps protect users.

[21] https://research.stlouisfed.org/publications/review/2021/02/05/decentralized-finance-on-blockchain-and-smart-contract-based-financial-markets.
[22] https://www.reuters.com/article/us-usa-banks-cobol-idUSKBN17C0D8.

permissionless finance, and fighting discrimination in the financial system

The sheer number of unbanked and underbanked in our existing financial system only form part of the problem. There are shameful inequities in terms of which groups are disproportionately left out of access to financial systems, and rampant discrimination. A report by the World Economic Forum found that only 37% of women in South Asia had a bank account, compared to 55% of men.[23] A study of women seeking loans in India found that almost every aspiring borrower encountered difficulties when accessing finance from institutions.[24] Women entrepreneurs who applied for loans to launch new enterprises are turned down at twice (19% to 8%) the rate of men.[25] The evidence of widespread discrimination is impossible to dismiss, and is certainly not limited to sexism. Another study in India found that loan applicants from lower castes found it disproportionately hard to access finance.[26] While the causes of socio-financial dislocation are complex, the ugly byproducts of human biases are not hard to spot.

In contrast, DeFi lending and borrowing protocols like Aave and Compound do not require either a borrower or the lender to identify anything about themselves. They are 'permisionless' – there is no centralised staff member at Aave or Compound deciding which borrowers are trustworthy and which are not. These permissionless lending protocols have their own flaws, namely that they rely on over-collaterisation – in order to borrow from a DeFi protocol, you typically need to put up collateral that will then be 'liquidated' if you do not meet the terms of your loan. The challenge of how to offer uncollateralised loans is an ongoing design challenge that different protocols are working towards solving. However, while this core disadvantage will hold DeFi lenders back from assisting borrowers

[23] https://www.weforum.org/agenda/2015/09/why-are-women-in-developing-economies-excluded-from-banking/.
[24] https://scroll.in/article/988166/why-women-run-fewer-than-13-of-indias-small-businesses.
[25] https://scroll.in/article/988166/why-women-run-fewer-than-13-of-indias-small-businesses.
[26] https://journals.sagepub.com/doi/abs/10.1177/0007650320982609.

who cannot put up collateral for now, it should not take away from the fact that these protocols are still operating in a permissionless way.

This lack of capacity for human discrimination and biases reflects a significant advantage for decentralised financial systems, compared to the shady lenders and commercial banks across developed and developing economies alike. The issue of discrimination in the financial system is by no means limited to developing states. According to data from the US Federal Reserve, more than half of American companies that have black owners are turned down for loans, a rate twice as high as white business owners.[27] The Fed report found that while black-owned firms were the most likely to have applied for bank financing, less than 47% of these applications were fully funded.[28] Even when black business owners are approved, their rate of failure to receive full financing is the highest among all categories by more than 10%. These statistics are sobering and reflect poorly on our status quo.

It is perhaps no surprise that a recent survey showed that 30% of black and 27% of Hispanic investors in the United States own cryptocurrency, compared to 17% of white investors – with most black and Hispanic investors prizing decentralisation as a feature of crypto.[29] The prospect of permissionless financial protocols, where a smart contract has no conception or care for the applicant's colour, is tantalising as a weapon against the discrimination suffered by minorities in developed and developing economies alike.

Another important point is in terms of how DeFi protocols are global, not limited by geographic vicinity. One of the more radical things about DeFi is how they allow anyone in the world with an internet connection to access financial services on the blockchain. For female entrepreneurs struggling to access finance from

[27] https://www.federalreserve.gov/publications/2017-september-availability-of-credit-to-small-businesses.htm.
[28] https://www.federalreserve.gov/publications/2017-september-availability-of-credit-to-small-businesses.htm.
[29] https://www.forbes.com/sites/korihale/2021/08/10/why-black-investors-seemingly-prefer-cryptocurrencies-over-traditional-stocks/?sh=395170326839.

discriminatory decision-makers in legacy institutions, permissionless financial protocols may well be a breakthrough.

avoiding the next GFC through structural transparency

As Mike Novogratz theorised earlier in 2021, "we wouldn't have had a mortgage crisis in 2007 if we could have just looked on chain and seen Bear Stearns's mortgage exposure".[30] While an over-simplification, this gets at one of the more underrated benefits of an economy built on an infrastructure of digital smart contracts: transparency as a built-in feature. All transactions, functions and smart contracts on a public blockchain like Ethereum are accessible to anyone who wants to look. Smart contracts can be analysed on-chain and their code can be inspected line-by-line.

We can contrast the structural transparency of DeFi protocols and blockchain systems generally with the opaque nature of traditional financial systems. The causes of the GFC are well-documented, and there have been strenuous efforts since 2008 to increase scrutiny of key institutions in the financial system and ensure more transparency of how systems are operating. However, despite incremental changes to law and policy, the traditional financial system has barreled on in much the same way.

