

**ASSESSING THE ROLE AND REGULATORY IMPACT OF DIGITAL ASSETS  
IN DECENTRALIZING FINANCE**

**by  
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# Abstract

This project will explore the development of decentralized financial (DeFi) markets since the first introduction of digital assets created through the application of a form of distributed ledger technology (DLT), known as blockchain, in 2008. More specifically, a qualitative inquiry of the role of digital assets in relation to traditional financial markets infrastructure will be conducted in order to answer the following questions:

- (i) can the digital asset and decentralized financial markets examined in this thesis co-exist with traditional assets and financial markets, and, if so,*
- (ii) are traditional or novel forms of regulation (whether financial or otherwise) needed or desirable for the digital asset and decentralized financial markets examined herein?*

The aim of this project will be to challenge a preliminary hypothesis that traditional and decentralized finance can be compatible; provided, that governments and other centralized authorities approach market innovations as an opportunity

## ABSTRACT

to improve existing monetary infrastructure and delivery of financial services (both in the public and private sector), rather than as an existential threat. Thus, this thesis seeks to establish that, through collaborating with private markets to identify the public good to which DeFi markets contribute, the public sector can foster an appropriate environment which is both promotive and protective of the public interest without unduly stifling innovation and progress.

**Primary Reader and Advisor:** Cristino Arroyo

**Secondary Reader:** Tito Cordella

**Third Reader:** Filippo Zatti

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# Dedication

For my parents in heaven. I hope that I made you proud.

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<b>Zschach, Tom</b>	Chief Innovation Officer	SWIFT	n. 140

# Glossary of Defined Terms

1. “**Asset Clawback**” means a design feature of a specific blockchain protocol that allows issuers to claw back tokens from any token-holding account.
2. “**Atomic Settlement**” means both sides of a transaction are settled either simultaneously or not at all.
3. “**Blockchain**” means a form of distributed ledger technology that is self-authenticating; it can be thought of as a digital spreadsheet with systematized protocols for verifying the accuracy of data capture and other activity.
4. “**Central Bank Digital Currency**” or “**CBDC**” means a digital currency issued and controlled by a sovereign government.
5. “**Centralized**” means a single source for decision-making and control.
6. “**Centralized Finance**” or “**CeFi**” means financial (including monetary) transactions that are carried out in an environment subject to centralized decision-making and control.

## GLOSSARY OF DEFINED TERMS

7. “**Centralized Monetary System**” means a fiat market where a centralized government authority issues, controls, and supervises a national or supranational currency.
8. “**Code Audit**” means a function or process for testing a blockchain platform’s underlying vulnerabilities or weaknesses which could negatively impact the platform’s performance.
9. “**Coin Swap Service**” means a service that allows various types of digital assets to be swapped for other types of digital assets and fiat currency.
10. “**Confidence Effects**” means adverse events in one segment of the market influencing asset and/or investor behavior in other segments or markets irrespective of catalyst.
11. “**Consensus Protocol**” means proof of work, proof of stake, or any related mechanism that establishes the basis upon which to achieve consensus on a blockchain platform.
12. “**Crypto-Assets**” means digital assets (including cryptocurrencies), which are created and transacted using cryptography.
13. “**Crypto-Asset Service Provider**” or “**CASP**” means virtual asset service provider or VASP.
14. “**Cryptocurrency**” means a digital currency that is issued and transacted using cryptography.

## GLOSSARY OF DEFINED TERMS

15. **“Cryptography”** means a computerized form of securing a digital asset and authenticating ownership via the use of public and private keys which provides for access to the asset only through pre-defined credentialing.
16. **“Cryptoization”** means dollarization using crypto-assets.
17. **“Decentralized”** and **“Decentralization”** means independent of or facilitating independence from a centralized authority, such as a sovereign government or financial intermediary, including a custodian, transfer agent, or clearinghouse.
18. **“Decentralized Autonomous Organization”** or **“DAO”** means a form of governance used in distributed networks in replacement of traditional corporate forms, such as companies limited by shares, limited liability companies, and limited partnerships, with the objective of eliminating the concentration of decision-making and better aligning incentives among and between principals, agents, and other stakeholders.
19. **“Decentralized Finance”** or **“DeFi”** means financial (including monetary) transactions capable of being carried out on a decentralized, distributed digital network independent of any centralized authority or other intermediary, such as a commercial bank, insurance agent, or securities broker.
20. **“Development Economics”** means the economics of developing countries that are not considered part of the “first” or developed world.

## GLOSSARY OF DEFINED TERMS

21. **“Digital Assets”** means assets created through the application of computer programming code that exist only on computerized networks and not in the physical world.
22. **“Digital Asset Economy”** means products and services that are represented by digital assets and transacted over digital networks.
23. **“Digital Currencies”** means digital assets the use case of which is digital money.
24. **“Digital Currency Mixer”** means a service that mixes digital asset transactions prior to settlement so that the source and destination are unknown to the counterparties.
25. **“Digital Finance”** means both centralized finance and decentralized finance (or a hybrid thereof) carried out using digital assets and/or distributed ledger technology (including blockchain).
26. **“Disintermediation”** means the effect of removing one or more middlemen from a transaction allowing direct interaction between two or more counterparties.
27. **“Distributed Ledger Technology”** means a digital spreadsheet that can be shared and populated across computerized networks.

## GLOSSARY OF DEFINED TERMS

28. **“Dollarize”** and **“Dollarization”** means the adoption of a foreign currency by a country or its citizens in a manner that substitutes for the traditional role of the country’s sovereign currency, whether that be as a means of payment, unit of account, or store of value.

29. **“Double-spending”** means any circumstance in which a singular unit of account is attributable to more than one first degree purchase.

30. **“Ecosystem”** means “a complex network or interconnected system” as defined by Oxford Languages.

31. **“Evolution”** means “the gradual development of something” and **“Evolve”** means “to develop gradually, especially from a simple to a more complicated form” as defined by Oxford Languages and the Oxford Learner’s Dictionary, respectively; in each case without distinction as to legal, economic, or other significance in the context of usage.

32. **“Fiat Currency”** means coins and notes minted by a sovereign government for use as money.

33. **“Global Financial Crisis”** or **“GFC”** means the financial crisis that began in the United States banking sectors in 2007.

34. **“Great Recession”** means the devastating financial impact to the United States economy that resulted from the Global Financial Crisis, which also extended to various degrees across the global economy.

## GLOSSARY OF DEFINED TERMS

35. “**HashTree**” means a consensus reached by summarizing data across a distributed ledger to determine a single value, which is then compared and validated across the network.

36. “**Invisible Finance**” means financial products and services delivered through a single customer interface for all aspects of buying, using, and selling - covering both non-financial and financial goods and services.

37. “**Monetary Diplomacy**” means the use of centralized monetary systems and fiat currencies (including central bank digital currencies) as a tool for political engagement with other sovereigns.

38. “**Nodes**” means the computer servers that contribute to the sharing, managing, and storing of data across a distributed network.

39. “**Price Oracle**” means a source of price data streamed onto the blockchain, often from more liquid centralized digital asset exchanges to less liquid decentralized exchanges.

40. “**Proof of Work**” or “**PoW**” means a method for validating transactions on a blockchain based on the computational power that each validator contributes.

41. “**Proof of Reserves**” or “**PoR**” means the method by which an entity’s asset reserves against corresponding liabilities can be independently verified.

42. “**Proof of Stake**” or “**PoS**” means a method for validating transactions on a blockchain according to each validator’s stake in the corresponding digital asset.

## GLOSSARY OF DEFINED TERMS

43. “**Seignorage**” means revenue that constitutes the “profit made by a government by issuing currency, especially the difference between the face value of coins and their production costs” as defined by Oxford Languages.

44. “**Self-hosted wallet**” means a method to self-custody digital assets that is generated by computer protocols and available to anyone with internet access.

45. “**Smart Contracts**” means legal agreements that are generated through the application of computer programming language for transacting over blockchains and other forms of distributed ledger technology.

46. “**Stablecoin**” or “**stable coin**” means a digital currency (including cryptocurrency) whose value is pegged to another asset, typically a fiat currency, another digital currency, or a basket of fiat and/or other digital currencies.

47. “**Staking**” means with respect to a PoS protocol, the pledging of digital currencies by validators in exchange for receiving validation preferences and rewards in relation to that protocol.

48. “**Subprime Loans**” means loans typically extended to borrowers who are deemed less than creditworthy, thus carrying higher risk to the lender, for which the lender charges a higher rate of interest.

49. “**SWIFT**” means Society for Worldwide Interbank Financial Telecommunications, a global interbank messaging system founded in the early 1970s in the country of Belgium and connecting various banks and financial institutions throughout the world.



## GLOSSARY OF DEFINED TERMS

50. **“Sybil Attack”** means attempting to manipulate a distributed ledger’s consensus mechanism by gaining majority control of network nodes or hash power.
51. **“Tokenization”** means a mechanism by which digital assets are represented by tokens issued to users on a distributed network carrying pre-assigned rights associated with the network to which the token relates.
52. **“TradFi”** means traditional financial services and markets.
53. **“Use Case”** means the application of any specific digital asset in a particular manner that determines the utility of that application and thus the utility of the digital asset.
54. **“Validator”** means anyone or anything, such as a designated computer, charged with verifying the accuracy of information recorded on a blockchain.
55. **“Vehicle Currency”** means a currency that is used as an international medium of exchange, particularly when it is not the domestic currency of any party to the transaction.
56. **“Virtual Asset Service Provider” or “VASP”** means a service provider in digital asset markets, such as virtual asset exchanges and wallets.
57. **“Virtual Currency Mixer”** means a digital currency mixer.

# **Chapter 1**

## **Introduction: The Birth and Growth of Digital Assets**

A combination of structural forces working together resulted in a domino effect of bank and other financial institution failures, beginning in the United States (U.S. or US) in 2007 and working its way through the global financial system. The catalysts included financial de-regulation, loose credit standards, an overheated housing market, ample access to capital markets financing through structured products, and excessive leverage. The defining moment of what is known as the Global Financial Crisis (GFC) was the failure of Lehman Brothers, which occurred on September 15, 2008, and constituted the largest bankruptcy filing in history (Baldwin & Wyplosz 2019, 476-479). Shortly thereafter, the federal receivership of Washington Mutual

Bank on September 25, 2008, became the largest bank failure in U.S. history (Office of Thrift Supervision 2008, 3).

The GFC constituted the worst fiscal crisis since the 1929 U.S. stock market crash, which triggered the Great Depression. The devastating impact to the U.S. economy, which rippled to various degrees across the global economy, is known as the Great Recession (Baldwin and Wyplosz 2019, 477-479). Impacted governments responded in a variety of ways to shore up their financial systems, including buying up distressed assets, injecting liquidity, and brokering acquisitions of faltering institutions. This resulted in growing public indebtedness in both the U.S. and Europe (King & Gales 2017, 21).<sup>1</sup> In fact, the U.S. Federal Reserve Bank (FRB) more than doubled the size of its balance sheet during this time, while the balance sheet of the European Central Bank (ECB) increased by greater than 50 percent (Baldwin & Wyplosz 2019, 479-480).<sup>2</sup>

Did the GFC catch regulators off guard and expose the inadequacy of their tools for addressing systemic risk? There are those who certainly think so.<sup>3</sup> Fairly or unfairly, there was a perception that, even if regulators were not complicit in the crisis, they did not do enough to prevent it (Baldwin & Wyplosz 2019, 486). In

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<sup>1</sup> Asian and Latin American banks were not as badly affected due to lessons learned from previous financial crises (Baldwin & Wyplosz 2019, 479).

<sup>2</sup> The rapid increase in the FRB and ECB balance sheets during the GFC was largely due to asset purchases and other financing measures intended to stabilize the deteriorating financial condition of the banking sector (Baldwin & Wyplosz 2019, 479). While larger balance sheets mean that both assets and liabilities have increased, they are not always matched 1:1. For example, a short-term loan (a liability to the borrower) could finance the purchase of an illiquid asset. The loan may then come due before the asset can be liquidated to generate sufficient proceeds for repayment. A mismatch can also occur when an asset is marked down in value while the repayment obligation on the borrowings used to acquire the asset remains unchanged (Baldwin & Wyplosz 2019, 476).

<sup>3</sup> "The economic and financial crisis confronted policymakers with problems for which they lacked solutions, further reducing trust in traditional political parties while at the same time widening economic and social inequalities" (Jones 2019, 13-14).

addition, there was also concern (again whether accurate or not), that losses resulting from the GFC were socialized through institutional bailouts while previous gains were privatized (Baldwin & Wyplosz 2019, 476-477).

Around this same time, a white paper was published under the pseudonym Satoshi Nakamoto that described, in just nine short pages, a cryptographic protocol that allows for a secure system of peer-to-peer payments using a digital asset known as bitcoin (Nakamoto 2008).<sup>4</sup> The possible impact to traditional financial services providers from this new technology was so significant that an international body of financiers and academics, known as the Group of Thirty (G30), later declared this invention as “potentially the most radical disruption of the payment system since the advent of bank intermediation” (Working Group on Digital Currencies 2020, 18).

In the first part of the following decade, an impending Greek debt default (or at least the perception thereof)<sup>5</sup> resulted in a joint May 2010 effort between the International Monetary Fund (IMF), the European Union (EU), and the ECB to provide financial assistance to the country. Later that same year circumstances necessitated financial assistance to Ireland and in succeeding years to three other European countries facing similar challenges: Portugal in 2011; Spain in 2012; and Cyprus in 2013 (Baldwin and Wyplosz 2019, 480-483). Once again, the net effect of

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<sup>4</sup> There is evidence that the publication of this white paper was coincidental in timing rather than in direct response to the GFC. Even so, timing matters and cannot be overlooked when assessing the evolution of use cases following a period of catastrophic economic turmoil (Buterin 2013). In the words of European Commissioner, Mairead McGuinness, during a speech at a September 27, 2022, Banque de France conference, “I think it is no coincidence that the Bitcoin network started operating in 2009, against the backdrop if you like, of the financial crisis, and the distrust of financial institutions that resulted from that crisis. It is also perhaps no surprise that crypto markets have exploded since” (European Commission 2022, 2-3).

<sup>5</sup> Not improbably triggered by collective nervousness and credit caution following the GFC.

this in certain circles was an erosion in public confidence of government stewardship of the worldwide financial system (Jones 2019, 17).

A common theme underlying early adopters of DeFi networks has been a libertarian view of over-consolidation of state (Bolleyer and Salat 2021, 1121-1122) and cryptocurrency has been acknowledged to have “originated as a libertarian revolt against the government monopoly of money” (Adler and Pollock 2022, 4).<sup>6</sup> It is hardly surprising, therefore, that throughout the remainder of the decade the application of the Bitcoin network for various use cases,<sup>7</sup> including digital payments and settlements, as an alternative store of value, as well as an inflation hedge and investment asset, saw increasing adoption and acceptance. In addition, other decentralized<sup>8</sup> applications and protocols developed to support competing, complementary, or alternative digital assets for payments, transactions, investments, and other purposes began to surface. By the end of the last decade, a whole ecosystem<sup>9</sup> around these decentralized technologies had developed and blossomed (Arner, Auer, and Frost 2020, 2). And then, once again, the world faced yet another major global crisis with far-reaching implications.

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<sup>6</sup> See also Pollock and Adler 2022, Ch. 6.

<sup>7</sup> “Use case” for the purposes of this paper means the application of any specific digital asset. A use case will determine the utility of that application and thus the utility of the digital asset. See also Glossary of Defined Terms.

<sup>8</sup> Use of the terms “decentralized” and “decentralization” in the context of this paper is intended to capture the uniqueness of transactions using cryptography, which allows for anyone with computer access, an internet connection, and coding skills to create digital assets that can then be used to transact on a distributed network. These assets could thus be generated and transacted independent from any government authority, such as a central bank, whose role has traditionally been as the exclusive issuer and manager of currency (e.g., United States Dollar) backed by the full faith and credit of a sovereign nation (otherwise known as fiat). See also Glossary of Defined Terms.

<sup>9</sup> In this context, ecosystem is used in a general sense to encapsulate “a complex network or interconnected system” versus the more scientific usage which is defined by “a biological community of interacting organisms and their physical environment” (OxfordLanguages 2022).

In March 2020, the World Health Organization declared a global pandemic - officially labelled Covid-19. States around the world took measures, including closed borders, quarantines, internal restriction of movement, and various health and sanitation protocols to control it.<sup>10</sup> Two years later, with additional variants surfacing, government-imposed mandates, travel restrictions, vaccination requirements and other measures remained in force. The damage to economies, businesses, and individual lives was long-lasting and often severe.<sup>11</sup> The result was extended lock-down scenarios, concomitant retrenchments throughout affected industries, lifestyle changes due to remote working, home-schooling, and a general desire to pursue alternative sources of fulfilment after witnessing so much dislocation, suffering, death, and disruption. In addition, the pandemic served to accelerate the DeFi movement (Akana and Li 2022, 1-2; Arner, Auer, and Frost 2020, 2; Corporate Finance Institute 2020, 2-4). For example, the Bank for International Settlements (BIS) found that the pandemic changed the way that retail transactors approached methods of payment. In particular, the BIS reported in Working Paper 1055 that payment behaviour was influenced by trepidation “about viral transmission through cash” which ultimately “led both consumers and merchants to switch to digital payment methods” (Auer, Cornelli, and Frost 2022, 2).

In March 2022, the Bank of England published findings indicating that “[t]he outstanding value of cryptoassets grew around tenfold between early 2020 to

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<sup>10</sup> “Several governments have issued stay-at-home orders around the world to fight against the Coronavirus disease 2019 (COVID-19) pandemic. Even essential sectors (e.g., food production) have experienced shutdowns due to workers diagnosed with COVID-19, because COVID-19 spreads mainly through person-to-person contact” (Yilmazkuday 2021, 1).

<sup>11</sup> “The Coronavirus Disease 2019 (COVID-19) reduced economic activity in an unprecedented way. This resulted in extraordinary unemployment levels around the world. Accordingly, several central banks, including the U.S. Federal Reserve System, reacted to the economic developments due to COVID-19 by reducing their policy rates” (Yilmazkuday 2022, 67-68).

November 2021, peaking at US \$2.9 trillion” (Bank of England 2022, 6).<sup>12</sup> Those findings also reported an aggregate cryptoasset market valuation of US \$1.7 trillion at the time of publication versus an aggregate valuation of US \$0.13 trillion in January 2019 (Ibid, 11).<sup>13</sup> Graphic 1a) on the page following depicts the trading volumes of bitcoin and ether<sup>14</sup> relative to other cryptoassets, stablecoins, and fiat currencies during the period January 1, 2020 to May 17, 2022. Graphic 1b) on the page following depicts associated liquidity for the first five months of 2022:

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<sup>12</sup> “The price of a Bitcoin, for example, went virtually straight up from \$10,000 in October 2020 to over \$63,000 in April 2021, increasing more than six-fold” (Pollock and Adler 2022, Ch. 6).

<sup>13</sup> See Graphic 4a) in Chapter 4, Central Research Issues.

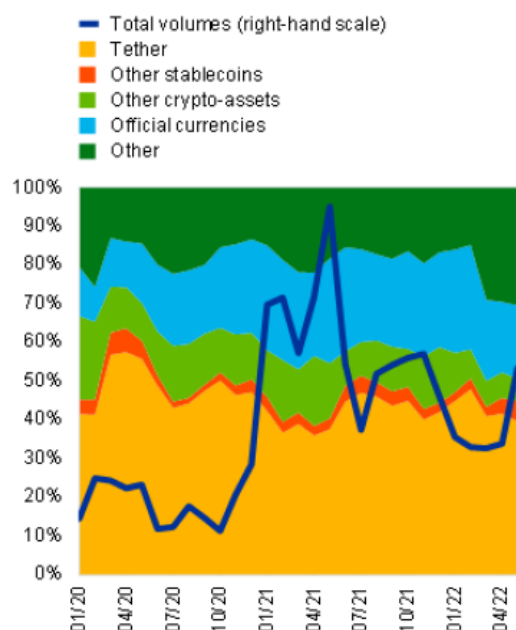
<sup>14</sup> Ether (ETH) is a digital asset trading on the Ethereum network described later in this section and as further discussed in Chapter 3, Literature Review and Theory.

### Graphic 1a) and 1b): Crypto-Asset Trading Volumes and Liquidity Provision

Tether dominates trading volumes within the crypto-asset ecosystem, and stablecoins provide most of the liquidity for decentralised trading and lending

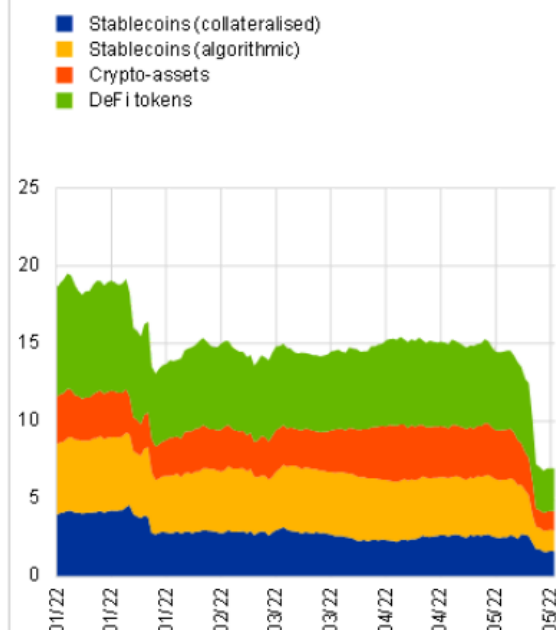
**a) Trading volumes of bitcoin and ether vis-à-vis other crypto-assets, stablecoins and official currencies (monthly average)**

(1 Jan. 2020-17 May 2022; left-hand scale: percentage points, right-hand scale: EUR billions)



**b) Liquidity provision for DeFi trading by type of asset (Curve, Uniswap, SushiSwap)**

(1 Jan. 2022-17 May 2022; EUR billions)



Sources: IntoTheBlock, CryptoCompare and ECB calculations.

Notes: Panel a: trading volume data are based on CryptoCompare's real-time aggregate index methodology (CCCAGG), which aggregates transaction data from more than 250 exchanges. The chart reflects the sum of trading volumes involving bitcoin or ether (monthly average), as well as the respective percentages of the volume of trades occurring between bitcoin/ether and listed assets or asset groups. "Other stablecoins" includes USD Coin, DAI, Pax Dollar, TerraUSD and 12 other large stablecoins. "Other crypto-assets" includes 29 of the largest unbacked crypto-assets after bitcoin and ether. "Official currencies" includes USD, EUR, JPY, GBP, RUB, PLN, AUD, BRL, KRW, TRY, UAH, CHF, CAD, NZD, ZAR, NGN, INR and KZT. "Other" consists of remaining assets not included in the preceding categories. Panel b: stablecoin liquidity in DEXes is approximated based on the ten most liquid pairs on Curve, Uniswap and SushiSwap as of 17 May 2022. Curve, Uniswap and SushiSwap represent approximately 50% of total value locked in DEXes. "Stablecoins (collateralised)" includes Tether, USD Coin and True USD. "Stablecoins (algorithmic)" includes DAI, Magic Internet Money and three further stablecoins. "Other crypto-assets" includes ether, PAX Gold and FNK wallet. "DeFi Tokens" includes wrapped bitcoin, Uniswap's governance token UNI, SushiSwap's governance token SUSHI and 16 other tokens of different DeFi protocols.



In June 2022, the Cambridge Center for Alternative Finance, World Bank Group, and World Economic Forum additionally published a joint 199-page study on the Global Covid-19 Fintech Market Impact, which noted that: “The Covid-19 pandemic necessitated an accelerated shift toward remote financial services” (Cambridge Center for Alternative Finance et al. 2022, 6). That following December, the BIS also released Working Paper 1055, previously referenced above, which described “greater familiarity with digital payment methods, or the quicker introduction of new payment methods” as examples of pandemic behaviours that “could have important, lasting effects on payment systems” (Auer, Cornelli, and Frost 2022, 5).

The steps governments took to try to ease the pandemic burden on the public, including small business loans, mortgage forbearance, student loan deferrals, and pandemic-relief payments, ultimately had a significant inflationary impact from extensive government borrowing.<sup>15</sup> As a Senior Fellow at the Hoover Institution observed:

- “The 2008 financial crisis was met with a torrent of borrowed and printed money to stimulate the economy...The COVID-19 recession was met with a tidal wave”.
- “Given these precedents, our financial system now firmly trusts that the government will borrow or print money in the event of any future crisis. But once fiscal space has run out and given way to inflation, the government’s ability to stop the next crisis may evaporate”.

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<sup>15</sup> Government-imposed COVID-19 measures “have created unprecedented unemployment rates around the world. Accordingly, several central banks have reacted by changing their policy rates to help their economies” (Yilmazkuday 2021, 1).

- “When people no longer have confidence that the borrowed money will be repaid, or that the printed money will be soaked up again, they will not lend more. Today’s small (so far) inflation is a taste of this fundamental change”

(Cochrane 2022, 1-2).<sup>16</sup>

Proponents of decentralized finance would point to this lack of confidence in the governance mechanisms of the existing monetary system as the primary catalyst for its growth: “The original cryptocurrencies offered an alternative to a financial system that had been dominated by governments and centralized institutions such as central banks” (Harvey, Ramachandran, and Santoro 2021, 12). More specifically, bitcoin has been heralded as a credible sovereign neutral and deflationary alternative to fiat that “will continue to grow as an important store of value and a potential inflation hedge - over long horizons” (Ibid, 11-12).<sup>17</sup>

But it has also been acknowledged that there can, indeed, be significant friction using traditional financial channels in crisis and other scenarios, as has recently been supported by Asian Development Bank (ADB) research.<sup>18</sup> Solving for this should then theoretically be a use case that transcends libertarian ideology. For example, in addition to the obvious burden of absorbing onerous transmission costs when sending money overseas to needy recipients, the ADB noted that such transaction

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<sup>16</sup> The inflation rate has remained consistently elevated since the April 15, 2022, publication of these remarks.

