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# DeFi: Shadow Banking 2.0?

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DEFI: SHADOW BANKING 2.0?

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## ABSTRACT

*The growth of so-called "shadow banking" was a significant contributor to the financial crisis of 2008, which had huge social costs that we still grapple with today. Our financial regulatory system still has not fully figured out how to address the risks of the derivatives, securitizations, and money market mutual funds that comprised Shadow Banking 1.0, but we are already facing the prospect of Shadow Banking 2.0 in the form of decentralized finance, or "DeFi." DeFi's proponents speak of a future where sending money is as easy as sending a photograph—but money is not the same as a photograph. The stakes are much higher when money is involved, and if DeFi is permitted to develop without any regulatory intervention, it will magnify the tendencies towards heightened complexity, leverage, rigidity, and runs that characterized Shadow Banking 1.0.*

*Fortunately, though, there is still time to prevent DeFi from becoming Shadow Banking 2.0. This Article argues for precautionary regulation of DeFi, designed to limit its growth and to cordon off whatever remains from the established financial system and real-world economy. While proponents of DeFi will contend that such regulation will limit innovation, this Article argues that DeFi innovation has limited benefits for society. DeFi does not aspire to provide new financial products and services—it simply aspires to provide existing financial products and services in a decentralized way (meaning, without intermediaries). This Article will demonstrate that the DeFi ecosystem is, in fact, full of intermediaries and explain why full disintermediation of financial services is an entirely unrealistic aspiration. This Article will then proceed from that finding to argue that if DeFi cannot deliver on decentralization, regulators should feel emboldened to clamp down on DeFi in order to protect the stability of our financial system and broader economy.*

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INTRODUCTION

"Decentralized finance" or "DeFi" has become one of the hottest trends in finance in the last few years. DeFi is usually discussed in aspirational terms, invoking comparisons to other types of techno-logical innovations: we frequently hear that DeFi will make sending money as easy as sending a photograph or an email.[1] But money is not the same as photographs and emails—the consequences of losing money (both for the affected individual and for confidence in the financial system as a whole) are much greater than the conse-quences of a lost photograph or email.[2] Because money and finance are the lifeblood of our economy, finance has always been highly regulated in a way that Kodak's provision of photographs and FedEx's delivery of couriered letters never have been.[3]

The existence of strong financial regulation has often spurred attempts to arbitrage it—and that regulatory arbitrage is some-times facilitated by complex financial innovation.[4] That was what happened in the lead-up to the 2008 crisis, when credit default swaps and mortgage-backed securitizations evolved around exist-ing financial regulation, just as money market mutual funds had decades earlier[5] (because these services provided functional equivalents for banking products but operated outside the regulated banking sphere, they came to be known as "shadow banking," and

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1. *See, e.g.*, *Decentralized Finance (DeFi)*, ETHEREUM, https://ethereum. org/en/defi/#send-money [https://perma.cc/7GRG-5KXC] (last updated Sept. 1, 2022) ("Ethereum makes sending money around the world as easy as sending an email.").

2. *See, e.g.*, Janet L. Yellen, Vice Chair, Bd. of Governors of the Fed. Rsrv. Sys., Address at the Trans-Atlantic Agenda for Shared Prosperity Conference: A Painfully Slow Recovery for America's Workers: Causes, Implications, and the Federal Reserve's Response 2, 6 (Feb. 11, 2013), https://www.federalreserve.gov/newsevents/speech/yellen20130211a.pdf [https://perma.cc/K4XV-RSVF].

3. RICHARD SCOTT CARNELL, JONATHAN R. MACEY, GEOFFREY P. MILLER & PETER CONTI-BROWN, THE LAW OF FINANCIAL INSTITUTIONS 3 (7th ed. 2021).

4. *See* Saule T. Omarova, *License to Deal: Mandatory Approval of Complex Financial Products*, 90 WASH U. L. REV. 63, 70 (2012); Dan Awrey, *Complexity, Innovation, and the Regulation of Modern Financial Markets*, 2 HARV. BUS. L. REV. 235, 256 (2012).

5. *See* GILLIAN TETT, FOOLS GOLD: HOW THE BOLD DREAM OF A SMALL TRIBE AT J.P. MORGAN WAS CORRUPTED BY WALL STREET GREED AND UNLEASHED A CATASTROPHE 49 (2009); Hilary J. Allen, *Money Market Fund Reform Viewed Through a Systemic Risk Lens*, 11 J. BUS. & SEC. L. 87, 89-90 (2010).

this Article will refer to them as "Shadow Banking 1.0").[6] Few steps were taken to rein in these types of innovation, and the increased leverage, rigidity, and fragility they created became evident during the 2008 financial crisis—only in the aftermath of that crisis did legislators and regulators step up with some regulatory fixes.[7] These have helped, but have not fully addressed, the problems associated with Shadow Banking 1.0.

The crisis of 2008 had searing social consequences. The recession that followed had obvious and immediate impacts on employment and wealth, but it also generated a lingering mental and physical toll for the most vulnerable members of our society.[8] Nearly fifteen years after the financial crisis of 2008, we are still learning more about the damage that the crisis caused: recent work has focused on how the crisis has exacerbated inequality;[9] another developing area of literature considers the political repercussions of the crisis (and financial crises more generally), suggesting that such crises can lead to political radicalization.[10] The 2008 crisis was not inevitable, though. Some of the blame can be laid at the feet of financial regulators for taking a "wait and see" approach to Shadow Banking 1.0: in its report on the causes of the crisis, the Financial Crisis Inquiry Commission concluded that "widespread failures in financial regulation and supervision proved devastating to the stability of the nation's financial markets."[11]

Confidence in our traditional financial system (and the regulators that oversee it) was justifiably shaken by the crisis of 2008; this has

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6. *See* Zoltan Pozsar, Tobias Adrian, Adam Ashcraft & Hayley Boesky, *Shadow Banking*, 19 Fed. Rsrv. Bank N.Y. Econ. Pol'y Rev. 1, 1-2 (2013).

7. *See* Gary Gorton & Andrew Metrick, *Regulating the Shadow Banking System*, 2010 Brookings Papers on Econ. Activities 261, 261-62.

8. *See* Yellen, *supra* note 2, at 2, 6, 9.

9. See Jonathan Bridges, Georgina Green & Mark Joy, *Credit, Crises and Inequality* 1 (Bank of Eng., Staff Working Paper No. 949, 2021).

10. For a literature review (as well as findings that the severe banking crisis in Germany in 1931 not only led to "broad-based political radicalization shortly thereafter; once the Nazis were in power, both pogroms and deportations were more common in places more affected by the banking crisis"), see Sebastian Doerr, Stefan Gissler, José-Luis Peydró & Hans-Joachim Voth, *Financial Crises and Political Radicalization: How Failing Banks Paved Hitler's Path to Power* 2 (Bank for Int'l Settlements, Working Paper No. 978, 2021).

11. Fin. Crisis Inquiry Comm'n, The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States, at xviii (2011).

understandably piqued interest in visions of an alternative decentralized financial system where no one needs to trust any intermediary because intermediaries have been rendered superfluous. Unfortunately, this is an entirely unrealistic goal. DeFi has evolved such that users have to trust in some combination of ISPs, core software developers, miners, wallets, exchanges, stablecoin issuers, oracles, providers of client APIs used to access distributed ledgers, and concentrated owners of governance tokens.[12] In short, DeFi does not so much disintermediate finance as replace trust in regulated banks with trust in new intermediaries who are often unidentified and unregulated. This Article will argue that DeFi innovations that are supposed to displace the need for trust in intermediaries succeed only in making DeFi more fragile than traditional financial services.

I have posed this Article's title, "DeFi: Shadow Banking 2.0?," as a question. There is already abundant evidence that DeFi mirrors and magnifies the fragilities of the shadow banking innovations that resulted in the crisis of 2008; the question is whether policymakers will allow DeFi to grow and become sufficiently integrated with the established financial system such that it can cause widespread harm. This Article argues that such an outcome is not inevitable. Policymakers should take a precautionary approach to DeFi regulation, limiting the use of DeFi where financial regulators are able to exercise jurisdiction and then cordoning off whatever DeFi remains from the established financial system and real-world economy.

This approach will admittedly limit innovation in the DeFi ecosystem, but not all innovation is good innovation. If the risks of innovation outweigh any possible benefits it might deliver, then preventing that innovation is good public policy. In this context, it is important to understand that DeFi is not intended to provide new types of financial products or services—generally, it just aspires to deliver existing financial products and services in a decentralized way.[13] Given that decentralization is an entirely unrealistic goal, we

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12. *See infra* Part II.A.

13. LILY FRANCUS, TARUN CHITRA, DAVID HAMILTON & MATT DOBEL, MOODY'S ANALYTICS, BLOCK BY BLOCK: ASSESSING RISK IN DECENTRALIZED FINANCE (2022), https://www.moodys analytics.com/articles/2021/block_by_block_assessing_risk_in_decentralized_finance [https://perma.cc/7R4R-EAPP] ("[Defi] aims to solve the same market needs for capital and services as the traditional financial ecosystem, and largely to benefit the same participants.").

are left with technology that may be interesting from an academic perspective[14] but in practical terms is inefficient in its complexity (and as a result, does not respond well to the needs of those who are underserved by our existing financial system). As such, policymakers would serve us well by taking preemptive steps to prevent the growth of Shadow Banking 2.0.

This Article will proceed as follows. Part I will provide an overview of Shadow Banking 1.0, with a focus on the fragilities of credit default swaps, mortgage-backed securitizations, money market mutual funds, and their contributions to the financial crisis of 2008. Part II will describe how the key fragilities Shadow Banking 1.0 created (namely increased complexity, leverage, rigidity, and susceptibility to runs) will be present, and sometimes magnified, in a DeFi ecosystem built on distributed ledgers, tokens, smart contracts, and stablecoins. Part III argues that the correct regulatory response to these fragilities is not to provide incomplete regulatory fixes to DeFi's individual fragilities but to stop the DeFi ecosystem from growing and integrating with the established financial system. While this kind of regulatory approach will limit innovation, Part III argues that DeFi is not particularly decentralized or efficient and does little to further financial inclusion and that limiting this kind of innovation is, therefore, a good policy outcome.

## I. Shadow Banking 1.0

Following the financial crisis of 2008, a significant amount of academic and policy work was done on "shadow banking."[15] Generally speaking, shadow banking describes financial activities that are the functional equivalent of activities carried out in the regulated banking system, but which escape bank regulation.[16] Around the

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14. Cryptographic consensus mechanisms are a novel solution to the double spending program associated with digital assets. Edmund Schuster, *Cloud Crypto Land*, 84 Mod. L. Rev. 974, 988 (2021).

15. *See* Tobias Adrian & Adam B. Ashcraft, Fed. Rsrv. Bank of N.Y. Staff Reps., Shadow Banking: A Review of the Literature 10 (2012).

16. Pozsar et al., *supra* note 6, at 1 ("Shadow banks are financial intermediaries that conduct maturity, credit, and liquidity transformation without explicit access to central bank liquidity or public sector credit guarantees.").

time of the crisis, shadow banking included "such familiar institutions as investment banks, money-market mutual funds (MMMFs), and mortgage brokers; some rather old contractual forms, such as sale-and-repurchase agreements (repos); and more esoteric instruments such as asset-backed securities (ABSs), collateralized debt obligations (CDOs), and asset-backed commercial paper (ABCP)."[17] Because they facilitate new forms of leverage outside of the banking system,[18] credit default swaps are also considered part of the shadow banking system.[19] This Part of the Article will use credit default swaps as well as money market mutual funds and mortgage-backed securitization (a particular type of asset-backed securitization) to illustrate some of the fragilities that this generation of shadow banking introduced into the financial system.

Although these forms of shadow banking differ in many respects, one thread that unites them is their complexity, which is a destabilizing force in and of itself. Complexity can make financial products—and their possible interactions with the broader financial system—harder to understand, increasing the chance that risks will go unanticipated.[20] Even if risks are anticipated, complexity-induced opacity increases the chance that such risks will be underestimated in good times (causing bubbles), and overestimated in bad times (making panics worse).[21] More generally, there is a whole discipline of complexity science that explores how increased complexity makes systems more fragile (particularly by obscuring how steps that are taken to make individual system components more robust can end up transmitting problems with those components throughout the broader system).[22] Increased complexity writ large is certainly part of the shadow banking story: this Part will explore the particular types of complexity inherent in credit default swaps, mortgage-backed securitization, and money market mutual funds.

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17. Gorton & Metrick, *supra* note 7, at 261-62.

18. *See* John Geanakoplos, *Solving the Present Crisis and Managing the Leverage Cycle*, 16 Fed. Rsrv. Bank N.Y. Econ. Pol'y Rev. 101, 113-14 (2010).

19. *See* Pozsar et al., *supra* note 6, at 3-4.

20. Awrey, *supra* note 4, at 250.

21. Nicola Gennaioli, Andrei Shleifer & Robert Vishny, *Neglected Risks, Financial Innovation, and Financial Fragility*, 104 J. Fin. Econ. 452, 452-53 (2012).