While cryptocurrency is typically associated with inscrutable systems and (as Senator Warren put it) 'shadowy faceless groups of super coders', the reality is that DeFi protocols are much more transparent than any kind of traditional financial system. Warren and others might be concerned that DeFi developers can be anonymous. Still, it does not matter how shadowy or faceless they are – there is no way of sneaking anything onto a blockchain. Every aspect of a DeFi protocol can be, and is, pored over by analysts. If the choice is between a transparent financial system and unknown contributors to that system, and well-known bank CEOs in charge of completely opaque and labyrinthian banking systems, there is

[30] https://fortune.com/longform/decentralized-finance-crypto-wall-street/.

no comparison. As the St Louis Fed pointed out in its comprehensive research report, the availability of on-chain historical and current data is "a vast improvement over traditional financial systems, where much of the information is scattered across a large number of proprietary databases or not available at all".[31]

Particularly from the perspective of avoiding a future financial crisis, there is significant value in being able to scrutinise DeFi protocols at any point, and react in real time to any problems as and when they emerge – no matter if DeFi developers are anonymous. As the financial system fell to pieces during the GFC, nobody thought it was a silver lining to know who Lehman Brothers' CEO was.

cascading innovations in DeFi, and who benefits

The DeFi economy lends itself towards cascading innovations that learn, build, and integrate with each other – a happy byproduct of the protocols being composable and permissionless, meaning both that anyone can use them and anyone can build on them. As analysed previously, due to low transition costs and the ease of smart contract development, DeFi developers are relentlessly competing on merit to provide the best financial protocol possible. This results in an array of technological advances, including new kinds of financial services and instruments that could not be created in the traditional financial system. Most of these advances lead to direct benefits for end users or expand DeFi's reach to the unbanked and underfinanced. In this section I provide an example of each of these – both taken from recent months, August and September 2021.

The first is the work of MakerDAO in the area of 'Real World Finance', bridging the gap between on-chain economies on the blockchain, like Ethereum, and real-world economic activity. MakerDAO is one of the oldest protocols in DeFi, as covered earlier in my brief DeFi history. It is a sophisticated protocol which 'mints' DAI, a stablecoin representing $1 USD of value, in return for users locking up cryptocurrency like ether in MakerDAO's smart contracts. However, MakerDAO

[31]https://research.stlouisfed.org/publications/review/2021/02/05/decentralized-finance-on-blockchain-and-smart-contract-based-financial-markets.

has been successfully experimenting with providing finance to actors outside the crypto sphere as well. In one recent example, MakerDAO (through a successful vote from tokenholders[32]) elected to finance a $21m solar farm development in New York City.[33] This is a compelling example of a DeFi protocol driving real-world economic activity, and a riposte to critics who allege that crypto is destined to remain an insular pocket for speculators. Providing capital to 'green' energy projects may well become an area of high growth for DeFi, with climate-friendly development projects in need of finance which is not always forthcoming from existing institutions.[34] Certainly, Maker has provided a clear vision for how DeFi can bring this about – founder Rune Christensen's case for 'Clean Money' makes for compelling reading.[35]

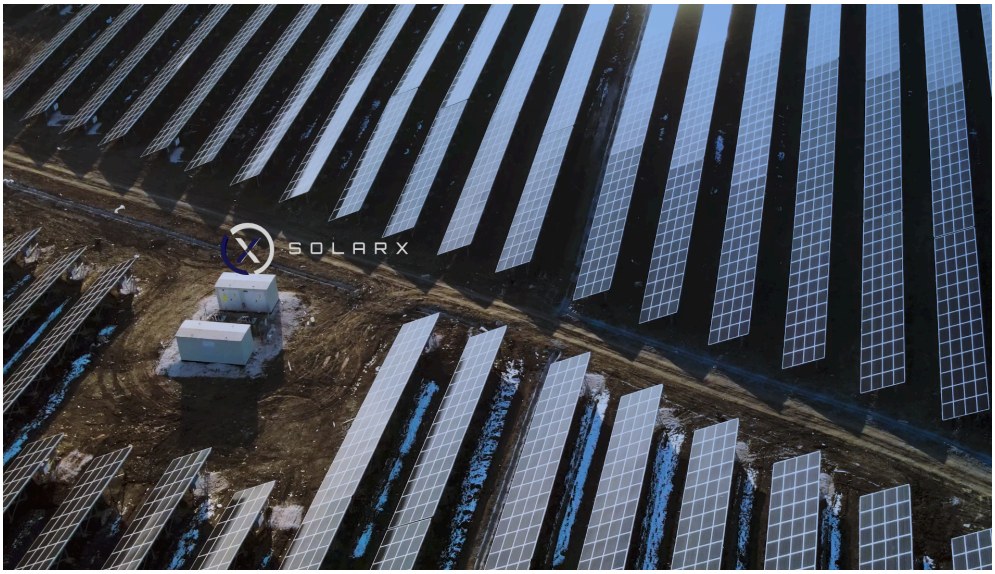

Figure 5: Solar X is developing a $21m solar farm funded by MakerDAO

Breakthrough innovations in smart contract and protocol design are not the sole domain of well-funded larger teams. Take the permissionless 'yield aggregator' called Nirn, invented by the team at Indexed Finance.[36] This is a terrific example