<sup>17</sup> See Annex following the conclusion of this paper for a further exploration of this concept through a case study of El Salvador’s bitcoin adoption and corresponding governance analysis.

<sup>18</sup> The ADB research revealed that Covid-19 “led to a massive spike in cross-border remittances to Pacific Island countries, with transfers to Fiji and Samoa increasing by as much as 400%” (Zoumboulis 2020). This research also concluded that “despite the growing money flows, the high fees charged by payment system operators and infrastructure providers (often with minimal or no competition) remain key obstacles” (Didenko and Buckley 2021, 12), one of the issues that blockchain proponents maintain the technology can solve.

inefficiencies “obstruct achievement of Sustainable Development Goal<sup>19</sup> 10 targets, particularly the elimination of ‘remittance corridors with costs higher than 5%’ and reduction of transaction costs of migrant remittances to less than 3% by 2030” (Didenko and Buckley 2021, 12).

So, in essence, what DeFi offers is potentially multi-fold. On the one hand crypto-assets, such as bitcoin, can (i) improve payment efficiency, (ii) serve as a store of value, and (iii) offer a hedge against the inflationary potential of traditional fiat and “political unrest at the hands of global governments” which could jeopardize the safety and soundness of a nationally controlled currency (Ibid, 11). On the other hand, cryptographic infrastructure such as Ethereum,<sup>20</sup> which allows for the creation and transaction of crypto-assets other than bitcoin through a smart-contract enabled digital network, “has properties that make it superior to traditional banking and finance” (Schueffel 2021, 6), the result of which can also “improve the building and linking of financial applications” and the overall delivery of financial services (Fraunhofer Institute for Applied Information Technology (FIT) 2022, 8). Indeed, it has been asserted that the “technologies that DeFi is based on push the very scope of the financial services industry itself” (Schueffel, 2021, 2).

States and regulatory authorities have only recently begun to consider the extent to which the DeFi movement can change the socio-economic landscape. The G30 has warned that it could be a “challenge to align interests” (Working Group on Digital Currencies 2020, 18), while at the same time also noting that “the externalities posed by digital currencies may prove so significant that previously

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<sup>19</sup> United Nations (UN) 2015.

<sup>20</sup> See note 14.

unthinkable levels of international coordination become possible” (Ibid, 20). The need for international coordination efforts has arguably only increased in importance following a distressing year for the crypto-markets in 2022, when several platforms operating across numerous jurisdictions suffered crippling losses, and in some cases ended up insolvent. Naysayers who may have previously discounted the digital asset and DeFi trend as a fad or sideshow are now no longer able to either ignore its growing popularity or its potential to unleash devastating consequences. Indeed, the G30 has concluded that “tokenization of payment systems using blockchain<sup>21</sup> has evolved to the point where government agencies and financial authorities can no longer afford to be passive bystanders” (Working Group on Digital Currencies 2020, 25).

This thesis will assess the role of digital assets in decentralizing financial markets, including the merits and risks thereof, as well as the role of centralized regulatory authorities in carrying out their responsibilities, including whether existing regulatory oversight is sufficient, or new or adaptive regulation is necessary to achieve regulatory objectives. A particular focus will be oriented towards digital asset platforms that contributed to the 2022 crypto-market crash, specifically Celsius, FTX, Terra/Luna, and Three Arrows Capital (3AC). A separate analysis of the monetary policy implications of El Salvador’s adoption of bitcoin as an alternative to sovereign-issued money is also annexed following the synthesis and conclusion of

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<sup>21</sup> Blockchain is a form of distributed ledger technology that is self-authenticating. It can be thought of as a digital spreadsheet with systematized protocols (i.e., cryptography) for verifying the accuracy of data capture and other activity. It has been described by Europol as “a transactional database...that employs an encryption method known as cryptography and uses specific mathematical algorithms to create and verify a continuously growing data structure – to which data can only be added and from which existing data cannot be removed” (Europol 2021, 6). See also Glossary of Defined Terms.

this thesis for some additional insight on the current and potential use and impact of these assets. In addition to Bitcoin, Ethereum, Celsius, FTX, Terra/Luna, and 3AC, other digital assets and platforms mentioned in this thesis include Paxos, Ripple, Tether, and USD Coin, as reflected in Graphic 11b) located at the beginning of Chapter 8.

Along with the aforementioned case studies, this thesis will also take a look at the evolution of money and the technological underpinnings of distributed ledger and blockchain technology (which provides the foundation for the creation of digital assets and the operation of their respective platforms) in Chapter 6, as well as the Macro Risks of Digital Finance in Chapter 7, including cyber crime, national security, and financial stability. Finally, an analysis of stablecoins, a type of digital asset that is pegged to another referenced asset (typically a sovereign currency or basket of such currencies or other digital assets), and the concept of central bank digital currencies will be undertaken in Chapter 9, leading into the conclusion of this thesis. The Chapter 10, Synthesis and Conclusion summarizes the case studies and analysis and ultimately arrives at an answer to each of the Questions Explored in the affirmative, i.e., that digital assets and decentralized financial markets can co-exist with traditional assets and financial markets, and in many circumstances standing regulation can address the risks inherent in these markets, while in other situations new or adaptive forms of regulation will be warranted.

## Chapter 2

### Questions Explored

The overarching questions that this thesis will aim to answer are as follows:

- (i) can the digital asset and decentralized financial markets examined in this thesis co-exist with traditional assets and financial markets, and, if so,*
- (ii) are traditional or novel forms of regulation (whether financial or otherwise) needed or desirable for the digital asset and decentralized financial markets examined herein?*

In order to reasonably and effectively do so, this thesis will first examine relevant literature across government and non-governmental organizations, industry and trade groups, as well as universities and academia in Chapter 3, Literature Review and Theory, followed by a presentation of the Central Research Issues in Chapter 4, which include cyber crime and national security, financial stability and resolution,

and global governance and accountability. An explanation of the qualitative methodology underlying the research and analysis, as well as the rationale behind the selection of each case study (i.e., different platform specializations involving lending, trading, private currency, investment asset, and in the annexed case study on El Salvador, adoption of a fiat alternative) is then provided in Chapter 5, Research Methodology, as a final step before moving into the research findings, corresponding analysis, and conclusion.

As a recent Deutsche Welle video queried: “Who do you want to control and safeguard your money? A central bank? A social media company like Facebook? Or (maybe) nobody at all? The answer to that question could well determine our future relationship to money.” (Pandey 2002; embedded video).

## Chapter 3

### Literature Review and Theory

Various use cases of digital assets have created novel issues for government agencies and regulatory authorities to consider. As the Group of Thirty summarizes, “the challenge posed by disruption from digital currencies affects all branches of government, not to mention international financial organizations such as the International Monetary Fund and the World Bank” (Working Group on Digital Currencies 2020, 1). The Financial Stability Board (FSB) has also concluded that although “crypto-assets remain a small portion of overall global financial assets” the “markets are fast evolving **and could reach a point where they represent a threat to global financial stability** due to their scale, structural vulnerabilities and increasing interconnectedness with the traditional financial system” (FSB Publication 2022, 1) (emphasis added). Indeed, this sentiment was reflected throughout the activities of the FSB over the course of the past year, including a



Consultative Document published in October 2022 on Regulation, Supervision and Oversight of Crypto-Asset Activities and Markets, a separate Consultative Report published that same month reviewing the FSB’s High-Level Recommendations of the Regulation, Supervision and Oversight of “Global Stablecoin” Arrangements, as well as a Statement on International Regulation and Supervision of Crypto-asset Activities issued the previous July (Financial Stability Board 2022).<sup>22</sup>

But these new innovations can also be employed to assist government agencies in fulfilling their respective missions. For example, many countries have been experimenting with the use of distributed ledger technology (DLT) for centralized digital currency transactions.<sup>23</sup> The Bank for International Settlements has explored this concept in more detail and concluded that the adoption and issuance of central bank digital currencies (CBDCs) **could indeed create efficiencies and lead to a more robust international monetary system** (emphasis added).<sup>24</sup> The International Monetary Fund (IMF) has also acknowledged that: “Cross-border payments are oftentimes slow, expensive, and risky as they are exposed to fundamental obstacles to trade...The need for better cross-border payments has long been recognized by the international community” (IMF Working Paper 22/217, 6).<sup>25</sup> At the same time, however, the BIS has cautioned that these ecosystems are creating an environment

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<sup>22</sup> The FSB had initially published a Final Report and High-Level Recommendations on Regulation, Supervision and Oversight of “Global Stablecoin” Arrangements in October of 2020 (Financial Stability Board 2020). See also Financial Stability Board Report to the G20 on crypto-assets (FSB Report 2018).

<sup>23</sup> See Graphic 2a) and 2b).

<sup>24</sup> The BIS has additionally reviewed retail central bank digital currency infrastructure, including the status, risks, and motivations of seventeen different ongoing CBDC projects globally (Auer and Böhme 2020). See also Auer, Cornelli, and Frost 2020; Auer, Frost, Gambacorta et al. 2021.

<sup>25</sup> See also *Opening Remarks by DMD Bo Li, Peer Learning Series on Digital Technologies and Digital Money in Asia and the Pacific*: “Moving money from one country to another can still be slow, expensive, and inconvenient...We can, and must, do better” (International Monetary Fund 2022, 2).

of “upheaval” that could “work against the public good” (Annual Economic Report 2021, 90). Specifically, the BIS has warned that, in addition to “the walled garden ecosystems of big techs” cryptocurrencies and stablecoins are “capable of fomenting a vicious circle of entrenched market power and data concentration” (Ibid).<sup>26</sup>

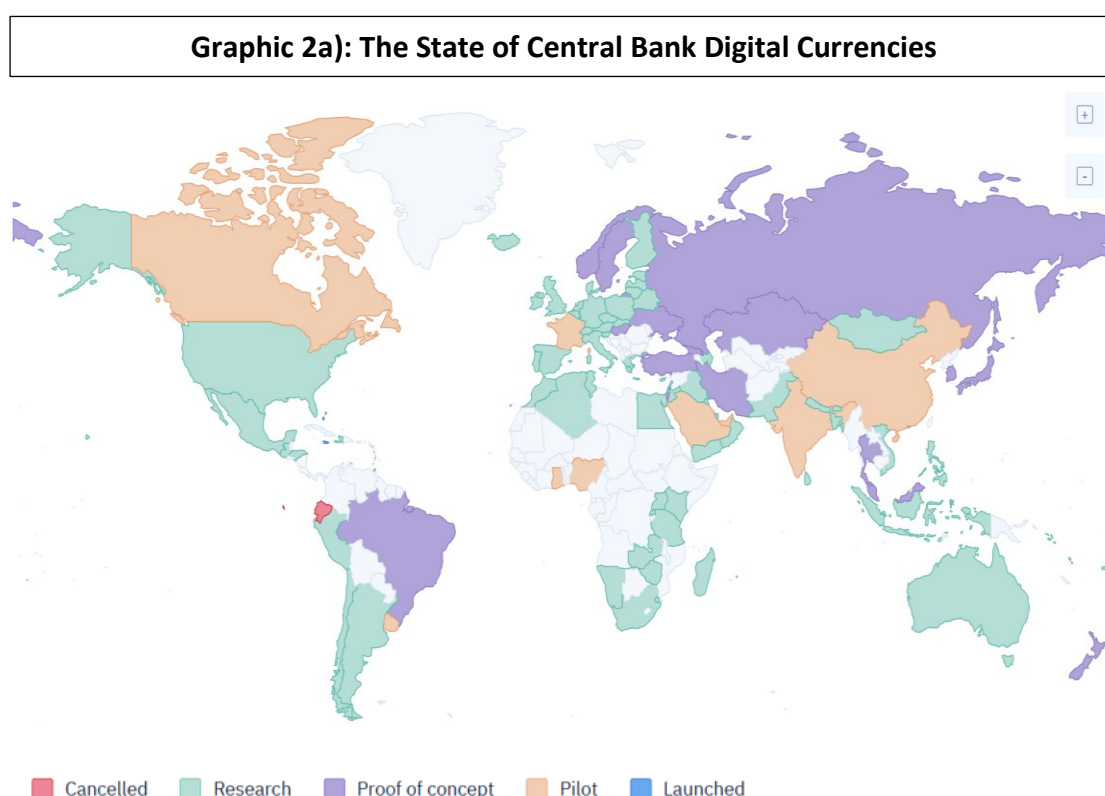
On the matter of impact of design choices on monetary policy, the BIS notes that “policymakers initially contemplated a CBDC that duplicated features of cash, without adding design characteristics that would make it more likely to compete with money issued by commercial banks – the so called disintermediation problem. However, more recently central banks have taken a broader view, and have been more open to the possibility that CBDCs can help them to fulfil their mandates, either in the present or the future. **Central banks are increasingly viewing CBDCs as a way to improve the payment system, promote financial inclusion, enhance monetary policy transmission, and reduce systemic risk**” (BIS Working Paper 1046 2022, 4) (emphasis added). For example, in March 2022, the BIS reported on Project Dunbar, which addresses international settlements using CBDCs (BIS Innovation Hub 2022).<sup>27</sup> The results of this collaboration demonstrated that “cross-border

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<sup>26</sup>The IMF, meanwhile, has expressed other concerns, noting that “disruption in cross-border payments emerging with new technologies...may allow for transactions that circumvent borders and regulations” leading to “fears of fragmentation that have risen given ongoing geopolitical conflicts” (IMF Working Paper 22/217, 6).

<sup>27</sup> Project Dunbar is described as “a collaboration between the Bank for International Settlements (BIS) Innovation Hub Singapore Centre, the Reserve Bank of Australia, Bank Negara Malaysia, the Monetary Authority of Singapore and the South African Reserve Bank” (BIS Innovation Hub 2022, 3). This was followed in July 2022 by a report to the Group of Twenty (G20) on the use of CBDCs for cross-border payments (Joint Report to the G20 2022). In March of the previous year, the BIS published a paper on multi-CBDC arrangements (BIS Paper No. 115 2021), as well as a report the following September on Project mBridge, its multi-CBDC collaboration with the People’s Bank of China, the Hong Kong Monetary Authority, the Bank of Thailand, and the Central Bank of the UAE through the BIS Innovation Hub Hong Kong SAR Centre (Bank for International Settlements 2021). Also in September 2021, the BIS announced that a multi-CBDC prototype showed potential for

payments could be made faster, cheaper and safer by reducing reliance on intermediaries, simplification of settlement processes, consolidation of common processes and process automation using smart contracts” and concluding that interoperable platforms for cross-border settlements could “approach the efficiency of domestic payments systems” that are currently being deployed (Ibid). Graphic 2a) provides a visual representation of CBDC experimentation, trial, and adoption around the world, followed by an indicative table of select countries’ CBDC experimentation in Graphic 2b):



Source: [Central Bank Digital Currency \(CBDC\) Tracker \(cbdctracker.org\)](https://www.cbdctracker.org/)

reducing costs among other benefits (September 28th Press Release), while the BIS Innovation Hub reported again on its work with Project mBridge in October 2022 (Bank for International Settlements 2022). The BIS has also published several related working papers exploring how central bank digital currency design choices impact monetary policy (BIS Working Paper No. 1046 2022), how to use CBDCs across borders, and on a prototype for two-tiered CBDC, known as Project Aurum (Bank for International Settlements 2022).

**Graphic 2b): Indicative Table of CBDC Adoption**

Government	CBDC Identifier	Test Stage	Fiat Currency	Other Features
Bahamas	Sand Dollar	In Circulation	Dollarized (USD Peg)	Retail CBDC; First CBDC Adoption
Brazil	Digital Real	Proof of Concept	Strong <sup>28</sup>	Retail CBDC; pilot targeted for 2024
China	E-CNY	Pilot <sup>29</sup>	Strong	Retail CBDC; Private Sector Digital Currency Prohibited <sup>30</sup>
El Salvador	BTC	Legalized 2021	Dollarized (USD)	Retail CBDC Proxy; USD/Fiat Alternative
European Union	Digital Euro	Research	Strong	Wholesale and Retail CBDC for EU Currency Union
Singapore	Project Urbin	Pilot	Strong	Wholesale CBDC; Project Orchid Retail CBDC cancelled 2022
Sweden	e-krona	Proof of Concept	Strong <sup>31</sup>	Retail CBDC; piloted Feb. 2020-Feb. 2021 <sup>32</sup>
United Kingdom	Digital Pound	Research	Strong	Digital Pound Foundation Formed Oct. 2021 <sup>33</sup>
United States	Digital Dollar	Research	Strong (Reserve)	Discussion Paper Issued by Federal Reserve Bank Jan. 2022

<sup>28</sup> Despite its relatively low exchange rate, the Brazilian real is still considered one of the strongest currencies in Latin America (Corporate Finance Institute 2022, 2-3; Yahoo! News 2022, 1).

<sup>29</sup> As Accenture recently presented at the OMFIF: “By the end of 2021, ‘s digital yuan pilot had reached 18% of the population with 261m users” (Velissarios and Patchay 2022, 2).

<sup>30</sup> “China has completely banned all cryptoassets and cryptoasset activities, including minting, use and circulation in the market as currency, public offerings, trading and speculation. It is also illegal for any overseas crypto exchange to provide services to Chinese residents via the internet.” (Elliptic Connect 2022, 1). Eight other countries have also imposed absolute bans, including Algeria, Bangladesh, Egypt, Iraq, Morocco, Nepal, Qatar, and Tunisia (The Law Library of Congress 2021). See also Graphic 3.

<sup>31</sup> On November 18, 2022, Fitch affirmed Sweden’s AAA Long-Term Foreign Currency Issuer Default Rating citing a “record of macroeconomic and financial stability” (<https://www.fitchratings.com>).

<sup>32</sup> “Sweden is one of the lowest cash-usage countries in the world” (<https://www.cbdctracker.org>).

<sup>33</sup> Elliptic Connect 2022, 1. “The Bank of England was one of the first banks to initiate research into CBDCs” (<https://www.cbdctracker.org>).

In June 2022, the BIS issued a second consultation on the prudential treatment of crypto-asset exposures, followed by a report on the prudential treatment of such exposures in December that same year incorporating feedback from the consultation (Basel Committee on Banking Supervision 2022).<sup>34</sup> Upon implementation, **banks will be required to “to classify cryptoassets on an ongoing basis into two groups”** for the purposes of determining risk based capital and corresponding risk management criteria (Ibid, 5) (emphasis added). Specifically: **“Group 1 cryptoassets are subject to capital requirements based on the risk weights of underlying exposures** as set out in the existing Basel Framework” whereas **Group 2 cryptoassets “are subject to a newly prescribed conservative capital treatment”** (Ibid).

Additionally, the BIS has published two working papers addressing cryptocurrencies and decentralised finance and how to build regulation into DeFi (BIS Working Papers 811 and 1061 2022). Reflecting on the utility and potential drawbacks of decentralised finance, the BIS acknowledges that DeFi “applications might have the potential to democratize finance by creating a level playing field among providers of financial products and services” but also cautions **“that the current design of DeFi applications, which are predominantly built on permissionless and pseudonymous blockchains generates formidable challenges for tax enforcement, aggravates issues of money laundering and other kinds of financial malfeasance,** and as a result creates negative externalities on the rest of the economy” (BIS Working Paper 1061 2022, 10) (emphasis added). Nevertheless,

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<sup>34</sup> The December report “sets out the final standard which the Committee has agreed to implement by 1 January 2025” noting that “the standard is unchanged from the proposal set out in the second consultation” (Basel Committee on Banking Supervision 2022, 5).

the BIS proposes that **“regulatory oversight in this new ecosystem” can be achieved “at the level of developers and validators, which in turn control the network protocol”** and that **if such “regulatory compliance is established, many other functions can be built that would address the majority of issues”** previously identified and **“preserves most of the desired properties of the blockchain such as observability of transactions”** (Ibid, 11) (emphasis added).<sup>35</sup>

The BIS’s proposed regulatory approach in Working Paper 811 differs from that set forth in Working Paper 1061, insofar as the focus is “relying on the trust-creating mechanism of decentralised markets for supervisory purposes” as opposed to validators and developers (BIS Working Paper 811 2022, 5). As an example, the BIS asserts that **“for the case of a bank that holds asset-backed tokens, compliance with the Basel III capital standards could be automatically verified.** This would be done by computing the ownership of (borrowing and lending) balances and the associated risk weights in the relevant distributed ownership ledgers. **In similar vein, in a token ecosystem, the full asset backing of a stablecoin could be monitored automatically”** (Ibid) (emphasis). Notwithstanding the differing approaches to regulatory oversight via developer and validator (WP 1061) versus embedded supervision (WP 811), however, these approaches are not necessarily incompatible as they can be used to address different regulatory issues.

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<sup>35</sup> The Bank of Canada has also noted the benefits afforded by permissionless usage: “Most Defi protocols are run as a *permissionless* environment where anyone can use the protocol without third-party consent. Contracts can then freely interact with each other, be built on top of other existing contracts and even function across different protocols. As a result, DeFi protocols are *composable*. For example, one can write a smart contract that builds on a lending protocol and an exchange protocol to create a margin trade protocol” (Chiu, Kahn, and Koepl. 2022, 8).

Elsewhere on the continent, the European Central Bank (ECB) issued a Macroprudential Bulletin in July 2022 containing its views on the functions and risks of stablecoins (Adachi, Bento Pereira Da Silva, Born et al. 2022).<sup>36</sup> This was followed by a Supervision Newsletter in August on licensing of crypto-asset activities, as well as a Research Bulletin in October that same year on the economics of central bank digital currency (European Central Bank 2022).<sup>37</sup> With respect to its position on stablecoins, the ECB has acknowledged that “they have become a critical part of the crypto-asset ecosystem **due to their frequent use in the trading of crypto-assets and as liquidity providers in DeFi**”<sup>38</sup> (ECB Macroprudential Bulletin 18 2022, 1-2) (emphasis added), although “the speed and cost of stablecoin transactions, as well as their redemption terms and conditions, have fallen short of what is required of practical means of payment in the real economy” (Ibid, 1). Additionally, the ECB has reported that “**the trading volumes of stablecoins surpassed those of unbacked crypto-assets in the course of 2021**,”<sup>39</sup> reaching average quarterly volumes...almost on par with those of U.S. equities on the New York Stock Exchange” (Ibid, 2), and warned of “**wide-ranging implications for crypto-asset markets if a large stablecoin were to fail**” including “**contagion effects if crypto-assets’ interlinkages with the traditional financial system continue rising**” (Ibid, 1) (emphasis added).

In November 2021, Fabio Panetta, Member of the Executive Board of the ECB, noted “history has repeatedly shown us that different forms of private money

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<sup>36</sup> The BIS also published a working paper on the risks, potential, and regulation of stable coins in November of 2020 (Arner, Auer, and Frost 2020). Stablecoins are digital assets pegged to traditional fiat currencies such as the U.S. Dollar or other digital assets. See also Glossary of Defined Terms.

<sup>37</sup> The ECB had previously issued a Eurosystem Report on a digital euro in October 2020 (European Central Bank 2020).

<sup>38</sup> See Graphic 1b).

<sup>39</sup> See Graphic 1a).

coexisting in the absence of sovereign money leads to crises. **The primary policy objective of a digital euro would be to pre-empt such a situation**” (The ECB Blog 2021) (emphasis added). As a follow on, the ECB additionally published a working paper in July 2022 on the optimal quantity of CBDC in a bank-based economy (European Central Bank 2022), while the European Commission separately issued a targeted consultation in April 2022 on a digital euro (European Commission 2022). The premise behind the April consultation is that a **“digital euro aims to preserve the role of public money in a digital economy”** and that **“the accessibility and usability of central bank money in the digital era is key to protect monetary sovereignty and the well-tested two-layer monetary system** based on convertibility of regulated/supervised forms of money into central bank money” (Ibid, 3) (emphasis added). The Commission additionally asserts in the consultation that a digital euro “would thus complement cash in providing a monetary anchor to the payments system **by ensuring that private money can always be converted in safe public money**” which “would support **confidence in the singleness of money and financial stability in the digital age**” (Ibid) (emphasis added).

In the United Kingdom, the Bank of England published a discussion paper on opportunities and challenges of CBDCs in March of 2020 (Bank of England 2020).<sup>40</sup> This was followed in June 2021 with a discussion paper on new forms of digital money (Bank of England 2021), and in December 2022 with an analysis addressing the governance of blockchain technology should it become materially integrated with the global financial system (Bank of England 2022).<sup>41</sup> Additionally, HM Treasury

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<sup>40</sup> Responses to the March 2020 Discussion Paper were published June 2021 (Bank of England 2021).

<sup>41</sup> That same month, the Bank of England also issued a publication entitled “CBDC Sample Wallet Proof of Concept and Research” (Bank of England 2022).



published consultation responses and a call for evidence in April 2022 related to the regulation of crypto-assets, stablecoins, and distributed ledger technology (HM Treasury 2022), followed by a new consultation in May 2022 concerning systemic failures in the digital asset space (HM Treasury 2022).<sup>42</sup> On the issue of governance, the Bank of England concluded that “DLT and programmable ‘smart contracts’ may enable a different – potentially simpler – network of relationships in financial markets, **which could bring a number of benefits** including greater efficiency and enhanced resilience, **if the technology is governed effectively** (Bank of England 2022, 2) (emphasis added). It was also recognized that DLT and, more specifically, blockchain technology, “**do not constitute critical financial infrastructure (yet)**” but “could conceivably become so in the future **if cryptoasset activity and its interconnectedness with the wider financial system continue to develop**” (Ibid, 3) (emphasis added). With respect to its views on regulation of distributed ledger technology and the transactions and services that it facilitates, HM Treasury has communicated its desire “to support industry in ensuring that current legislation and regulation is adapted to accommodate tokenisation and DLT” while at the same time “ensuring that broad regulatory outcomes are still met, and on the basis that **legislation should be technology neutral**” (HM Treasury 2022, 9) (emphasis added).