22. For an overview of this literature, see Hilary J. Allen, *Payments Failure*, 62 B.C. L. Rev. 453, 463-67 (2021).

## A. Credit Default Swaps

In finance, "leverage" refers to using debt to acquire financial assets.[23] Bank loans are perhaps the most familiar and simple form of debt: investors—including other financial institutions—can use the money they borrow from banks to increase their exposure to the assets they want to invest in.[24] Another familiar form of leverage entails investors borrowing some of the purchase price for an asset from their broker, which is known as trading on margin.[25] Leverage can multiply profits, but when an investor only puts down a little bit of their own money to buy an asset and borrows the rest, their down payment can be quickly wiped out if the price of the asset falls.[26] Then the investor may have to sell the asset (or something else) in order to repay their debt or to satisfy a lender's demand for more loan collateral.[27] From a financial-stability perspective, too much leverage is problematic both because of its ability to multiply exposure to assets, which can inflate bubbles, and because the deleveraging process, once the market turns south, generates significant "fire sale externalities" as the borrower is forced to sell assets at a discount in order to satisfy their lender.[28] This drives down the market price for the assets that are being sold, which may force other market participants to deleverage, and may even drive them into insolvency.[29] Economist John Geanakoplos has observed that "[a]ll leverage cycles end with: (1) bad news that creates uncertainty and disagreement, (2) sharply increasing collateral rates, and (3) losses and bankruptcies among the leveraged optimists."[30]

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23. ANAT ADMATI & MARTIN HELLWIG, THE BANKERS' NEW CLOTHES: WHAT'S WRONG WITH BANKING AND WHAT TO DO ABOUT IT 25 (2013) (ebook).

24. *Id.* at 5-6.

25. *See Purchasing on Margin, Risks Involved with Trading in a Margin Account*, FINRA, https://www.finra.org/investors/learn-to-invest/advanced-investing/purchasing-margin [https://perma.cc/UF7T-GW4F].

26. *See* ADMATI & HELLWIG, *supra* note 23.

27. *See* FINRA, *supra* note 25.

28. Geanakoplos, *supra* note 18, at 114 ("Losses by leveraged buyers of assets can cause a chain reaction when a margin call forces a leveraged buyer to sell, which might lower the price and force another leveraged buyer to sell and so on.").

29. *Id.* at 106.

30. *Id.* at 102.

Because too much leverage makes the financial system more fragile, traditional bank lending and margin lending by brokers has long been subject to regulatory requirements that have the practical effect of ensuring that the borrower always makes some kind of minimum down payment, preventing unlimited leverage.[31] The development of credit default swaps (CDSs) in the mid-1990s, however, created a new and initially unlimited way of creating leverage.[32] CDSs work similar to a type of insurance policy that will pay out if an underlying bond suffers some kind of credit-related problem—except that one does not need to hold the underlying bond to buy a CDS.[33] For this reason, multiple CDSs can reference the same underlying bond and, by doing so, multiply the number of people getting exposure to that bond. In the lead-up to 2008, CDS buyers often failed to demand any "down payment" of collateral from their counterparties, and so an unlimited amount of leverage could be created: "Many firms, like AIG, were allowed to write CDS insurance with little or no initial margin."[34] And so the development of CDSs allowed for the creation of more leverage in the financial system, which came to a head during the 2008 crisis. The Financial Crisis Inquiry Commission report on the causes of the 2008 crisis noted that leverage was hidden in derivatives positions, and labeled derivatives (particularly CDSs) as a significant contributor to the crisis.[35]

In the aftermath of the 2008 crisis, Congress and regulators took steps to reduce the amount of leverage that swaps could create in the financial system: Title VII of the Dodd-Frank Act encouraged clearing of swaps (with the expectation that clearinghouses would impose margin requirements as well as net out obligations) and introduced margin requirements for uncleared swaps.[36] We have already discussed how the "down payment" required by margin requirements limits leverage; netting is another way of reducing the

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31. CARNELL ET AL., *supra* note 3, at 205, 629.

32. For a comprehensive recount of the development of credit default swaps, see TETT, *supra* note 5, at 3-7, 22-25, 46-59.

33. Geanakoplos, *supra* note 18, at 114.

34. *Id.*

35. FIN. CRISIS INQUIRY COMM'N, *supra* note 11, at xx, xxiv.

36. MICHAEL S. BARR, HOWELL E. JACKSON & MARGARET F. TAHYAR, FINANCIAL REGULATION: LAW AND POLICY 1084, 1086 (1st ed. 2016).

amount of leverage in the system. When CDS obligations are netted out against one another, they cancel each other out, reducing the amount of leverage associated with an asset.[37] Geanakoplos demonstrates this using the following example:

> A Firm B that was neutral, betting one way against Firm A on [a bond], and betting the opposite way on the same [bond] against Firm C, could come out a loser anyway. If Firm A defaults on its insurance payment, then B will be unpaid by A but still on the hook for paying C. So instead of just one Firm A going bankrupt and another Firm C going unpaid in the absence of collateral, as would happen with netting, another Firm B might also go bankrupt, closing shop, firing workers, and creating other social costs.[38]

Regulation requiring netting as part of the clearing process eliminates exposure for parties such as *B* and reduces the amount of leverage in the system overall (although it does concentrate a significant amount of risk in clearinghouses themselves).[39] Title VII of Dodd-Frank is an improvement over the unregulated status quo that prevailed before it was enacted, which allowed CDSs to create almost unlimited leverage, but Title VII has many limitations and has come in for its fair share of criticism—particularly regarding the amount of risk building up in clearinghouses.[40]

## B. Mortgage-Backed Securities

When banks make loans and hold them on their books, they are required to meet regulatory capital requirements with respect to those loans (in other words, to continue funding them with specified amounts of equity).[41] However, if banks make loans and then sell them, then they have no continuing obligation to satisfy capital

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37. *See id.* at 1091.

38. Geanakoplos, *supra* note 18, at 114.

39. *See* BARR ET AL., *supra* note 36, at 1089-92.

40. *See, e.g.*, Adam J. Levitin, Response, *The Tenuous Case for Derivatives Clearinghouses*, 101 GEO. L.J. 445, 447-48 (2013).

41. For a more detailed description of regulatory capital requirements, see Hilary J. Allen, *Let's Talk About Tax: Fixing Bank Incentives to Sabotage Stability*, 18 FORDHAM J. CORP. & FIN. L. 821, 828-33 (2013).

requirements with respect to those loans; they also avoid any ongoing default risk associated with those loans.[42] Securitization provides a way for banks to sell their loans right away: shortly after the bank makes the loans, they are sold to a bankruptcy-remote entity that pays for the loans by selling bonds or other debt instruments to investors—in exchange, those investors receive payments of principal and interest over time that are derived from the pool of loans.[43] When the assets are mortgage loans, payments to investors come indirectly from borrowers' repayments on their individual mortgages.[44]

Mortgage-backed securitization (MBS) therefore provides a way for the capital markets to fund the types of loans that banks traditionally made and do so in a way that avoids the regulatory capital requirements designed to regulate how banks fund such loans.[45] MBS can be very efficient, but when banks do not hold onto the loans they make, we lose the benefit of their assessment and ongoing monitoring of the credit risk associated with those loans.[46] Without any "skin in the game," the banks making the loans may have limited incentives to ensure borrowers' ability to repay.[47] Furthermore, the securitization structure introduces new rigidities that came back to haunt the financial system during the 2008 financial crisis. Law professors Anna Gelpern and Adam Levitin have observed that MBS was intentionally made inflexible by including contractual prohibitions on modifications and by structuring the transactions to be remote from the modifying powers of bankruptcy courts.[48] Gelpern and Levitin vividly describe these features as "a layering of rigidities designed to produce a species of hyperrigid contracts that boost commitment in good times but function as suicide pacts in bad times."[49]

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42. *See* BARR ET AL., *supra* note 36, at 1137-38, 1140.

43. Gorton & Metrick, *supra* note 7, at 270-72.

44. Anna Gelpern & Adam S. Levitin, *Rewriting Frankenstein Contracts: Workout Prohibitions in Residential Mortgage-Backed Securities*, 82 S. CAL. L. REV. 1075, 1082 (2009).

45. *See* BARR ET AL., *supra* note 36, at 1140.

46. *See* Gelpern & Levitin, *supra* note 44, at 1085-86.

47. *See* BARR ET AL., *supra* note 36, at 1154-55.

48. Gelpern & Levitin, *supra* note 44, at 1079.

49. *Id.*

When bad times came, in the form of a nationwide mortgage foreclosure crisis, "the mortgage securitization pipeline lit and spread the flame of contagion and crisis."[50] The rigidities of the securitization structure made it harder for the underlying mortgages to be modified, thereby increasing the number of foreclosures; they also exacerbated the turmoil in the financial markets. Because securitization contracts did not contemplate a nationwide foreclosure crisis and because they were so hard to renegotiate once such a crisis occurred, the value of the securities produced became very unclear.[51] This valuation uncertainty made MBS very difficult to trade (or at least, to trade without a significant discount), and leveraged financial institutions that had significant holdings of MBS were often forced to sell off other assets in fire sales, depressing the values of other financial asset classes, forcing leveraged institutions exposed to *those* asset classes to engage in fire sales, in a vicious cycle.[52] In sum, Gelpern and Levitin observe that "[a]lthough securitization contracts generate significant externalities and impose costs on a wide range of constituencies beyond the contracting parties, they are designed to limit the government's capacity to mitigate their potential adverse impact on the economy."[53] No real reform was made to the regulation of securitizations after the 2008 crisis,[54] so the rigidities associated with the structure remain.

## C. Money Market Mutual Funds

Deposit-taking banks used to face caps on the amount of interest they could pay, and as interest rates rose in the 1970s, this proved very frustrating for depositors.[55] Money market mutual funds

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50. FIN. CRISIS INQUIRY COMM'N, *supra* note 11, at xxiii.

51. *See* Gelpern & Levitin, *supra* note 44, at 1124-27.

52. *See* ADMATI & HELLWIG, *supra* note 23, at 63-64. On fire sales generally, see Anil K. Kashyap, Richard Berner & Charles A.E. Goodhart, *The Macroprudential Toolkit*, 59 IMF ECON. REV. 145, 147-48 (2011).

53. Gelpern & Levitin, *supra* note 44, at 1127.

54. *See* Steven L. Schwarcz, *Securitization Ten Years After the Financial Crisis: An Overview*, 37 REV. BANKING & FIN. L. 757, 760 (2018).

55. *See* Gary B. Gorton & Jeffery Zhang, *Taming Wildcat Stablecoins*, 90 U. CHI. L. REV. (forthcoming 2023) (manuscript at 21), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3888752 [https://perma.cc/QBM6-KUT8].

(MMFs) were developed to capture this market.[56] Because shares in these funds are not *actually* bank deposits, no interest rate caps apply[57]—and neither does deposit insurance. These MMFs work as a functional substitute for deposits because of special accounting treatment that allows a share in a fund to be consistently valued at one dollar, notwithstanding that a share in an MMF is actually a share in a pool of assets with fluctuating prices so its value changes constantly.[58] If the value of an MMF share deviates too far from one dollar, the special accounting treatment ceases to be available and MMF shareholders will find their shares revalued below one dollar, which is known as "breaking the buck."[59]

In September 2008, the Reserve Primary Fund, an MMF with exposure to Lehman Brothers, broke the buck, and that event caused many investors in other MMFs to panic.[60] A run ensued as panicked investors rushed to redeem their MMF shares as quickly as possible.[61] They feared that if they waited too long, their fund would have already sold its best assets to satisfy other investors' redemption requests, leaving them less likely to receive one dollar per share—a calculation that mirrors the calculation that depositors make during bank runs (or at least, a calculation they used to make before the introduction of deposit insurance).[62] During a run, redemption requests can force MMFs to start liquidating invest-ments at fire sale prices in order to satisfy redemption requests, depressing asset markets and cutting off credit for the corporations in which MMFs usually invest through the commercial paper market.[63]

Three days after the Reserve Primary Fund broke the buck, the Treasury Department temporarily guaranteed the one dollar share price for all MMFs, and the Federal Reserve provided emergency liquidity to MMFs in order to limit fire sales and prop up the

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56. *Id.*

57. *See* BARR ET AL., *supra* note 36, at 1198.

58. The special accounting treatment is authorized by 17 C.F.R. § 270.2a-7(c) (2023).

59. *See* Gorton & Zhang, *supra* note 55, at 22.

60. Allen, *supra* note 5, at 94-95.

61. *See id.* at 94.

62. On the theory of bank runs, see Douglas W. Diamond & Philip H. Dybvig, *Bank Runs, Deposit Insurance, and Liquidity*, 91 J. POL. ECON. 401, 403 (1983).

63. Allen, *supra* note 5, at 95-96.

commercial paper market.[64] Once these temporary measures expired, policymakers considered multiple reform proposals that would make MMFs less susceptible to runs. A variety of reforms were adopted in 2010 and 2014[65]—but these measures were insufficient to prevent a run at the beginning of the COVID pandemic in March 2020. As MMF shareholders again began to increase their redemptions, a repeat of the Federal Reserve's 2008 emergency intervention was required.[66] These multiple instances of government support have most likely created expectations among managers of MMFs that they will receive similar support in the future—expectations of future support may encourage managers to include riskier (and therefore more profitable) assets in their reserves going forward.[67] These kinds of perverse incentives are known as "moral hazard."