[32] https://vote.makerdao.com/polling/QmNfzNPY?network=mainnet#vote-breakdown.
[33] https://forum.makerdao.com/t/solarx-mip6-application-uprets-solarx-industrial-real-estate-backed-loans/6718.
[34] https://www.reuters.com/business/sustainable-business/hard-central-banks-extend-qe-fund-green-policies-ex-policymaker-says-2021-09-01/.
[35] https://forum.makerdao.com/t/the-case-for-clean-money/10684
[36] https://github.com/indexed-finance/nirn-whitepaper/blob/main/Nirn_Whitepaper.pdf.

of a smart contract that takes full advantage of the composable, modular nature of existing DeFi services like the lending platforms Compound and Aave. Nirn solves the problem for DeFi users looking for the best interest rate possible when depositing their funds with a DeFi lending contract, given that the interest rates tend to fluctuate day-to-day. The Nirn aggregator can 'read' the smart contracts within Compound and Aave and shift your money between the lending protocols to ensure you receive the highest amount of interest available. It is a permissionless platform: anyone can propose a new weighting of funds within the Nirn protocol, but Nirn will only execute a new weighting after verifying that the proposal would provide a better interest rate. While yield aggregators have existed in DeFi for a while, Nirn offers a step forward, being truly permissionless and decentralised. There is no need to trust a permissioned agent or team to move your money around for you.

While Nirn is new, think about some of the implications in your own life if a protocol like Nirn was available. Imagine not needing to be tied to any particular bank, if a protocol was safely balancing your money between financial institutions to guarantee the highest return at any particular moment. What if your credit card debt was constantly being shopped around by an indefatigable broker, saving you money by shifting the debt around to ensure the lowest interest rates at any given moment? The innovations in DeFi offer a paradigm shift towards financial innovations benefitting the everyday person. It will be much harder for banks to participate in their usual rent-seeking when they, eventually, compete with decentralised protocols that look to optimise for end outcomes for users. Nirn is just one of hundreds of new financial protocols coming online in DeFi with the capacity to disrupt the architecture of the traditional financial system.

As the Federal Reserve of St Louis notes in its report, and as the example of Nirn illustrates, it would be wrong to underestimate the genuine innovation in financial instruments taking place in DeFi.[37] While it might seem like DeFi protocols have focused on replicating financial services common in the legacy financial system,

[37] https://research.stlouisfed.org/publications/review/2021/02/05/decentralized-finance-on-blockchain-and-smart-contract-based-financial-markets

there has been a flurry of new kinds of instruments that are only possible due to smart contracts. The St Louis Fed names atomic swaps, autonomous liquidity pools, decentralised stablecoins and flash loans as "just a few of many examples that show the great potential of this ecosystem". As we have seen, the benefits of these innovations in DeFi are disproportionately accruing to the end user – a healthy product of the competition between innovative developers in DeFi.

democratising financial governance

We have looked at a range of ways in which DeFi protocols are democratising finance, through a new paradigm shift towards new financial services which benefit users and expand access. However, there is a separate collection of reasons to be optimistic about how DeFi protocols are forces for democratising finance. These relate to how DeFi protocols are governed, and how power over these nascent protocols is shared and managed.

In the following sections, I will lay out the idea that governing important financial institutions via DAOs is a radical shift towards empowering users and communities. In contrast to the warped incentives and profiteering that plagues legacy financial institutions, the development of decentralised governance offers a new way of thinking about managing financial protocols, and human coordination more generally.

the deep malaise of governance in legacy finance

A mountain of studies agree that weak and ineffective corporate governance in banks was one of the leading causes of the GFC.[38] There are deep, structural problems with how financial institutions are managed and run, which will prove very difficult to shake. Banks face a fundamental contradiction in corporate governance: large shareholders have an incentive to transfer wealth to themselves through fixed claimants like everyday users and the government. The incentives of a financial institution's leadership do not align with their customers, and opaque legacy banking operations make it difficult to hold legacy financial institutions to account for their decisions.

These problems are not lost on the general public. Trust in banks has cratered in the last decade, and public opinion has long since turned against Wall Street and bankers generally. Years of government policymaking in the interests of

[38]https://www.researchgate.net/publication/269652456_Corporate_Governance_in_Banks_Problems_and_Remedies.

commercial bankers has helped contributed to a lack of trust in society's most important financial institutions. As SEC Commissioner Hester Peirce notes, popular antipathy toward Wall Street is "aggravated by ongoing government policies that are viewed as disproportionately benefiting large asset holders now in exchange for an inflationary tab in the future that will hit working Americans hardest."[39]