Across the pond, The White House and U.S. banking regulators jointly reported on the evolution of stablecoins in November 2022, along with perceived regulatory risks and recommendations for prudential regulatory oversight (President’s Working Group on Financial Markets, the Federal Deposit Insurance Corporation,

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<sup>42</sup> See also the FCA’s Policy Statement guidance on cryptoassets (Financial Conduct Authority 2019).

and the Office of the Comptroller of the Currency 2021; Board of Governors of the Federal Reserve System Discussion Paper No. 1334 2022).<sup>43</sup> Previously, the FRB had launched its inaugural public discussion regarding CBDCs in January that same year, accompanying a discussion paper on the growth potential and impact of stablecoins (Board of Governors of the Federal Reserve System 2022).<sup>44</sup> In February 2022, a white paper published by the Federal Reserve Bank of Boston and the Digital Currency Initiative at the Massachusetts Institute of Technology (MIT) summarized initial findings from Project Hamilton, a research collaboration on central bank digital currencies. The accompanying press release describes the first phase of the project as involving “concepts from cryptography, distributed systems, and blockchain technology **to build and test platforms that would give policymakers substantial flexibility in the potential creation of a CBDC**” (Federal Reserve Bank of Boston 2022, 1-2) (emphasis added).<sup>45</sup> And more recently, the Federal Reserve Bank of Richmond published an Economic Brief on central bank digital currencies and stablecoins in November 2022 (Sultanum 2022), which accompanied two press releases issued by the Federal Reserve Bank of New York that same month covering the initial results of its blockchain-based Project Cedar trials for cross-border

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<sup>43</sup> Earlier in April 2022, the FDIC published a Financial Institution Letter on Engaging in Crypto Related Activities (Federal Deposit Insurance Corporation FIL-16-2022). The Board of Governors of the Federal Reserve System also previously issued a Joint Statement with the FDIC and the Office of the Comptroller of the Currency regarding a Crypto-Asset Policy Sprint Initiative in November 2021.

<sup>44</sup> See also FEDS Notes Central Bank Digital Currency Literature Review (Carapella and Flemming 2020).

<sup>45</sup> It is important to note that the press release distinguished this project as “separate from the Federal Reserve Board’s evaluation of the pros and cons of a CBDC” (Federal Reserve Bank of Boston 2022, 1). The Federal Reserve Bank of St. Louis has also previously published research on blockchain and smart contracts (Schär 2021).

payments (November 4), as well as a proof-of-concept project involving DLT-based bank-to-bank digital money transfers (November 15).<sup>46</sup>

Michelle Neal, Executive Vice President and Head of Markets for the Federal Reserve Bank of New York, addressed several of these initiatives during a November 4, 2022 speech at the Singapore FinTech Festival where she acknowledged that advances in digital technology “has the potential to benefit the financial system writ large by reducing transaction costs, increasing competition, and broadening access to a wider range of participants” while at the same time expressing that such advances **“presents opportunities to both reinforce the role of central banks and regulatory bodies in stewardship of the global financial system and be positioned at the technological frontier”** (Neal 2022, 1) (emphasis added). On the prospect of central bank digital currency, Neal added that “a digital form of the U.S. dollar that is a direct liability of the Federal Reserve – has the potential to offer significant benefits. It could enable a payment system that is more efficient, provide a foundation for further technological innovation, and facilitate faster cross-border transactions” (Ibid). Regarding Project Hamilton, it was noted that “the Hamilton

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<sup>46</sup> See also the Federal Reserve Bank of New York’s Liberty Street Economics article: “The Future of Payments Is Not Stablecoins” (Garrett, Lee, Martin, and Torregrossa 2022). Other countries that issued 2022 reports on CBDCs include France (Joint CBDC Experiment Report with HSBC and IBM) (Banque de France 2022) and Japan (Interim Report by the Liaison and Coordination Committee on Central Bank Digital Currency) (Bank of Japan 2022). The Bank of Japan also previously published a 2020 Collaborative Report on CBDCs with the Bank of Canada, the Bank of England, the U.S. Federal Reserve System, the Bank for International Settlements, the European Central Bank, the Swiss National Bank, and the Sveriges Riksbank (Bank of Canada et al. 2020; see also Executive Paper Summary). And the BIS announced in February 2021 that the central banks of China and the UAE were collaborating on its digital currency project for cross-border payments (Bank for International Settlements 2021), which was followed by a BIS press release in October 2022 that it had completed a successful CBDC pilot with twenty banks in China, the UAE, Hong Kong, and Thailand (Bank for International Settlements 2022). In September 2022, the BIS also announced the launching of Project Icebreaker, a retail CBDC collaboration with the central banks of Israel, Norway, and Sweden (Sveriges Riksbank) (Bank for International Settlements 2022), followed with an announcement in November by the Banque de France that it had conducted a successful wholesale CBDC pilot with the Banque centrale du Luxembourg (November 29<sup>th</sup> Banque de France Press Release).

team was able to demonstrate the potential for usage at scale, which would be a key design element of a retail CBDC” (Ibid). And with respect to Project Cedar, the results presented “indicates that a modular ecosystem of ledgers has the potential for continued scalability, and that distributed ledger technology<sup>47</sup> could enable settlement times well below the current industry standard of two days, with the added guarantee of atomic settlement” (Ibid, 2).<sup>48</sup>

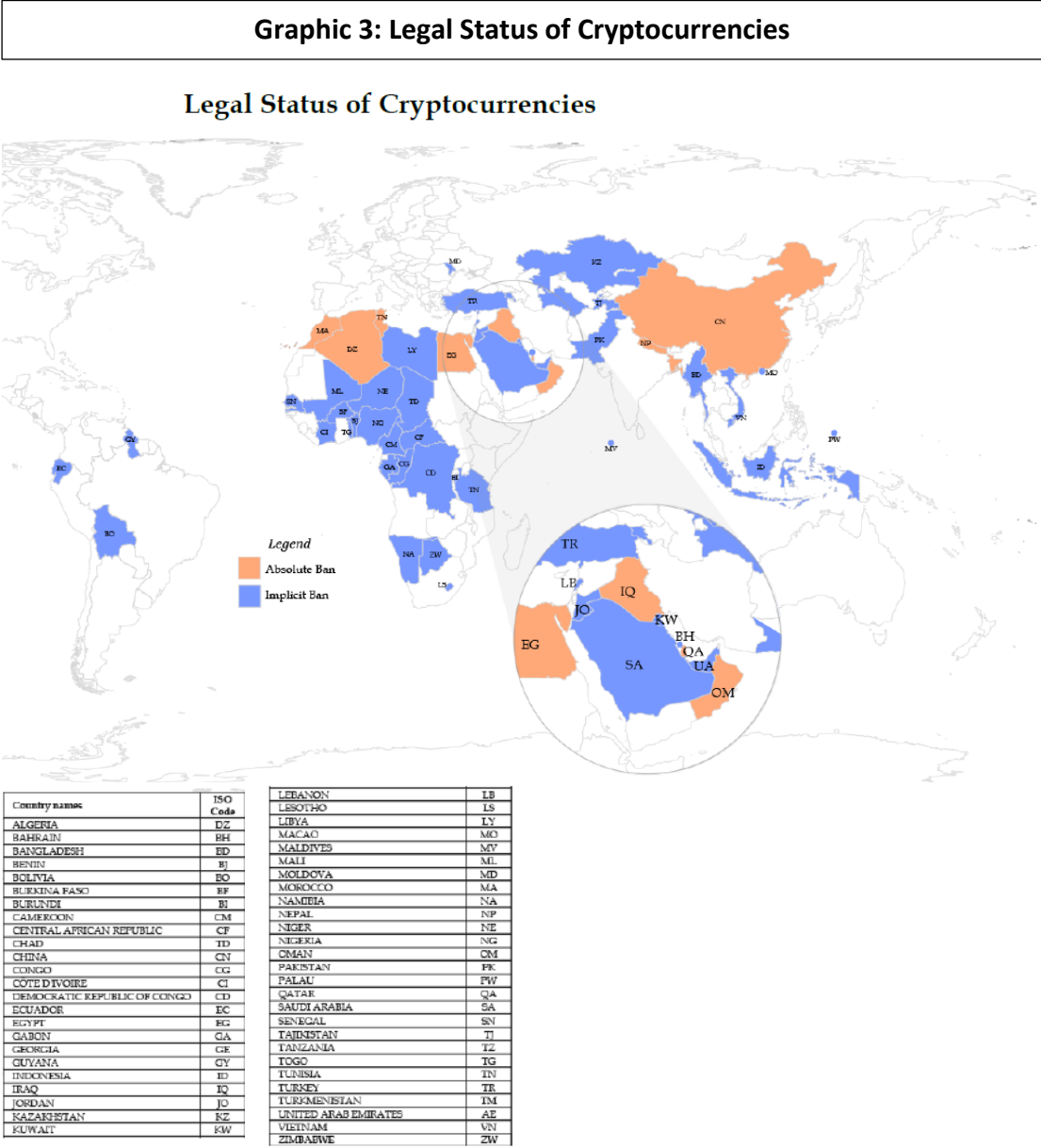
Thus, as a preliminary answer to the Questions Presented, the literature suggests that existing centralized monetary systems and novel decentralized financial systems can be compatible; provided, that governments and other centralized authorities approach these innovations as an opportunity for improvement across both the private and public sectors rather than as an existential threat. Indeed, the literature supports not only a general consensus that **blockchain technology offers features that can contribute to efficiencies** in the processing of payments and other financial transactions, **but also a willingness by regulators to find workable solutions** to address financial stability and other issues presented by delivery of financial services through decentralized protocols and privately controlled digital assets as opposed to seeking to eliminate them. The G30 has also rightfully recognized, however, that “competition between the private sector and the public sector is never a level playing field” (Working Group on Digital Currencies

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<sup>47</sup> Distributed ledger technology uses a digital spreadsheet that is shared and populated across computerized networks to record transactional data. Europol describes it as “a way of recording and sharing data across multiple data stores (also known as ledgers), which each have the exact same data records and are collectively maintained and controlled by a distributed network of computer servers called nodes” (Europol 2021, 6). See also Glossary of Defined Terms.

<sup>48</sup> Project Cedar involved testing “a hypothesis that there is a distributed ledger technology solution for wholesale FX settlement that results in instant and atomic settlement in which a wholesale CBDC is the settlement asset” (Neal 2022, 2). Atomic settlement is defined in the project summary as “meaning both sides of the simulated transactions were settled either simultaneously or not at all” (Federal Reserve Bank of New York 2022, 1). See also Glossary of Defined Terms.

2020, 21) and that the “history of currency shows that **while the private sector may innovate, in due time the government regulates and appropriates**” (Ibid) (emphasis added). In fact, as of January 2022, at least nine countries had banned private-sector digital currencies, while forty-two others had imposed various restrictions on transacting in digital assets such that the ability to do so in those countries has been severely inhibited (Quiroz-Gutierrez 2022). Graphic 3 provides a visual overview of the legal status of cryptocurrencies throughout the world:



Source: Susan Taylor, Law Library of Congress.

In the United States, select members of the U.S. Senate issued a letter to Facebook CEO Mark Zuckerberg in October 2021 urging the company not to continue pursuing Diem, a rebranded digital asset formerly developed as Libra. A similar letter was issued in 2019 to the Libra Association in connection with Facebook's previous iteration of the digital currency. In the more recent letter, the Senators noted that certain U.S. agencies responsible for financial regulation were "studying the risks that stable coins pose to financial stability" and "are considering how to address these inherent risks and clarify regulations and supervision of these products" (Senators Schatz et al. 2021, 3). On June 7, 2022, the "Lummis-Gillibrand Responsible Financial Innovation Act" was introduced to the United States Congress as Senate Bill 4356, the first U.S. federal legislative attempt to establish a comprehensive regulatory framework around digital assets (Lummis and Gillibrand 2022). This was followed the next day by virtual currency guidance issued by the New York State Department of Financial Services on stablecoins backed by the U.S. Dollar (Harris 2022), and a few weeks later by the introduction of Senate Bill 4760 to the U.S. Congress on August 3, 2022, otherwise known as the "Digital Commodities Consumer Protection Act of 2022" (Stabenow et al. 2022). Additionally, on December 21, 2022, U.S. Senator Pat Toomey introduced a related Senate bill entitled the "Stablecoin Transparency of Reserves and Uniform Safe Transactions Act of 2022" (United States Senate Committee on Banking, Housing, and Urban Affairs 2022).<sup>49</sup>

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<sup>49</sup> Alternatively referred to as the "Stablecoin TRUST Act of 2022"; see also US Senate Bill SIL22574 104. Meanwhile, in the U.S. House of Representatives, Rep. Josh Gottheimer had a draft bill in the

Earlier in March 2022, U.S. President Joseph Biden signed Executive Order 14067, which outlined seven areas of the Administration’s focus concerning digital asset innovation and use, including: (1) the protection of U.S. consumers, investors, businesses; (2) protection of U.S. and global financial stability and mitigation of systemic risk; (3) mitigation of illicit finance and national security risks posed by the use of digital assets; (4) promotion and reinforcement of U.S. leadership in the global financial system and technology and economic competitiveness; (5) promotion of equitable access to safe and affordable financial services; (6) supporting technological advances and ensuring responsible development and use of digital assets; and (7) exploring a U.S. central bank digital currency (The White House 2022). The following September witnessed the release of at least five reports generated as a result of this Executive Order; including two covering Climate and Energy Implications of Crypto-Assets, along with a Technical Evaluation for a U.S. Central Bank Digital Currency (The White House 2022), two from the Treasury Department on Implications for Consumers, Investors, and Businesses of crypto-assets, along with an Action Plan to Address Illicit Financing Risks of Digital Assets (U.S. Department of the Treasury 2022), and a separate report from the U.S. Department of Justice (DOJ) on The Role of Law Enforcement in Detecting, Investigating, and Prosecuting Criminal Activity Related to Digital Assets (The United States Department of Justice 2022).<sup>50</sup> Previously, in February that same year, the

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works called the “Stablecoin Innovation and Protection Act of 2022”. Further information about and discussion of relevant US Congressional legislation can be located in Chapter 9 and Graphic 13.

<sup>50</sup> According to a Fact Sheet issued on September 16, 2022, nine reports had been generated pursuant to Executive Order 14067 at that time (The White House 2022). Previously, the DOJ issued a report On International Law Enforcement Cooperation For Detecting, Investigating, And Prosecuting Criminal Activity Related to Digital Assets in June 2022 (The United States Department

DOJ had announced the appointment of its inaugural Director of the National Cryptocurrency Enforcement Team (NCET) (Press Release 22-140), which was formed in October of 2021 (Press Release 21-974). In its announcement, the DOJ stated that the mission of the NCET will be to “set strategic priorities regarding digital asset technologies, identify areas for increased investigative and prosecutorial focus, and lead the department’s efforts to coordinate with domestic and international law enforcement partners, regulatory agencies and private industry to combat the criminal use of digital assets” (Ibid). It also identified a new Virtual Asset Exploitation Unit of the Federal Bureau of Investigation (FBI) as a source of inter-agency collaboration (Ibid).

Back over the Atlantic, the European Council issued its own announcements on June 29, 2022, and June 30, 2022, that it had reached provisional agreements on regulating transparency of crypto assets for anti-money laundering purposes, along with a regulatory framework for markets in cryptoassets (MiCA), respectively (Council of the European Union 2022).<sup>51</sup> And in July 2022, The Law Commission of England and Wales published both a consultation paper on digital assets, as well as

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of Justice 2022), while the Treasury Department published a Request for Comment concerning Responsible Development of Digital Assets in July 2022 (U.S. Department of the Treasury 2022; see also related July 7, 2022, Press Release containing a Fact Sheet on a Framework for International Engagement on Digital Assets). The FSOC, which is chaired by the Department of the Treasury, also issued a Report on Digital Asset Financial Stability Risks and Regulation in October 2022 (Financial Stability Oversight Council 2022; see also related FSOC Fact Sheet published that same day).

<sup>51</sup> The provisional agreement on MiCA also involved the European Parliament. Agreement on the full text of the MiCA regulation was reached by the Council in October of 2022, subject to EU Parliament approval (Simmons & Simmons 2022) which occurred in April 2023. The European Parliament’s Policy Department for Citizens’ Rights and Constitutional Affairs separately issued a study in October 2022 on Intellectual Property Rights and Distributed Ledger Technology (European Parliament 2022).



a proposal calling for legal reforms related to digital assets and cryptotokens (The Law Commission of England and Wales 2022).<sup>52</sup> The proposal for reforms included:

- “Explicitly recognising a distinct category of personal property under the law which is better able to accommodate the unique features of digital assets”;
- “Options for how this distinct category of personal property could be developed and implemented under current law”;
- “Clarifying the law around ownership and control of digital assets”; and
- “Clarifying the law around transfers and transactions involving digital assets”

(Ibid, 3). Regulatory and possible enforcement action notwithstanding, the tokenization<sup>53</sup> of traditional economic markets is neither exclusive to transactions commonly associated with conventional fiat currency (e.g., payments) nor to transactions involving illicit activity. As such, decentralized ecosystems may potentially find ways to legitimately prosper irrespective of government bans<sup>54</sup> or restrictions on digital assets as a customary means of exchange within a centralized monetary system<sup>55</sup> (Kampakis 2018, 79).<sup>56</sup> The Law Commission has recognized this

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<sup>52</sup> See also related Summary of the Consultation Paper and Current Project Status on digital assets issued that same month (Law Commission of England and Wales 2022).

<sup>53</sup> “Tokenization” is a reference to the mechanism by which many digital assets are transacted (i.e., with tokens issued to users carrying pre-assigned rights associated with the blockchain platform to which the token relates). See also Glossary of Defined Terms.

<sup>54</sup> As of January 4, 2022, a *Fortune* article reported that cryptocurrency had been banned in China and eight other countries (Quiroz-Gutierrez 2022; see also note 30 and Graphic 3).

<sup>55</sup> “Centralized monetary system” in this context refers to a traditional fiat market where a centralized government authority issues, controls, and supervises a national or supranational currency. See also Glossary of Defined Terms.

and thus its reform proposals were designed to “help to create an environment that is more conducive to digital assets and their markets” (The Law Commission of England and Wales 2022, 3).

For example, in the book *Decentralization: Technology’s Impact on Organizational and Societal Structure*, the authors describe feasible and legitimate applications of decentralized, self-authenticating, DLT transactions, including currency, banking, lending, property, and insurance, as well as traditional financial assets such as securities, commodities, and their derivatives. The authors posit that “markets become more efficient, more profitable, and less risky when they achieve greater power decentralization, greater transparency, and more open membership.” (Calcaterra & Kaal 2021, Ch. 8, 14). The authors primarily look to liquidity in support of this position, noting “the more autonomous the members of the market are, the more they will have divergent interests and desires, which improves the market’s liquidity” (Ibid, 13), while additionally stating that “the more transparent the statistics of the market’s transaction is, the better it is for price discovery, which improves the market’s liquidity” (Ibid). The authors further assert that a “disadvantage of a centralized market is the overhead that a central authority charges” while at the same time decreasing liquidity via concentration of power (Ibid), which not only supports the authors’ claim of increased liquidity leading to increasing market efficiency but also their claim of higher profitability (Ibid).<sup>57</sup>

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<sup>57</sup> “The tokenization process can be described as an encapsulation of value in tradable units of account, called tokens or coins. The disruptive potential lies in expanding the concept of value that can be partitioned and traded beyond purely economic terms, including reputation, work, copyright, utility, and voting rights. Once tokenized, all these manifestations of value can be detected, accounted for, and leveraged in the context of a system of incentives that may promote fair levels of wealth and power redistribution” (Freni, Ferro, and Moncada 2022, 2).

Thus, to answer the question whether DeFi and traditional monetary systems can be compatible, it is also prudent to explore to what extent new decentralized digital ecosystems are innovating. More specifically, this would include ways extraneous to, for example, tokenized payment systems, which are not necessarily disruptive to the existing framework of embedded monetary systems but may radically transform the overall economic environment anyway. Such innovations are not only more likely to be readily embraced by existing monetary and regulatory authorities than applications which by intent or design threaten to displace them, but they may also provide a means or mechanism through which these authorities may better carry out the very supervisory roles and responsibilities they are charged with.<sup>58</sup>

The original Bitcoin (BTC) whitepaper is instructive to understanding the underlying technology primarily relied on for decentralized payments infrastructure (Nakamoto 2008). The subsequent whitepaper laying out the concept for Ethereum and its digital asset, Ether (ETH), expands this instruction to use cases beyond payments and settlements, such as the hosting of applications and smart contracts (Buterin 2013).<sup>59</sup> In addition to introducing the technology protocol underlying the digital asset ETH, Ethereum developer Vitalik Buterin asserts that the premise of

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<sup>58</sup> “The main concern for the ECB is not only that private companies dominate the payment sector, but that these companies are usually non-European companies, and they could eventually dominate the European payment market. Thus, the conclusion that the ECB drew from these risks is that to preserve a stable and reliable payment system in Europe, and to protect the strategy autonomy of European payments and monetary sovereignty, it is necessary to have a digital euro.” (Pymnts 2022, 2).

<sup>59</sup> “As its script is rather simple, Bitcoin is mainly a system for recording ownership and transferring value. It is not designed as a foundational layer for other protocols to build on. In contrast, Ethereum...was specifically built to support the execution of smart contracts” (Chiu, Kahn, and Koepl 2022, 9). The Ethereum network and ETH are the second-largest decentralized digital infrastructure and asset, respectively, following BTC’s development, although ether trading volumes have at times been higher than bitcoin (International Monetary Fund 2021, 2).

decentralized digital payment and transactional systems has existed “for decades” but failed to attract mass adoption previously due to an inability to solve for pure decentralization and delink from authentication through traditional intermediation (Ibid, 2).<sup>60</sup> While the Bitcoin protocol allows for disintermediation<sup>61</sup> via distributed consensus, Buterin argues that its use cases are not without trade-offs and offers the Ethereum network as an alternative platform for operating within a decentralized economy with different trade-offs, particularly when speed and relative security are an issue. (Ibid, 12). These trade-offs have materialized in the distinct application of the different protocols, with Bitcoin being relied on primarily for monetary functions such as payments and value capture and Ethereum providing a much broader range of services facilitated through its smart contract capabilities that may or may not mimic traditionally regulated financial services transactions or challenge existing fiat currency usage or monetary policy.

A Geneva Report on the World Economy also explores the various features of technologies underlying decentralized economies, while considering associated impacts and presenting considerations for how to address these new ecosystems from a public policy and regulatory perspective **acknowledging that “when the internet was being adopted for use within the financial sector, it too raised novel**

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<sup>60</sup> Buterin’s assertion has more or less been acknowledged by the U.S. Department of Commerce in its own publication presenting an overview of the technology which states that in the year Nakamoto’s whitepaper was published “the blockchain idea was combined with several other technologies and computing concepts to create modern cryptocurrencies: electronic cash protected through cryptographic mechanisms instead of a central repository or authority” and that “such blockchain based cryptocurrency was Bitcoin” (Yaga, Mell, Roby, and Scarfone 2018, 6).

<sup>61</sup> Disintermediation occurs when a middleman or intermediary is eliminated in the transaction process. An example would be purchasing a mutual fund directly from a mutual fund company, such as Fidelity or Vanguard, as opposed to purchasing this same instrument through a broker of securities products (OxfordLanguages 2022). Reducing the number of intermediaries in a transaction should theoretically also reduce the cost of the transaction as there are fewer parties to pay in the execution process. See also Glossary of Defined Terms.

**public policy questions”** (Casey, Crane, Gensler, Johnson, and Narula 2018, 54) (emphasis added). As an example, the report notes that “the SEC introduced Regulation ATS in 1998 to address new trading protocols emerging on the internet” while also reminding the reader **“that the new financial applications developed during the first phase of the internet – and the regulatory response they prompted – occurred some years after the core, underlying infrastructure had been built out”** (Ibid) (emphasis added). Furthermore, the report highlights some aspects of blockchain that it characterizes as “truly revolutionary” including that **“a blockchain system could securely track the ownership of every financial instrument and exposure in the global economy”** (Ibid, 89) (emphasis added). This capability could then lead to the following results: **“Money laundering and terrorist finance would be much easier to police. Authorities could monitor position concentrations and systemic risk. And financial market participants could overcome information asymmetries, improving risk pricing and capital allocation”** (Ibid) (emphasis added). But the report also warns that it could lead to *“a world without privacy”* adding that “it would be deeply ironic if...a technology initially championed by libertarians disenchanted by government and fiat money, ended up by narrowing the range of individual freedoms” (Ibid). At the same time, however, the report acknowledges that **for “law enforcement, financial regulators and risk managers, such a system could be a dream”** (Ibid) (emphasis added).

The U.S. Department of Commerce has additionally provided an overview of how the technology underlying decentralized ecosystems works, expressing as its rationale the “hype around the use of blockchain technology, yet the technology is not well understood. It is not magical; it will not solve all problems” (Yaga, Mell,

Roby, and Scarfone 2018, 6). The overview goes on to state that the **“use of blockchain technology is not a silver bullet**, and there are issues that must be considered such as how to deal with malicious users, how controls are applied, and the limitations of the implementations” as well as highlights other “technology issues that need to be considered,” including “governance issues that affect the behaviour of the network” (Ibid, 7). As an illustration of this point, the overview notes that **“in permissioned blockchain networks...there are design issues surrounding what entity or entities will operate and govern the network** for the intended user base” (Ibid) (emphasis added). It further emphasizes that the “technology is still new and should be investigated with the mindset of ‘how could blockchain technology potentially benefit us?’ rather than ‘how can we make our problem fit into the blockchain technology paradigm?’. Organizations should treat blockchain technology like they would any other technological solution at their disposal and use it in appropriate situations” (Ibid, 8).

An entry entitled “Some Economics of Fintech” published in a compendium of works by The 2<sup>nd</sup> International Conference on Blockchain Economics, Security and Protocols in 2020 (Tokenomics 2020)<sup>62</sup> effectively summarizes existing challenges and debate on this topic:

- ***“Digital currencies...can provide consumers with user-friendly low-cost means of payment and facilitate the integration of payment systems across borders. They may also offer alternatives in countries with dysfunctional national monetary systems. On the supply side, private***

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<sup>62</sup>Specifically, six regular papers, four short papers, and three invited talks.