## II. DeFi

CDSs, MBS, and MMFs all had roles to play in spurring or exacerbating the financial crisis of 2008. The Financial Crisis Inquiry Commission report on the causes of the crisis found that "the mortgage securitization pipeline lit and spread the flame of contagion and crisis,"[68] discussed leverage hidden in derivatives positions,[69] and labeled derivatives (particularly credit default swaps) as a significant contributor to the crisis.[70] While MMFs did not cause the crisis, the run on the Reserve Primary Fund following Lehman Brothers' collapse certainly exacerbated panic in the financial markets and necessitated government support for MMFs.[71] In short, Shadow Banking 1.0 damaged financial stability by helping to multiply the amount of leverage in the financial system and by making the system more rigid and more susceptible to runs

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64. Gorton & Zhang, *supra* note 55, at 23.
65. President's Working Grp. on Fin. Mkts., Overview of Recent Events and Potential Reform Options for Money Market Funds 6-8 (2020).
66. Gorton & Zhang, *supra* note 55, at 24.
67. Barr et al., *supra* note 36, at 1211.
68. Fin. Crisis Inquiry Comm'n, *supra* note 11, at xxiii.
69. *Id.* at xx.
70. *Id.* at xxiv.
71. *See* Barr et al., *supra* note 36, at 1210-11.

with spillover effects. An overarching theme is that Shadow Banking 1.0 made the financial system more complex. This Part will explore whether the nascent DeFi ecosystem has the potential to do the same.[72]

## A. Introduction to DeFi

Similar to any new and evolving business model or technology, DeFi is hard to pin down with a precise definition.[73] Right now, the term is typically used to describe a software application (known as a "Dapp") that serves as a simulacrum of traditional financial services provided using coins and tokens hosted on a permissionless distributed ledger.[74] A distributed ledger is, at its core, a database hosted on multiple computers, and a distributed ledger is "permissionless" if no central authority is in charge of determining who has the right to record transactions on the ledger—currently, the Ethereum blockchain (a permissionless ledger) is the ledger that is predominantly used for DeFi Dapps.[75] Tokens and coins are computer files stored on the distributed ledger, and payments in DeFi are often made using a type of coin known as a "stablecoin."[76] Stablecoins try to avoid the volatility associated with cryptocurrencies such as Bitcoin by pegging their value to the U.S. Dollar or some other fiat currency.[77] Dapps are built using smart contracts, which are computer programs that run on the distributed ledger

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72. For another comparison of DeFi to CDSs, MBS, and MMFs, see Michael Hsu, Acting Comptroller of the Currency, "Cryptocurrencies, Decentralized Finance, and Key Lessons from the 2008 Financial Crisis" (Sept. 21, 2021), https://www.occ.gov/news-issuances/speeches/2021/pub-speech-2021-101.pdf [https://perma.cc/GC6N-XZKJ].

73. One widely used working definition describes DeFi as having four defining characteristics: "1. Financial services....; 2. Trust-minimized operation and settlement....; 3. Non-custodial design....; [and] 4. Open, programmable, and composable architecture." WHARTON BLOCKCHAIN & DIGIT. ASSET PROJECT, DEFI BEYOND THE HYPE: THE EMERGING WORLD OF DECENTRALIZED FINANCE 2-3 (2021), https://wifpr.wharton.upenn.edu/wp-content/uploads/2021/05/DeFi-Beyond-the-Hype.pdf [https://perma.cc/5NCE-QANB].

74. *Id.* at 2.

75. *See* PRESIDENT'S WORKING GRP. ON FIN. MKTS., FDIC & OFF. OF THE COMPTROLLER OF THE CURRENCY, REPORT ON STABLECOINS 9 (2021).

76. *Id.* at 8.

77. The President's Working Group describes stablecoins as "digital assets that are designed to maintain a stable value relative to a national currency or other reference assets." *Id.* at 1.

and govern the operation of tokens and coins in a way that is intended to be self-executing and self-enforcing.[78] However, most users of DeFi Dapps cannot easily access the distributed ledger directly from their phones or laptops; Dapps therefore typically integrate the smart contracts with more traditional forms of software to create "user-facing interfaces."[79]

Proponents of DeFi assert that these technologies will be used in concert to provide new versions of "payments, lending, trading, investments, insurance, and asset management" services.[80] To be clear, this is largely aspirational: as it operates right now, DeFi has few applications outside of the self-referential cryptoverse,[81] and it is rife with new types of scams such as "rug pulls."[82] I will return to the realities of DeFi in Part III, but in this Part, I will take DeFi proponents at their word and consider how DeFi might create new versions of existing financial services. These new versions may avoid much of the regulation that typically applies to the existing financial services they are emulating, but they still have many of the same (or worse) fragilities as those existing services. Specifically: (1) the unlimited production of tokens can introduce more leverage into the system, potentially outstripping the leverage associated with credit default swaps in the lead-up to the 2008 crisis; (2) smart contracts are designed to be even more rigid than the mechanisms that turned MBSs into "suicide pacts" during the crisis; and (3) stablecoins share many of the features of MMFs that made them susceptible to runs in 2008 and again in 2020.

More generally, DeFi Dapps are highly complex. The "composability" of DeFi Dapps (in the sense that smart contracts can be programmed to interact with one another so that "anyone in a

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78. WHARTON BLOCKCHAIN & DIGIT. ASSET PROJECT, *supra* note 73, at 2-3.

79. *Id.*

80. *Id.* at 2.

81. "The problem is that all this fancy financial engineering has, as yet, no 'real' economy to service. Instead it underpins an incorporeal casino: most of those using DeFi do so to facilitate or leverage their bets on one of many speculative tokens." Alice Fulwood, *Decentralized Finance Is Booming, But It Has Yet to Find Its Purpose*, THE ECONOMIST (Nov. 8, 2021), https://www.economist.com/the-world-ahead/2021/11/08/decentralised-finance-is-booming-but-it-has-yet-to-find-its-purpose [https://perma.cc/A6T5-PRVD].

82. *DeFi Scams 101: How to Avoid the Most Common Cryptocurrency Frauds*, COINTELE-GRAPH, https://cointelegraph.com/defi-101/defi-scams-101-how-to-avoid-the-most-common-cryptocurrency-frauds [https://perma.cc/3XL9-AKJR].

network [can] take existing programs and adapt or build on top of them") is often heralded as a benefit,[83] but complexity science cautions that increased interoperability between components of a system makes that system more complex and therefore fragile.[84] DeFi Dapps are also complex in the sense that most investors, including established financial institutions, are used to reviewing balance sheets and written disclosures to assess investments. Few are able to read the computer code of the smart contracts that make up the Dapps—and even those who can will struggle to find flaws simply by looking at the code in the abstract.[85] While it is possible for the operators of Dapps to provide written disclosures to their users, written disclosure documents may prove to be highly inconsistent with how the code of the relevant smart contracts actually functions—and there is no way for investors (or regulators) to verify this unless they can run a beta test, or at the very least read the code.[86] Finally, added complexity arises as a result of the convoluted governance structure that often controls the Dapps' software as well as the governance structure of the permissionless ledgers on which the Dapps run. This means that if a problem were to occur and emergency intervention needed to be provided within the DeFi ecosystem to head off catastrophic spillover effects for the rest of the financial system, it could be difficult to figure out to whom to provide emergency support.

The complexity of DeFi services can hide financial risks. Past experience with Shadow Banking 1.0 has shown us that financial risks cannot be eliminated with clever engineering; they can only be moved—and complexity creates a kind of opacity that obfuscates where risks have been moved to.[87] While the availability of data on the blockchain creates some transparency that was not present in

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83. Linda Xie, *Composability Is Innovation*, FUTURE (June 15, 2021), https://future.com/how-composability-unlocks-crypto-and-everything-else/ [https://perma.cc/TU4U-9V7F].

84. *See* David L. Alderson & John C. Doyle, *Contrasting Views of Complexity and Their Implications for Network-Centric Infrastructures*, 40 IEEE TRANSACTIONS ON SYS., MAN, & CYBERNETICS 839, 842-43 (2010).

85. For information on the limitations of reviewing source code, see Joshua A. Kroll, Joanna Huey, Solon Barocas, Edward W. Felten, Joel R. Reidenberg, David G. Robinson & Harlan Yu, *Accountable Algorithms*, 165 U. PA. L. REV. 633, 638, 647 (2017).

86. Shaanan Cohney, David Hoffman, Jeremy Sklaroff & David Wishnick, *Coin-Operated Capitalism*, 119 COLUM. L. REV. 591, 598 (2019).

87. Gennaioli et al., *supra* note 21, at 453.

Shadow Banking 1.0, complexity strains the ability of both human cognition and economic models to assess the risks associated with those data.[88] Furthermore, the increasing popularity of so-called "off-chain" transactions, which are not settled on the blockchain itself, limits this transparency.[89] The Financial Stability Board has concluded that all of this "limits the amount of insight that can be gained with regard to the crypto-asset market structure and functioning.... [I]t is very difficult to determine who the market participants are, or where crypto-asset-holdings are concentrated."[90] The DeFi ecosystem therefore has many complexity-related fragilities; the next Part will look with more particularly at how DeFi mirrors certain aspect of Shadow Banking 1.0.

## B. DeFi as Shadow Banking 2.0

### 1. Leverage

CDSs can create leverage in the financial system by multiplying the number of times someone can get exposure to the same underlying asset (typically, a bond).[91] Multiplying the number of assets available to borrow against can also increase the amount of leverage in the system.[92] That is a significant concern with DeFi, in which financial assets in the form of tokens can be created out of thin air

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88. Moody's Analytics notes that

Analysis of risk in DeFi protocols can be quite different when compared to traditional finance. The transparency and composability of DeFi protocols allows for a more technical evaluation of risk. For instance, instead of creating VaR models to predict an unknown counterparty's risk, one can train fine-grained models directly on historical market participant data.... However, the technical complexity of such models is much higher.

FRANCUS ET AL., *supra* note 13, at 8.

89. Jake Frankenfield, *Off-Chain Transactions (Cryptocurrency)*, INVESTOPEDIA (Aug. 24, 2021), https://www.investopedia.com/terms/o/offchain-transactions-cryptocurrency.asp [https://perma.cc/R4FC-PSDN] ("Off-chain transactions refer to those transactions occurring on a cryptocurrency network that move the value outside of the blockchain. Due to their zero/low cost, off-chain transactions are gaining popularity, especially among large participants.").

90. FIN. STABILITY BD., ASSESSMENT OF RISKS TO FINANCIAL STABILITY FROM CRYPTO-ASSETS 19 (2022), https://www.fsb.org/wb-content/upload/P160222.pdf [https://perma.cc/4PHA-ZX4G].

91. *See supra* Part I.A.

92. *See supra* Part I.A.

by anyone with computer programming knowledge.[93] There is no legal constraint on the quality of the tokens accepted as collateral for loans or the amount that can be borrowed against that collateral—amounts borrowed can then be used to acquire yet more assets. An unconstrained supply of financial assets to serve as collateral therefore means more opportunities for asset bubbles to grow and for more assets to be dumped during fire sales (more assets also means more trading transactions, which could create operational problems if the transactions are done on-chain: distributed ledgers are relatively slow at processing transactions and could become overwhelmed at peak times[94]—these operational failures can have their own spillover effects).[95]

As mentioned in the earlier discussion of CDSs, regulations relating to reserve, capital, margin, and netting requirements are all used to limit leverage in the established financial system, but research has found that "[t]he maximum permitted margin in [decentralized exchanges] is higher than in regulated exchanges in the established financial system."[96] Market practices requiring DeFi transactions to be overcollateralized could act as some constraint on leverage in the DeFi ecosystem, but given how volatile many tokens are, even an overcollateralized loan could end up creating leverage (stablecoins are typically a less volatile form of collateral, but when stablecoins are used as collateral, the token proceeds of those loans can be used as collateral for other loans, which can then be used as collateral for further loans, and so on.[97] Also, stablecoins may be more volatile than their marketing suggests).[98] In any event, market practices around overcollateralization are not the same as regulatory requirements—after all, market practices allowed AIG to issue

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93. Saule T. Omarova, *New Tech v. New Deal: Fintech as a Systemic Phenomenon*, 36 YALE J. ON REGUL. 735, 775 (2019).

94. *Introduction to Dapps*, ETHEREUM, https://ethereum.org/en/developers/docs/dapps/ [https://perma.cc/AS2E-G4ZA] (last updated Sept. 1, 2022) ("Currently, the network can only process about 10-15 transactions per second; if transactions are being sent in faster than this, the pool of unconfirmed transactions can quickly balloon.").

95. For a discussion of spillovers from operational failures in payments systems, see Allen, *supra* note 22, at 480.

96. Sirio Aramonte, Wenqian Huang & Andreas Schrimpf, *DeFi Risks and the Decentralisation Illusion*, BIS Q. REV., Dec. 2021, at 29-30.

97. *Id.* at 29.

98. *See infra* Part II.B.3.

uncollateralized CDSs in the lead-up to the 2008 crisis.[99] For example, the subgenre of DeFi lending known as "flash loans" does not require any collateral at all.[100] These loans can be huge and can therefore exponentially multiply the amount of leverage in the system, even if only for a very short period of time.[101] While counterparty credit risk is purportedly eliminated in flash loans because loans are repaid within the same block of transactions in which they are borrowed,[102] further investigation is needed of the systemic impact of large bursts of leverage into the DeFi ecosystem.