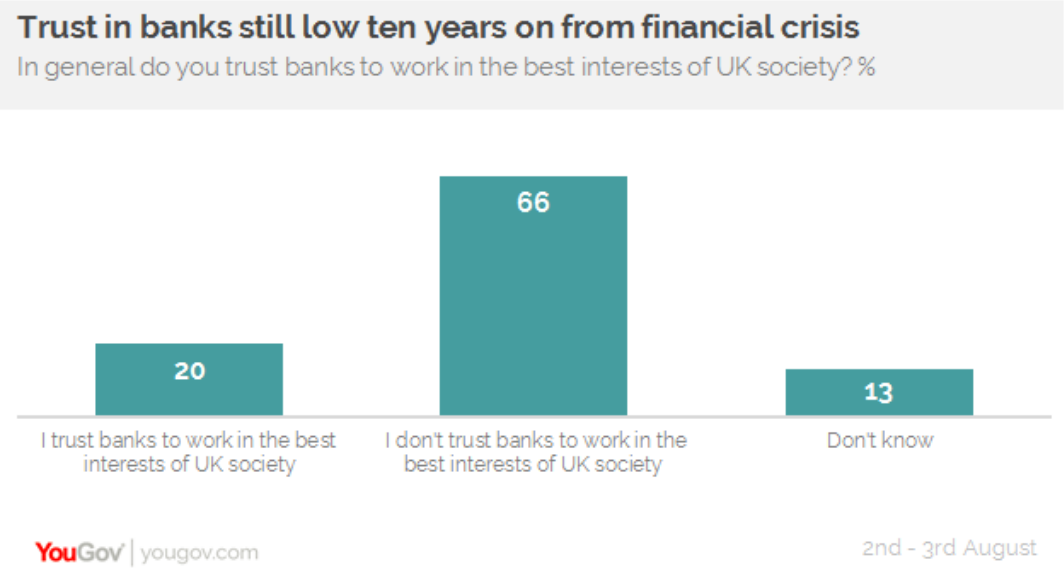

Figure 6: 2018 YouGov poll

Newer players in the financial system, including more technologically nimble fintechs, are unlikely to contribute to any substantive change in terms of the incentives that underpin legacy finance. Even when these savvier companies appear to provide innovations that favour the user, these services are inevitably compromised. Take Robinhood, the well-known stock trading app. Robinhood's core value proposition for users is that you can trade "for free".[40] By not having to pay a fee or commission per trade, Robinhood users ostensibly benefit from a protocol that is more affordable and more accessible. Unfortunately, Robinhood is monetising the user in more insidious ways. Robinhood makes money through providing order flow information – information about the trades and purchases

[39] https://www.sec.gov/news/speech/peirce-atomic-trading-2021-02-22.
[40] https://robinhood.com/us/en/.

that users are making – to large market makers, who can take advantage of the information asymmetries that follow.[41]

The issue is not only that Robinhood users pay artificially higher prices, but that Robinhood's operations fundamentally lack transparency. At no point do users meaningfully consent to their data being used against them, and the leaders at Robinhood have no incentive to be open about how its processes work in practice. Of course, Robinhood's opaque internal processes were the subject of significant controversy in early 2021, where the GameStop debacle saw user frustration come to a head. Despite marketing itself as a more democratic and inclusive financial platform – "investing is for everyone!" – users were blindsided and powerless to stop the platform from unilaterally ceasing trading of popular 'meme' stocks. Most users thought Robinhood was conspiring with the hedge funds being outmaneuvered by retail investors, and tens of thousands attempted to join a class-action lawsuit accusing the company of market manipulation.[42]

Robinhood is only the latest example in a long history of financial institutions that rarely act in the best interests of their users. Simply put, traditional corporate governance structures do not do a good job of aligning incentives between decision-makers, shareholders and everyday users. The latter group is the party that inevitably bears the cost of these misaligned incentives. This fact is not lost on the general public – trust in financial institutions is at an all time low, and legacy finance makes no attempt to include more people or a wider group of stakeholders in governance structures. Financial services themselves are leaving everyday people on the outer, and this should be understood as a product of governance structures that themselves cater only to a shareholder elite.

[41] https://www.cnbc.com/2020/08/13/how-robinhood-makes-money-on-customer-trades-despite-making-it-free.html.
[42] https://www.nytimes.com/2021/08/07/business/dealbook/robinhood-legal-issues.html.

some key differences between DAOs and companies

DAOs represent a new model for thinking about how financial platforms should be managed, and offer some appealing points of difference compared to the traditional models and their failings as described above. In the early sections of this report I looked at how DAOs worked and articulated some of their common features: collective decision-making, transparent on-chain governance processes and an overarching smart contract that automates core functions. In this section, I look at how this model represents a significant change from traditional legacy structures, and a company structure in particular. While a DAO model carries its fair share of advantages and disadvantages, there are some fundamental reasons why decentralised governance is well suited for financial protocols.

In an excellent journal article reviewing the differences between DAOs and company structures, Wright notes that the fundamental structures of DAOs bears little comparison to existing structures.[43] He argues that members within a DAO tend to stand on "equal footing", where everyone has the same ability to access operating information about the DAO and its underlying platform. Governance is much less hierarchical, especially compared to a traditional company under the leadership of a CEO and board of directors. Lacking these positions, DAOs rely on group consensus between DAO members.