*digital currencies can be a source of funding...and allow businesses to retain consumers and collect information”.*

- *“Popular permissionless cryptocurrencies lack in their current form the price stability necessary to serve as a store of value...Stable coins pegged to a central-bank currency and backed by safe collateral...creates new challenges: collateral must be segregated and prudentially supervised to ensure consumer protection...More generally, a private digital currency would raise a range of public policy issues ranging from tax fraud and money laundering control to loss of seignorage revenue,<sup>63</sup> impediments to monetary policy, and the potential threat to financial stability”.*
- *“Central Bank Digital Currencies (CBDC) may provide a solution...But the scope of a CBDC’s deployment needs to be carefully calibrated: a CBDC directly held by wholesale or retail depositors would compete with bank deposits, limiting banks’ ability to engage in their essential function...Overall, the deployment of new technologies for payments can create meaningful value for consumers. However, technological disruption does not upend the fundamental economic principles that have shaped our financial systems and its regulatory framework”*

(Tirole 2020, 11) (emphasis added).

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<sup>63</sup> Seignorage revenue is the “profit made by a government by issuing currency, especially the difference between the face value of coins and their production costs” (OxfordLanguages 2022). See also Glossary of Defined Terms.

To summarize and expand on this thinking and the rest of the literature reviewed, it can be helpful to view the historical discourse around digital assets and decentralized financial markets through the separate lenses of (i) government and non-governmental organizations (NGOs), (ii) industry and trade groups, and (iii) universities and academia to highlight where there is consistency or divergence of thought.

### 3.1 Governments and NGOs

Much of the literature has been focused on the publications and actions of governments and NGOs because, in order to answer the Questions Explored as to (i) whether digital asset and decentralized financial markets can co-exist with traditional assets and financial markets, and, if so (ii) whether traditional or novel forms of regulation (financial or otherwise) are needed or desirable for such assets and markets, understanding the thinking of governments that have the authority to regulate and NGOs which influence the actions of those authorities is arguably the most critical. After all, governments that have the authority to regulate also have the authority to extinguish, whether directly (i.e., outright bans) or indirectly (e.g., by making operational compliance cost prohibitive). Indeed, we have seen this already with China and several other countries. So, what else is there to learn?

Perhaps most importantly, despite the approach that some countries have taken to ban or severely restrict digital assets and the decentralized financial markets they transact in, even more countries are experimenting with central bank digital currencies in an effort to procure the benefits of the same underlying technology for a sovereign purpose. This is true even for countries like China which, notwithstanding the ban on private market transactions, has been one of the



leaders in exploring the benefits of the technology for state use, as is evidenced by its digital yuan pilot and participation in the BIS sponsored Project mBridge.

Additionally, we know that apart from initiatives sponsored by the BIS - which represents 63 central banks the world over - several jurisdictions' central banking systems have independently been experimenting with distributed ledger and blockchain technology, along with the markets that this technology supports, to determine what risks and benefits may be presented. This includes the European Central Bank, the Bank of England, the Bank of Japan, the Reserve Bank of Australia, the Monetary Authority of Singapore, the Bank of Canada, as well as the U.S. Federal Reserve System and the Federal Reserve Banks of St. Louis, Richmond, New York, and Boston. Furthermore, we know that other NGOs are weighing in, such as the IMF, who has reported on both the potential for blockchain technology and the digital assets it supports to improve the efficiency of cross-border payments, while also expressing concern over ensuring cohesiveness in those transaction for regulatory and geo-political purposes. Separately, the Financial Stability Board has registered its own concerns over the area that it knows best – the financial stability risks that may be posed by the introduction of digital asset and decentralized financial markets. And, returning to government, the White House has publicly voiced its concerns around not only financial stability risks, but also risks involving national security and cyber crime.

### 3.2 Industry and Trade Groups

Financial stability and cyber crime were additionally a topic of consideration at Tokenomics 2020, notwithstanding that digital asset and decentralized financial markets are largely a product of industry. While the real identity of Satoshi

Nakamoto remains unknown and may, in fact, belong to more than one person, what is clear is that **the initial adopters of the Bitcoin protocol were not governmental authorities or NGOs, but industry.** This was additionally true for the Ethereum network and all subsequent creations of digital assets and associated platforms over the initial decade or so that these assets and networks were developing. That is, until more recently when governments began experimenting with distributed ledger and blockchain technology through application of the infrastructure generally and, even more recently, with the exploration of the utility of central bank digital currencies. It would be expected, of course, that industry trade groups would largely take positions that benefit the interests of their constituents. This can be seen, for example, in the El Salvador Case Study included in the Annex to this thesis. In that case study, the founder of a blockchain trade association in Peru is noted as championing Peruvian preferences for crypto-assets and the decentralization of currency exchange. The main premise for this support is a common theory that crypto-assets can provide a means to counter local concerns over unwelcome sovereign action in countries, like Peru, which have seen their fair share of political problems and economic distress.

Particularly noteworthy at the intersection of industry and government is the now-defunct Libra/Diem project engineered by the social media platform, Facebook. As discussed previously, the U.S. Senate directed a letter to Facebook which amounted to essentially a cease-and-desist request with respect to further development of the project. The basis upon which the Senate issued the request was that the financial stability risks of such a product, along with appropriate regulation and supervision, were still being evaluated from a public policy

perspective. This was quite an unusual move considering that what Facebook was doing was perfectly legal and constitutional in the United States and, in any event, matters concerning U.S. regulatory compliance are within the auspices of the executive branch, not the legislative branch, just as matters concerning U.S. constitutional interpretation are within the auspices of the judicial branch, and not the legislative branch. Of course, many other digital assets have been created for similar commercial purposes as Libra/Diem without rankling the feathers of Congress. Thus, it was likely the massive market share and reach of Facebook globally that was the primary cause of concern as it created an environment in which the potential mass adoption of such a product, should it have manifested, was less a theoretical possibility than a probable reality. Indeed, as we have seen, the U.S. Federal Reserve System is, itself, considering the implications of a central bank digital currency to supplement or complement the U.S. Dollar, and has partnered with the Massachusetts Institute of Technology in Project Hamilton on this initiative.

### 3.3 Universities and Academia

The importance of contributions from universities and the broader academic community is, in general, one of neutrality. Insofar as universities and academia can be viewed as offering an objective take on nascent developments, it serves as a useful benchmark from which to measure the positions emanating from government and industry, both of which - at least theoretically - may approach issues with a bias towards advancing a particular agenda (e.g., self-preservation) and/or achieving a specific goal (e.g., profit-seeking). That said, it is perhaps not always the case, as there are instances when academia partners with either industry or government to achieve a common objective. Project Hamilton, the joint effort of

MIT and the Federal Reserve Bank of Boston to test the viability of a U.S. sponsored central bank digital currency, is one such example. While MIT institutionally is likely agnostic as to whether there is a U.S. issued CBDC, its partnership with a quasi-governmental institution on Project Hamilton suggests that, at least with respect to this project, its interests are almost certainly aligned with the goals of its project sponsor, the U.S. Federal Reserve System.

Outside of government and industry collaborations, one can find academic perspectives that are both supporting and critical of digital asset and decentralized financial markets. Sticking with MIT for the time-being, it will be discovered later in the Chapter 6 discussion of blockchain technology and its uses that the head of MIT's Cryptoeconomics Lab is a proponent of the technology underlying the issuance and transacting of digital assets, stating that the ability which this creates to decentralize commercial activities is one of blockchain's most promising features. Indeed, in this same discussion, the Editorial Director of an MIT business school publication is quoted as believing that blockchain technology, and by derivation, digital assets will become commonplace in the exchange of goods and services. But not everyone in academia is so bullish on crypto-assets and decentralized finance, as will be revealed in Chapter 4's presentation of the Central Research Issues. Specifically, in the discussion of potential financial stability risks, an American University law school professor refers to digital assets and decentralized financial markets as "Shadow Banking 2.0" and compares the risks of such markets to similar risks in traditional financial markets that precipitated the Global Financial Crisis. So, ironically, it appears we have come full circle as it was the GFC that is largely believed to have

been the catalyst for the origination of digital assets and decentralization of finance to begin with.

The Bitcoin whitepaper was released by its anonymous developer in 2008 on top of the ashes of the GFC representing the first iteration of a DeFi ecosystem that has considerably evolved almost a decade and a half later, with significant additional adoption arising from the chaos of the more recent Covid-19 pandemic. In political theory concerning statehood, five change agents of “displacement, layering, drift, conversion, and exhaustion” have been claimed as contributing to “the gradual emergence of new models that call into question old ones” (Gerschewski 2020, 46). Others have pointed to the “radicalization of individualization” and “demand for more democracy – and, sometimes, radical democracy” and a current social movement that favours increasing autonomy and flexibility thus “demanding new forms of rule” (Domingues 2019, 79, 84). One argument is that a backlash against established geopolitical and socio-economic norms has been brewing for a while as a response to a complex layering of issues “that made many ordinary people...feel threatened and marginalized, falling in status and economic prospects” (Diamond 2020, 37). Another claim is that the GFC both contributed to the increasing importance of financial markets as an agent of state, as well as compromised the state as a unifying force for constituencies due to the ripple effects of the crisis in consolidating the markets globally (King and LeGaylès 2017, 20-21). A parallel case could also be made in the aftermath of the Covid-19 pandemic (Bolleyer and Salát 2021, 1121-1122).<sup>64</sup>

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<sup>64</sup> “The concern about the power and potential corruptibility or fragility of intermediaries, possibly heightened by the experience of the 2008 financial crisis, has contributed to the new ‘revolution’

Increasingly, technology provides a platform for the democratization of public discourse and exchange of ideas, transaction of commerce, and a means for transparency that challenges existing centralized power structures in a manner that is novel and complex (Diamond 2020, 36).<sup>65</sup> Exploring the socio-economic and geopolitical catalysts for the development of decentralized ecosystems could thus offer insight into how these systems may integrate with existing centralized monetary structures, including ways that governments and policymakers could potentially approach these new markets to address mutual concerns.<sup>66</sup> Or, as Accenture has cogently articulated to the Official Monetary and Financial Institutions Forum (OMFIF): “With change comes both challenges and opportunities. For those institutions that have built a business around the friction that these new developments are intended to overcome, there will be resistance. For those that will benefit from this change, it could not come soon enough. **Innovation in new forms of digital money is not just about technology but also the potential strategic and economic impacts**” (Velissarios and Patchay 2022, 2) (emphasis added).

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brought about by the blockchain technology, which is one of the fastest growing financial innovations over the last decade. Its attraction lies in the ability to build decentralized and open access platforms that reduce the reliance on centralized trusted intermediaries and middlemen” (BIS Working Paper 1061 2022, 8).

<sup>65</sup> “A long time has passed since 1776, when Adam Smith defined political economy in his monumental work ‘The Wealth of Nations’” (Kampakis 2018, 2).

<sup>66</sup> “The use of blockchain-based tokens allows the creation of new kinds of economies, completely customisable and adaptive, while at the same time ensuring security and transparency without a central authority...Indeed a very interesting question is what would happen if central banks and governments were able to integrate blockchain within their current monetary system” (Ibid).

## Chapter 4

### Central Research Issues

Based on the foregoing literature review, this paper will focus on the following key themes and issues material to the evolution of decentralized finance to arrive at a reasoned conclusion to the questions presented:

#### 4.1 Cyber Crime and National Security

Two focus areas laid out in the recent U.S. Executive Order on digital asset innovation are **“the protection of US consumers, investors, businesses”** and the **“mitigation of illicit finance and national security risks posed by the use of digital assets”** (The White House 2022) (emphasis added). In alignment, two of the public policy issues highlighted at Tokenomics 2020 were tax fraud and money laundering control (Tirole 2020). In addition, a recent McKinsey & Company study noted that: **“Those engaged in prohibited and outlawed activities** – such as illicit drug trade,

tax-avoidance schemes, money laundering, and consumer scams – **are increasingly utilizing digital-payments channels**, raising the risk that money is being laundered by these means” (Mikkelsen, Rajdev and Stergiou 2022, 2) (emphasis added).

#### 4.1.1 Cyber Crime

According to the World Economic Forum (WEF), “**the pseudonymous and borderless nature of cryptocurrency systems**<sup>67</sup> (and the fact that virtually anyone can create a new cryptocurrency and send it to other addresses) **raises potential financial integrity risks**” (World Economic Forum 2021, 8) (emphasis added).<sup>68</sup> In addition, the WEF has noted that “regulators have raised concerns about the prospect of self-hosting due to the nascent development of true non-intermediated transactions **and their potential for money laundering (ML) and terrorism financing (TF)**” pointing out that “the Financial Crimes Enforcement Network (FinCEN) made self-hosted wallets the focal point of its Notice of Proposed Rulemaking released in December 2020”<sup>69</sup> which, if adopted, would require “that services providers collect KYC information when performing transactions involving self-hosted wallets (Ibid, 11) (emphasis added).<sup>70</sup> The WEF also acknowledged, however, that “such approaches have been met with criticism by some who say that such data collection erodes existing thresholds of privacy, is practically difficult to

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<sup>67</sup> Footnote from quoted text intentionally omitted.

<sup>68</sup> “Countries that have proposed bans due to concerns about fraud and AML/CFT risks include Turkey, India and Nigeria, among others” (World Economic Forum 2021, 18); See also note 30.

<sup>69</sup> The public comment period for the proposed rule (85 FR 83840), which was originally set to expire on January 4, 2021, was reopened by supplemental publication in the Federal Register on January 15, 2021 (86 FR 3897), with a new outside expiration date of March 1, 2021. On January 28, 2021, it was further announced in the Federal Register that the deadline had been extended to March 29, 2021 (86 FR 7352). There is no evidence that any further action has been taken by FinCEN on the rule proposal since then.

<sup>70</sup> “Self-hosted wallets” are described by the WEF as “generated by computer protocols and are available to the public directly via the internet” (World Economic Forum 2021, 9). See also Glossary of Defined Terms.



enforce and establishes a stricter set of rules than those that apply to cash transactions today” (Ibid).<sup>71</sup>

#### 4.1.2 National Security

The World Economic Forum has also pointed out that “the decentralized nature of cryptocurrency transactions is not dependent on entities on which financial sanctions and embargoes can be imposed via traditional means. As a result, it is difficult for governments and international organizations to enforce financial sanctions or embargoes” (Ibid, 8).<sup>72</sup> For example, “Western governments have unleashed punishing sanctions on Russia in response to their invasion of Ukraine, cutting off Russia’s financial system (including its Central Bank)” leading some to question whether “Bitcoin and cryptocurrency could enable Russia to bypass these restrictions” (Pines 2021, 38).<sup>73</sup> If these concerns were proven accurate, it would necessarily lead to an even bigger question as to **whether DeFi networks more generally pose risks to national security**: “The same properties of digital assets that make them attractive to criminals - such as censorship resistance, pseudonymity and the ease with which they can be transferred across borders - also make them

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<sup>71</sup> It is also worth noting that AML/KYC laws are not in force or adequately enforced in every jurisdiction: “Since China has prohibited virtual asset activities, many AML/KYC requirements remain inapplicable” and India has “no regulation implementing the FATF’s Travel Rule for cryptocurrency service providers” (World Economic Forum 2021, 22). According to the WEF: “The Financial Action Task Force (FATF) has examined and provided recommendations for a risk-based approach to regulating cryptocurrencies aimed at preventing money laundering and terrorism financing” but that disparity in “implementation of the recommendations has also resulted in issues related to regulatory arbitrage” (Ibid, 24).

<sup>72</sup> “One major challenge in crypto is that there is not – and never can be – a single comprehensive list of all crypto addresses controlled by sanctioned actors. While data analytics techniques can identify ‘clusters’ of wallets that sanctioned actors control, those actors often use new crypto addresses with no previous transaction history. It is only after those new addresses begin to transact that data analysis can link them to a sanctioned actor’s wallet cluster” (Elliptic Connect 2022, 1).

<sup>73</sup> “The growing prevalence of virtual currency as a payment method brings greater exposure to sanctions risks – like the risk that a sanctioned person or a person in a jurisdiction subject to sanctions might be involved in a virtual currency transaction” (Redbord and Cronan 2022, 2).

valuable tools for all intelligence agencies looking to fund clandestine operations” (Robinson 2022, 2). According to Lawrence Scheinert, OFAC’s Associate Director of Compliance and Enforcement, “the virtual currency industry – including technology companies, exchangers, administrators, miners, wallet providers, and users – **play an increasingly critical role in preventing sanctioned persons from exploiting virtual currencies to evade sanctions and undermine U.S. foreign policy and national security interests**” (Redbord and Cronan 2022, 2) (emphasis added).<sup>74</sup>

#### 4.2 Financial Stability and Resolution

A further issue covered by the U.S. Executive Order is “**protection of US and global financial stability and mitigation of systemic risk**” (The White House 2022) (emphasis added). This is consistent with some of the challenges addressed at Tokenomics 2020 as summarized previously: “Popular permissionless cryptocurrencies lack in their current form the price stability necessary to serve as a store of value...Stable coins pegged to a central-bank currency and backed by safe collateral...creates new challenges: collateral must be segregated and prudentially supervised to ensure consumer protection...More generally, a private digital currency would raise a range of public policy issues...impediments to monetary policy, and the potential threat to financial stability” (Tirole 2020, 11).

In April 2022, *The Atlantic* published an interview with American University law professor, Hilary J. Allen, entitled “Is Crypto Re-Creating the 2008 Financial Crisis?” (Warzel 2022). The interview was inspired by the author’s review of another paper

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<sup>74</sup> OFACs position is based on “sanctioned persons and countries” becoming “more desperate for access to the U.S. financial system” presumably which becomes less available once such persons and countries are publicized as being the subject of sanctions (Office of Foreign Assets Control 2021, 9).

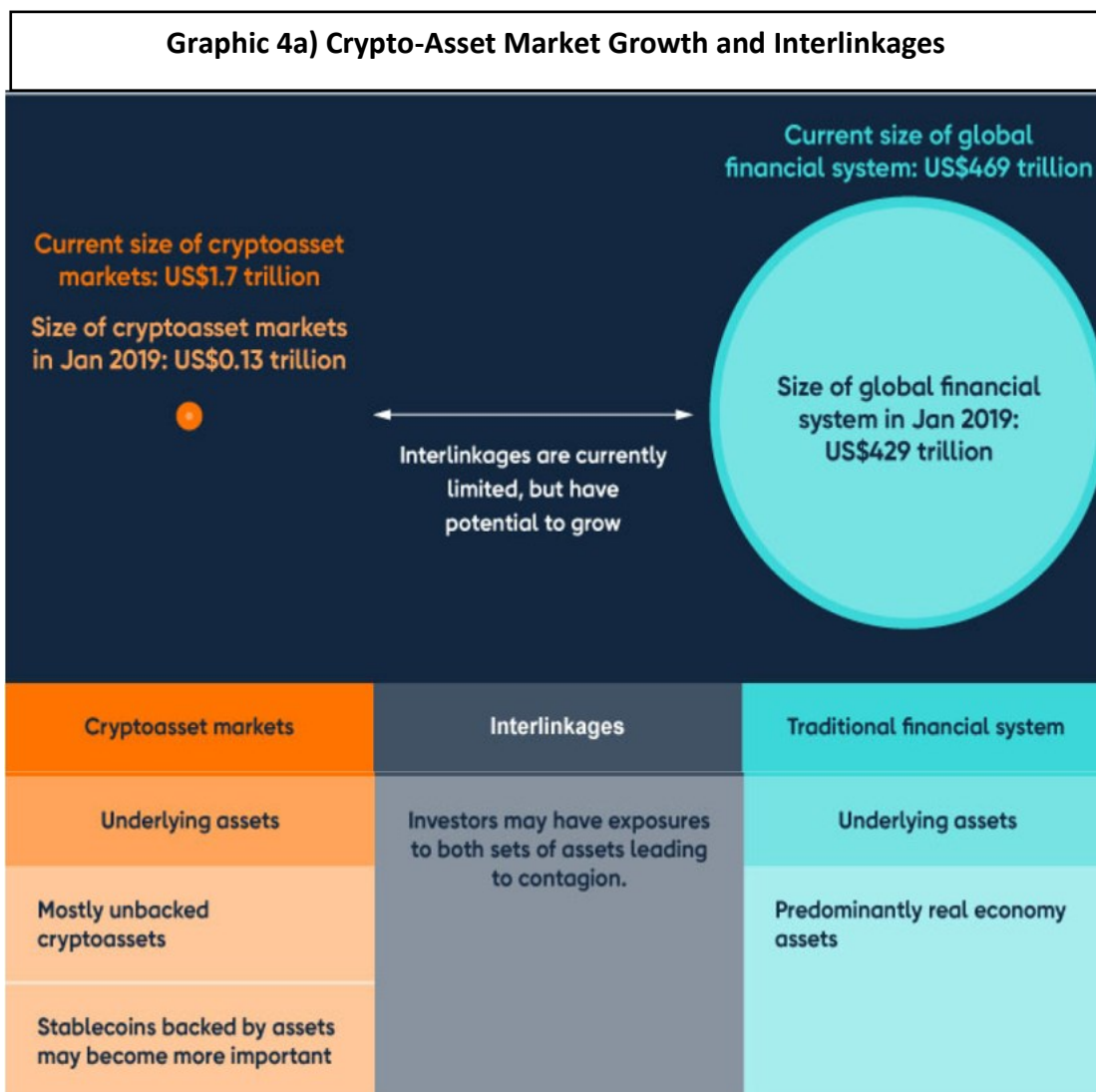
penned by Allen entitled “DeFi: Shadow Banking 2.0” (Ibid).<sup>75</sup> In the article, Allen observes: “The growth of so-called ‘shadow banking’ was a significant contributor to the financial crisis of 2008, which had huge social costs that we still grapple with today” (Allen 2022-2023, 1). Allen goes on to caution: “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’re already facing the prospect of Shadow Banking 2.0 in the form of decentralized finance, or ‘DeFi’**” (Ibid) (emphasis added).

In contrast, a recent Bank of England Financial Policy Committee study has concluded that “direct risks to the stability of the UK financial system from cryptoassets and DeFi are currently limited” (Bank of England 2022, 4). But this study also concluded that **“if the pace of growth seen in recent years continues, and these assets become more interconnected with the wider financial system, cryptoassets and DeFi will present financial stability risks”** (Ibid) (emphasis added). The study further noted that “[m]any of **the risks posed by cryptoassets and DeFi are similar to those managed by the existing regulatory framework** in other parts of the financial system” and in such cases **“the existing regulatory framework can be used to manage the risks”** (Ibid, 14) (emphasis added).<sup>76</sup> Graphic 4a) on the page following provides more information and data on crypto-asset market growth and interlinkages:

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<sup>75</sup> This article, which was originally posted online in draft form in 2022, was subsequently published May 2023 in the William & Mary Law Review ; <https://papers.ssm.com/so13/>

<sup>76</sup> See also Graphic 4a) and 4b).



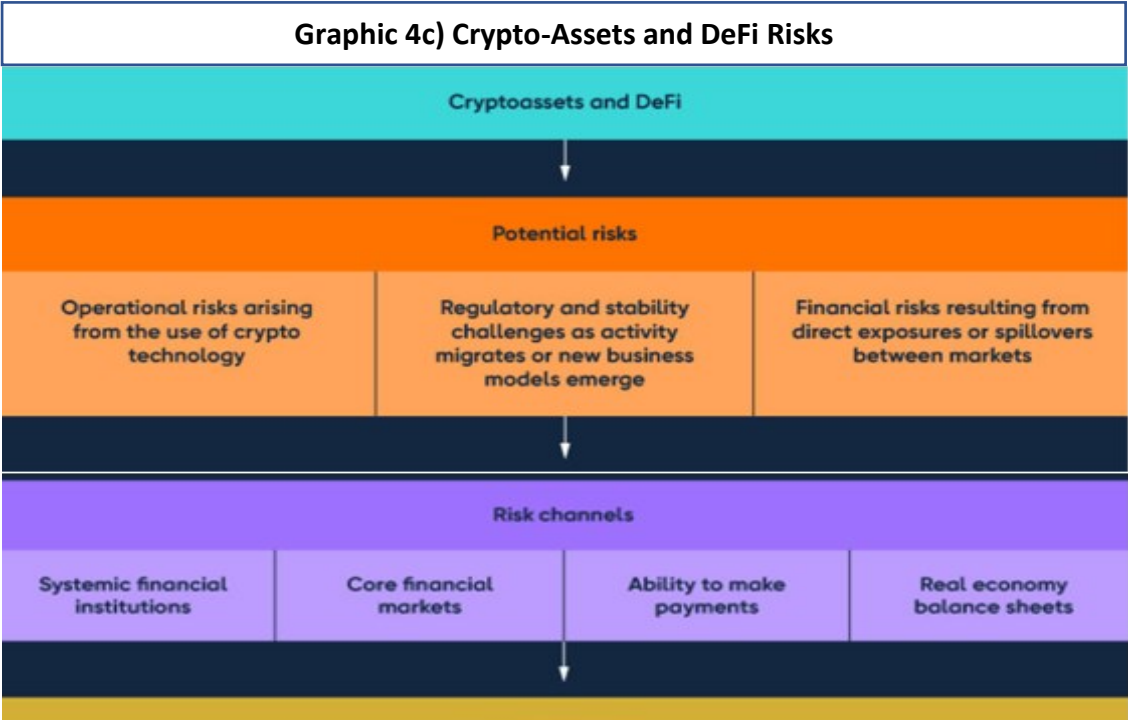
Source: CoinMarketCap, Financial Stability Board and Bank Calculations

The Bank of England’s views were more or less echoed in the BIS’s second consultation on the prudential treatment of cryptoasset exposures, which states: “Since the publication of the first consultative document the cryptoasset market has expanded further...**While the cryptoasset market remains small relative to the size of the global financial system**, and banks’ exposures to cryptoassets are currently limited, **its absolute size is meaningful** and there continue to be rapid developments. The Committee believes that **the growth of cryptoassets and related services has the potential to raise financial stability concerns** and increase

risks faced by banks” (Basel Committee on Banking Supervision 2022, 5) (emphasis added). This notwithstanding, the BIS also noted that the purpose of the second consultation “was to achieve the general principles set out in the first consultative document of ‘**same risk, same activity, same treatment**’” (ibid) (emphasis added). Graphic 4b) and 4c) depict crypto-asset market activities and risks:

Graphic 4b) Crypto-Asset Market Activities		
Activities		Activities
Trading	Investors can borrow in one system and invest proceeds in the other.	Trading
Lending		Lending
Asset management	Activity could migrate from traditional system to cryptoasset markets and vice versa.	Asset management
Payments		Payments
Insurance		Insurance
Wallet providers		Asset managers and investment firms

Source: CoinMarketCap, Financial Stability Board



Source: Bank of England 2022.