Just as CDSs were, tokens are also being used to create synthetic exposure to real-world assets: for example, the Mirror Protocol has been developed to create synthetic exposure to real-world assets on the distributed ledger.[103] A recent report from the Bank for International Settlements also observed that unregulated DeFi versions of derivatives trading on decentralized exchanges are multiplying the amount of leverage in the DeFi ecosystem.[104] The same report noted that fire sales occurred in the DeFi ecosystem in September 2021 as a result of deleveraging when "[f]orced liquidations of derivatives positions and loans on DeFi platforms accompanied sharp price falls and spikes in volatility."[105] Financial regulators should be very wary of the possibility of significant leverage building up in the DeFi ecosystem, particularly if there are channels of contagion that would allow deleveraging/fire sales in the DeFi ecosystem to impact the mainstream financial system and broader economy.

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99. For a discussion of why market participants do not address systemic risks on their own, see *infra* notes 198-200 and accompanying text.

100. Xie, *supra* note 83.

101. Aramonte et al., *supra* note 96, at 27.

102. Xie, *supra* note 83.

103.
> Through the use of advanced smart contracts, the platform allows anyone to issue and trade synthetic assets that monitor and track the price of arbitrary real-world assets. Impressively, this is all accomplished without requiring physical backing.... [T]he goal of the project is to speed up the integration of traditional assets entering the blockchain sector.

David Hamilton, *Investing in the Mirror Protocol (MIR)—Everything You Need to Know*, SECURITIES IO, https://www.securities.io/investing-in-the-mirror-protocol-mir-everything-you-need-to-know/ [https://perma.cc/4E3Z-WMYS] (last updated Dec. 21, 2022).

104. Aramonte et al., *supra* note 96, at 29.

105. *Id.* at 30.

Recent International Monetary Fund (IMF) research has found increasing correlation between the performance of crypto investments and more traditional investments such as equities, especially during market volatility, and cautioned that "[i]ncreased crypto-stocks correlation raises the possibility of spillovers of investor sentiment between those asset classes."[106] Other, more direct channels for contagion might include regulated financial institutions investing in, or even offering their own, DeFi products, and traditional financial institutions are becoming increasingly interested in investing in, and offering, crypto. A consortium of regulated banks have recently proposed issuing a stablecoin to compete with Tether and USDC.[107] Aave has partnered with Fireblocks to "whitelist" crypto wallets that have satisfied "know your client" requirements so that regulated financial institutions feel comfortable transacting with those wallets (when asked whether their technology goes against the whole principle of decentralized technology, Fireblocks CEO responded "[t]he simple answer is that it does").[108] The largest Wall Street banks are already providing crypto custody services and dealing in crypto-related derivatives, and in March of 2022, Goldman Sachs "became the first major U.S. bank to carry out an over-the-counter crypto trade."[109] As one reporter put it, Wall Street's "recent conversion [to crypto] has less to do with any epiphany about crypto's utility than it does a simple reality: They don't want to lose the business to rivals."[110]

If the integration of banking and DeFi continues, banks will be vulnerable to deleveraging in the DeFi ecosystem. So what might

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106. Tobias Adrian, Tara Iyer & Mahvash S. Qureshi, *Crypto Prices Move More in Sync with Stocks, Posing New Risks*, IMF Blog (Jan. 11, 2022), https://blogs.imf.org/2022/01/11/crypto-prices-move-more-in-sync-with-stocks-posing-new-risks/ [https://perma.cc/3CNS-99R2].

107. Jamie Crawley, *US Banks Form Group to Offer USDF Stablecoin*, CoinDesk (Jan. 13, 2022, 11:29 AM), https://coindesk.com/business/2022/01/12/us-banks-form-group-to-offer-usdf-stablecoin [https://perma.cc/CD3Y-93DW].

108. Ian Allison, *Fireblocks 'Whitelists' 30 Trading Firms for Aave's Institutional DeFi Debut*, CoinDesk (Jan. 5, 2022, 2:15 PM), https://coindesk.com/business/2022/01/05/fireblocks-whitelists-30-trading-firms-for-aaves-institutional-defi-debut/ [https://perma.cc/V6DY-2M9F].

109. Hannah Lang, *Factbox: How U.S. Banks Are Dipping Their Toes in the Crypto Water*, Reuters, Apr. 5, 2022, 10:18 AM, https://reuters.com/business/finance/how-us-banks-are-dipping-their-toes-crypto-water-2022-04-05/ [https://perma.cc/VH9A-VCTU].

110. Justin Baer, *Wall Street Reluctantly Embraces Crypto*, Wall St. J. (May 1, 2022, 5:33 AM), https://wsj.com/articles/wall-street-reluctantly-embraces-crypto-11651347654 [https://perma.cc/Q7CX-2N4X].

spur such a deleveraging? There are many possibilities. There could be a problem with an intermediary on which DeFi relies (these intermediaries are discussed in detail in Part IV). DeFi is also rife with scams, and "[f]orks, hacks, rug pulls, vampire attacks, and flash loans all have the potential to surprise, erode trust, and spark fear."[111] While these types of events have not yet destroyed confidence in DeFi, most current users are likely to be "hardcore believers in the technology and thus are both understanding of the risks and willing to forgive them."[112] That is unlikely to remain the case if DeFi is more widely adopted, in which case these kinds of events could destroy confidence in the value of DeFi assets more generally. Or deleveraging might start simply as a correction to a crypto bubble if the "irrational exuberance" starts to wear off.[113]

### 2. Rigidity

When critical parts of the financial system become overleveraged, flexibility may be needed during the bust cycle to release the largest entities from obligations to respond to margin calls or repay loans—otherwise the failures of intermediaries and fire sales will have ripple effects that can drag down the whole system.[114] Unfortunately, smart contracts may prove too rigid to provide the flexibility needed to avoid such an outcome. Smart contracts are designed to execute their preprogrammed instructions instantly, without waiting for input from the parties, a regulator, or a court.[115] In good times, this makes things more efficient, but smart contracts will execute just as quickly in bad situations, even if everyone would be better off if they did not. That hackers can exploit flaws in smart contracts to steal tokens and coins has already become evident,[116]

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111. Hsu, *supra* note 72, at 6.

112. *Id.* at 7.

113. On the psychology of bubbles, see ROBERT J. SHILLER, IRRATIONAL EXUBERANCE 136-43 (2000).

114. On the need for legal elasticity to ensure the survival of the financial system, see Katharina Pistor, *A Legal Theory of Finance*, 41 J. COMPAR. ECON. 315, 320 (2013).

115. FIN. STABILITY BD., *supra* note 90, at 16.

116. *See* Ephrat Livni, *For Rules in Technology, the Challenge Is to Balance Code and Law*, N.Y. TIMES (Nov. 23, 2021), https://www.nytimes.com/2021/11/23/business/dealbook/crypto currency-code-law-technology.html [https://perma.cc/79AC-6N6F] (discussing the hack of the Poly Network).

but less attention has been paid to the fact that in the future, there may be situations where the stability of the financial system would benefit if smart contracts simply did not execute.

For example, DeFi loans are often structured so that they are automatically liquidated if insufficient collateral is posted.[117] To meet margin calls for more collateral and avoid liquidation, borrowers might have to sell off other assets, which could drive down prices in other asset markets.[118] There might therefore be situations in which it would be better to suspend loan liquidations to avoid these kinds of spillovers, but the execution of a Dapp can only be paused, changed, or undone with the consent of whoever controls it. Control of the Dapp might lie with the creators of the Dapp,[119] or those creators may have ceded control to a DAO (a blockchain-based entity, often controlled by the holders of governance tokens).[120] Locating the creators, let alone coordinating a dispersed group of governance token-holders, would take time, and it seems highly unlikely that this could be achieved *before* the smart contract executes its programming. That leaves us with the possibility of undoing the transaction once it has occurred, but this would require making changes to the distributed ledger on which the Dapp operates, and when the ledger in question is decentralized and permissionless (such as the Ethereum ledger), there is no single intermediary who could coordinate the process. Instead, any reversal of a transaction would require the consensus of all the nodes in the ledger, which would take time.[121] Any intervention may come too late to prevent runs, fire sales, and other destabilizing harms.

While there are steps that can be taken to better equip a smart contract to adapt to unexpected events (for example, a smart contract can be programmed to consult another smart contract or an

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117. Aramonte et al., *supra* note 96, at 27.

118. FIN. STABILITY BD., *supra* note 90, at 4.

119. *Id.* at 17 ("Typically, there also exists a founding team that holds 'admin keys', who can make unilateral decisions and exercise control of the overall functioning of the internal governance at least during the initial phases of development.").

120. *See* Letter from Andreessen Horowitz to U.S. Senate Comm. on Banking, Hous., & Urb. Affs. (Sept. 27, 2021), https://a16z.com/wp-content/uploads/2021/10/Andreessen-Horo witz-Senate-Banking-Proposals.pdf [https://perma.cc/3EB3-V3Z7].

121. *See, e.g.*, PRIMAVERA DE FILIPPI & AARON WRIGHT, BLOCKCHAIN AND THE LAW: THE RULE OF CODE 188 (2018) (ebook) (after a DAO was hacked in 2016, it took over a month for the nodes of the Ethereum distributed ledger to coordinate their response).

external data source known as an "oracle," which is controlled by a trusted party), taking these kinds of steps will increase transaction costs. The Ethereum ledger charges a "gas cost" for any computing done, and consulting an extra oracle would increase the gas cost necessary to execute a smart contract.[122] Participants in the DeFi markets will probably be willing to bear these charges up to a certain point, but eventually, these ongoing operational costs will discourage measures that cater to very unusual events. Unfortunately, when we are talking about financial stability, low-probability high-consequence tail events are the ones with which we are most concerned. These are the types of events that turned MBSs into "suicide pacts"[123]—smart contracts may prove to be even more dangerous in the midst of such events if the speed of their self-execution leaves no time for emergency intervention. It is also important to note that gas costs on the Ethereum ledger increase when there are a lot of transactions to be processed,[124] and we have no idea what the impact of increasing gas costs will be on smart contract operation if there are unprecedented numbers of transactions during such a tail event.

### 3. Runs

Because MMFs were created to be a functional equivalent of deposit accounts, that their vulnerabilities can manifest as analogues to traditional bank runs is not surprising. A number of scholars have observed that stablecoins, which make up the building blocks of DeFi arrangements, may be similarly susceptible to runs.[125] Uncertainty around the redemption mechanics for these stablecoins complicates this analysis, though. There are different kinds of stablecoins, with some offered by a centralized issuer (such

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122. HILARY J. ALLEN, DRIVERLESS FINANCE: FINTECH'S IMPACT ON FINANCIAL STABILITY 99 (2022) (ebook).

123. Gelpern & Levitin, *supra* note 44, at 1079.

124. Anthony Clarke, *Vitalik Buterin Says ETH Layer-2 Fees Need to Reach $0.05 to Be Acceptable,* CRYPTOSLATE (May 5, 2022, 12:10 PM), https://cryptoslate.com/vitalik-buterin-says-eth-layer-2-fees-need-to-reach-0-05-to-be-acceptable/ [https://perma.cc/68NT-HHXC] ("For a long time, the Ethereum network has occasionally suffered from astronomically high gas prices and limited scalability whenever the network experiences a high volume of transactions.").

125. *See, e.g.*, Gorton & Zhang, *supra* note 55, at 1.

as Tether or USDC), and others, such as DAI, being more decentralized.[126] There are also algorithmic stablecoins (such as the ill-fated TerraUSD) that rely on arbitrageurs rather than a reserve to maintain their one-dollar peg—although a reserve of cryptoassets was eventually established to act as an insurance or guarantee fund for TerraUSD.[127] In each case, the mechanisms for stablecoin holders to redeem their stablecoins and benefit from the underlying reserve are not entirely clear.[128] While investors in MMFs have contractual rights to demand redemption of their shares from the fund itself, the expectation seems to be that rank and file stablecoin holders will seek to redeem those stablecoins on crypto exchanges rather than directly from the stablecoin issuer.

For example, Tether does not allow U.S.-resident holders of its stablecoins to redeem them directly from Tether, so those holders are forced to go to a crypto exchange (such as Coinbase) if they want to convert their Tether to fiat currency.[129] Tether states on its website that other "verified customers" can request redemptions, but this can be suspended in an emergency, and Tether reserves the right to redeem Tether "in-kind" for noncash assets from the reserve.[130] DAI is more decentralized and is maintained by a DAO

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126. Alyssa Hertig, *What Is a Stablecoin?*, Coindesk (Jan. 19, 2023, 2:03 PM), https://coindesk.com/learn/what-is-a-stablecoin/ [https://perma.cc/PHH2-SAW3].

127. Joe Light, *Bitcoin Faces a New Threat: Algorithmic Stablecoins*, Barron's (Apr. 21, 2022, 11:27 AM), https://www.barrons.com/articles/bitcoin-stablecoins-51650554572 [https://perma.cc/N47L-VR97].

128. *See* Oleksii Konashevych, *Do You Have the Right to Redeem Your Stablecoin?*, Cointelegraph (May 21, 2022), https://cointelegraph.com/news/do-you-have-the-right-to-redeem-your-stablecoin [https://perma.cc/5H4Z-7EKV].

129. *Stablecoins: How Do They Work, How Are They Used, and What Are Their Risks?*: *Hearing Before the H. Comm. on Banking, Hous., & Urb. Affs.*, 117th Cong. 3 (2021) (statement of Alexis Goldstein, Director of Financial Policy, Open Markets Institute).

130.

> In order to cause Tether Tokens to be issued or redeemed directly by Tether, you must be a verified customer of Tether. No exceptions will be made to this provision. The right to have Tether Tokens redeemed or issued is a contractual right personal to you. Tether reserves the right to delay the redemption or withdrawal of Tether Tokens if such delay is necessitated by the illiquidity or unavailability or loss of any Reserves held by Tether to back the Tether Tokens, and Tether reserves the right to redeem Tether Tokens by in-kind redemptions of securities and other assets held in the Reserves. Tether makes no representations or warranties about whether Tether Tokens that may be traded on the Site may be traded on the Site at any point in the future, if at all.