This is particularly important in the context of governing a financial system. DAOs are very unlikely to pass decisions in the narrow interests of an elite minority. Because DAO decision-making tends to aggregate the views of a wide community of users, there is less scope for wealthy stakeholders to capture the governance processes.[44] On the other hand, in traditional corporate structures, executives are beholden to the whims of shareholders – usually a small group of wealthy elites and institutions. Where the interests of shareholders turn against the interests of a financial company's users, executives are compelled to act in favour of the

[43] https://stanford-jblp.pubpub.org/pub/rise-of-daos/release/1.
[44] There is still the potential for governance capture to occur in DAOs, particularly when large tokenholders can monopolise governance processes. However, this occurs less often in DAOs compared to companies (where this is ubiquitous), and the transparency of DAOs makes it clear whether a small number of holders are dictating the results of votes.

minority group, even at the expense of a much larger group of people that actually use or rely on that service. On the other hand, DAOs have no special incentive to act in favour of a privileged group. DAO members and protocol users are often the same group of people, partially due to the way DAOs distribute governance.

Smart contracts play an important role in aggregating members' preferences and allow for a DAO to execute changes that reflect a group consensus. As set out in this report's early sections, smart contracts set out the ruleset or constitution as to how DAO members operate. While companies in the traditional finance system also have constitutions and policies, smart contracts play significant role in facilitating the actual day-to-day management of a DAO. In DeFi, a DAO's smart contracts will often automate practices that would generally be delegated to senior executives in the traditional financial system (like transacting capital). This reduces the risk of graft or fraud, and again eliminates barriers between the preferences of a protocol's community and the actions that actually take place.

Another crucial difference between DAOs and companies in providing financial services is the transparency of process. The functions and decisions of a DAO can be tracked transparently on Ethereum's public blockchain, much like the financial transactions themselves. In addition, the more informal discourse and consensus-building within DAOs also play out on publicly accessible platforms like Discord or online forums. In this way, DAOs cannot pass decisions in secret – both the discussions leading up to a decision, and the decision itself, are publicly accessible and open to scrutiny. This radically opens up the way that governance is carried out by financial protocols, giving ordinary users much more information about the direction of a protocol, how it works, and how to get involved in governing a protocol if they so choose.

There is strong evidence that this radical transparency of governance leads to greater community input and decision-making processes that empower ordinary users, even when 'whales' control more governance tokens than other DAO members. A good example of this was the recent 'Sushi Phantom Troupe'

episode, centring on the popular exchange protocol SushiSwap and its DAO.[45] A range of 'strategic investors' – well-funded venture capitalists – approached SushiSwap for a proposed strategic raise, where $60m USD worth of Sushi's treasury of SUSHI governance tokens would be sold at a 25% discount to their market price. This kind of strategic raise is common for early-stage technology companies, as is a discount for strategic investors, and Sushi's lead developers were in favour of the deal. This deal would be a fait accompli if SushiSwap was managed by a traditional organisation like a company. However, Sushi's community balked at the terms being offered, with the Phantom Troupe forum post garnering 363 posts of largely critical comments from DAO members. Astonishingly, the VCs themselves had to come onto the forum themselves and each try to justify to the community why their involvement was worth the proposed discount. This illustrates the power of open, transparent governance processes – decisions that would normally be hashed out behind closed doors between executives and wealthy investors instead play out in public over the internet. These open processes have advantages as well as disadvantages, but it is hard to deny that they give much more power and information to ordinary users.

To summarise, DAOs and companies operate in significantly different ways, befitting their different organisational frameworks. DAOs have smart contracts that automate part of the practice of governance, and delineate the roles and functions of the DAO's stakeholders. DAO members vote on changes to the protocol or other decisions that need to be made, in contrast to decision-making by central authority seen in traditional organisations. Formal DAO governance processes are open to scrutiny as they are transparently verifiable on a blockchain, and informal group consensus-building is also widely accessible to anyone interested in governing the DAO. These differences offer significant advantages in terms of including more stakeholders in decisions about financial protocols. DAOs are a fundamentally inclusive way of structuring an organisation,

[45] https://forum.sushi.com/t/withdrawn-sushi-phantom-troupe-strategic-raise/4554.

which tends to empower stakeholders who successfully build consensus among a varied community.

financial inclusion via distributing governance widely

As I have set out above, DAOs represent a step towards democratising power in financial systems through the way they operate, with collective decision-making and structural transparency. However, DAOs in the DeFi space also democratise power through their distribution of governance. Unlike traditional structures, DAOs have been incredible vehicles for distributing power to a protocol's users. The 'norm' in DeFi is to distribute governance to as many users as possible, to sustain a stronger community that can govern a DAO into the future. The happy byproduct of this is many more avenues for everyday users of financial systems to have actual governance power within those systems.

We have already covered one of the most large-scale examples of this distribution of governance within DeFi, Uniswap's distribution of its governance token between hundreds of thousands of users who had previously interacted with the protocol. Uniswap's example inspired waves of further innovations in distributing governance. While different protocols take very different approaches to governance, newer protocols increasingly start 'DAO-first' (with an initial token distribution and then governance by the nascent DAO – rather than governance by a company or foundation).

Barnbridge, a DeFi protocol focusing on fixed interest and risk management, is a terrific example of this. Below is a graph depicting how Barnbridge's token, BOND, has already been distributed among individual stakeholders.