### 4.3 Global Governance and Accountability

A third theme covered by the U.S. Executive Order is “exploring a US central bank digital currency” (The White House 2022) (emphasis added). While the utility of a CBDC might ultimately be multifaceted, it could arguably also satisfy the themes of the Executive Order concerning “promotion of equitable access to safe and affordable financial services and promotion and reinforcement of US leadership in the global financial system and technology and economic competitiveness”, as well as “supporting technological advances and ensuring responsible development and use of digital assets” (Ibid).<sup>77</sup> That said, it is worth noting that the purpose of CBDC adoption in relation to developed market economics should be expected to be primarily motivated by different policy objectives than one of financial inclusion or fiat substitution as would more likely be the case in development economics.<sup>78</sup>

For example, the World Economic Forum has pointed out that “another concern expressed by central banks is that **widely adopted cryptocurrency could potentially weaken a country’s monetary sovereignty if fewer people use the domestic unit**

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<sup>77</sup> As was noted at Tokenomics 2020: “Overall, the deployment of new technologies for payments can create meaningful value for consumers” and “provide consumers with user-friendly low-cost means of payment”, as well as “facilitate the integration of payment systems across borders” and provide “a source of funding” facilitating “businesses to retain consumers and collect information” (Tirole 2020, 11). As a result, many countries are exploring or have even implemented a digital currency tied to the country’s existing internal monetary system, which would thus be issued, monitored, and controlled on a centralized basis utilizing similar technological protocols and platforms on which bitcoin and other digital assets operate on a decentralized basis. These government controlled digital assets are generically referred to as Central Bank Digital Currencies or CBDCs. See also Glossary of Defined Terms.

<sup>78</sup> CBDCs have additionally been credited with providing “alternatives in countries with dysfunctional national monetary systems” (Ibid); however, this is a characteristic more commonly attributed to emerging markets and developing economies, such as El Salvador, which is covered in more depth in the Annex. For example, the World Economic Forum has reported: “Globally, it is estimated that more than 1.7 billion adults are counted as ‘unbanked’ and lack access to even a basic savings account” and that “de-risking decisions have increased in the financial sector and have consequently reduced the number of financial services available to populations in the affected jurisdictions, often smaller countries with younger financial markets” (World Economic Forum 2021, 14; citing Lee 2021).

**of account.** Though there are no current examples of this taking place, central bankers are concerned that **this could potentially result in more volatility of domestic prices as the central bank cannot employ monetary policy as effectively**” (World Economic Forum 2021, 7) (emphasis added). In her May 26, 2022, testimony before the United States House of Representatives Committee on Financial Services, Federal Reserve Vice Chair Lael Brainard noted that: “In the 19<sup>th</sup> century, active competition among issuers of private paper banknotes led to inefficiency, fraud, and instability in the U.S. payments system, which ultimately necessitated a uniform form of money backed by the national government” (Brainard 2022, 2). And she further observed that: “In some future circumstances, **CBDC could coexist with and be complementary to stablecoins and commercial bank money by providing a safe central bank liability in the digital financial ecosystem**, much like cash currently coexists with commercial bank money” (Ibid) (emphasis added).<sup>79</sup>

While both the Asian Development Bank and Tokenomics forum also support the premise that CBDCs can offer solutions, others have questioned the utility of a central bank digital currency to transact in a token-based economy **in which decentralization has been inherent to the design and benefits of implementation**.<sup>80</sup> In turn, similar to the concerns laid out during the Tokenomics

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<sup>79</sup> An April 2022 World Economic Forum report cites “87 countries” collectively “constituting over 90% of global GDP” are currently undergoing some stage of a CBDC-based initiative, including “14 countries already piloting CBDCs” (Slavin and Waliczek 2022, 3-4; see also Graphic 2a) and 2b)).

<sup>80</sup>The ADB research determined that CBDCs “likely offer the best solution to the financial inclusion and remittance problems that bedevil the Pacific region” (Didenko and Buckley 2021, 2). In doing so, however, the bank also noted that the CBDC must be “well-designed and implemented” given that it is based on “a complex piece of software” with a “complex digital framework” that could result in both “economy-wide benefits and shocks” (Ibid).

forum about the risks of CBDC usage,<sup>81</sup> **other risks in addition to “banking sector disintermediation”** have been cited in a recent World Economic Forum publication, **including “challenges of cybersecurity, costs of implementation for central banks, implications for the international financial system” and what is flagged as perhaps the gravest risk: “user privacy”** (Slavin and Waliczek 2022, 4) (emphasis added).<sup>82</sup>

Irrespective of whether the United States moves forward with U.S. CBDC adoption, however, there remains the matter of its role as issuer of the world’s primary reserve currency and custodian of its largest financial market. In such capacity, and insofar as the DeFi movement exists **in a conceptually borderless ecosystem**, the approach that the U.S. ultimately takes to regulating this market **will have material implications** not only for the development of this market globally **but also for the role the U.S. will ultimately play within it**. As reflected at this year’s World Economic Forum: “The White House is about to make a concerted effort to regulate the digital asset industry – given the size and growth of the industry, that push cannot come soon enough” (White, Goel, and Waliczek 2022, 3). A visual representation of the CBDC and stablecoin ecosystem is provided in Graphic 5 on the page following:

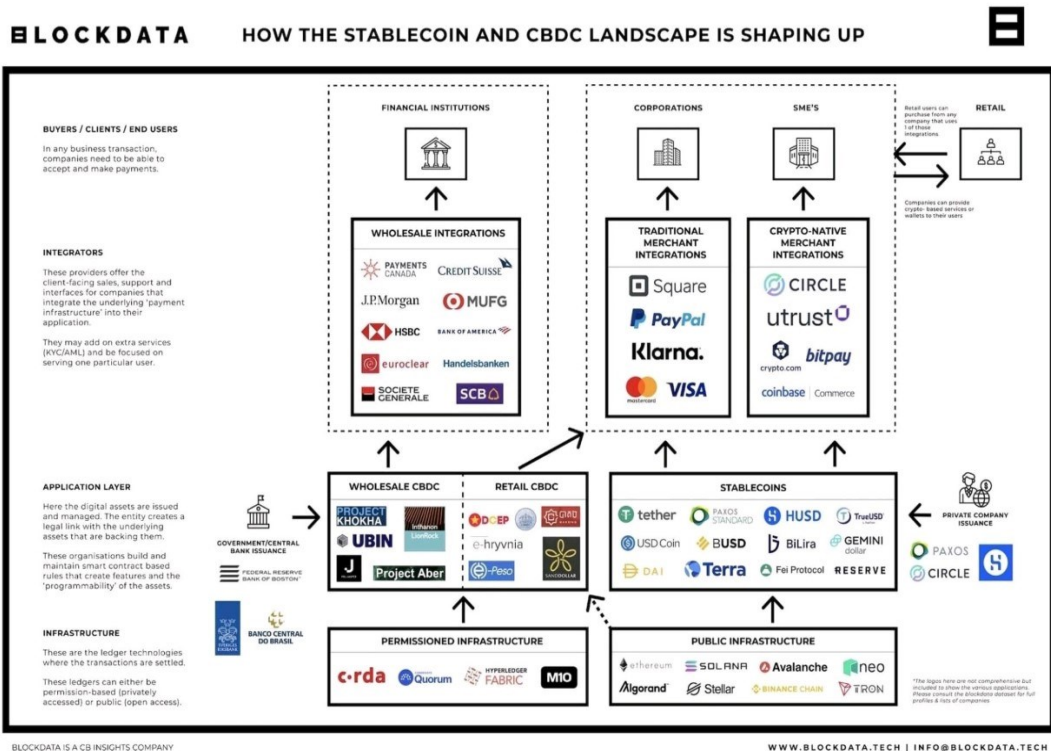
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<sup>81</sup> Specifically, that “a CBDC directly held by wholesale or retail depositors would compete with bank deposits, limiting banks’ ability to engage in their essential function” and hence that this underscores the need to ensure that “technological disruption does not upend the fundamental economic principles that have shaped our financial systems and its regulatory framework” (Tirole 2020, 11). Considering this, it was cautioned that while CBDCs may “provide a solution...the scope of a CBDC’s deployment needs to be carefully calibrated” (Ibid).

<sup>82</sup> World Economic Forum research has also found that “global transaction fees average 6.38% for remittances” noting that “the UN Sustainable Development Goals (SDGs) call for universal access to financial services, and lowering of the average cost of sending remittances to less than 3% by 2030” and offering that “where remittance corridors remain very expensive...cryptocurrency (including stablecoins) could offer a means of rapid and lower-cost remittances” (World Economic Forum 2021, 15; footnote from quoted text intentionally omitted).



**Graphic 5: Stablecoin and CBDC Landscape**



The purpose of this governance analysis will be to take a closer look at the risks posed by digital assets: Are they creating greater risks or merely similar risks to traditional finance that can be effectively managed either by (i) applying existing regulation or (ii) adapting such regulation to whatever the unique characteristics of the market are (e.g., its decentralized nature or use of decentralized autonomous organizations (DAOs) for governance) that may leave current iterations of existing regulation something short of entirely workable? Hence, this analysis will also focus on exploring a regulatory response to the development of the digital asset and DeFi markets, whether that be CBDC adoption, existing or adaptive regulation, new regulation altogether, or a combination of each. Included in this analysis will be

further inquiry into the impact of decision-making in these areas on the development of the digital asset ecosystems globally.<sup>83</sup>

In addition to the Central Research Issues summarized above, this thesis will also present some foundational information on the following topics for the purposes of aiding the reader in better understanding the genesis of the Questions Explored, the Central Research Issues, and their evaluation through the Recent Case Studies and Global Governance analysis:

- a brief history of money and its evolution to the place where the current (or centralized) international monetary system exists today given that private digital assets, such as bitcoin, are being used as an alternative to or substitution for fiat currency for the purposes of payments and settlements, storing value, inflation hedging, and investment returns,

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<sup>83</sup> There has been much debate around the energy consumption of digital asset transactions and whether the use of distributed ledger technologies is contributing to the global movement toward clean energy and carbon neutrality or further expanding the carbon footprint and increasing the negative impact of human civilization on the planet. A recent IMF study has concluded that “based on the parts of the payment system on which data on energy use is available, an estimate of 43.7 TWh of annual energy consumption” is attributed to global digital payments infrastructure (Agur et al. 2022, 27). This study further quantified the impact as “about 0.2 percent of total global electricity consumption” and measured this impact as “roughly comparable to the annual electricity consumption of a small, advanced economy, like Portugal, or a sizeable developing economy, like Bangladesh” (Ibid). In addition, a recent IMF blog post makes the case that “some kinds of crypto assets can be more energy efficient than much of the current payment landscape, including credit and debit cards” (Agur, Lavayssière and Bauer 2022, 3). Thus, at least from the IMF’s point of view, the environmental impact of digital asset transactions is not ostensibly overly burdensome and could, in fact, be leveraged in a manner that minimizes the impact of more traditional payment mechanisms. But others see things differently. For example, in an article written for the 2022 World Economic Forum Annual Meeting, Rick Lacaille, the Global Head, Environmental, Social and Governance at State Street Corporation, reflected: “Cryptocurrencies get a bad rap from environmentalists - and with good reason. Bitcoin consumes more electricity in a year than Sweden, Norway, or the United Arab Emirates” (Lacaille 2022, 2). Thus, this issue has clearly not been settled. Notwithstanding the importance of this debate, however, it nevertheless shall remain outside the scope of this research.

and governments are also exploring central bank digital currencies as a complement to or replacement of this phenomenon;

- the features of self-authenticated distributed ledger (or blockchain) technology that serves as the infrastructure for decentralized digital asset transactions insofar as some basic technical knowledge of the way DLT provides the infrastructure for digital assets, as well as the benefits and limitations of the technology and the risks and issues it presents, is instructive for understanding the Questions Explored, Central Research Issues, and related analysis;<sup>84</sup>
- various use cases of blockchain technology both in its existing state and with respect to its potential for future application as a means of showcasing the evolution of the digital asset and decentralized financial economy and its potential reach and possibilities, as well as how the selected case studies fit within that overall landscape;
- issues associated with such use cases that make the use case either more or less attractive (or neither) as compared to traditional market channels to offer some more perspective on reasons for (or against) user adoption of private digital assets, as well as the relative growth of digital asset markets generally; and
- use cases that venture into areas traditionally regulated, managed, and/or administered through government and other centralized authorities, as well as any attempts by such centralized authorities to

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<sup>84</sup> “Prudent regulation requires an in-depth understanding of the blockchain technology that underpins cryptocurrencies, and its power to revolutionize the global financial system” (World Economic Forum 2021, 26).

either prohibit, severely restrict, or commercially regulate such use cases to highlight areas in which governments and regulatory authorities may have legitimate policy concerns (whether or not acted upon).

The aim of this project is to address the Central Research Issues and answer the Questions Explored based on the results of the research described in the following pages and an analysis of the Recent Case Studies presented, with the intent of both contributing to a better understanding of the digital asset economy, its impact on current financial markets, and the implications this may have for regulatory and monetary policy, as well as furthering the discussion of how digital asset markets are shaping the future of decentralized finance.

## **Chapter 5**

### **Research Methodology**

This project employs a qualitative approach, incorporating contemporaneous and historical review through sources secondary or tertiary to the primary source material, including interview and survey-based research not the author's own. This qualitative approach has been applied given that the nature of the Questions Explored, along with the relatively nascent availability of robust and relevant data sources, do not lend themselves readily to a more quantitative methodology. Interview and survey-based research is oriented around academics, policy strategists, industry experts, regulatory representatives, and related participants, including both supporters and skeptics of decentralized finance and alternative monetary systems, and has been obtained exclusively from previously published sources as opposed to being conducted by the author independently. A list of referenced persons can be located in the front matter and the sources relied on for

the written research can be found in the bibliography following the annex to this thesis.

The primary assumption underlying the application of this methodology is that most interview subjects would be predisposed to bias in favour of their existing professional roles/agency relevant to the Questions Explored and the Central Research Issues presented. Due to this inherent bias, the Research Methodology has emphasised written research over interview and survey sources, although the latter will be presented as a component of previously published, relevant authoritative sources where appropriate. Specific case studies that the author has curated from the written research to serve as a foundation for exploring the Central Research Issues and answering the Questions Presented include Celsius, FTX, Terra/Luna, and Three Arrows Capital:

- Celsius. Celsius Network, LLC was one of the largest crypto lenders prior to its bankruptcy in July 2022. Its founder and CEO has since resigned due to the turmoil and questions have been raised regarding the platform's regulatory status, including whether it was involved in offering unregistered securities (Post 2022), in addition to claims by former employees that the organization was disorganized and engaged in heavy risk-taking, as well as possible market manipulation (Capoot, Rooney, and Tortorelli 2022, 3).
- FTX. FTX was a cryptocurrency exchange founded in 2019, which at one point operated as one of the largest crypto trading platforms in the world (Hawkins 2022). On November 11, 2022, FTX's U.S. operations filed for Chapter 11 bankruptcy protection in the United States following a series

of events that left the company severely undercapitalized (Huigsloot 2022).

- Terra/Luna. Terra is a USD pegged algorithmic stablecoin through its companion coin, Luna, that lost its peg and virtually all its value in May 2022, after having previously been listed as one of the top ten most valuable cryptocurrencies.<sup>85</sup> Its founder, Kwon Do-Hyung, is now under suspicion of money laundering and possible securities law violations (Levi 2022, 2).
- Three Arrows Capital. Three Arrows Capital (3AC) was a hedge fund investing in and arbitraging crypto assets. 3AC filed for bankruptcy in June 2022, after rapid declines in crypto markets exposed the fund's over-levered positions (including in the cryptocurrency Luna which was algorithmically associated with Terra by design) (Wieczner 2022).

An additional case study on El Salvador has been included in the Annex following the conclusion of this thesis. El Salvador is a country in Central America that is considered an emerging markets economy (Muci and CoinDesk 2022). Its national currency is pegged to the U.S. Dollar<sup>86</sup> and it also legalized bitcoin as a fiat alternative in September 2021 (Hanke and Hofmann 2022; Rosen 2022; The Daily Forkast 2022).<sup>87</sup> As of June 2022, it was being reported that the country had

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<sup>85</sup> Specifically, Terra's market value fell approximately 99% in less than 24 hours from > US \$40 billion to about US \$500 million (Levi 2022, 1). The failure of TerraUSD resulted in a US \$60 billion loss to holders and investors (Duggan 2022, 3). Prior to this, Terra had at one point been ranked only behind Tether (USDT) and USD Coin (USDC) in overall market capitalization (Wong 2022, 1). See Graphic 11b).

<sup>86</sup> See Graphic 2b).

<sup>87</sup> Purportedly as a result the country currently owns at least 2,301 bitcoins (Rosen 2022, 2). And other sources estimate this amount to be even higher "accumulating over 2,381 Bitcoin worth \$57 million as of July 2022" (Ferranti 2022, 2). See also note 334.

sovereign debt with a principal value of \$800 million coming due the following January,<sup>88</sup> with an estimated probability of default just below 50% (Muci and CoinDesk 2022).<sup>89</sup> This case study is the only one involving bitcoin transactions, an important application given the foundational underpinnings of the Bitcoin Whitepaper to the development of digital asset markets overall. Because the use case concerns El Salvador as a sovereign, however, it is also the only case study involving public versus private market adoption. Thus, its governance analysis is necessarily separate and distinct from the other four use cases and, as a result, is also addressed separately and distinctly outside of the main body of this thesis.

The case study approach has been adopted primarily as a means of introducing more than anecdotal evidence of the risk inherent in and/or exposed by digital asset and decentralized financial markets that, in turn, can inform the resulting governance and related regulatory impact through contemporaneous real-life examples. In addition to their contemporary relevance, these case studies were also chosen because they each represent a different potential use case, namely 1) lending, 2) trading, 3) private currency, 4) investment asset, and with respect to the El Salvador case study included in the Annex, fiat alternative.

Although the research upon which this thesis is based was derived exclusively from sources independent of the author, the identification of the Central Research Issues, the formulation of the Questions Explored, the presentation of the Recent

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<sup>88</sup> A more recent source has reported this amount to be approximately \$667 million (Rosen 2022, 3).

<sup>89</sup> The country's S&P-assigned debt rating of CCC+ was also significantly below investment grade (Ibid). On January 23, 2023, El Salvador's Finance Minister announced that the country had repaid the maturing bond in full; however, "[t]he government still owes \$367 million plus interest on an \$800 million bond maturing in January 2025" (Associated Press. 2023, 1).



Case Studies, and the assembly, arrangement, articulation, and synthesis of the research findings in support of the conclusions reached are the author's own.

## Chapter 6

# Of Money, Technology, and Finance

To better frame this discussion, it is important to first understand the history of money as a social contract, the basic framework of distributed ledger technology (DLT), the more specific application of blockchain as a form of DLT, and the implications of adopting and applying this technology across various use cases.

### 6.1 The Evolution of Money<sup>90</sup>

Those born after 1990 have never known life without the internet. In contrast, those born in 1890 would have never known life with it. Thus, to conceptualize how

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<sup>90</sup> Oxford Languages defines the noun “evolution” as “the gradual development of something”. An example of proper usage is noted as “the forms of written languages undergo constant evolution” (OxfordLanguages 2023). In the context of its use as a verb (i.e., “to evolve”), the definition from the Oxford Advanced Learner’s Dictionary is “to develop gradually, especially from a simple to a more complicated form”. Examples of proper usage include: “Our products have been evolving according to the requirements of the times” and “The market has evolved considerably in recent years.” The terms “evolve”, “evolution”, and other variations thereof used herein and throughout this thesis are intended to follow a substantially similar meaning without distinction as to legal, economic, or other significance in the context of usage (Oxford Advanced Learner’s Dictionary 2023; <https://www.oxfordlearnersdictionaries.com>). See also Glossary of Defined Terms.

digital assets may change the way in which the world transacts, it is important to reflect on how our current international monetary system has evolved. Our existing system of money can be traced back many centuries to at least King Alyattes of Lydia to whom minting of the “first physical currency” in the form of coins has been attributed “over 2,600 years ago” (Worldline Scientific Community 2021, 5).<sup>91</sup> There are also indications its genesis was even earlier, with one source suggesting that metal coinage with “inherent value based on the quality and quantity of materials from which they were made” was circulating as early as 2200 BC (Didenko and Buckley 2019, 13).<sup>92</sup> Currency made from “leather and animal hide” can also be traced back to around “the 6<sup>th</sup> century BCE” with similar forms of money used in ancient Rome, Carthage, and “what is now France and Russia” up to “Peter the Great’s reign (1682-1725)” (Tikkanen 2023, 2). Paper currency is “widely believed to have originated in China”<sup>93</sup> around the time of Emperor Zhenzong (997-1022) and eventually migrated to Europe “in the 13<sup>th</sup> century”.<sup>94</sup> Worldline cites to 1661 as the year Lydian coinage evolved into a more modern day form of banknote<sup>95</sup> with “certificates exchangeable for a fixed amount of a certain commodity” reportedly

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<sup>91</sup>The Kingdom of Lydia geographically approximates to modern-day Turkey (Tikkanen 2023, 2). “Coinage came... with the first modern coins in Lydia around 600 BCE. These coins provided the now traditional functions of money: unit of account, medium of exchange and store of value” (Harvey, Ramachandran, and Santoro 2021, 8).

<sup>92</sup> The Encyclopaedia Britannica also supports this claim noting that “the use of metal money can be traced back to Babylon before 2000 BCE” even though “standardized and certified coinage may not have existed until the 7<sup>th</sup> century BCE” (Tikkanen 2023, 2).

<sup>93</sup> Tikkanen 2023, 2.

<sup>94</sup> Harvey, Ramachandran, and Santoro 2021, 8.

<sup>95</sup> Worldline Scientific Community 2021, 5.

appearing in the 18<sup>th</sup> century.<sup>96</sup> And, eventually, the first “electronic money transfer was made in 1871 by Western Union using a telegram”.<sup>97</sup>

Before there was currency in any of its various forms, however, there was the barter system. **“The earliest form of market exchange was peer to peer, also known as barter.** Barter was highly inefficient because supply and demand had to be exactly matched between peers. To solve the matching problem, money was introduced as a medium of exchange and store of value. **Initial types of money were not centralized.** Agents accepted any number of items such as stones or shells in exchange for goods. Eventually, specie money emerged, a form in which the currency had a tangible value” (Harvey, Ramachandran, and Santoro 2021, 5) (emphasis added). **Interestingly, peer-to-peer exchange is the same principle underlying the Bitcoin protocol,** as is explicit in Nakamoto’s white paper: “A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending.<sup>98</sup> We propose a solution to the double-spending problem using a peer-to-peer network” (Nakamoto 2008, 1). Thus, is the concept of money merely coming full circle?

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<sup>96</sup> Known as “‘commodity-backed’ money” its value was derived solely “from (i) acceptance by state and (ii) redeemability into precious metals” (Didenko and Buckley 2019, 15, FN 52).

<sup>97</sup>Worldline Scientific Community 2021, 5. This has been echoed elsewhere: “Non-physical transfer of money originated in 1871 with Western Union” (Ibid). “The idea of a form of digital money is not recent. Even in the ‘prehistory’ of cryptocurrencies, the traceability of payments was raised” (Zatti and Barresi 2020, 2). See also internal reference sources Chaum, D. 1982. “Blind Signatures for Untraceable Payments.” *Advances in Cryptology*: 199-203; [https://doi.org/ 10.1007/978-1-4757-0602-4\\_1](https://doi.org/10.1007/978-1-4757-0602-4_1) and <https://blog.forte.net/electronic-payments-history/>

<sup>98</sup> “Double-spending is a situation in which the same token can be spent more than once. Fundamental cryptography offers tools to prevent double-spending while maintaining transaction anonymity” (World Economic Forum 2021, EN 2). See also Glossary of Defined Terms.

Agustin Carstens, the general manager of the Bank for International Settlements, pointed out in a speech to Hoover Institution and Stanford University affiliates **that digital assets in the form of money is not a novel concept** and “commercial bank money has been digital for decades.” (Carstens 2021, 1) (emphasis added).<sup>99</sup> This notwithstanding, Carstens additionally acknowledged that technological innovation has “reached the financial system – and even the design of money itself” (Ibid, 2). He further pointed out that one of the most rapidly evolving areas is in the payments space given that **“they are relatively less capital intensive** than other financial services, and **the information they generate is highly valuable** for cross-selling.” (Ibid). In his speech, Carstens cited several examples in this area, including FedNow,<sup>100</sup> to demonstrate “that the existing system can adapt” and as illustrations “of how innovation in public private partnerships is working (Ibid). He also cautioned, however, that “no one is compelled to choose the path of the existing monetary system” and that **digital currencies “could transcend both**

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<sup>99</sup> This concept was expanded upon in a June 2022 research paper in which the authors point out that central bank digital currencies are also “not a novel idea.” In support of this assertion, the authors cite research dating back to the early 1980s involving proposals for digital cash and central bank retail deposit accounts (Guo, Kreitem, and Moser 2022, 1). The authors further note that to the extent “both banks and selected financial partners already have access to digital central bank money in the form of accounts” the creation of a wholesale central bank digital currency “simply serves as the tokenization of such money” (Ibid, 5). Other research also supports prior efforts to digitize money: “DigiCash (Ecash), E-gold, Liberty Reserve are the significant examples of the attempts made before Bitcoin and cryptos focused on privacy like Monero, Zcash, and Mimblewimble” (Zatti and Barresi 2020, 2).