*Legal: 1-Terms of Service*, Tether, https://tether.to/en/legal/ [https://perma.cc/ F57W-8FP5]

(MakerDAO) that relies on smart contracts buying and selling a reserve of cryptoassets, including a significant amount of the centralized stablecoin USDC, to stabilize DAI's price.[131] The ultimate decision to liquidate DAI's reserve (an "Emergency Shutdown") is triggered by the MakerDAO governance process, and "the value of Collateral that Dai holders can redeem may vary ... [and] [i]t is, therefore, possible that Dai holders will receive less or more than 1 USD worth of Collateral for 1 Dai."[132] MakerDAO also expects exchanges to play a role during an emergency shutdown, stating: "In the event of emergency shutdown we envision that it will still be possible to sell Dai on the open market."[133] Similar to most algorithmic stablecoins, TerraUSD started out without a reserve, but ultimately a Singapore-based nonprofit called the "Luna Foundation Guard" established a reserve of cryptoassets, including bitcoins, that were intended to be available in "emergencies but not otherwise."[134] Just as with the other stablecoins, there was not much clarity about when liquidation of the reserve could be forced.[135] In hindsight, it appears that the TerraUSD reserve may have been used to compensate large players, while small investors were left holding worthless TerraUSD.[136] If other stablecoins have preferential arrangements with crypto whales and exchanges, then those large players may be able to force liquidation of reserves, and then experience with MMF runs is likely to be instructive.

Runs happen when people lose confidence that a particular asset (like a share in an MMF) will continue to retain its value and

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(last updated Sept. 2, 2022).

131. Lyle Daly, *5 Things to Know Before You Buy DAI*, THE ASCENT (Sept. 1, 2021), https://www.fool.com/the-ascent/cryptocurrency/articles/5-things-to-know-before-you-buy-dai/ [https://perma.cc/9TBU-JLCS].

132. *Emergency Shutdown*, MAKERDAO, https://perma.cc/J4RW-6D5F.

133. *Dai and Collateral Redemption During Emergency Shutdown*, MAKERDAO, https://docs.makerdao.com/clis/dai-and-collateral-redemption-during-emergency-shutdown [https://perma.cc/XRL6-LN3C].

134. Krisztian Sandor, *Bailout Fund, Backstop or Bouncy Ball? Here's How LFG's Bitcoin 'Reserve' Might Work*, COINDESK (Apr. 22, 2022, 3:46 PM), https://www.coindesk.com/markets/2022/04/22/bailout-fund-backstop-or-bouncy-ball-heres-how-lfgs-bitcoin-reserve-might-work/ [https://perma.cc/L7Z4-93UC].

135. *Id.*

136. Paul Amery, *Did Terra Operators Bail Out Crypto Whales?*, NEW MONEY REV. (May 16, 2022), https://newmoneyreview.com/index.php/2022/05/16/terra-operators-bailed-out-crypto-whales/ [https://perma.cc/6VAW-M8XR].

function as expected.[137] Right now, it appears that the vast majority of stablecoins are not being used for payments for real-world goods and services.[138] Instead, the recent exponential growth in stablecoin usage has been driven by people who have purchased stablecoins to speculate in the crypto markets.[139] U.S. Securities and Exchange Commission (SEC) Chair Gary Gensler has described them as "poker chips" that are the price of admission to the "casino."[140] If something were to shake confidence in stablecoins' acceptance in the crypto ecosystem (this something could range from a hack, to a problem with the reserve of assets backing a stablecoin, to a problem with the smart contracts managing the value of a decentralized stablecoin, to a loss of confidence in the stablecoin issuer), we could then expect holders to start redeeming their stablecoins when they could. This would force stablecoin issuers to start liquidating the reserve of assets backing the stablecoin, depressing the market value of those assets. Whether this kind of run would pose a significant threat to the broader financial system and economy depends on the contents of stablecoins' reserves.

The recent President's Working Group *Report on Stablecoins* observed that

> [b]ased on information available, stablecoins differ in the riskiness of their reserve assets, with some stablecoin arrangements reportedly holding virtually all reserve assets in deposits at insured depository institutions or in U.S. Treasury bills, and others reportedly holding riskier reserve assets, including commercial paper, corporate and municipal bonds, and other digital assets.[141]

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137. Diamond & Dybvig, *supra* note 62, at 403.

138. *See* PRESIDENT'S WORKING GRP. ON FIN. MKTS. ET AL., *supra* note 75, at 8.

139. *Id.* ("At the time of publication of this report, stablecoins are predominantly used in the United States to facilitate trading, lending, and borrowing of other digital assets.").

140. Cheyenne Ligon, *SEC's Gensler Calls Stablecoins 'Poker Chips' at the Wild West Crypto Casino*, COINDESK (Sept. 22, 2021, 5:35 PM), https://www.coindesk.com/policy/2021/09/21/secs-gensler-calls-stablecoins-poker-chips-at-the-wild-west-crypto-casino/ [https://perma.cc/4B4G-RE48].

141. PRESIDENT'S WORKING GRP. ON FIN. MKTS. ET AL., *supra* note 75, at 4 (footnote omitted).

It is possible that mass withdrawals by stablecoin issuers from insured deposit accounts could trigger runs on the institutions, like banks, that provide those deposit accounts. I will argue in Part III.B that banks should therefore be prohibited from holding stablecoin reserves on deposit.

With regard to other types of assets in stablecoin reserves, the systemic impact of fire sales will depend on the size and contents of the relevant stablecoin reserve. For example, DAI and TerraUSD hold/held their reserves in cryptoassets, so the impact of a sell-off on the prices of Bitcoin and Ether could be significant, but the impact on real-world assets might be limited (although DAI invests heavily in USDC, so a run on DAI might trigger a run on USDC, which does invest its reserve in real-world assets).[142] Interestingly, the reserves of Tether, which currently has by far the largest market value of any stablecoin, may not actually be as big as expected. As one recent report put it:

> Exactly how Tether is backed, or if it's truly backed at all, has always been a mystery. For years a persistent group of critics has argued that, despite the company's assurances, Tether Holdings doesn't have enough assets to maintain the 1-to-1 exchange rate, meaning its coin is essentially a fraud.[143]

If true, this would be highly problematic for holders of Tether, but it would also limit the systemic impact of any fire sale of Tether's reserve assets because there would not be so many of them. However, if centralized stablecoin issuers start to become an important source of capital for the real economy as MMFs did before them, then runs on stablecoins will be a potential source of systemic risk.

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142. *See Dai Generated by Collateral*, DAI STATS, https://daistats.com/#/collateral [https://perma.cc/7289-CXR3].

143. Zeke Faux, *Anyone Seen Tether's Billons?*, BLOOMBERG (Oct. 7, 2021, 2:25 PM), https://www.bloomberg.com/news/features/2021-10-07/crypto-mystery-where-s-the-69-billion-backing-the-stablecoin-tether [https://perma.cc/4HNS-ZUP2].

III. How to Respond

The previous Part gave an overview of DeFi's inherent fragilities and what they might mean for the stability of our broader financial system in the future. However, in deciding how regulation should respond to DeFi, it is important to take a step back from what DeFi aspires to be and consider what DeFi actually is right now. A recent report from the Bank for International Settlements described DeFi as largely self-referential and concluded that "[g]iven this self-contained nature, the potential for DeFi-driven disruptions in the broader financial system and the real economy seems limited for now."[144] DeFi is not yet an entrenched part of our financial system, and regulators still have the opportunity to take a precautionary approach that will have a real impact on how DeFi develops. Regulators may be able to ensure that DeFi never reaches a scale at which it could threaten the stability of our broader financial system—and if steps are taken from the outset to limit the growth of DeFi and its integration with the traditional financial system regulation, then regulators will not need to respond directly to the destabilizing problems discussed in Part II. If the DeFi ecosystem does grow and become integral to broader economic functioning, then regulators *will* need to respond to those destabilizing problems with bank-like regulation; however, experience with regulating Shadow Banking 1.0 suggests that those kinds of reforms would be an incomplete solution. The more effective approach is to deploy regulation to separate DeFi from the established financial system and limit its growth more generally: subjecting DeFi to bank-like regulation too early runs the risk of legitimizing and turbocharging the growth of DeFi in a way that would not be possible without regulatory imprimatur, essentially making Shadow Banking 2.0 a self-fulfilling prophecy.[145]

The growth of Shadow Banking 1.0 was not inevitable either. A series of policy choices allowed it to develop. This is illustrated most

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144. Aramonte et al., *supra* note 96, at 21.

145. *See Stablecoins: How Do They Work, How Are They Used, and What Are Their Costs?: Hearing Before the S. Comm. on Banking, Hous., & Urb. Affs.*, 117th Cong. 1 (2021) (statement of Hilary J. Allen, Law Professor, American University Washington College of Law).

obviously by Congress's passage of the Commodity Futures Modernization Act in 2000, which prevented the SEC and CFTC from regulating swaps[146]—and which Congressman Bliley justified as necessary in part because "[d]erivative instruments ... reflect the unique strength and innovation of American capital markets" and because "U.S. markets and market professionals have been global leaders in derivatives technology and development."[147] We hear the same rhetoric with regard to stablecoins and other DeFi projects,[148] and this kind of rhetoric could encourage regulators to accommodate the growth of DeFi. As I have argued previously, though, this is "not a neutral approach. Instead, it stacks the deck in favor of the innovators [and the venture capital firms who fund them] who get to profit by generating risks that, if they come to fruition, will be borne primarily by the rest of society."[149] Regulators should instead pursue a precautionary approach to DeFi, erring on the side of caution to protect society from the risks it would otherwise generate, which include not only the financial stability risks discussed in Part II.B but also serious consumer protection concerns, environmental costs, and national security risks.[150]

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146. S. Rep. No. 106-390, at 13 (2000).

147. Thomas Bliley, Commodity Futures Modernization Act, H.R. Rep. No. 106-711, pt. 3, at 45-46 (2000).

148. For example, Senator Toomey recently said that stablecoin legislation should be "designed to promote innovation in the rapidly evolving global digital economy" and "seek to maintain the international competitiveness of the United States." *Toomey Outlines Stablecoin Principles to Guide Future Legislation*, U.S. Senate Comm. on Banking, Hous., & Urb. Affs. (Dec. 14, 2021), https://www.banking.senate.gov/newsroom/minority/toomey-outlines-stable coin-principles-to-guide-future-legislation [https://perma.cc/KQ8D-7HPH].

149. Allen, *supra* note 122, at 41.

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> Bitcoin is notorious for consuming as much electricity as the Netherlands, but there are around 10,000 other cryptocurrencies, most using similar infrastructure and thus also in aggregate consuming unsustainable amounts of electricity. Bitcoin alone generates as much e-waste as the Netherlands, cryptocurrencies suffer an epidemic of pump-and-dump schemes and wash trading, they enable a $5.2B/year ransomware industry, they have disrupted supply chains for GPUs, hard disks, SSDs and other chips, they have made it impossible for web services to offer free tiers, and they are responsible for a massive crime wave including fraud, theft, tax evasion, funding of rogue states such as North Korea, drug smuggling, and even as documented by Jameson Lopp's list of physical attacks, armed robbery, kidnapping, torture and murder.

David Rosenthal, *EE380 Talk*, DSHR's Blog (Feb. 9, 2022, 5:00 PM), https://blog.dshr.org/2022/02/ee380-talk.html [https://perma.cc/XDS9-LTU3].

Given these risks, regulators would be more than justified in taking steps to limit the growth of DeFi and preventing its integration with the established financial system, unless there were something truly transformative about DeFi innovation. As this Part will explore, though, many of the touted benefits of DeFi are illusory, so lawmakers and regulators should have few qualms about using regulation to limit DeFi innovation. The latter half of this Part will provide some brief discussion of the forms that this kind of DeFi regulation could take.

## A. The Cost-Benefit Calculus

### 1. Decentralization

Together with the broader vision of a decentralized "Web3," DeFi is marketed in aspirational terms; its value is consistently described as lying in its potential.[151] However, there are many reasons to doubt that potential. Most obviously, crypto technology has existed for well over a decade and has yet to find an application for much other than trading other crypto.[152] Putting that aside, it is important to recognize that DeFi's primary aspiration is to provide existing financial products and services in a decentralized way, so any benefits associated with DeFi innovation are largely dependent on their decentralization. However, "decentralization" is a largely unrealistic goal.[153]

Recent research from the Bank for International Settlements has observed that "[t]here is a 'decentralisation illusion' in DeFi due to the inescapable need for centralised governance and the tendency

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151.
> [W]eb3 is a somewhat ambiguous term, which makes it difficult to rigorously evaluate what the ambitions for web3 should be, but the general thesis seems to be that web1 was decentralized, web2 centralized everything into platforms, and that web3 will decentralize everything again. web3 should give us the richness of web2, but decentralized.

Moxie Marlinspike, *My First Impressions of Web3*, MOXIE (Jan. 7, 2022), https://moxie.org/2022/01/07/web3-first-impressions.html [https://perma.cc/5XU5-U2YE].

152. Molly White, *It's Not Still the Early Days*, MOLLY WHITE (Jan. 14, 2022), https://blog.mollywhite.net/its-not-still-the-early-days/ [https://perma.cc/74ET-RJKJ].