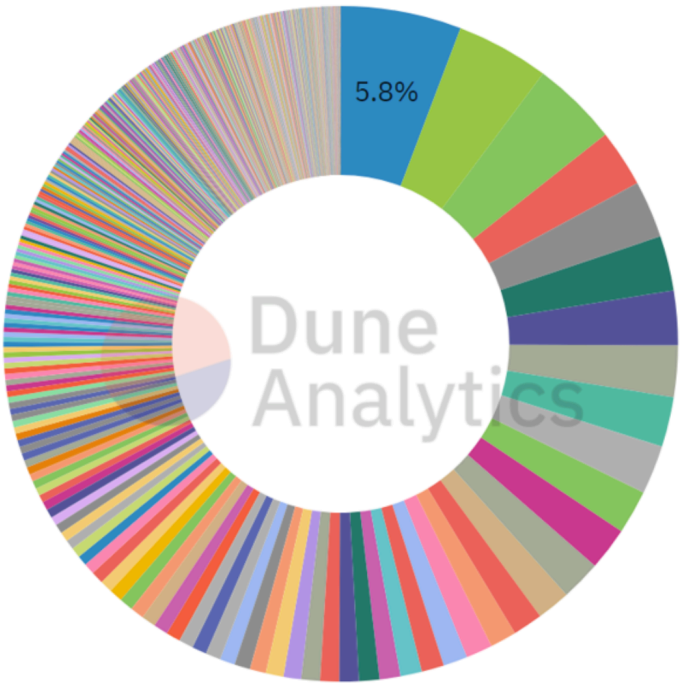

Figure 7: Chart of staked tokenholders in Barnbridge as at September, 2021

Compare this barely one-year-old DeFi protocol to longstanding commercial banks and large public companies. 80% of Wells Fargo is owned by a select elite of institutions and insiders – retail investors own only 20%.[46] The story is the same no matter where you look in legacy finance. Ordinary stakeholders and users have a dwindling stake in the institutions that rule their financial lives. DeFi protocols offer a different, more inclusive paradigm. This broad distribution from DeFi protocols is likely to be a sustained trend, as DAOs actively seek out means of widening their bases of community members. More members in a DAO means more contributors to protocol development and governance processes, and helps ensure the DAO's activities can be sustained into the future.

There are several advantages for everyday users of financial protocols in distributing governance in this way. The first and most obvious is that users can benefit from having a financial stake in the protocols they use. Users benefit from

[46] https://www.capitaliq.com/.

the growth and success of the protocols that they are using, and have an incentive to continue contributing to that protocol (like taking part in votes in the protocol's DAO). DeFi users are also much less likely to be subject to DAO decisions that undermine users. This is both because users dominate governance in DAOs to begin with, and because DAO smart contracts provide no scope for malign governance actions that harm users (for instance, there is no capacity for a DAO to seize funds stored on a platform even if DAO members vote to do so).

While DAO governance is still far from an idyllic democracy – some DeFi 'whales' control a disproportionate share governance power in some platforms – the norms and practices around distributing governance to users are transformative. As the DeFi community continues to workshop the best ways to govern a protocol democratically,[47] the chasm between DeFi and governance inclusion in the legacy financial system continues to widen.

a prototype for positive-sum human coordination

At the risk of having my report denounced for waffly idealism, it is still worth concluding this section by looking at the importance of experiments in decentralised governance for society more broadly. While it is fantastic to build DAOs that can manage financial services as collectives and distribute governance responsibility widely, there are many more coordination issues in the world than just those relating to finance. Suppose DAOs and other mechanisms in the world of DeFi succeed in coordinating disparate groups of people to manage a new financial system. If so, we should take some hope in the possibility that the same social infrastructure could be used in other areas.

Following on from early beginnings in DeFi, DAOs have already expanded beyond finance, and will continue to do so. The underlying infrastructure of blockchain governance is inherently transparent and secure. Governance systems built on top of this trust infrastructure allow for newfound means of coordination, particularly between people who do not know each other but share a common cause or goal. Improving coordination has a variety of positive externalities. Kevin

[47] https://vitalik.ca/general/2021/08/16/voting3.html.

Owocki cites that improving human coordination is the ticket to "better resource allocation, less corruption, and more symmetry between value created and value captured. It's bad for intermediaries, and good for everyone else."[48]

The power of blockchains as new infrastructure for governance and social coordination lies in the flexibility of smart contracts. Because smart contracts on Etheruem are highly expressive, they can be used to design many kinds of different platforms and creative systems to align the incentives of stakeholders. By contrast, traditional frameworks like companies are fundamentally inflexible. It is difficult to circumvent the primacy of shareholders within a company structure, which typically leads even well-meaning projects down a path to maximising profits. Governance structures built on blockchain structures benefit from the customisation of smart contracts, allowing for a theoretically limitless array of options in arranging and organising a group of stakeholders.