<sup>100</sup> FedNow is a real-time payments protocol developed by the U.S. Federal Reserve System that went live on July 20, 2023 (Board of Governors of the Federal Reserve System 2023, 1). The purpose of FedNow is to provide a government-sponsored instant payment system to replicate services already available in the private sector but are not being maximized due to concerns about utilization from competitors. The FedNow system is intended to be available 24 hours a day/seven days a week to depository institutions across the United States and is consistent with similar services that already exist in other countries throughout the world (e.g., China, India, Brazil, Mexico, Thailand, and South Korea (Marek 2022; Carstens 2021).

**traditional account-based money and physical cash”** (Ibid, 3) (emphasis added).<sup>101</sup>

Carstens went on to express a view that “fully replacing either bank accounts or cash is neither desirable or realistic” (Ibid).<sup>102</sup> But it is important to remember that traditional account-based money and physical cash were once transcendent themselves. Carstens’ quote of a former president of the Federal Reserve Bank of Minneapolis that “money is memory” is indeed reflective of this concept (Ibid).<sup>103</sup> In other words, money as we know it is merely a system that has been adopted as a socially accepted form of recordkeeping. And any system that has at one point been adopted can also be a system that evolves into something else, is actively discarded, or passively becomes obsolete.

Notable from Carstens’ speech is his reference to both 11<sup>th</sup> century Maghreb<sup>104</sup> systems and 18<sup>th</sup> century European bills of exchange that allowed merchants to trade through trusted intermediaries in business transactions with unknown, non-local counterparties, as a means of addressing issues of trust in facilitating transactions with such unknown parties (Ibid, 7). He uses these not only as examples

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<sup>101</sup> In a Cointelegraph article, for example, the author describes bitcoin as “the greatest revolution of the modern age” and that, through its creation and adoption “citizens are staging a peaceful protest against the indentured servitude brought on by fiat economics” (Bourgi 2022, 2). This is echoed in a Bitcoin Magazine opinion piece: “You can design a currency however you like, but you cannot force people to value it. The free market has historically been one to seek and select a desirable currency when old ones have failed them” (Craik 2022, 2).

<sup>102</sup> Separately, the Bank of England has stated that “price volatility makes unbacked cryptoassets unsuitable to be widely used as money, for example as a means of exchange or a store of value” (Bank of England 2022, 8).

<sup>103</sup> The quote is attributed to a 1998 paper written by Narayana Kocherlakota (Carstens 2021). Kocherlakota served as the 12<sup>th</sup> President of the Federal Reserve Bank of Minneapolis from 2009 through 2015 before assuming his current position as an economics professor at the University of Rochester. The Bank for International Settlements has also described money as “a record of goods sold and services rendered” (Auer, Monnet, and Shin 2021, 1).

<sup>104</sup> The Maghreb is a region in Northwest Africa largely defined by the existing countries of Algeria, Libya, Mauritania, Morocco, and Tunisia (Eurostat 1999).

of the foundation of the modern banking system,<sup>105</sup> but also to support his view **that decentralized peer-to-peer networks** envisioned in Satoshi Nakamoto's **whitepaper are not a superior substitute** (Ibid, 4). Nonetheless, Carstens acknowledges that **technological advances have provided an opportunity to offer a "superior representation of central bank money"** which retains the features of "trust, transparency, legal backing and finality" (Ibid, 8) (emphasis added). Hence, he concludes that the question should not be whether we need digital currencies, **but rather whether the technological foundation supporting the concept of digital currencies can be leveraged to improve money** as a "social convention that involves a role both for the private sector and for the central bank or other public authorities" (Ibid, 10) (emphasis added). Carstens additionally points out that current banking operations "could run successfully on distributed ledger technology (DLT)" and that "despite all the limitations with bitcoin and other permissionless cryptocurrencies" a permissioned version of DLT in which "a known network of validators replaces the traditional model with one central validator" has been proven workable in trial experiments (Ibid, 11). He further notes that this would be particularly useful in circumstances where "trust in, and enforcement of, the rule of law is limited" (Ibid). Otherwise, he maintains that "a trusted central intermediary fares even better" than permissioned DLT citing findings set forth in BIS Working Paper 924 published around the same time (Ibid).

Those findings focus on the "scalability trilemma", which the authors describe as **"the challenge of attaining a ledger that is simultaneously decentralized, secure,**

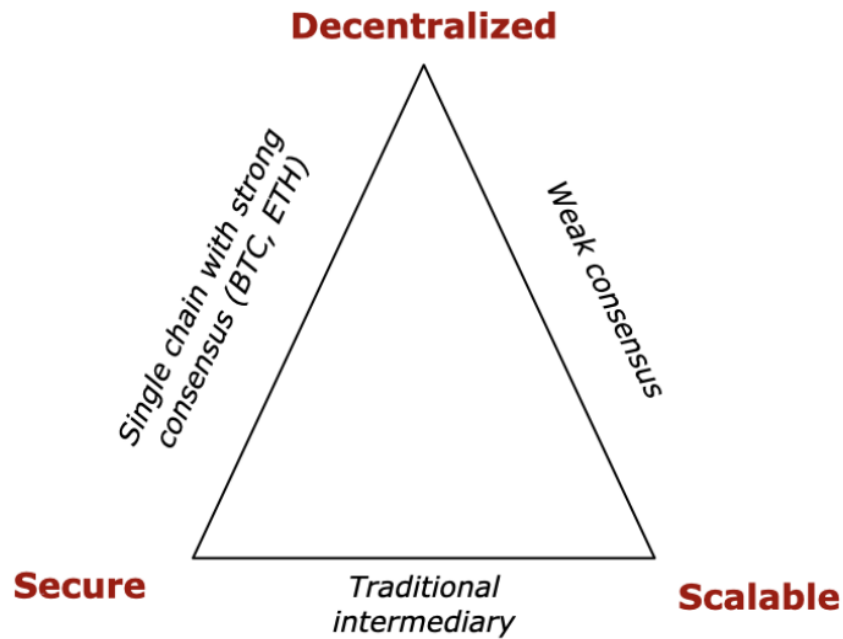
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<sup>105</sup> Italy's Banca Monte dei Paschi di Siena founded in 1472 is widely accepted as the oldest retail depository institution, while Sweden's Sveriges Riksbank founded in 1668 claims status as the world's oldest central bank (The Business Standard 2020).

**and scalable**” (Auer, Monnet, and Shin 2021, 5) (emphasis added). When faced with the trilemma, the authors assert that the choice is between (i) decentralized and secure, (ii) decentralized and scalable, or (iii) scalable and secure. If security is non-negotiable, as would be expected for monetary transactions performed through a digital network, then the authors maintain that the compromise is decentralization. They base this claim on the economics associated with multiple validators involved in a decentralized model, the aggregate fees imposed which would ultimately inhibit any significant scalability. Accordingly, “a direct consequence of aiming for stronger security is that the validators need to be given a bigger piece of the social surplus in the form of rents” (Ibid, 6). And they state this is true because “each validator needs to perform their assigned task of verifying the transactions” which “entails a small cost for each validator” (Ibid). Thus, “the rewards that accrue to the validators” must be high enough to offset this cost or “the validation protocol may not be followed” (Ibid). The result, the authors assert, is a reduction in “the overall size of the pie in terms of the economic gains that arise from monetary exchange” (Ibid). Hence, their conclusion that while “rents are necessary for security” they also “undermine scalability” (Ibid, 6-7). And their solution is that “security and scalability can be achieved” in circumstances where a “single validator node can be trusted with managing the ledger” (Ibid, 7). Or, in other words, a traditional intermediary such as a central bank as Carstens alludes to. The scalability trilemma is visually represented in Graphic 6 on the page following:



**Graphic 6: Scalability Trilemma**

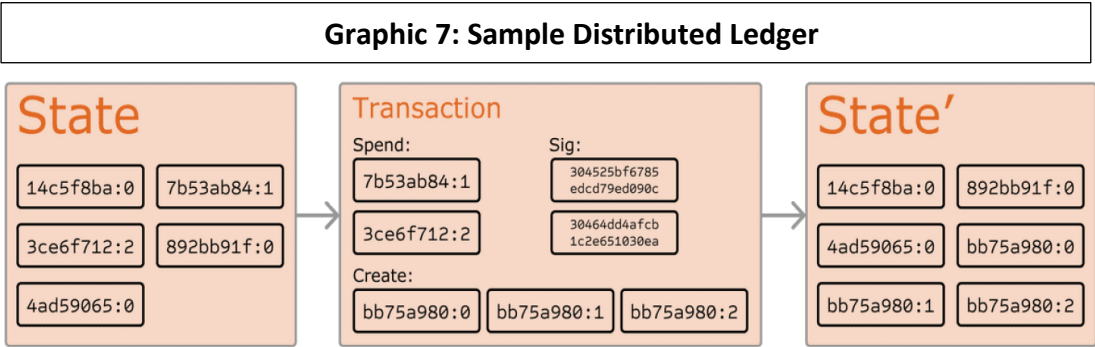


*Source: Bank for International Settlements 2021.*

## 6.2 Distributed Ledger Technology

As explained in Chapter 5, this thesis is primarily exploring the viability of emerging decentralized financial markets from a theoretical perspective. Therefore, it is also important to have at least a basic understanding of the technology underpinning the development and implementation of these markets. The previous section discusses the scalability trilemma as a reason for the BIS's rejection of decentralization as the optimal form of transacting using distributed ledger technology (DLT). But what exactly is distributed ledger technology to begin with? Simplistically, DLT functions as a digital spreadsheet. Returning to the concept that "money is memory", the premise of money as a record-keeping construct has been

compared to the use of money as the manifestation of a physical ledger **on the basis that the possession of cash is a representation of both actual and recorded ownership**. A good visual representation of this can be found in the Ethereum whitepaper set forth below in Graphic 7:



Source: Ethereum White Paper 2013.

In describing this visual, Vitalik Buterin refers to the “State” on the left-hand side of the ledger (A) as representing “the ownership status of all existing bitcoins” and the “State” on the right-hand side of the ledger (B) as the “new state” after a “state transition function” captured by the “Transaction” in the middle of the ledger (Buterin 2013, 3). He then compares this to the existing monetary system by explaining that “the state is a balance sheet, a transaction is a request to move \$X from A to B, and the state transition function reduces the value in A’s account by \$X and increases the value in B’s account by \$X” (Ibid). Buterin further notes that when “A’s account has less than \$X in the first place, the state transaction function returns an error” (Ibid). Given the obvious complexity and inconvenience of individuals independently maintaining similar such ledgers in their physical form for the benefit of the collective, however, paper money and coinage has been accepted and utilized

as a realistic and workable alternative.<sup>106</sup> But with the options that current technology make available, the burdensome physical ledger and its physical cash and coin equivalents can now be replaced with far more mobile digital representations as described in the Ethereum whitepaper and represented in Graphic 7.<sup>107</sup> It follows then why some may be questioning whether money in the form of **tangible currency** continues to serve a legitimate social purpose. (Auer, Monnet, and Shin 2021, 4).

In his January 27, 2021, speech BIS General Manager Carstens makes the distinction between permissioned DLT and permissionless DLT while sharing his opinions on the merits of the technology and its potential to improve existing monetary infrastructure. When referencing permissioned vs. permissionless distributed ledger technology, Carstens was distinguishing alternative forms of DLT, which exists in both public and private form as well as in permissioned and permissionless form (Guo, Kreitem, and Moser 2022, 4). In its Report on the DLT Pilot Regime, the European Securities and Markets Authority (ESMA) expands on the different forms of DLT as follows:

- *“[A] public DLT should be understood as a DLT network in which virtually anyone can access and become a participant in the validation and consensus process, otherwise described as an unrestricted DLT.*

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<sup>106</sup> “We must note that human exchange is the basis of civilization, as it allows for the ever-scaling division of labor and specialization of craft that provides greater yield per unit of energy spent. This is why Layer 2 paper monies, which are supposed to be convertible for the economy’s underlying asset, were a breakthrough technology...This and the Medici family’s double-entry ledger system are two shining examples of money as an ever-advancing technology” (Craik 2022, 3).

<sup>107</sup> “The conceptual elegance of ‘money as memory’ was precisely that the social convention of money dispenses with the need for everyone to carry around such a ledger” at a time when imagining such was presented “less as a serious proposal than as a theoretical construct with all of its impractical absurdity” (Auer, Monnet, and Shin 2021, 2).

- *A private DLT should be understood as a DLT network limiting access and participation in the validation and consensus process to selected participants, otherwise known as restricted DLT.*
- *A permissioned DLT should be understood as a DLT network with unrestricted access (i.e., similar to a public DLT for access), but with restricted participation in the validation and consensus process (i.e., similar to a private DLT for validation and consensus)”*

(ESMA 2022, 12). Thus, Carstens’ reference to “permissionless” distributed ledger technology is equivalent to ESMA’s definition of a public DLT with an unrestricted consensus mechanism, while his reference to “permissioned” DLT would be a hybrid public-private DLT with public access and private validation and consensus as captured by ESMA’s own definition of the same.<sup>108</sup>

Why is this important? Because it refers back to the scalability trilemma and the tradeoffs from unrestricted validation discussed earlier. In his speech, Carstens admitted there were possibilities for improving on existing infrastructure **through adapting permissioned DLT** to the current monetary system while at the same time generally **discarding the notion of permissionless DLT** as an option based on its “limitations”. One can generally assume the limitations Carstens references are associated with the integrity of recordkeeping on a distributed ledger where access and authentication is unrestricted and the challenges associated with securing that integrity through multiple validators as would be the case with permissionless

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<sup>108</sup> It has been reported that the country of Estonia, a former Soviet state in the Baltic region, runs many government processes “from taxes and transfers, incorporating a business, paying bus fare, applying for citizenship, certifying a marriage, and tens of thousands of other services” using “a distributed, cryptographically secured ledger developed in the 2000s as a precursor to the blockchain” (Hammond 2022, 4).

DLT.<sup>109</sup> In other words, limiting transactions to permissioned DLT also enables a limitation on the number of validators, thus ensuring integrity while also allowing for scalability.<sup>110</sup>

### 6.3 Blockchain and its Uses

The specific form of distributed ledger technology that bitcoin and other digital asset transactions are conducted on is called the blockchain. How is the blockchain unique? “The challenge of digital currency pre-Nakamoto was that it could be duplicated across several transactions and spent multiple times since it does not occupy a physical place” (Achenbach 2022, 5). This is the “Byzantine Generals” problem that Nakamoto is credited with solving through development of the Bitcoin protocol.

The Byzantine Generals problem references a hypothetical decision set within a combat scenario in which dispersed military camps are faced with collective decision-making regarding a strategic approach to addressing enemy territory. Since the camps are distributed, decisions can only be made between camps through non-face-to-face communication via messenger. The problem arises given the possibility of traitors in the mix. In other words, circumstances in which consensus appears to have been achieved and yet one or more camps intentionally fails to act in accordance with that consensus at the time and place agreed for action. An example

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<sup>109</sup> Validators decide the accuracy of what is recorded on distributed ledgers in an environment where everyone is entitled to serve as recordkeeper and there is no singular authority of truth by design. “In a decentralized network, multiple entities operate independently under a network-wide shared governance framework, eliminating the single point of failure of control” (World Economic Forum 2021, 5). See also Glossary of Defined Terms.

<sup>110</sup> ‘While most cryptocurrency projects rely on a distributed ledger system, there are two primary types of ‘access’ permission: (1) permissionless, where networks are open and any entity can participate in terms of sending transactions, reading the history (ledger) of transactions, or participating in transaction verification; or (2) permissioned, where participation in these activities is limited by a governance framework that restricts participation” (World Economic Forum 2021, 5).

would be consensus for an enemy strike in reliance on all collective forces, the failure to act by one or more camps which then reduces the effectiveness of the offense and leads to enemy victory rather than defeat. Any solution to the Byzantine Generals problem thus would neutralize the presence of nefarious actors within the camps (Yao, Lamport, Shostak, and Pease, 8-28).<sup>111</sup>

Because Bitcoin was developed as a form of “self-authenticating” distributed ledger technology, the design of Nakamoto’s blockchain protocol was precisely conceived to remove the influence of traitors in the validation process (Nakamoto 2008). “Under a proof-of-work system, the ability to censor transactions on the blockchain requires achieving ‘majority hash power,’ **meaning that the censor must control at least 51% of the computing power employed by all miners.** Achieving such a status is not feasible due to the sheer quantity of computing power dedicated to Bitcoin mining, as well as the amount of electricity required to power the mining chip. Furthermore, **the structure of the Bitcoin network incentivizes Bitcoin owners to oppose any individual’s acquisition of majority hash power** by purchasing or producing their own mining chips, because majority hash power also enables a ‘double spending attack’ that results in the duplication of Bitcoin, which would likely destroy confidence in the cryptocurrency (Ferranti 2022, 13) (emphasis added).<sup>112</sup>

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<sup>111</sup> For a more detailed description of the Byzantine Generals problem, a Cornell University course slide deck is available online at: <https://www.cs.cornell.edu/courses/cs6410/2018fa/slides/18-distributed-systems-byzantine-agreement.pdf/>

<sup>112</sup> “In 2014, the Bitcoin mining pool Ghash.io briefly acquired majority hash power, and faced a combination of public criticism, cyber-attacks, and abandonment by miners that quickly reduced its market share below 50%. No mining pool has ever acquired majority hash power in Bitcoin since then” (Ferranti 2022, 14; citing Hruska 2014).

Christian Catalini, a research scientist at MIT Sloan and founder of the School's Cryptoeconomics Lab, describes Nakamoto's blockchain as facilitating "a network of computers to agree at regular intervals on the true state of a distributed ledger" which "can contain different types of shared data, such as transaction records, attributes of transactions, credentials, or other pieces of information" (Ibid). The Editorial Director of MIT Sloan School of Management's *Ideas Made to Matter* articulated that "blockchain is hard to understand and predict, but could become ubiquitous in the exchange of digital and physical goods, information, and online platforms" (Church 2017, 1). At the time of the article's May 2017 publication date bitcoin<sup>113</sup> was noted as the "largest implementation of blockchain technology to date"<sup>114</sup> and Catalini adds that **blockchain "is particularly useful when you combine a distributed ledger with a cryptotoken"** as the result is "an entire network that can achieve internet-level consensus about the state and authenticity of a block's contents in a decentralized way" **which, in essence "is one step away from a distributed marketplace"** (Ibid, 2) (emphasis added).

And it's this concept of a distributed marketplace that is the primary **characteristic of decentralized financial markets**. Why? Because it doesn't require intermediaries. According to Catalini, the internet "still needs intermediaries" and "those intermediaries are costly and earn rents for processing payments, maintaining a reputation system, matching demand and supply" (Ibid, 3).<sup>115</sup>

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<sup>113</sup> When bitcoin appears in all lower-case letters it is meant to reference the digital asset that trades on the distributed network. The network itself is referred to as Bitcoin with a capital B.

<sup>114</sup> Bitcoin's market capitalization at the time of publication was noted as US \$40 billion. Its market capitalization as of December 31, 2022, had risen to approximately US \$319 billion, an almost 8-fold increase over just five and a half years.

<sup>115</sup> Examples provided include Airbnb, eBay, PayPal, and Uber.

Thus, the overarching utility and promise of blockchain DLT is that “the friction of the transaction is reduced, resulting in cost and time savings” (Church 2017, 3), with finance noted to be one of the primary and active beneficiaries of the technology by means of “companies seeking to offer low cost, secure, verifiable international payments and settlements” (Ibid).<sup>116</sup> And there are potential use cases outside of finance and currency as well, including “digital rights, intellectual property, identity, or property titles, to name a few” (Ibid). For example, a Straits Times article announcing the Republic of Singapore’s granting of a full regulatory licence<sup>117</sup> to a company called MetaComp to function as a regulated cryptocurrency exchange notes that, as a result, MetaComp and its separately regulated parent company, MetaVerse Green Exchange,<sup>118</sup> “are able to offer exposure to tokens backed by real-world assets such as intellectual property, supply chain financing and carbon credits in the form of carbon neutrality tokens” (Huang 2022, 1-2). A tokenized economy can result in “digital representations of nearly anything” (Birch 2022, 2), including “bonds, gold and carbon in digital form” (Ibid, 3), as well as facilitation of “trading, borrowing [and] lending, but with the scale of institutional assets” (Ibid 3, quoting Tyrone Lobban, Head of JPMorgan’s Onyx Digital Assets division at Consensus 2022).<sup>119</sup>

As The Financial Times has reported:

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<sup>116</sup> Ripple is cited as one of the leading applications of this use case as of the article’s publication date. See Graphic 11b.

<sup>117</sup> Specifically, a “full major payment institution permit under the Payment Services Act” (Huang 2022, 1).

<sup>118</sup> Specifically, “the recognised market operator license as well as the capital market service license under Singapore’s Securities and Futures Act” (Ibid, 2).

<sup>119</sup> “Consensus is CoinDesk’s longest-running and most influential crypto event.” More information can be located at: <https://consensus.coindesk.com>



*“Over the past two centuries, the world has seen many generations of financial technologies. Digital ledger representations of traditional assets such as cash, bonds, and equities could be an important progression, **as the original computer ledgers and real-time payments were from paper before them.** This can lead to improvements in accuracy of record-keeping, easier handling of certain asset types such as real estate and loans and speedier, more efficient settlement. **The distributed ledger technology underlying cryptoassets can be used to underpin new market infrastructure that offers benefit to the financial system**”*

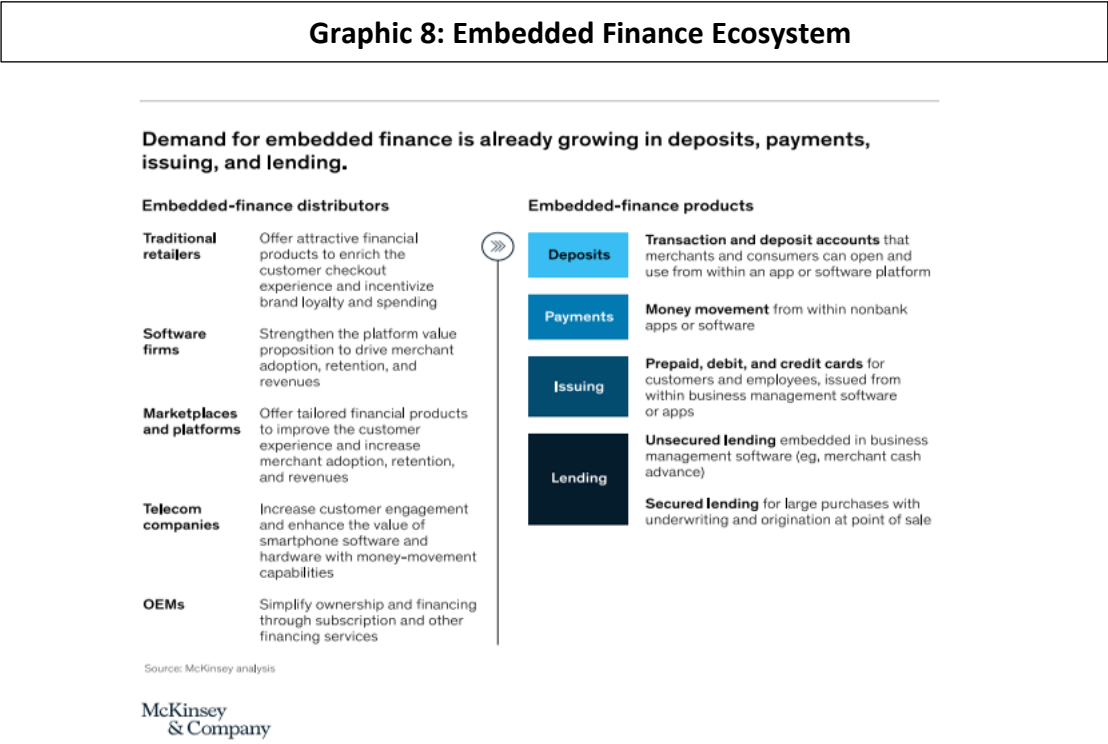
(Vince 2022, 2) (emphasis added). Related to this would be the many central bank projects associated with possible application of the technology to accomplish one or more of the following objectives: “lower settlement risk, more efficient taxation, faster cross-border payments, inter-bank payments, and novel approaches to quantitative easing” (Ibid). This includes experiments in place that are testing the merits of a central bank digital currency, whether wholesale (bank to bank) or retail (consumer direct) that Agustin Carstens was describing in his January 2021 speech on the evolution of technology as it relates to money.<sup>120</sup>

Research conducted by McKinsey & Company has concluded that certain “businesses starting today may never interact with a conventional bank” (Dresner,

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<sup>120</sup> Recall that Carstens recognized current banking operations “could run successfully on distributed ledger technology (DLT)” and that a permissioned version of DLT in which “a known network of validators replaces the traditional model with one central validator” has been proven workable (Carstens 2021, 11). Although he has stated his preference for a single validator model to address scalability issues associated with multiple rent-seekers, “the validator network is designed to create trust in the absence of a centralized authority, like a government or other central entity” (World Economic Forum 2021, 5). In addition, “the way networks reach ‘consensus’ between validators is varied, some use proof of work (e.g. BTC), others proof of stake (e.g. ADA and other mechanisms)” (Ibid), thus further complicating the scalability argument. See also Graphic 11b.

Murati, Pike, and Zell 2022, 1). Instead, these businesses will engage with financial applications embedded into non-financial related platforms for a “single seamless, convenient, and easy-to-use customer experience” (Ibid). Graphic 8 highlights different types of embedded finance products and the ways in which they are distributed:



Additionally, this experience is envisioned to be facilitated by “software companies that partner with banks and technology providers” and work together to deliver these embedded finance products (Ibid). An example of how this might work is described in Graphic 9 on the page following:

## Graphic 9: Embedded Finance Distribution Network

To embed financial products into their customer journeys, distributors work with technology and balance sheet providers.