153. The likely endgame is "a costly, inefficient database, which is not in fact decentralized." Schuster, *supra* note 14, at 992.

of blockchain consensus mechanisms to concentrate power."[154] No less than internet pioneer Tim O'Reilly has noted that "history teaches us that there will always be new avenues for power to become centralized" and that "[b]lockchain turned out to be the most rapid recentralization of a decentralized technology that I've seen in my lifetime."[155] This "inescapable need for centralized governance" arises because scaling up is very challenging for decentralized services[156]—as is amply demonstrated by the significant increases in gas fees on the Ethereum ledger when it is busy.[157] It also derives in part from issues we have already discussed in the context of smart contracts: because addressing all possible eventualities in advance is impossible, an intermediary is often needed to resolve unanticipated situations (for example, reversing erroneous or problematic transactions).[158] And perhaps most obviously, where there are opportunities to profit from streamlining unwieldy decentralized services for users (especially when venture capitalists are standing ready to fund such projects), the evolution of centralized intermediaries seems inevitable.[159] Ultimately, the need for intermediaries is an economic issue, not a technological one, and therefore is not something that technology can fix: as tech veteran David Rosenthal puts it, "economics forces successful permissionless blockchains to centralize."[160]

We often think of computerized activities as dehumanized (and as having greater legitimacy as a result of their dehumanization),[161] so people overlooking the fact that distributed ledger technology relies on *people* to operate is unsurprising. But every level of

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154. Aramonte et al., *supra* note 96, at 22.

155. Dan Patterson, *Internet Guru Tim O'Reilly on Web3: "Get Ready for the Crash,"* CBS News (Feb. 10, 2022, 11:09 AM), https://www.cbsnews.com/news/web3-cryptocurrency-nft-tim-oreilly/ [https://perma.cc/CH4W-LJAK].

156. In its discussion of drawbacks to Dapps, Ethereum notes that "scaling is really hard" and that "[w]hen one dapp uses too many computational resources, the entire network gets backed up." Ethereum, *supra* note 94. For more on scaling challenges, see *infra* notes 183-85 and accompanying text.

157. *See* Clarke, *supra* note 124.

158. Aramonte et al., *supra* note 96, at 27.

159. Rosenthal, *supra* note 150.

160. *Id.*

161. This tendency is known as "automation bias." *See* Linda J. Skitka, Kathleen Mosier & Mark D. Burdick, *Accountability and Automation Bias*, 52 Int'l J. Hum.-Comput. Stud. 701, 702 (2000).

infrastructure involved in providing DeFi products and services does indeed depend on decisions made by human beings, so recognizing that these human beings have the same incentives to concentrate wealth and power that people have always had is important. For example, as we have already established, the actual Dapps offered to consumers might be controlled by their creators, or the creators may have ceded control to a DAO that is controlled by the (human) holders of governance tokens.[162] These DAOs are not always so decentralized, though: one recent research paper found that "DeFi's voting rights are highly concentrated, and the exercise of these rights is very low" and that "*minority rule* is the probable consequence of tradable voting rights plus the lack of applicable anti-concentration or anti-monopoly laws."[163] Many of the investors driving the growth of DeFi are institutional players, often engaging in transactions worth $10 million or more of cryptocurrency,[164] and the holder of a single governance token in a DAO administering a DeFi Dapp is unlikely to have any real voice in how the DAO or the Dapp operates[165] (especially if the original developer holds onto lots of governance tokens or has governance tokens with special rights, just as the founders of corporations like Snap and Google own shares that allow them to retain control of their now publicly traded corporations).[166] The promises that the industry makes about decentralization—that everyday people will have "the opportunity to read, write and now own the very internet services we depend on"[167]—seem hollow. Not only can concentrated ownership of DAO

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162. *See supra* note 121 and accompanying text.

163. Tom Barbereau, Reilly Smethurst, Orestis Papageorgiou, Johannes Sedlmeir & Gilbert Frigden, *Decentralised Finance's Unregulated Governance: Minority Rule in the Digital Wild West* (Feb. 8, 2022) (unpublished manuscript), https://ssrn.com/abstract=4001891 [https://perma.cc/EW7V-GZQP].

164. *DeFi Whales Turned Central, Northern & Western Europe into the World's Biggest Cryptocurrency Economy*, CHAINALYSIS (Oct. 14, 2021), https://blog.chainalysis.com/reports/central-northern-western-europe-cryptocurrency-geography-report-2021-preview/ [https://perma.cc/4PQP-3JL2].

165. FRANCUS ET AL., *supra* note 13 ("Much like the shareholders of a large corporation, most platforms' governance tends to be at the behest of a few active investors with large governance token stakes.").

166. Amy Deen Westbrook & David A. Westbrook, *SnapChat's Gift: Equity Culture in High-Tech Firms*, 46 FLA. ST. U. L. REV. 861, 871-72 (2019).

167. Dante Disparte, *10 Stablecoin Myths: Internet Wildcat Banking or Always-On Dollars*, CIRCLE (Dec. 2021), https://www.circle.com/en/10-stablecoin-myths-busted [https://perma.cc/

governance tokens subvert governance, it can also allow value to be stolen from smaller investors. For example, one bad actor was able to exploit Beanstalk (another algorithmic stablecoin) by using flash loans to borrow enough governance tokens to create a fake improvement proposal that funneled out almost $80 million worth of Ether.[168]

The Dapps operate on top of another layer of infrastructure: a distributed ledger, like the Ethereum blockchain, which is also dependent on many humans for its functioning (Professor James Grimmelman and Jason Windawi point out an important and often unappreciated layer of infrastructure needed to support the distributed ledgers: the internet itself.[169] The actions of ISPs could, therefore, impact the operation of distributed ledgers, although we tend to take the neutral functioning of ISPs for granted[170]). Most decisions relating to the operation of a distributed ledger are made by the core developers of the computer code governing that ledger and by the people with the power to validate transactions on that ledger. While the underlying code of ledgers like the Ethereum and Bitcoin blockchains is open-source, that does not mean that there is no hierarchy in terms of the computer programmers able to modify that code. Instead, so-called "core developers" "function as the leaders and decision makers in relation to the code."[171] Validators are also important actors because they determine the definitive version of the ledger, which is the definitive record of who owns the cryptoassets associated with that ledger.[172]

Right now, the two most common consensus mechanisms used to validate transactions on distributed ledgers are proof-of-work and

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168. Michael McSweeney, *Ethereum-Based Stablecoin Protocol Beanstalk Loses About $182 Million to Exploit*, THE BLOCK (Apr. 17, 2022, 9:38 AM), https://www.theblockcrypto.co/link ed/142272/ethereum-based-stablecoin-protocol-beanstalk-loses-more-than-80-million-to-exploit [https://perma.cc/Y3FQ-PB3W].

169. James Grimmelman & A. Jason Windawi, *Blockchains as Infrastructure and Semi-commons*, 64 WM. & MARY L. REV. 1097, 1102 (2023).

170. DE FILIPPI & WRIGHT, *supra* note 121, at 177-78.

171. Angela Walch, *In Code(rs) We Trust: Software Developers as Fiduciaries in Public Blockchains, in* REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES 61 (Philipp Hacker et al. eds., 2019).

172. DE FILIPPI & WRIGHT, *supra* note 121, at 26.

proof-of-stake.[173] Proof-of-work relies on people known as "miners" attempting through trial and error to guess the answer to a mathematical problem that relates to a block of transactions.[174] Once a miner has an answer, they can submit it to all the nodes that host the ledger, and it is very easy for those nodes to verify if the miner's answer works—if it all checks out, those nodes, by consensus, will adopt the block of transactions that the miner has proposed, adding it to the distributed ledger and thereby consummating those transactions.[175] Professor Angela Walch has highlighted, however, that "[m]iners select, order, and propose transactions to be added to the blockchain record," meaning that "[t]ransactions do not appear on the blockchain record unless a miner chooses to put them on" and that "the exploitation of the transaction ordering power has become a major issue" because miners (or more realistically, mining pools—in recent years, the majority of Bitcoin mining power has consistently been concentrated in a few mining pools[176]) can profit from selling off earlier processing slots.[177] Mining pools in a proof-of-work system are not only made up of people; they are made up of people with conflicts of interest.

Proof-of-work is extremely energy intensive because significant amounts of electricity are needed to generate enough computer power to make the repeated guesses. As a point of reference, some estimates suggest that Bitcoin mining uses the same amount of electricity as the entire country of the Netherlands.[178] As a result, the Ethereum blockchain has announced plans to shift away from proof-of-work and adopt a proof-of-stake consensus mechanism (although the adoption has been pushed back multiple times, and it

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173. Luke Conway, *Proof-of-Work vs. Proof-of-Stake: Which Is Better?*, BLOCKWORKS (Feb. 18, 2022, 2:52 PM), https://blockworks.co/proof-of-work-vs-proof-of-stake-whats-the-difference/ [https://perma.cc/9A2Z-3P6F].

174. DE FILIPPI & WRIGHT, *supra* note 121, at 23-24.

175. *Id.*

176. Rosenthal, *supra* note 150 ("It only took six years for Bitcoin to fail Nakamto's [sic] goal of decentralization, with one mining pool controlling more than half the mining power. In the seven years since no more than five pools have always controlled a majority of the mining power.").

177. *See Overview of Cryptocurrencies: Cryptocurrencies: What Are They Good For?: Hearing Before the S. Comm. on Banking, Hous., & Urb. Affs.*, 117th Cong. 1 (2021) (statement of Angela Walch, Law Professor, St. Mary's University School of Law).

178. Rosenthal, *supra* note 150.

is possible that it will never eventuate).[179] With proof-of-stake, existing holders of the relevant cryptoasset can stake their cryptoassets as collateral in order to become part of the pool of potential validators.[180] While proof-of-stake may help address environmental concerns, it is not expected to address transaction validators' conflicts of interest.[181] In fact, some have argued that proof-of-stake will encourage concentration of ownership and collusion, making conflicts of interest even worse.[182]

Ultimately, the computer code is not running the show on its own: institutions and individuals govern DeFi, and we have already seen many instances of these institutions and individuals exercising their power. For example, when $60 million of Ether were stolen from an early DAO (known as "The DAO") in 2016, core developers and some miners banded together to "hard fork" the Ethereum distributed ledger, which "effectively rolled back the Ethereum network's history to before The DAO attack and reallocated The DAO's ether to a different smart contract so that investors could withdraw their funds."[183] More recently, one of the founders of the DeFi protocol Wonderland used Twitter to announce that the "experiment is coming to an end" (after it had been made public that his cofounder was a convicted felon), notwithstanding that the DAO administering the protocol had voted to continue Wonderland rather than wrap it up.[184] And when the value of the TerraUSD algorithmic stablecoin

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179. Owen Fernau, *Ethereum's Merge Delayed Despite Successful 'Shadow Fork' Test*, THE DEFIANT (Apr. 13, 2022), https://thedefiant.io/eth-merge-delayed/ [https://perma.cc/XZR2-87DP].

180. *See* Conway, *supra* note 173.

181. "[N]or [would] moving to proof-of-stake ... solve the MEV problem on Ethereum." Michelle Lim, *Could Ethereum's Upgrade Affect Miners' Manipulations for Extra Profits?*, FORKAST (Aug. 5, 2021, 1:14 PM), https://forkast.news/how-will-ethereums-upgrade-affect-miners-mev/ [https://perma.cc/3U9D-C4JC].

182. Aramonte et al., *supra* note 96, at 28.

183. CRYPTOPEDIA, *What Was The DAO?*, GEMINI (Mar. 16, 2022), https://www.gemini.com/cryptopedia/the-dao-hack-makerdao#section-what-is-a-dao [https://perma.cc/4LR4-UFF5].

184. Daniele Sestagalli (@danielesesta), TWITTER (Jan. 30, 2022, 11:33 AM), https://twitter.com/danielesesta/status/1487826195978899457 [https://perma.cc/YBX8-QWAA]; *see also* Emily Nicolle, *Wonderland Community Votes to Keep DeFi Project Going After Scandal*, BLOOMBERG (Jan. 31, 2022, 6:31 PM), https://www.bloomberg.com/news/articles/2022-01-31/wonderland-community-to-keep-defi-project-going-after-scandal [https://perma.cc/3775-RMGY].

lost its one-dollar peg in May 2022, it received a rescue package of crypto loans from a nonprofit association known as the Luna Foundation Guard, which TerraUSD creator, Do Kwon established.[185] TerraUSD was unable to regain its one-dollar peg and subsequently became largely worthless; however, some have suggested that during the turmoil, the Luna Foundation Guard allowed some large players "to exit their Terra stablecoin positions ... at close to par value, while retail holders of Terra and Luna have lost nearly all their money."[186]

In short, the DeFi ecosystem is centralized because of concentrations of wealth and power that may be even more stark than what we see in the traditional financial system.[187] In addition, many undeniably centralized intermediaries are also critical to the DeFi ecosystem. This is not really surprising: decentralized services do not scale well,[188] and many DeFi intermediaries exist to compensate for the difficulties associated with decentralized technology. For example, encryption pioneer Moxie Marlinspike has observed that DeFi Dapps rely on APIs that allow users' devices to access the distributed ledger on which transactions take place because "[b]lockchains are designed to be a network of peers, but not designed such that it's really possible for your mobile device or your browser to be one of those peers."[189] Marlinspike found that almost all DeFi users ultimately rely on client APIs provided by either Infura or Alchemy for this purpose[190]—Infura and Alchemy are therefore critical intermediaries for the DeFi ecosystem, as are the wallet providers who provide users with access to their digital

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185. Frances Yue, *Why Is UST, LUNA Crashing? Collapse of a Once $40 Billion Cryptocurrency, Explained*, MARKETWATCH (May 14, 2022, 7:55 AM), https://www.marketwatch.com/story/what-is-an-algorithmic-stablecoin-why-is-terra-in-the-news-will-it-collapse-and-could-it-endanger-the-whole-crypto-ecosystem-11652227450 [https://perma.cc/AJ6H-MKZC].