Ryan Sean Adams and David Hoffman have been making the case for the importance of Ethereum as social infrastructure for some time. As Hoffman writes, "The story of the human species is finding better and better tools to coordinate with each other… and uphold the collective social contract."[49] I agree with him that Ethereum breaks exciting ground as a generalised toolkit for coordination. My view is that we are only getting started with the different decentralised systems that smart contracts can enable. DeFi protocols are a grand experiment in this new social infrastructure, a prototype for how decentralised groups of people can coordinate to govern financial platforms and public goods.

Of all the ideas and concepts I have covered in this report, this prospect of decentralised governance as a new building block for societal coordination may be the most ambitious. And yet, the fruits of success in this area would be wide-reaching indeed. If the worthy goal of democratising the financial system was not enough reason to follow the progress of DeFi protocols and DAOs, this future scope for decentralised governance should provide another.

[48] https://newsletter.banklesshq.com/p/the-ultimate-dao-report.
[49] https://newsletter.banklesshq.com/p/ethereum-slayer-of-moloch-.

conclusion

We can do better than the legacy financial system. While there is no doubt that the young DeFi economy has a way to go before it can scale to the degree necessary to service all quarters of the world's economy, technological progress and case studies to date show promise. The fact is that our existing financial system, dependent on creaky legacy banks and predatory institutions like payday lenders, does not set the bar high in terms of financial inclusion.

DeFi offers a new financial paradigm that rethinks some of the basic premises and practices we are used to in the existing financial system. For instance, by providing secure infrastructure for economic transactions between DeFi users who do not know each other, DeFi removes the need for intermediaries like banks and lenders. This makes financial services cheaper, more efficient, and limits discrimination by abstracting away scope for human discretion. This new structure for finance is transparent at its core, providing assurances and security to users and allowing for intensive scrutiny of DeFi systems. Lastly, low transitional costs place DeFi protocols in a perpetual competition to provide the best service to users: there is little scope for rent-seeking or market capture.

The DeFi economy also drives social mobility and financial inclusion through a new approach to the governance of financial protocols. DeFi protocols are managed by DAOs, fundamentally novel organisational structures. DAOs make decisions by group consensus, distributing power among a community of stakeholders. Governance processes are transparent, accessible, and decentralise power to ordinary users.

Combined with the inclusive nature of DeFi protocols themselves, I hope these changes portend the democratisation of the financial system as we know it. The serious problems and inequities of our financial system demand serious concern, and we can ill afford navel-gazing in the face of crisis. The power of decentralised financial infrastructure offers the possibility of course correction.

afterword: a letter to DeFi skeptics

My aim in this report has been to set out a substantive analysis for DeFi in terms of its capacity to improve financial services for everyday people and make the financial system more equitable. I have parsed the statements and comments of well-known DeFi skeptics to emphasise the commonalities between their goals and those in the crypto space, rather than engage in direct rebuttal.

However, it is worth taking some time to set out some explicit responses to the most common criticisms fired at DeFi and the crypto space (often treated as one and the same by skeptics). By addressing some popular misconceptions and misinformation, we can hopefully move on to find common ground about the benefits that a DeFi economy could bring to our financial system. This is not to say that DeFi is perfect, nor that there are not well-founded criticisms of how the DeFi economy functions at present. However, like the Economist, long-time critic of cryptocurrencies, conceded in September 2021, "Ethereum is a self-improvement machine".[50] The special promise of DeFi is not in its lack of issues, but the speed with which it innovates and iterates to solve problems.

Let us start with the issue of high gas prices, commonly touted as one of the most serious issues for DeFi users (not least by Senator Warren in a senate hearing)[51]. This is an example of a technical challenge that can be overcome, rather than some kind of permanent and immutable feature of decentralised finance. In fact, a technological solution called 'optimistic roll-ups' has already reduced gas prices to almost nothing for specific DeFi protocols, and soon almost all of Ethereum's DeFi protocols are likely to incorporate roll-ups to some extent.

The technical details of roll-ups are unimportant for the purposes of understanding the end impact for users, namely significantly decreased fees and

[50] https://www.economist.com/leaders/2021/09/18/the-beguiling-promise-of-decentralised-finance.
[51] https://www.warren.senate.gov/newsroom/press-releases/warren-to-sec-chair-at-hearing-regulators-need-to-step-up-to-address-cryptos-regulatory-gaps-and-ensure-an-inclusive-financial-system.

transaction costs for interacting with DeFi. While there is no denying that high gas costs have been an issue for DeFi users over the last year, the implementation of new technological advances like optimistic roll-ups looks set to curtail that issue for good. On the other hand, the exorbitant transaction fees charged by banks for remittances and other transactions are going nowhere in a hurry.[52]

the climate question

Another commonly misunderstood issue ascribed to DeFi protocols is carbon emissions and climate change. This is another example of DeFi being lumped in with Bitcoin. While it is true that Bitcoin's 'Proof of Work' consensus system poses climate concerns with little hope of improvement in the near term, DeFi's home blockchain, Ethereum, is a different story. Ethereum is about to pivot entirely to a 'Proof of Stake' consensus system, which will reduce its energy consumption by a factor of up to 10,000.[53] While it is understandable to lack context around the different consensus systems used by different blockchains and their differing climate footprints, it is unreasonable to assume that cryptocurrency communities do not care about climate change. This is especially unfair in the context of significant examples to the contrary, like the ongoing transition to Proof Stake and Maker's 'Case for Clean Money'.[54] This is not a sector without any regard for the environment, and insinuations to the contrary are unfounded.