	Distributor	Technology provider	Balance sheet provider
<b>Role in embedded finance</b>	Works with technology and balance sheet providers to embed financial products in its customer, employee, and partner journeys	Maintains and configures technology for delivering financial products to distributors via APIs	Provides distributors with access to regulated license, risk framework, funds, and a place to hold deposits
<b>Types of firms involved</b>	Traditional retailers, software firms, marketplaces and platforms, telecom companies, OEMs	Fintechs and banks	Banks

Source: McKinsey analysis

McKinsey  
& Company

Consistent with Carstens' January 2021 speech, however, McKinsey also notes that embedded finance as a concept is **not particularly new** stating that "nonbanks have offered financial services via private-label credit cards at retail chains, supermarkets, and airlines" for quite some time now (Ibid). **Rather, the evolution is the digitalization of this concept** and the "interfaces that users interact with daily" the result of which "acquiring financial services becomes a natural extension of a nonfinancial experience such as shopping online, scheduling employees to work shifts, or managing inventory" (Ibid).<sup>121</sup> Even Jamie Dimon, Chairman and CEO of JPMorgan Chase expressed in an annual shareholder letter that "decentralized finance and blockchain are real" (Dimon 2022, 24) despite being in contrast to previous public statements which have been quite dismissal of bitcoin.<sup>122</sup> In his

<sup>121</sup> Examples of the types of embedded finance platforms offered include "customer loyalty apps, digital wallets, accounting software, and shopping cart platforms" while key providers might include "retailers, business-software firms, online marketplaces, platforms, telecom companies, and original equipment manufacturers (OEMs)" (Dresner, Murati, Pike, and Zell 2022, 2-3).

<sup>122</sup> The following statement has been attributed to Dimon: "I don't care about bitcoin. I have no interest in it" (Birch 2022, 1).

annual letter, Dimon noted that Apple, a hardware and software product and services provider, has already entered the financial services arena “with Apple Pay and the Apple Card” (Dimon 2022, 19), a perfect example of embedded finance. Apple is also “actively extending services into other banking-type products, such as payment processing, credit risk assessment, person-to-person payment systems, merchant acquiring and buy-now-pay-later offers” (Ibid).<sup>123</sup>

McKinsey has estimated that the revenue-based value of embedded finance in the United States in calendar year 2021 was US \$20 billion and “**could double in size within the next three to five years**” (Ibid, 2) (emphasis added). This revenue is attributed primarily to banks as the risk taker and balance-sheet provider (55%) and the distributors as owners of the customer relationship (30%), leaving the technology providers to seek a greater portion of the pie (Dresner, Murati, Pike, and Zell 2022, 6-7). For example, McKinsey notes that “payments-focused technology providers are leading the charge on embedded finance, using their money movement capabilities to attract distributors and then expanding into products that have been the strongholds of banks, such as lending” (Ibid, 9). As noted previously, **it is this concept of disintermediation of traditional market participants, ostensibly to deliver more efficient and cost-effective services, that underpins the notion of decentralized finance.**<sup>124</sup>

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<sup>123</sup> “There has been rapid growth within the digital asset market, with an estimated 46 million Americans now owning crypto. Legacy investment banks such as JPMorgan Chase, payment apps like PayPal, and credit card titans like Mastercard have all incorporated cryptocurrency into their services. We now exist in an age where cryptocurrencies are normalized and intertwined with other facets of the financial sector” (Richmond 2023, 2).

<sup>124</sup> “This is where DeFi comes into play. Instead of relying on high fees, it can run a platform that – based on a distributed ledger and smart contracts – can guarantee the execution of a borrowing contract. Hence, DeFi can either substitute for traditional intermediation or allow for better, bilateral loans between contracting parties. The value of DeFi lies therefore in both disintermediation and financial inclusion” (Chiu, Kahn, and Koepl 2022, 5).

## Chapter 7

### The Macro Risks of Digital Finance<sup>125</sup>

Now that we have explored the technology underlying digital assets and decentralized financial markets and the various ways in which this technology can be deployed in commerce, it is important to explore the risks that these assets and markets may introduce. In her September 2022 Banque de France conference speech, Commissioner McGuinness acknowledged the potential of blockchain technology by recognizing its capability to bypass traditional service providers “removing the need for centralized processes and intermediaries” (European Commission 2022, 3). In doing so she continued, the technology “can make

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<sup>125</sup> In the context of this chapter and throughout the remainder of this thesis, any reference to digital finance can include both centralized finance and decentralized finance (or a hybrid thereof). Both centralized finance and decentralized finance can be executed via digital assets, blockchain, or distributed ledger technology and, thus, also constitute digital finance but neither are limited in this manner or by any specific method or means other than the mechanism by which they are controlled. See also Glossary of Defined Terms.

transactions more efficient and transparent, by recording key information in an unchangeable format, making it accessible to all market participants. And this could make payments cheaper, faster and safer” (Ibid).<sup>126</sup> However, she also referred to the current blockchain-enabled marketplace as “a Wild West” and stated that **“crypto poses big risks for the system, for our financial system”** citing that such markets “have expanded to a global market capitalization of around 1 trillion euro” (Ibid) (emphasis added). In support of this position, McGuinness noted that “the Financial Stability Board warned that crypto markets have the potential to grow into a threat to global financial stability” (Ibid).<sup>127</sup> And she continued that **“even if crypto markets do not yet present systemic risks, they already present many other risks”** (Ibid) (emphasis). As examples, she references losses due to volatility, lack of supervision, deception, and fraud, money laundering and international sanctions violations, as well as cybersecurity risks due to hacking (Ibid, 4).

McGuinness also took this opportunity to announce an agreement on the markets in crypto-assets or “MiCA” framework, the European Union’s regulatory response to the digital asset economy under which “crypto-asset service providers will be subject to both prudential requirements and rules of conduct” as well as required to “disclose information on the environmental and climate footprint of crypto-assets” (Ibid, 6).<sup>128</sup> For reasons stated previously, it is not the intent of this

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<sup>126</sup> During her speech, the Commissioner also described the Distributed Ledger Technology pilot program with Banque de France, the purpose of which is to “develop secondary markets for ‘tokenised’ financial instruments, where market participants can experiment with trading, clearing and settling securities using DLT” in an effort “to identify ways to improve efficiency” through a platform that “is all about innovation and experimentation but within a safe environment where the citizen is protected” (European Commission 2022, 5).

<sup>127</sup> This warning was stated to have occurred in February of 2022 (Ibid).

<sup>128</sup> McGuinness also announced that the EU’s Transfer of Funds Regulation would apply to crypto-assets and their related service providers.

paper to cover the climate risks of digital assets in any significant way, a topic which is likely worthy of a whole separate study.<sup>129</sup> The remainder of the concerns associated with cyber crime, national security, and financial stability touch directly on the Central Research Issues which are the focal point of this thesis, however, and thus merit further discussion. This chapter will now take a closer look at each.

## 7.1 Cyber Crime

Digital asset platforms have been criticized since inception for inviting illicit activity due, in part, to the anonymized nature of transactions on the blockchain, which is one of the hallmarks of the technology, in an environment where regulatory standards can differ vastly across different jurisdictions if there are any standards at all. A recent Elliptic Connect report, for example, revealed that approximately US \$1.2 billion of crypto assets have been laundered over coin swap services<sup>130</sup> by various dark web operatives (Elliptic Connect 2022, 1). The research indicated that a significant majority of this amount is sourced from the Bitcoin platform,<sup>131</sup> with the remaining originating on Ethereum and Tether.<sup>132</sup> As a result, the Office of Foreign Assets Control (OFAC), the division of the Department of the Treasury responsible for anti-money laundering and sanctions regulation and enforcement in the United States, announced in August 2022 that it had sanctioned Tornado Cash, a type of coin swap service that OFAC described as a “virtual currency mixer.”<sup>133</sup> In

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<sup>129</sup> See note 83.

<sup>130</sup> A coin swap service allows various types of digital assets to be swapped for other types of digital assets and even fiat currency (Elliptic Connect 2022, 1,4). See also Glossary of Defined Terms.

<sup>131</sup> More than US \$1.1 billion (Ibid, 3).

<sup>132</sup> Approximately US \$47.7 million and US \$1.7 million, respectively (Ibid, 4).

<sup>133</sup> Specifically, OFAC designated Tornado Cash as a sanctioned entity pursuant to Executive Order 13694 “for having materially assisted, sponsored, or provided financial, material, or technological support for, or goods or services to or in support of, a cyber-enabled activity originating from, or directed by persons located, in whole or in substantial part, outside the United States that is

the announcement, OFAC acknowledged that the “purported purpose” of Tornado Cash’s platform “is to increase privacy” but also stated that such platforms “are commonly used by illicit actors to launder funds” (U.S. Department of the Treasury 2022, 2) and indicated that “more than \$7 billion worth of virtual currency” had been laundered over the Tornado Cash platform since it first became operational in 2019 (Ibid). Despite this, OFAC also acknowledged that “**most virtual currency activity is licit**” and thus not illegal or derived from criminal activity (Ibid, 1) (emphasis added).<sup>134</sup>

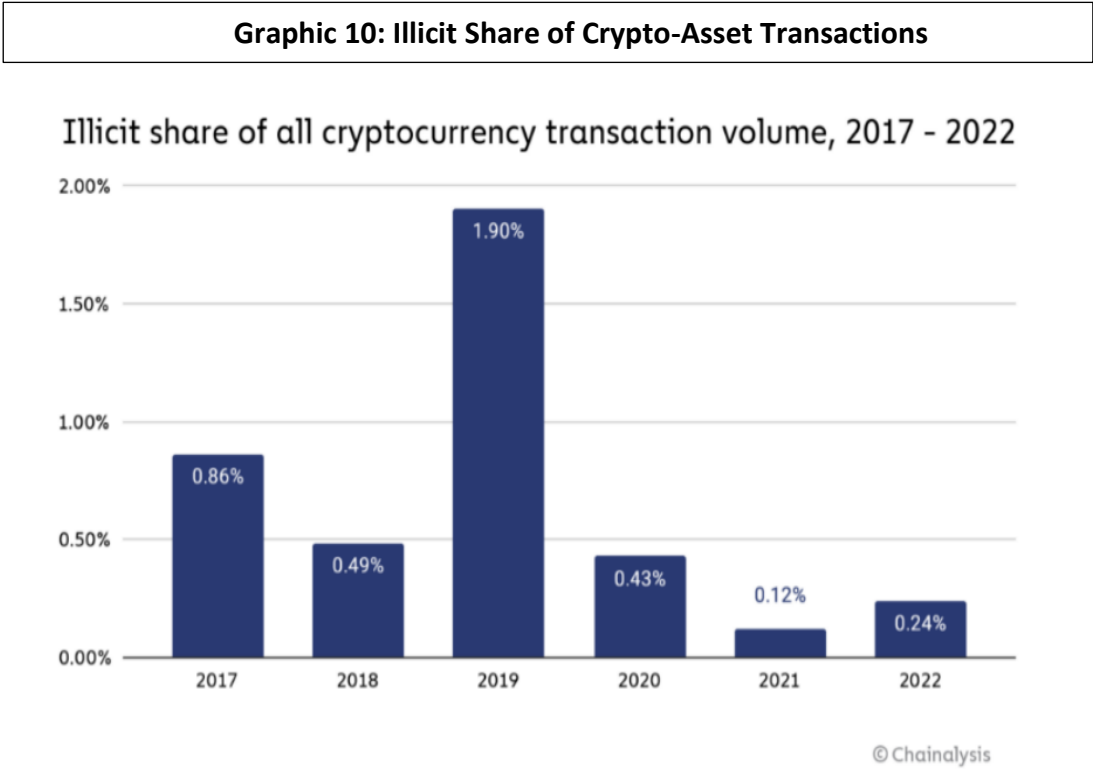
Furthermore, fines and penalties for anti-money laundering and sanctions non-compliance is hardly unique to the digital assets space, given that many traditional financial services institutions have been crossing hairs, sometimes repeatedly, with regulators for having inadequate systems, processes, oversight, controls, or any combination of the foregoing. For example, in September 2022, the Financial Conduct Authority (FCA) fined Santander UK plc approximately £107.8 million citing “serious and persistent gaps in its anti-money laundering (AML) controls” affecting over 560,000 client accounts (Financial Conduct Authority 2022, 1). As Europol has noted: “Criminals and criminal networks involved in serious and 87rganized crime

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reasonably likely to result in, or has materially contributed to, a significant threat to the national security, foreign policy, or economic health or financial stability of the United States and that has the purpose or effect of causing a significant misappropriation of funds or economic resources, trade secrets, personal identifiers, or financial information for commercial or competitive advantage or private financial gain” (U.S. Department of the Treasury 2022, 2). OFAC previously sanctioned another digital currency mixer, Blender.io, in May 2022 primarily for its role in facilitating transactions by state-sponsored North Korean Lazarus Group to launder proceeds of various cybercriminal activity (Ibid, 1). OFAC separately sanctioned Lazarus Group in September 2019 (Ibid).<sup>134</sup> OFAC made a similar assertion in its press release announcing sanctions against Blender.io ( U.S. Department of the Treasury 2022, 4). This has also been echoed in other sources: “Crypto is often equated with illegality, yet only 2.1% of the world’s crypto is used for unlawful activity, according to The Chainalysis 2021 Crypto Crime Report. That’s a tiny percentage of otherwise legitimate use” (Saks 2022, 2; see also Europol 2021, 2; Wagman 2022, 4).



also continue to rely on traditional fiat money and transactions to a large degree, in addition to emerging value transfer opportunities” (Europol 2021, 2).<sup>135</sup> Graphic 10 reflects the illicit share of crypto-asset transactions over the previous five-year period according to research conducted by Chainalysis:<sup>136</sup>



The World Economic Forum has also recognized: “Data evidence shows that illicit activity comprises just 0.34% of all cryptocurrency transactions, which is lower than the incidence of illicit activity in the traditional financial system” (World Economic Forum 2021, 8). Furthermore, because transactions on public blockchains **are visible to everyone**, law enforcement has the ability to directly monitor for and trace illicit activity in a way that is not available to it in traditional cash markets: “What many

<sup>135</sup> “The number of cases involving cryptocurrencies for the financing of terrorism remains limited” (Europol 2021, 2).

<sup>136</sup> Chainalysis Team 2023, 5. Chainalysis provides blockchain-based “data, software, services, and research to government agencies, exchanges, financial institutions, and insurance and cybersecurity companies in over 70 countries” (<https://www.chainalysis.com/company>).

people forget about is that **every crypto transaction is traceable**, which makes it ill-suited for use by people involved in these illicit endeavours – at least, if they do not want to be caught” (Melville 2022, 2) (emphasis added).

That said, there are other risks associated with DeFi platforms, as captured in an August 2022 warning published by the U.S. Federal Bureau of Investigation (FBI): “Cyber criminals are increasingly exploiting vulnerabilities in the smart contracts governing DeFi platforms to steal cryptocurrency...Cyber criminals seek to take advantage of investors’ increased interest in cryptocurrencies, as well as the complexity of cross-chain functionality and open source nature of DeFi platforms” (Federal Bureau of Investigation 2022, 2). Among several recommendations accompanying the warning, the FBI advised users to: “Ensure the DeFi investment platform has conducted one or more code audits performed by independent auditors” (Ibid, 3).<sup>137</sup> Other than the unique features of DeFi platforms, such as the use of smart contracts and programmable money, however, it’s not clear that cyber risk associated with the use of such platforms is **any more significant** than cyber risks associated with online activity, such as online banking. In addition, the unique nature of DeFi platforms **can also prove beneficial** to thwarting criminal activity:

*“Aside from the risks associated with virtual assets, **their digital environment provides ample unique opportunities for law enforcement agencies (LEAs) to conduct financial investigations.** Analysis of public blockchain ledgers allows both the private sector (VASPs and other financial*

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<sup>137</sup> As the FBI describes: “A code audit typically involves a thorough review and analysis of the platform’s underlying vulnerabilities or weaknesses in the code that could negatively impact the platform’s performance (Federal Bureau of investigation 2022, 3). See also Glossary of Defined Terms.

*institutions) and LEAs to trace financial activities over the public blockchain and identify connections to suspicious transactions and illegal activities **even if the cryptocurrency holder is represented only by a wallet number**. The public ledgers allow analyzing and tracing a long history of transactions, thereby identifying whether the funds were involved in a known illicit activity, comingled with illegal funds, processed by an unregulated VASP, or were suspiciously treated (e.g., they were treated with an anonymity-enhancing mixer). In addition, **because the data is available in digital format, analysts can apply sophisticated machine learning and artificial intelligence techniques to reveal hidden information***”

(Wagman 2022, 10) (emphasis added).<sup>138</sup>

Furthermore, to the extent that digital asset service providers are already regulated through application of existing market regulations for traditional finance (TradFi) providers or regulations that have been specifically adapted for digital asset markets, some form of AML/KYC (i.e., Anti-Money Laundering/Know Your Counterparty) due diligence similar to that imposed in TradFi markets is part of the expectation of compliance.<sup>139</sup> It is also increasingly accepted that some type of identity recognition will be necessary even in unregulated markets if decentralized finance has any chance of attaining large-scale adoption and integration: “One thing

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<sup>138</sup> VASPs are Virtual Asset Service Providers “defined broadly to capture all relevant services, including virtual currency exchanges and certain types of wallet providers” (Wagman 2022, 8). See also Glossary of Defined Terms.

<sup>139</sup> “While the issuance and transfer of cryptocurrencies between users are less likely to pass through an intermediary, the interface between cryptocurrencies and the broader economy...will often go through a cryptocurrency exchange or other virtual asset service provider (VASP). In this context, preventive measures, including enhanced customer due diligence (CDD), transaction monitoring and record-keeping, as well as obligations to report suspicious transactions for higher threshold accounts, are already an important component of many national AML frameworks” (World Economic Forum 2021, 8).

that the advent of institutional DeFi will require is digital identity infrastructure because of the need for KYC etc. in legitimate markets” (Birch 2022, 4).<sup>140</sup> The critical balancing act will be **establishing a sufficient digital identity infrastructure while still preserving the requisite form of appropriate user privacy**: “Anonymity does not work for markets, but complete transparency does not work for participants. **What is needed is not the anonymity of the permission less blockchain but privacy in a well-regulated environment**, and this is where verifiable credentials deliver” (Ibid, 6) (emphasis added).

And while “in principle, and in the absence of additional cryptography schemes or failures in security, cryptocurrency transactions are **fully traceable and unalterable**” it has also been acknowledged that “some networks have developed features to claw back transactions in certain circumstances” which potentially addresses a challenge insofar as “the general design of cryptocurrency networks does not allow reversing transactions” (World Economic Forum 2021, 3; 8) (emphasis added).<sup>141</sup> This claw back feature “makes it easier for issuers to comply with various regulatory requirements, which helps bring traditional financial use cases and instruments into the 21<sup>st</sup> century” (Van der Hoeven 2021, 14). It has also been recognized that “DeFi applications **may be too rigid in their execution of smart contracts**” and that “technological advances **may make it possible to reduce the incompleteness of smart contracts or automate possible renegotiation**” (Chiu,

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<sup>140</sup> “Financial institutions today don’t typically engage with permissionless digital assets, because of their unregulated status and anonymity” (Birch 2022, 4; quoting Tom Zschach, Chief Innovation Officer at SWIFT).

<sup>141</sup> Asset clawback is a protocol feature that involves “a set of two new operations and an account flag that allows issuers to claw back tokens from any token-holding account” (Van der Hoeven 2021, 1). See also Glossary of Defined Terms.

Kahn, and Koepl 2022, 5) (emphasis added). Finally, while a recent study has found “evidence of systemic insider trading in cryptocurrency markets” this same study noted that the “significant price run-ups before official listing announcements” were **“similar to prosecuted cases of insider trading in stock markets”** (Félez-Viñas, Johnson, and Putniņš 2022, 1) (emphasis added). Hence, the results of this study could only “point to cryptocurrency markets **being susceptible to the same forms of misconduct** that regulators have for a long time grappled with **in traditional financial markets**” rather than creating a blemish of distinction unique to digital asset markets (Ibid, 8) (emphasis added). This again suggests that holding out such markets as being any more susceptible to criminal activities than TradFi markets at the current maturation stage is not well supported.<sup>142</sup>

## 7.2 National Security

What about national security then? In each of its press releases announcing the sanctions against Tornado Cash and Blender.io, OFAC signaled a warning that it considered digital asset platforms which “assist criminals” to be “a threat to U.S. national security interests.”<sup>143</sup> More specifically, in the Blender.io release the

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<sup>142</sup> With one notable exception being that the level of “insider trading ahead of 10% -25% of cryptocurrency exchange listings” was proportionally high, likely due to a general lack of deterrence relative to TradFi markets given low levels of regulatory enforcement to date, although that appears to now be changing (Félez-Viñas, Johnson, and Putniņš 2022, 8). “On July 21, 2022 the SEC issued a complaint arresting and charging a former Coinbase employee (Coinbase is one of the largest cryptocurrency exchanges in the world) and his brother and a friend, with wire fraud in connection with cryptocurrency insider trading that occurred in April 2022. The trio are accused of using confidential information about coins that were scheduled to be added for listing on the Coinbase exchange” (Ibid, 1-2). It has been reported that in February 2023 the former employee and his brother both entered guilty pleas to “two counts of conspiracy to commit wire fraud while using confidential information about Coinbase’s cryptoasset listings” and, as of April 2023, the “SEC now has an ‘agreement in principle’” with the former employee “to resolve the agency’s claim” and his brother was also ‘having ‘good faith’ discussions with the regulator” (Nagarajan 2023, 2). Subsequently, the SEC announced on May 30, 2023, that it had reached a settlement with both brothers (SEC Press Release 2023-98).

<sup>143</sup> Tornado Cash press release page 2 and Blender.io press release page 4.

agency linked transactional activity on the platform to North Korean efforts “to generate revenue for its unlawful weapons of mass destruction (WMD) and ballistic missile programs” (U.S. Department of the Treasury 2022, 2). Separately, Elliptic Connect also noted in its report that transactions involving coin swaps between digital assets and the Russian ruble may ultimately run afoul of sanctions activity associated with the Russia-Ukraine War (Elliptic Connect 2022, 4).<sup>144</sup> A more recent announcement in November 2022 was a settlement by OFAC with digital currency exchange, Payward, Inc., which operates under the brand Kraken, for “826 apparent violations of the Iranian Transactions and Sanctions Regulations” (U.S. Department of the Treasury 2022, 1).<sup>145</sup> According to the press release “Kraken exported services to users who appeared to be in Iran” as a result of the platform’s “failure to timely implement appropriate geolocation tools, including an automated internet protocol (IP) address blocking system” which “allowed account holders who established their accounts outside of sanctioned jurisdictions” to maintain access to Kraken’s virtual asset exchange notwithstanding being “located in Iran at the time of the transaction” (Ibid).<sup>146</sup> National security issues are, of course, a concern that needs to be taken seriously. As we have seen with cybercrime, however, **the risks that digital assets pose are not necessarily materially different or greater than TradFi channels.** Could the same be said about national security issues as well?

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<sup>144</sup> “The global financial sanctions enforced against Russia following its February 2022 invasion of Ukraine are unprecedented in their scope” (Ferranti 2022, 2).

<sup>145</sup> 31 C.F.R. § 560.204.

<sup>146</sup> Specifically, “between October 14, 2015 and June 29, 2019, Kraken processed 826 transactions, totaling approximately \$1,680,577.10, on behalf of individuals who appeared to have been located in Iran at the time of the transactions” (U.S. Department of the Treasury 2022, 1). According to a separate article, Kraken also “reportedly allowed access to crypto for individuals in Syria and Cuba” which are also subject to U.S. sanctions (Wright 2022, 2; see also Wang, N. 2022, 2).

In October 2021, OFAC issued a publication entitled “Sanctions Compliance Guidance for the Virtual Assets Industry” for the purpose of laying out the agency’s expectations regarding how digital asset service providers approach U.S. sanctions compliance (Office of Foreign Assets Control 2021). In the guidance, OFAC acknowledges that “sanctions compliance obligations apply equally to transactions involving virtual currencies and those involving traditional fiat currencies” (Ibid, 5);<sup>147</sup> however, it has noted elsewhere that **“the transparency of cryptoasset flows of funds and other underlying features of the technology can also present novel compliance challenges that are unique to the crypto space and do not have clear analogies in the fiat currency realm”**(Elliptic Connect 2022, 1) (emphasis added). To elaborate, it has been pointed out “that there is not – and never can be – a single comprehensive list of all crypto addresses controlled by sanctioned actors. While data analytics techniques can identify ‘clusters’ of wallets that sanctioned actors control, those actors often use new crypto addresses with no previous transaction history. It is only after those new addresses begin to transact that data analysis can link them to a sanctioned actor’s wallet cluster (Ibid).<sup>148</sup>

In a 2022 interview on MSNBC’s The Rachel Maddow Show, former U.S. Secretary of State Hillary Clinton opined that U.S. and European regulators “should look hard at how they can prevent the crypto markets from giving an escape hatch to Russia, both governmental and private transactions in and out of Russia” after

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<sup>147</sup> OFAC FAQ 560 available on the U.S. Department of Treasury’s website reinforces that “the obligations are the same” (<https://www.home.treasury.gov/policy-issues/financial-sanctions/faqs/560/>).