186. Amery, *supra* note 136.

187. Rosenthal, *supra* note 150 ("Gini coefficients of cryptocurrencies are extremely high."). For more examples of founders and whales exercising their power in purportedly decentralized applications, see Scott Chipolina, *Cryptocurrency Fallout Delivers Sharp Kick to Decentralised Finance Dreams*, FIN. TIMES (June 22, 2022), https://www.ft.com/content/3d1a2409-4030-4a26-be27-dbcb25f6fd75 [https://perma.cc/EE6X-6ZWV].

188. Marlinspike, *supra* note 151 ("If something is truly decentralized, it becomes very difficult to change, and often remains stuck in time.").

189. *Id.*

190. *Id.*

assets[191] (again, these are needed because most users cannot access assets on a distributed ledger directly).[192] Centralized exchanges that enable users to exchange cryptoassets for one another also play a critical role in DeFi.[193] All of these centralized intermediaries have the power to prevent users from engaging in crypto transactions, and yet users trust them not to. Commenting specifically on the intermediaries Infura and Alchemy, Marlinspike observed that "[s]o much work, energy, and time has gone into creating a trustless distributed consensus mechanism, but virtually all clients that wish to access it do so by simply trusting the outputs from these two companies without any further verification."[194]

The DeFi ecosystem also depends heavily on stablecoins issued by centralized firms like Tether and Circle,[195] and, in turn, these stablecoins depend on traditional financial services like banks and fiat currencies in order to stabilize their value.[196] Although there are more decentralized stablecoins, such as DAI, with smaller market shares, DAI is partly collateralized by centralized stablecoins like USDC in order to stabilize its value and so ultimately depends on centralized intermediaries too.[197] Intermediaries may also be called upon to perform "know-your-customer" diligence on crypto wallets.[198] The operation of DeFi Dapps depends on data feeds from oracles maintained by trusted third parties.[199] DeFi users may need search engines, such as Etherscan, that allow them to search a distributed ledger for transactions.[200] The list goes on. Ultimately, trust is required in the DeFi ecosystem. A decentralized foundation just makes financial services more convoluted and replaces trust in established institutions (particularly government institutions and

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191. WHARTON BLOCKCHAIN & DIGIT. ASSET PROJECT, *supra* note 73, at 2 (explaining that wallets are "[s]oftware interfaces for users to manage assets stored on a blockchain").

192. *See* Marlinspike, *supra* note 151.

193. *See* WHARTON BLOCKCHAIN & DIGIT. ASSET PROJECT, *supra* note 73, at 8.

194. Marlinspike, *supra* note 151.

195. PRESIDENT'S WORKING GRP. ON FIN. MKTS. ET AL., *supra* note 75, at 9.

196. Aramonte, *supra* note 96, at 25.

197. Daly, *supra* note 131.

198. *See* Allison, *supra* note 108.

199. *See* WHARTON BLOCKCHAIN & DIGIT. ASSET PROJECT, *supra* note 73, at 3 (explaining that oracles are "[d]ata feeds that allow information from sources off the blockchain, such as the current price of a stock or a fiat currency, to be integrated into DeFi services").

200. Emily Perryman, *What is Etherscan?*, YAHOO! (Oct. 28, 2019), https://www.yahoo.com/video/etherscan-080428243.html [https://perma.cc/8D2Y-TE2X].

regulated banks) with trust in different—and sometimes unidenti-fied—actors.[201]

The conflicts of interest that these actors face can lead to suboptimal outcomes for crypto investors, and we can also expect that these actors will fail to take financial stability into account. There is little incentive for them to protect financial stability, because it is a public good that people cannot be excluded from or forced to pay for, and even if members of the crypto industry were unusually altruistic, they would not have enough information about other parts of the financial system to gauge the impact of their actions (or be able to force their competitors to join them even if they did know how to minimize systemic risk).[202] Although SEC Commissioner Hester Peirce has complimented the crypto industry on its ability to "collectively figure out how to deal with unantici-pated problems,"[203] this view of self-correcting markets neglects the fact that crypto intermediaries lack both the incentives and the information needed to address the negative externalities that crypto can create for the broader economy.[204]

While it seems implausible to suggest that DeFi will ever deliver financial services entirely "without centralized intermediaries or institutions,"[205] using the term "decentralized" to describe these services *does* serve marketing and political functions. Cynically, describing DeFi as "decentralized" can be an effective rhetorical strategy for avoiding regulation because, if policymakers believe the decentralization hype, then they may be misled into thinking that there are no intermediaries to regulate. The word "decentralized"

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201. It was recently revealed that the head of Treasury for the Wonderland DeFi project had previously been incarcerated for financial fraud, and that revelation led to a significant reduction in the value of the related TIME token. As one commentator put it, "[i]f the anonymous nature of DeFi means that a person like Michael Patryn can be in charge of a major DeFi treasury, that's a pretty big problem." Emily Nicolle, *Crypto Secrecy Makes DeFi a Financial Felon's Wonderland,* Bloomberg (Jan. 27, 2022, 5:59 PM), https://www.bloom berg.com/news/articles/2022-01-27/crypto-s-cloak-of-anonymity-makes-defi-a-wonderland-for-felon [https://perma.cc/B4SQ-CAGL].

202. *See* Allen, *supra* note 122, at 20-21.

203. Hester M. Peirce, Comm'r, U.S. Sec. & Exch. Comm'n, Speech at Texas Blockchain Summit: Lawless in Austin (Oct. 8, 2021), https://www.sec.gov/news/speech/peirce-2021-10-08 [https:// perma.cc/337P-YX4R].

204. *See* Rosenthal, *supra* note 150 ("Libertarianism's attraction is based on ignoring externalities, and cryptocurrencies are no exception.").

205. Wharton Blockchain & Digit. Asset Project, *supra* note 73, at 2.

also taps into the current fervor for "Web3," maximizing chances that startups will receive funding from venture capital firms[206] and is an effective marketing strategy for some customers. This commercial appeal of "decentralization" is driven in part by the political significance of the term. "The promise is a financial system that is democratized, decentralized, and secure. No banks. No bailouts. No more being ignored or betrayed"[207]—the appeal of this kind of rhetoric lies in the belief that the internet works as a countervailing force against government entities and regulated financial institutions (and neglects the reality that internet services can be another source of concentrated power with their own conflicts of interest).[208] In his book *The Politics of Bitcoin: Software as Right-Wing Extremism*, David Golumbia argues that much of crypto's pro-decentralization rhetoric actually derives from extreme right-wing talking points about the evils of government: the existence of DeFi intermediaries can be more easily reconciled with decentralization rhetoric if DeFi intermediaries are seen as less problematic than other kinds of intermediaries (extreme right-wing ideology holds that "no matter how much power corporations take, their power can never be 'evil' in the way that governmental power inherently is").[209]

## 2. Efficiency and Financial Inclusion

Returning to our core question of whether the likely benefits of DeFi are sufficient to justify the financial stability risks associated with Shadow Banking 2.0, we also need to consider whether DeFi may have other benefits that are more prosaic than decentralization. In particular, there is interest in making transactions quicker and cheaper, and this "increased efficiency" is sometimes pitched as a way to promote financial inclusion.[210] However, it does not seem

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206. Tressie McMillan Cottom, Opinion, *Wealth Inequality Drives the Appeal of Crypto*, N.Y. TIMES (Jan. 31, 2022), https://www.nytimes.com/2022/01/31/opinion/crypto-nfts-inequality.html [https://perma.cc/Q6VL-N3Y3].

207. Hsu, *supra* note 72.

208. DAVID GOLUMBIA, THE POLITICS OF BITCOIN: SOFTWARE AS RIGHT-WING EXTREMISM 7 (2016).

209. *Id.* at 10.

210. *See* Disparte, *supra* note 167.

possible that a technology that has been intentionally made more complex (in order to nominally decentralize) could ever be more efficient than a simpler, centralized alternative.[211] No matter which consensus mechanism is chosen for a decentralized ledger (proof-of-work, proof-of-stake, or something else), it will always be slower and more cumbersome than validation by a centralized intermediary—costly computations are the sine qua non of decentralized consensus mechanisms.[212] And yet, DeFi innovation is proliferating.[213] This Part will argue that technological superiority is *not* the primary driver of this innovation.

It became apparent following the 2008 crisis that some Shadow Banking 1.0 innovation was not a "rational demand-side response to market imperfections."[214] Instead, supply-side incentives often drove the innovation: financial institutions could profit from offering financial products that capitalized on interest in the "next new thing," notwithstanding that the result was sometimes socially useless overinnovation that hid risks from purchasers and created risks for the broader economy.[215] There are similarly perverse incentives for innovation in the tech industry, which can encourage firms to pursue innovation that is "buzzy" enough to attract venture capital funding, even if it is not particularly good technology.[216]

Notwithstanding the significant venture capital (VC) buzz about distributed ledger technology and a decentralized Web3,[217] some software engineers have become increasingly vocal in their criticisms in recent months, asserting that the technology is simply not

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211. *See* Schuster, *supra* note 14, at 992.

212. *Id.* at 993.

213. *See* Jackson Wood, *Emerging DeFi Technology Trends to Watch*, Coindesk (Apr. 7, 2022, 8:50 AM), https://www.coindesk.com/learn/emerging-defi-technology-trends-to-watch/ [https://perma.cc/RB9G-6ZWR].

214. Awrey, *supra* note 4, at 260.

215. *See id.* at 263-64.

216. For a discussion of the limitations of the venture capital funding model that result in suboptimal innovation, see Peter Lee, *Enhancing the Innovative Capacity of Venture Capital*, 24 Yale J.L. & Tech. 611, 616, 634 (2022) ("While VCs enjoy an iconoclastic reputation, in many contexts they tend to invest in the same popular technologies while eschewing truly revolutionary innovations. Historical evidence reveals several trends of 'hot' technologies receiving significant VC funding and then losing favor.").

217. *See* Cottom, *supra* note 206 ("[S]ome V.C.s have invested a lot in making blockchain inevitable. And the amount that V.C.s have available to throw at investments has ballooned over the past 10 years in a way the average person can't appreciate.").

very good.[218] For example, in a blog post titled *The Case Against Crypto*, software engineer and blogger Stephen Diehl writes that:

> The real world has fundamental constraints that make the technology unworkable, whenever it has to interact with the outside world the benefits of decentralization disappear and the solutions end up simply recreating slower and worse versions of processes and structures that already exist.... There are fundamental limitations to the scalability of blockchain-based technologies, and every use case is better served by another simpler technology except for crime, ransomware, extralegal gambling, and sanctions evasion; all of which are a drain on society not a benefit. Taken as a whole the technology has no tangible benefits over simply using trusted parties and centralized databases.[219]

Another software engineer and blogger Molly White similarly describes blockchain technology as "inefficient in every sense of the word" and also challenges assertions that this technology is in its infancy and just needs more time to develop useful applications, asking whether "we are to believe that as technology soared forward over the past decade, blockchain technologies spent that time tripping over their own feet?"[220]

It goes without saying that there are technologists who take the opposite view, but given DeFi's negative externalities, the burden should be on them to demonstrate why this aspirational technology is—in reality—superior to the simpler, centralized alternatives we could develop with the venture capital funding that is currently being poured into DeFi. In particular, the idea that DeFi can be used to improve financial inclusion is a dubious claim that the industry should be required to support with concrete examples because, as a recent World Economic Forum report on stablecoins found:

> stablecoins are subject to many of the same barriers that constrain citizens from accessing other financial products and

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218. *See, e.g.*, Rosenthal, *supra* note 150.

219. Stephen Diehl, *The Case Against Crypto*, STEPHEN DIEHL (Dec. 31, 2021), https://www.stephendiehl. com/blog/against-crypto.html [https://perma.cc/3ARS-QZ4D].

220. White, *supra* note 152.

services, such as bank accounts, mobile money accounts or fully digital remittance providers. Where stablecoins are accessible, they generally address financial inclusion barriers to a similar degree as other digital financial services.... [S]tablecoins as currently deployed would not provide compelling new benefits for financial inclusion beyond those offered by pre-existing options.[221]

Barriers (like the need for internet access) apply not just to stablecoins but also limit the utility of other DeFi Dapps for underserved communities.