I will venture further on the issue of climate change, to note that DeFi protocols and DAOs have the potential to offer a significant and wholly positive contribution to the climate crisis. Much like the financial system, the world's paltry attempts at meeting the challenge of the climate crisis are failing. It is widely agreed, including by the Intergovernmental Panel on Climate Change, that innovation forms a key part of what the world must do in order to meet the threat of a warming Earth. While most might think about climate innovation in the context of

[52] https://remittanceprices.worldbank.org/en.
[53] https://fortune.com/2021/05/27/ethereum-founder-vitalik-buterin-proof-of-stake-environment-carbon/.
[54] https://forum.makerdao.com/t/the-case-for-clean-money/10684.

something like geoengineering, the nascent social coordination tools boasted by DAOs offer some tantalising possibilities for the climate.

Take Klima DAO – a collective of environmentalists, developers and entrepreneurs looking to disrupt and improve existing carbon markets.[55] Klima DAO is building a market-driven system to internalise the cost of carbon, using KLIMA tokens to create a 'black hole' for carbon through incentivising climate-positive actions. DeFi smart contracts pave the way for Klima DAO to pool capital and direct it towards carbon removal, in a system facilitated by smart contracts and governed in a credibly neutral way by a mission-orientated collective. Of course, there is no guarantee that Klima DAO will succeed in its ambitious goals. But the remote possibility that it could do so would represent progress towards one of the world's greatest challenges. This is exactly the kind of technological innovation we should support.

More broadly, critics of DeFi should recognise that the only means by which something like Kima DAO could exist is the underlying infrastructure of smart contracts and decentralised governance. Innovations in social coordination may ultimately prove more influential in meeting the challenge of climate change than flashier innovations like geoengineering.

about those criminals and money-launderers

Finally, it is worth touching on one of the biggest criticisms of DeFi protocols – that they are a breeding ground for criminal activity and money laundering. Treasury Secretary Janet Yellen alleged that cryptocurrencies are used "to launder the profits of online drug traffickers; [they are] a tool to finance terrorism."[56] European Central Bank President Christine Lagarde editorialised that cryptocurrency was a "a highly speculative asset which has conducted some funny business and some interesting and totally reprehensible money-laundering activity".[57] The idea of a technologically advanced cabal of criminals monopolising

[55] https://klimadao.finance/
[56] https://home.treasury.gov/news/press-releases/jy0023.
[57] https://www.bloomberg.com/news/articles/2021-01-13/lagarde-blasts-bitcoin-s-role-in-facilitating-money-laundering.

a blockchain like some sort of modern-day Pirates of the Caribbean is enticing, but has little foundation in fact.

A comprehensive study of cryptocurrency transactions shows that significantly less than 1% of transactions have anything remotely illicit associated with them, and that the vast majority of these are simple scams, rather than sophisticated criminal activity or money laundering. The little illicit activity that has taken place has trended down in recent years, from 2% of total transactions in 2019 to less than 0.5% in 2020.[58] Far more money-laundering and criminal activity involve the US dollar compared to cryptocurrency.[59] Perhaps this is because activity on a blockchain, as covered extensively through this report, is fundamentally transparent – while there are means of covering a transaction's tracks, it is much easier for law enforcement to trace criminal activity. Don't believe me? Here's what the Department of Justice officials have stated in a journal article:[60]

"Cryptocurrency, despite the purported anonymity it grants criminals, provides law enforcement with an exceptional tracing tool: the blockchain. While the blockchain's historical ledger will not list the names of parties to transactions, it provides investigators with ample information about how, when, and how much cryptocurrency is being transferred. Moreover, this information is publicly available; no subpoenas or warrants are required to obtain it."

In short, few of the common critiques of DeFi protocols and cryptocurrencies generally stand up to scrutiny. This is not to say that DeFi or any of its nascent protocols are perfect. There are myriad issues to solve – from the ease with

[58] https://blog.chainalysis.com/reports/2021-crypto-crime-report-intro-ransomware-scams-darknet-markets.
[59] https://www.swift.com/sites/default/files/files/swift_bae_report_Follow-The%20Money.pdf.
[60] https://www.justice.gov/usao/page/file/1205051/download#page=170.

which DeFi users can send funds to the wrong address, to the danger of large stakeholders drowning out smaller users in governance decisions.

However, the critical point is that rough edges are to be expected in a space that is innovating and iterating at rapid speed, and the DeFi community has a track record of fixing its issues. Introducing roll-ups to cut gas fees and transaction costs for users is one example; transitioning to a Proof of Stake consensus system to eradicate its carbon footprint is another. If the idea of Ethereum as a "self-improvement machine" was indeed the cause of the Economist turning from trenchant DeFi critic to tentative supporter, my hope is that other skeptics will similarly keep an open mind.

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