More generally, we should think about what DeFi asks of underserved communities: reading financial disclosures is already hard enough—should people really be expected to understand the ins and outs of code as well before they can understand their financial services? As White puts it, "How long must the laymen, who are so eagerly hustled into blockchain-based projects that promise to make them millionaires, be scolded as though it is their fault when they are scammed as if they should be capable of auditing smart contracts themselves?"[222] Although certain DeFi practices such as "yield farming" are currently delivering high returns to some consumers, these practices may be highly exploitative: Sam Bankman-Fried, the CEO of cryptocurrency exchange FTX, admitted in an interview that the yield farming business model is essentially a Ponzi scheme.[223] Policymakers should be particularly attentive as to how communities of color might be harmed by DeFi as these communities are disproportionately investing in crypto[224] (analogies are already being drawn between crypto's

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221. WORLD ECON. F., WHAT IS THE VALUE PROPOSITION OF STABLECOINS FOR FINANCIAL INCLUSION? 1, 8 (2021), https://www3.weforum.org/docs/WEF_Value_Proposition_of_Stablecoins_for_Financial_Inclusion_2021.pdf [https://perma.cc/4M4X-H8MW].

222. White, *supra* note 152.

223. "Matt [Levine]: ... You're just like, well, I'm in the Ponzi business and it's pretty good.... [Sam Bankman-Fried]: So on the one hand, I think that's a pretty reasonable response, but let me play around with this a little bit. Because that's one framing of this. And I think there's like a sort of depressing amount of validity." Tracy Alloway & Joe Weisenthal, *Sam Bankman-Fried Described Yield Farming and Left Matt Levine Stunned,* BLOOMBERG (Apr. 25, 2022, 6:30 AM), https://www.bloomberg.com/news/articles/2022-04-25/sam-bankman-fried-described-yield-farming-and-left-matt-levine-stunned [https://perma.cc/SE2N-XVE7].

224. Charisse Jones & Jessica Menton, *Black, Latino, LGBTQ Investors See Crypto Investments Like Bitcoin as 'a New Path' to Wealth and Equity*, USA TODAY (Aug. 15, 2021,

exploitation of vulnerable communities, and the predations of the pre-2008 subprime mortgage market[225]).

## A. Regulatory Proposals

To summarize the previous Part, the inefficiencies and complexities of DeFi technology simply do not make sense outside of the decentralization narrative, and the decentralization narrative does not hold up to scrutiny. Given the financial stability risks that DeFi would create if it were allowed to grow into Shadow Banking 2.0 and given that proponents of the technology involved struggle to demonstrate any concrete superiority over simpler centralized alternatives, policymakers should pursue policies that prevent DeFi from growing. This Part will sketch in broad strokes some possible ways to achieve this. If DeFi remains largely disconnected from both real-world economic applications and the established financial system, then the risks articulated in Part II.B will not be a significant concern.

Because negative spillover effects from DeFi will wreak the most havoc on the real economy if regulated banks become integrated into the DeFi ecosystem, steps should be taken to insulate regulated banks from DeFi.[226] As a priority, regulated banks (and their affiliates) should be prohibited from issuing stablecoins or providing any Dapps, holding stablecoin reserves in a deposit account, investing in any crypto, or accepting any crypto as collateral (banking regulators already have the authority they need to implement these steps).[227] Some of these recommendations run counter to the President's Working Group *Report on Stablecoins*, which recommended that "legislation should require stablecoin issuers to be

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2:40 PM), https://www.usatoday.com/story/money/2021/08/13/crypto-seen-path-equity-black-latino-and-lgbtq-investors/5431122001/ [https://perma.cc/42RJ-YTWX].

225. Paul Krugman, Opinion, *How Crypto Became the New Subprime*, N.Y. TIMES (Jan. 27, 2022), https://www.nytimes.com/2022/01/27/opinion/cryptocurrency-subprime-vulnerable.html [https://perma.cc/CW24-ANHH] ("I remember the days when subprime mortgage lending was similarly celebrated—when it was hailed as a way to open up the benefits of homeownership to previously excluded groups.").

226. For an exploration of the financial stability and broader economic threats likely to arise from the integration of traditional finance and crypto, see ALLEN, *supra* note 122.

227. For further elaboration on these proposals, see Allen, *supra* note 145, at 18.

insured depository institutions."[228] This President's Working Group recommendation seeks to address stablecoin-related run risk, but if followed, it would create moral hazard by extending the public safety net of deposit insurance to the DeFi ecosystem in which stablecoins are deployed.[229] I have argued against pursuing the President's Working Group's recommendation at this point in time because taking this step now would legitimize stablecoins in a way that would likely fuel, rather than limit, the growth of DeFi.[230]

We should also explore other regulatory strategies designed to prevent DeFi from growing into Shadow Banking 2.0. Gary Gorton and Jeffery Zhang have noted that at least when it comes to stablecoins, Congress has the authority to "tax competitors of [the U.S. dollar] out of existence."[231] An alternative or complementary strategy would be for Congress to adopt a licensing regime for Dapps and stablecoins where the applicant would need to demonstrate (1) that the Dapp/stablecoin has a purpose that is connected to real-world economic growth, (2) that the applicant has the institutional capacity to manage both the financial and technological risks associated with the Dapp/stablecoin, and (3) that the Dapp/stablecoin is unlikely to have a negative impact on the stability of the financial system or on monetary policy.[232] With regard to the first prong, purely aspirational goals would not satisfy this test. For example, stablecoin issuers should have to demonstrate in detail how they plan to scale up to provide a real-world payments service that is superior to what is already available—it would not be enough to speak broadly about aspirations if most real-world merchants show no willingness to accept stablecoins for payments. The second prong of the licensing test is relatively straightforward and would require DeFi startups to invest in financial (as well as technological) expertise commensurate with the risks involved. With regard to the third prong, while it can be hard

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228. PRESIDENT'S WORKING GRP. ON FIN. MKTS. ET AL., *supra* note 75, at 2.

229. *See* Allen, *supra* note 145, at 8.

230. *Id.* at 2. It is also critical that antitrust measures be used to prevent any large tech firm from leveraging its network of users into a stablecoin platform, which would also boost DeFi growth. *See id.* at 18.

231. Gorton & Zhang, *supra* note 55, at 40.

232. For a more detailed proposal for such a licensing regime, see ALLEN, *supra* note 122, at 182-84. This licensing regime builds on proposals made in Omarova, *supra* note 4, at 67.

to predict the precise systemic impact of a Dapp or stablecoin, the tendencies for DeFi to increase complexity and leverage and introduce more rigidity and runs into the financial system certainly raise red flags.

Most of the stablecoins and Dapps currently available would struggle to satisfy these licensing requirements, so such a licensing regime would limit the growth of DeFi (if a license were ultimately awarded, the licensing process would still offer regulators the opportunity to make interventions to protect consumers and the financial system). However, with a more decentralized Dapp or stablecoin—for example, DAI[233]—there may be some confusion about who should apply for the license. If such a Dapp or stablecoin were launched without a license, enforcement action could be brought against the original founder (sticking with the DAI example, that would be Rune Christensen, the entrepreneur who established MakerDAO, which is the DAO that maintains DAI[234]), or if control has been handed over to a DAO, against the managers of the DAO (Christensen acted as CEO of the Maker Foundation, which managed MakerDAO at least into 2021) or significant beneficial owners of DAO governance tokens (MakerDAO uses MKR tokens; venture capital firm Andreessen Horowitz appears to have a significant holding of these MKR tokens).[235]

While regulators may sometimes struggle to assert jurisdiction over the relevant people (either because regulators cannot determine their identities or because they are located outside of the United States and lack U.S. assets to enforce judgments against), the licensing regime could still help contain Dapps and stablecoins by prohibiting centralized intermediaries, such as wallets and exchanges, from providing any services in connection with an unlicensed Dapp or stablecoin. Admittedly, there could also be jurisdictional issues associated with ancillary services that are provided in more decentralized ways (for example, the Uniswap exchange is more decentralized), so there is no single silver bullet

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233. *See supra* notes 131-33 and accompanying text.

234. *The Cointelegraph Top 100: Rune Christensen*, COINTELEGRAPH, https://cointelegraph.com/top-people-in-crypto-and-blockchain-2021/rune-christensen [https://perma.cc/55TP-7FNV].

235. *Id.*; Katie Haun & Jesse Walden, *Maker*, ANDREESSEN HOROWITZ (Sept. 24, 2018), https://a16z.com/2018/09/24/maker/ [https://perma.cc/9DF2-LXSP].

measure that can stop the growth of DeFi. However, if DeFi were forced to live up to its claims of decentralization by operating without *any* centralized intermediaries, then it would be very difficult for users to access DeFi or for DeFi services to scale up,[236] and this would limit the real-world fallout from any DeFi failures.

Until such licensing measures can be put in place, the SEC and the Commodity Futures Trading Commission should continue to regulate stablecoins and Dapps as speculative investments where appropriate, and the Financial Stability Oversight Council and the Office of Financial Research should continue to monitor the DeFi ecosystem and conduct stress testing to gain insight into potential spillovers that could harm the financial system and real economy. If necessary, the Financial Stability Oversight Council could explore using its designation authority under Title VIII for payment, clearing, and settlement activities that are systemically important.[237]

CONCLUSION

Innovation is certainly occurring in the DeFi space. Trying to decentralize financial services seems to be an engaging intellectual exercise for technologists, and venture capitalists are certainly throwing money at these kinds of projects.[238] But the job of policymakers is not to promote innovation at all costs but to consider when the downsides of innovation justify intervention. As Acting Comptroller of the Currency Michael Hsu put it, "[i]nnovation for innovation's sake ... risks creating a mountain of fool's gold."[239] This kind of innovation can distract with unrealistic promises, discouraging the hard work that is needed in the here and now to address pressing problems. As technology ethicist Elizabeth Renieris has observed, "[i]ncreasingly apparent in the Web3 discourse is a kind of *imaginative* obsolescence: As one vision of the future rapidly replaces the next, the technologies and systems now in place suffer decay and disrepair. Our imaginations and resources

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236. *See supra* notes 183-85 and accompanying text.

237. 12 U.S.C. § 5463.

238. *See* Cottom, *supra* note 206.

239. Hsu, *supra* note 72.

are once again diverted from fixing or rehabilitating what exists."[240] Despite DeFi's flawed realities, DeFi's aspirational promises can distract us from fixing and rehabilitating the financial system we actually have.

For example, part of DeFi's appeal derives from suspicions about concentrations of power in the largest banks, yet some of these largest banks are considering how they can profit in the DeFi ecosystem[241]—DeFi could ultimately enlarge, rather than disrupt, the biggest banks. *Real* solutions to the problem of "too big to fail" require actually shrinking the largest banks, and many reforms have already been suggested to this end—what is lacking is the political will to implement them.[242] Interest in decentralization (particularly Web3) is also being driven by distrust of large tech companies like Amazon, Google, and Meta (formerly Facebook)—but tech giants (and venture capitalists) are already eyeing Web3 as an opportunity to profit.[243] The large tech companies pose very real threats as a result of their market power and dominance as disseminators of information: these threats are beyond the scope of this paper, but as a start, legislation could be adopted that prevents these firms from issuing stablecoins or providing any other financial services.[244]

Financial inclusion is also a very real problem, with significant proportions of Americans being unbanked or underbanked.[245] But it

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240. Elizabeth M. Renieris, *Amid the Hype over Web3, Informed Skepticism Is Critical*, Ctr. for Int'l Governance Innovation (Jan. 14, 2022), https://www.cigionline.org/articles/amid-the-hype-over-web3-informed-skepticism-is-critical/ [https://perma.cc/J7Z8-TWQZ].

241. *See supra* notes 107-11 and accompanying text.

242. For a survey of these proposals and their political challenges, see Jeremy C. Kress, *Solving Banking's "Too Big to Manage" Problem*, 104 Minn. L. Rev. 171, 200-01 (2019).

243. *See* Ephrat Livni, *Tales from Crypto: A Billionaire Meme Feud Threatens Industry Unity*, N.Y. Times (Jan. 18, 2022), https://www.nytimes.com/2022/01/18/business/dealbook/web3-venture-capital-andreessen.html?partner=IFTTT [https://perma.cc/S465-9FMD]. For example, venture capital firm Andreessen Horowitz is one of the most influential promoters of Web3; its founder Marc Andreessen also sits on Meta's board. *Id.* Meta is aggressively moving into the Web3 space. Brian Quarmby, *Rise of Web3: Metaverse Tokens Surge as Meta's Share Price Plunges*, Cointelegraph (Feb. 4, 2022), https://cointelegraph.com/news/rise-of-web3-metaverse-tokens-surge-as-meta-s-share-price-plunges [https://perma.cc/6KCK-5VMF].

244. *See* Allen, *supra* note 122, at 208-12.

245. *See* Aaron Klein, Opinion, *Opening Statement at Roundtable on America's Unbanked and Underbanked*, Brookings (Dec. 15, 2021), https://www.brookings.edu/opinions/opening-statement-of-aaron-klein-at-roundtable-on-americas-unbanked-and-underbanked/ [https://perma.cc/7CSX-FNC7].

makes little sense to compare vague technological potential with the current inadequate status quo—a better comparison would be between the potential of DeFi and the potential of "all other solutions that *also* require a wholesale change of the status quo."[246] Unbanked and underbanked individuals would benefit enormously from access to simple, quick, low-cost financial services, and it seems to be a lack of political will rather than lack of innovation that prevents these from being provided.[247] Perhaps if DeFi can be contained so that it does not evolve into Shadow Banking 2.0, then policymakers can devote more of their energies to solving these underlying problems.

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246. Schuster, *supra* note 14, at 997.

247. *See, e.g.*, Klein, *supra* note 245 ("The single most impactful thing the federal government could do is to give people access to their own money immediately. This can be done by simply amending the Expedited Funds Availability Act to require immediate access for the first several thousand dollars of a deposit, instead of permitting the lengthy, costly delays that harm people living paycheck to paycheck.").