<sup>148</sup> “One example is OFAC’s enforcement action against payment processor Bitpay, which agreed to pay over \$500,000 for violations of multiple sanctions programs” because “BitPay allowed people who appear to have been located in the Crimea region of Ukraine, as well as Cuba, North Korea, Iran, Sudan and Syria, to transact with merchants in the U.S. and elsewhere using digital currency on Bitpay’s platform” (Ibid, 3; citing [https://home.treasury.gov/system/files/216/20210218\\_bp.pdf](https://home.treasury.gov/system/files/216/20210218_bp.pdf)).

expressing disappointment that “some of the so-called crypto exchanges, not all of them, but some of them, are refusing to end transactions with Russia” including banning Russian users from transacting on the exchange (Chipolina 2022, 1-2).<sup>149</sup> Separately, the President of the Russian Federation has recently been reported as calling “for a blockchain-based international payment system in light of Western economic sanctions being imposed” on Russia.<sup>150</sup> Russian President, Vladimir Putin, is quoted as stating: “The technology of digital currencies and blockchains can be used to create a new system of international settlements that will be much more convenient, absolutely safe for its users and, most importantly, will not depend on banks or interference by third countries” referring to foreign sanctions as “illegitimate restrictions.” (Lavere 2022, 2-3).<sup>151</sup> In March of 2022, seven Russian banking institutions were deliberately excluded from the Society for Worldwide Interbank Financial Telecommunications (SWIFT) system following the Russian invasion of Ukraine.<sup>152</sup> The following May, it was announced by the European Commission President, Ursula von der Leyen, that Sberbank, Russia’s largest,<sup>153</sup> would also be dropped from the SWIFT network (Bateman 2022, 1). The move is intended to ensure that these banks “are disconnected from the international

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<sup>149</sup> Not all digital asset exchanges would necessarily be subject to U.S. and OFAC sanctions jurisdiction, however, as acknowledged by the founding Director of the Centre for Financial Crime and Security Studies and Royal United Services Institute who asserted it was nevertheless a “reputation issue” asking whether such digital asset service providers “want now or after the fact to be known as the exchange that facilitated sanctions evasion, even if it were not technically illegal” and concluding “I guess they can make their choice, but when they lose Western banking access for having facilitated sanctions evasion, they might regret it” (Chipolina 2022, 2).

<sup>150</sup> These remarks were reportedly made by President Vladimir Putin at the International AI Journey Conference in Moscow sponsored by Sberbank (Lavere 2022, 2).

<sup>151</sup> “The ability of fiat reserve issuers to freeze transactions, which constitutes a form of *de facto* default on the underlying obligations, calls into question fiat reserve currencies’ assets as ‘safe haven’ assets” (Ferranti 2022, 2).

<sup>152</sup> Specifically, VTB Bank, Bank Otkritie, Novikombank, Promsvyazbank, Bank Rossiya, Sovcombank, and Vnesheconombank (VEB) (Hotten 2022, 2).

<sup>153</sup> Reportedly representing more than one-third of the country’s banking sector (Hotten 2022, 2).



financial system and harm their ability to operate globally” (Hotten 2022, 3).<sup>154</sup> And, yet, despite SWIFT’s indisputable dominance in traditional global interbank payment networks, **it is not the only game in town** (Bateman 2022, 4).<sup>155</sup> Thus, being excluded from the network “makes it much harder” for the Russian banks “to access financial markets around the world” **but does not completely impair** the Russian banking sector (Ibid). In fact, there have been doubts “about the lasting impact on Russia’s economy, particularly if banks find sustainable ways to reroute payments via countries that have not imposed sanctions” (Hotten 2022, 4).<sup>156</sup>

Based on the foregoing, **it is not clear that virtual currency networks serving as alternatives to SWIFT or any other traditional networks are currently adding to a national security threat in any material way.**<sup>157</sup> In addition, when considering national security, it is important to address whose national security is relevant.<sup>158</sup> For example, it has been reported that some European countries “were initially reluctant” to remove Russian banks from SWIFT because of “concerns that companies owed money by Russia would have to find alternative ways to get paid”

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<sup>154</sup> Certain Iranian banks (2019), as well as the country itself (2016 and 2012), were also barred from participation in SWIFT due to U.S. and international sanctions activity (Bateman 2022, 4).

<sup>155</sup> For example, Russia and China both maintain their own systems, the System for Transfer of Financial Messages (SPFS) and the Cross-Border Interbank Payment System (CIPS), respectively (Hotten 2022, 3).

<sup>156</sup> Despite the European Commission’s sanctioning of the Russian central bank due to the war in Ukraine “effectively cutting the Russian government off from over \$600 billion (€536 billion) of foreign currency reserves” the Russian rouble nevertheless “recovered to pre-war levels against the dollar” after an initial 30 percent decline (Bateman 2022, 4).

<sup>157</sup> “The primary non-fiat reserve asset is gold. Gold reserves under the physical control of a central bank are largely beyond the reach of financial sanctions by third parties. For example, despite facing U.S. financial sanctions, the Central Bank of Venezuela chartered Russian aircraft to sell its gold reserves in Africa...Since the Great Recession, central banks have steadily added gold to their reserves” (Ferranti 2022, 6).

<sup>158</sup> “The Ukrainian government has asked for donations in cryptocurrency and has so far raised more than \$50 million in crypto” (Allyn 2022, 2). “Bitcoin is both helping Ukrainians directly raise funds and enhancing Western pressure on the Russian government by enabling its citizens to escape the collapsing ruble” (Pines 2021, 38).

as well as “fears it could impact the global banking system” (Ibid).<sup>159</sup> Furthermore, non-Western countries may not see participation in alternative payments infrastructure to be problematic.<sup>160</sup> While apprehension about the potential negative impact of removing Russian SWIFT participation on the banking system has not borne out, perhaps there **should be cause for concern** about the proliferation of different alternative networks, including digital currency networks, **not just from a purely national security perspective but also with respect to its potential impact on global financial stability**. For issues concerning national security, the more countries can encourage the establishment and development of digital asset markets within their borders, the more jurisdictional control they will be able to assert over operators, transactions, and participants on these markets to allow for sovereign intervention when deemed necessary.<sup>161</sup> The following section will now take a closer look at issues from a global financial stability perspective.

### 7.3 Financial Stability

Several years ago, in 2018, the Financial Stability Board concluded that digital assets **did not create a material threat to financial market destabilization based on existing conditions** that, by its own admission, were subject to change. During a more recent February 18, 2022, interview on Times Radio, however, FSB Secretary General, Dietrich Domanski, acknowledged that “crypto asset markets are evolving fast” noting that “their market capitalization grew by factor of 3.5 in 2021”

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<sup>159</sup> Specifically, Germany, France, and Italy (Hotten 2002, 4).

<sup>160</sup> For example, reportedly Russia is actively engaged in efforts to network with China’s CIPS while, in turn, India is considering joining Russia’s SPFS (Ibid, 3).

<sup>161</sup> While banning activity perceived as threatening to national security objectives may seem like an obvious solution, as the World Economic Forum has observed “*it is not necessarily efficient*” given that with “the decentralized governance model of most cryptocurrencies, and the particular circumstances surrounding their existence and transfer, a legal ban will not necessarily imply the end of the activities surrounding them” (World Economic Forum 2021, 25).

(Domanski 2022). But he also pointed out that digital asset market capitalization of “about two and a half trillion US dollars” was still “relatively small compared to the amount of overall financial assets” (Ibid).<sup>162</sup> He additionally cautioned, however, that “the US subprime market which was also relatively small compared to the overall financial system” was, nevertheless, a primary catalyst for the Global Financial Crisis and thus **“just comparing the size of a market with overall financial assets may be misleading and perhaps provide too much of a false sense of safety”** (Ibid) (emphasis added).<sup>163</sup> Consistent with this, Domanski also shared the FSB’s perspective that **crypto asset markets “could reach a point where they present a threat to global financial stability”** resulting from a variety of factors, **including their “growing interconnectedness with the traditional financial system”** (Ibid) (emphasis added).<sup>164</sup> Graphic 11a) on the page following provides an overarching visual of the digital asset ecosystem to aid in understanding this interconnectedness:

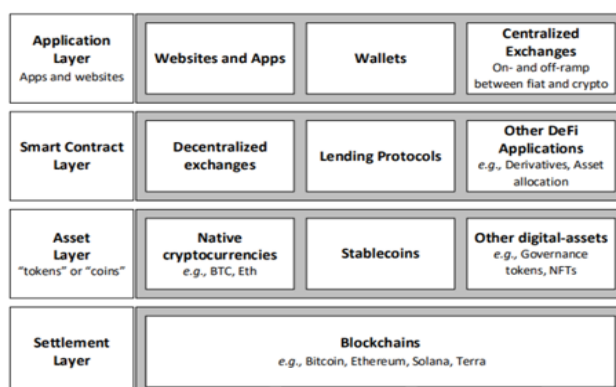
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<sup>162</sup>According to ESMA, this was the overall valuation in November 2021 when crypto markets peaked at an “equivalent to five times the previous high in 2018” (European Securities and Markets Authority 2022, 4). Other sources have estimated this at around US \$2.9 trillion (Bank of England 2022, 6).

<sup>163</sup> “We saw in 2008 how a poorly regulated subprime mortgage market decimated the global economy – an unregulated digital asset market collapse could have similar, or even worse, effects someday” (Richmond 2023, 2).

<sup>164</sup> The ECB has also warned: “Systemic risk increases in line with the level of interconnectedness between the financial sector and the crypto-asset market, the use of leverage and lending activity” and that “crypto-asset markets currently show all the signs of an emerging financial stability risk” such that “further steps that allow the traditional financial sector to increase its interconnectedness with the crypto-asset market space should be carefully weighed up” (Hermans et al. 2022, 10).

**Graphic 11a): Digital Asset Ecosystem**



*Note: Adapted from the IOSCO Decentralized Finance Working Group Report and Toolkit, March 2022 and Fabian Schär, "Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets," Federal Reserve Bank of St. Louis Review, Second Quarter 2021, pp. 153-74.*

A report assessing the risk of crypto assets to financial stability issued by the FSB that same February listed a number of concerns with market developments: **"These include increasing linkages between crypto-asset markets and the regulated financial system;** liquidity mismatch, credit and operational risks that make stablecoins susceptible to sudden and disruptive runs on their reserves, with the potential to spill over to short term funding markets; **the increased use of leverage** in investment strategies; concentration risk of trading platforms; **and the opacity and lack of regulatory oversight of the sector"** (Financial Stability Board 2022, 2) (emphasis added). Others have shared similar concerns.<sup>165</sup> For example, the IMF has cautioned that the digital asset marketplace has evolved in a way that should cause a reassessment of the FSB's original position. In support of this view, the IMF points

<sup>165</sup> In an October 2021 Financial Stability Report, the IMF echoed this view by noting that risks from crypto assets "should be closely monitored given the global implications and the inadequate operational and regulatory frameworks" while acknowledging that such risks "are not yet systemic" (International Monetary Fund 2021, 1). In this same report, the IMF coined the term "cryptoization" to refer to "macro-financial risks, especially with respect to asset and currency substitution" caused by increasing adoption of digital assets (Ibid). See also Glossary of Defined Terms.

out that the market has grown exponentially over this time,<sup>166</sup> such that **market capitalization size in some cases mimics that of traditional asset classes.**<sup>167</sup> In addition, trading volumes on some crypto asset exchanges rival those of certain countries' own stock exchanges.<sup>168</sup> Separately, the ECB has stated that while crypto markets "currently represent less than 1% of the global financial system in terms of size"<sup>169</sup> consistent "growth in the size and complexity of the crypto-asset ecosystem" coupled with increasing involvement of institutional participants **will eventually result in an environment in which "crypto-assets will pose a risk to financial stability"** (Hermans et al. 2022, 1) (emphasis added).<sup>170</sup> While the IMF concludes that "financial stability risks appear contained for now"<sup>171</sup> it also cautions that "the macro-criticality of crypto assets, and in particular stablecoins, can be

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<sup>166</sup> Specifically, "by a factor of 10" (Ibid 2021, 4). As stated earlier, the FSB has additionally echoed this sentiment noting: "Crypto-asset market capitalisation grew by 3.5 times in 2021 to \$2.6 trillion, yet crypto-assets remain a small portion of overall global financial system assets" while cautioning: "If the current trajectory of growth in scale and interconnectedness of crypto-assets to [traditional financial markets] were to continue, this could have implications for global financial stability" (Financial Stability Board 2022, 1). The Bank of England's Financial Policy Committee also supports this view: "The FPC continues to judge that direct risks to the stability of the UK financial system from cryptoassets and DeFi are currently limited. But the pace of growth and potential for interconnections with the wider financial system mean that they will present a number of financial stability risks in the future" (Bank of England 2022, 23).

<sup>167</sup> The IMF notes U.S. high-yield bonds as one example (International Monetary Fund 2021, 4). The ECB has also compared the size of crypto markets to "the securitized sub-prime mortgage markets that triggered the global financial crisis" (Hermans et al. 2022, 1).

<sup>168</sup> ECB research supports this: "Trading volumes for the most representative crypto-assets (including Bitcoin, Ether, and Tether) have at times been comparable or even surpassed those of the New York Stock Exchange or euro area sovereign bond quarterly trading volumes" (Ibid, 2).

<sup>169</sup> The Bank of England estimates a total market capitalization of approximately US \$1.7 trillion in the beginning of March 2022, representing approximately 0.4% of financial markets overall (Bank of England 2022, 6).

<sup>170</sup> In support of growing institutional adoption, ESMA has pointed to a 2021 Fidelity survey: "The results suggest that 52 % of all respondents have invested into crypto, with an even higher rate (56 %) among European professionals" (European Securities and Markets Authority 2022, 9).

<sup>171</sup> Lael Brainard, Vice-Chair of the U.S. Federal Reserve Bank has publicly commented that notwithstanding "significant investor losses, the crypto financial system does not yet appear to be so large or so interconnected with the traditional financial system as to pose a systemic risk." (The Daily Hodl100 2022, 2). Nevertheless, she emphasized that "foundations for sound regulation of the crypto financial system be established now before the crypto ecosystem becomes so large or interconnected that it might pose risks to the stability of the broader financial system" (Ibid).

significantly higher for some emerging market and developing economies where adoption has progressed fast” (International Monetary Fund 2021, 4).<sup>172</sup> The IMF additionally warns that this acceleration of adoption “has been accompanied by the entrance of new entities, some of which have poor operation, cyber risk management, and governance frameworks” (Ibid, 4-5). The IMF further flagged **concentration and integrity risks** associated with larger players controlling high percentages of market activity,<sup>173</sup> as well as “**limited or inadequate disclosure** and oversight” (Ibid, 5) and “**large technological and governance risks** arising from faulty computer code” (Ibid, 6) (emphasis added).<sup>174</sup>

An interview with American University law professor, Hilary J. Allen, published in The Atlantic’s Galaxy Brain newsletter further explored these issues, with Allen stating: “The technology is what is different, but **the financial transactions are very much similar to traditional finance**” (Warzel 2022, 3) (emphasis added). A comparison was then made to the Global Financial Crisis, including other financial products “like mortgage-backed securities and credit default swaps” which contributed to the crisis, with Allen cautioning: “These financialized tools **created additional complexity and rigidity and leverage into the financial system** that

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<sup>172</sup> The report cites external survey results (Statista and Finder 2021) indicating “the top five countries using or owning crypto assets in 2020 were emerging market and developing countries, whereas the lowest adopters were generally advanced economies” (International Monetary Fund 2021, 9).

<sup>173</sup> The report states that “Tether has issued more than half the supply of stablecoins” (Ibid, 5).

<sup>174</sup> ESMA has additionally commented on governance risks, noting that they fall into two categories, technology-based and human-based, and described each of these as follows: “Governance attacks (in which an entity controls 51% of governance tokens) are a source of vulnerability specific to DeFi. Unlike a Sybil attack, which targets the underlying blockchain consensus, governance attacks involve the accumulation of governance tokens that may enable attackers to manipulate voting on DeFi protocol design parameters” (European Securities and Markets Authority 2022, 7). A “Sybil” attack is defined by ESMA as an attempt “to manipulate the consensus mechanisms of distributed ledgers” through gaining “control of a majority (or a quorum) of network nodes (or hash power)” while citing to Makarov and Schoar 2022 as the basis for the assertion that over the last decade “there have been 33 known attempts to attack consensus (both successful and unsuccessful)” (Ibid, 6). See also Glossary of Defined Terms.

ultimately led to the collapse. And **I see similarities with what's being built in DeFi spaces** – what unites them is their opacity and complexity and the way that it is potentially destabilizing” (Ibid, 4) (emphasis added). A similar sentiment was expressed in a recent National Bureau of Economic Research (NBER) paper which explores the flaws in the TerraUSD stablecoin design that ultimately led to the catastrophic May 2022 de-pegging: “The system’s complexity also made it difficult even for insiders to accurately assess the buildup of risk and adjust system parameters accordingly” (Liu, Makarov, and Schoar 2023, 4).<sup>175</sup>

India’s central bank Governor, Shaktikanta Das, has also expressed an opinion on this.<sup>176</sup> In fact, Das has recently publicly stated that “the next financial crisis will come from private cryptocurrencies” and characterized such digital assets as posing “huge inherent risks for our macro economic and financial stability (Singh 2022, 2). In Das’s view, private cryptocurrencies “should be prohibited because if you try to regulate it and allow it to grow, please mark my words the next financial crisis will come (Ibid; Das 2022, 1).”<sup>177</sup> The country has nevertheless been testing a central bank digital currency, the e-rupee, since November 2022, which Das has characterized as “how the world is going to evolve”. Das has additionally denied that

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<sup>175</sup> A more in-depth analysis of the TerraUSD stablecoin and its companion coin, Luna, will be covered later in Chapter 8, Recent Case Studies.

<sup>176</sup> India has occupied the Presidency of the G20 since the beginning of 2022 and will retain this position until the end of November 2023. As such, the country has been a catalyst for framing any G20 actioning relative to digital asset markets globally during this time (Singh 2022, 1).

<sup>177</sup> Separately, however, India’s Finance Minister, Nirmala Sitharaman implied that regulation would be appropriate by publicly stating that regulation of crypto assets should be a priority for the G20 members and other international organizations, such as the IMF, FSB, and OECD, to ensure that any such regulation is fully embraced by the international community with “all countries being on board” (Singh 2022, 2). It was further suggested that India’s own regulatory approach would follow the international approach as respects digital assets generally, although she was careful to distinguish between digital assets and digital currencies, noting that all currencies would fall under the exclusive jurisdiction of the Reserve Bank of India which is perhaps not all that contradictory with Das’s desire that private cryptocurrencies be prohibited in the country (Ibid).

this development is merely a means by which India's central bank can compete with rising private cryptocurrency use stating: **"The world is becoming more digital...So, it's a currency of the future."** (Das 2022, 1) (emphasis added).

Case studies can be helpful to understanding how some of these issues have played out in real time, and there have been several interesting ones which surfaced over the course of 2022, as briefly summarized in the Research Methodology above. As ESMA has pointed out: "While some sources of risk are well understood from traditional markets, others are novel and linked to the product design, technological development, or the complex infrastructures built around crypto-assets" (European Securities and Markets Authority 2022, 3). Examples of both traditional market risk (e.g., Celsius, FTX, and Three Arrows Capital), as well more novel sources of risk (e.g., Terra/Luna) can each be found in the following chapter.<sup>178</sup>

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<sup>178</sup> A separate case study involving El Salvador's adoption of bitcoin as an alternative to sovereign issued money can be found in the Annex to this thesis, as noted previously.



## **Chapter 8**

### **Recent Case Studies**

As summarized in Chapter 5, Research Methodology the following case studies were chosen due to their contemporary relevance and because they each represent a different potential use case, namely 1) lending, 2) trading, 3) private currency, and 4) investment asset (in that order). They are also instructive of areas where flaws in the implementation of these markets have been exposed, as well as where existing regulatory infrastructure can be applied to address those flaws or where novel issues associated with these markets may require more tailored regulatory solutions. On the page following is a table of leading digital assets/service providers, one (Terra) of which is covered in the following case studies and another (Bitcoin) which is covered in the El Salvador Case Study located in the Annex to this thesis:

Graphic 11b): Table of Leading Digital Asset Platforms				
Name	Ticker	Use Case	Verification	Mining Cap
Bitcoin	BTC	Payments	Proof of Work	Yes
Ethereum	ETH	Applications	Proof of Stake <sup>179</sup>	N/A
Paxos	BUSD <sup>180</sup>	Stablecoin	Proof of Reserves	N/A
Ripple	XRP	Payments	Proof of Work <sup>181</sup>	Yes
Terra	UST	Stablecoin	Proof of Stake	N/A
Tether	USDT	Stablecoin	Proof of Reserves	N/A
USD Coin	USDC	Stablecoin	Proof of Reserves	N/A

Sources: Various Publicly Available Information

## 8.1 Celsius.

To reiterate and elaborate, Celsius Network, LLC (CEL) was one of the largest crypto lenders prior to its bankruptcy last year (Post 2022). Founded in 2017, it “claimed 1.7 million users and \$11.7 billion in assets under management (AUM)” as of May 2022 (Pontem Network 2022, 2). Based on information available on its website, however, Celsius’s AUM would have more than halved from the > US \$26 billion reported in October of 2021. Shortly thereafter CEL, the token issued and transacted on the Celsius network “as an internal rewards system”<sup>182</sup> lost 50% of its value overnight in June 2022, foreshadowing its issuer’s bankruptcy just one month later (Kharpal 2022, 4). CEL had previously fallen approximately 97% in value over the 12 months preceding, leading to the company eventually freezing customer withdrawals as of June 12, 2022,<sup>183</sup> several weeks ahead of its bankruptcy. Celsius was carrying approximately US \$5.5 billion in liabilities against US \$4.3 billion in

<sup>179</sup> Ethereum was Proof of Work prior to the September 15, 2022, merge to Proof of Stake (PoS.)

<sup>180</sup> “BUSD is Binance-branded stablecoin issued and managed by Paxos” (Crawley 2023).

<sup>181</sup> The XRP Ledger Consensus Protocol is a modified Proof of Work model wherein network validators are limited by reputation status on the network (<https://www.xrpl.org/consensus.html/>)

<sup>182</sup> “Customers could also stake their CEL to boost their rewards even further” (Pontem Network 2022, 2).

<sup>183</sup> Ibid, 6.

assets when it sought bankruptcy protection on July 11, 2022 (Pontem Networks 2022, 7; Duggan 2022, 2; Mish 2022).<sup>184</sup>

Celsius's business model, which was designed along the same model as traditional depository institution lending operations,<sup>185</sup> was nevertheless based on customer deposits of other virtual assets, not cash (Ibid). Those assets were then eligible to be loaned out to third parties, with depositors receiving a portion of the yield generated through interest payments on the loans<sup>186</sup> marketed at upwards of 18-20% (Pontem Network 2022, 2; Kharpal 2022, 4).<sup>187</sup> Clearly, Celsius was not

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<sup>184</sup> BlockFi, noted to be the second biggest lender to the bitcoin mining community as of June 2022 (Moura 2022, 2), announced a 20% staff reduction around that same time although it would not fail for several months after Celsius's insolvency (Wilson, Howcroft, and Lang. 2022, 2). When it did eventually file for bankruptcy on November 28, 2022, it was reportedly carrying a mere US \$256 million assets against liabilities estimated as upwards of US \$10 billion, inclusive of a US \$30 million unsecured claim in favour of the U.S. Securities and Exchange Commission (SEC). Just a year earlier in 2021, BlockFi was reported to have approximately US \$7.5 billion in loans outstanding against a deposit spread that was anywhere from two to three times this (Gladstone, Alexander, Vicky Ge Huang, and Soma Biswas 2022, 3). A third lender, Voyager Digital, had earlier filed for bankruptcy following contagion from the insolvency of Three Arrows Capital (3AC), a digital assets fund that will be covered as a separate case study and to which Voyager had significant credit exposure from outstanding loans (Andersen 2002,2; Duggan 2022, 2; Wieczner 2022, 4). According to market sources, 3AC was indebted to Voyager to the tune of 15,250 BTC and 350 million USDC. To add complexity, Voyager Digital was apparently partially secured against the 3AC liabilities via a revolving line of credit with Alameda Research, an affiliate of the now defunct FTX, another case study that will be covered later in this chapter. Reportedly, the revolving line of credit was against 15,000 BTC of which Voyager drew down US \$75 million based on the fair market value of bitcoin at the time (Andersen 2022, 2).

<sup>185</sup> Despite being modelled as such, Celsius itself was not a regulated financial institution and its website included the following disclaimer: "*Celsius is not a bank, depository institution, custodian or fiduciary and the assets in your Celsius account are not insured by any private or governmental insurance plan (including FDIC or SIPC)*" (Pontem Network 2022, 3). FDIC is an acronym for Federal Deposit Insurance Corporation, the quasi-governmental agency in the United States that insures bank deposits. and the Securities Investor Protection Corporation, or SPIC, performs a similar function for U.S. brokerage firms that carry customer deposits.

<sup>186</sup> As of May 2022, Celsius "also claimed to have issued \$8 billion in loans" (Ibid, 2).

<sup>187</sup> In BlockFi's case, a substantial portion of its loans were directed to miners of bitcoin that were collateralized by the computer equipment used by such miners. When the value of bitcoin declines so does the value of the mining equipment, which left BlockFi with poorly collateralized loans at the same time borrowers were less likely to be able to generate adequate revenue from mining to make payments on the loans (Moura 2022, 2-4). Bitcoin hit record highs during the Covid-19 pandemic, the most recent being the equivalent of US \$64,000 in November 2021 before losing over two-thirds of its market value. In contrast, its market value was the USD equivalent of approximately \$19,000 towards the end of October 2022, the month prior to BlockFi's bankruptcy filing (Totorelli 2022, 2). Standard market practice by firms like BlockFi was to offer loans on a "non-recourse" basis, meaning

crediting customers with the spread on a low-risk U.S. Treasury bond portfolio. Many of its borrowers, in fact, were other cryptoasset service providers, including Terraform Labs which is the subject of the Terra/Luna case study that will be covered later in this chapter (Pontem Network 2022, 5).<sup>188</sup> Due to the inherent riskiness of these platforms' business models, they were unlikely to be able to readily secure financing in traditional lending markets,<sup>189</sup> thus allowing Celsius to charge excessive rates for assuming the risk.

While Celsius was clearly contaminated by the general deterioration of the crypto markets at the time, including the collapse of Terraform Lab's algorithmic stablecoin, UST, Celsius has also been accused of failing "to implement basic risk management strategies to protect against the risk of price fluctuations that were inherent in many of the deployed investment strategies" (Pontem Network 2022, 7; citing a lawsuit filed against Celsius by an investment management client following its bankruptcy).<sup>190</sup> Fundamentally, therefore, **the foundation of the Celsius collapse appears to have been overly speculative and reckless lending and related investments, with inadequate risk management oversight** to guard against the

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that the lender had no legal rights to attach any other assets of the borrower beyond the specific collateral pledged (Moura 2022, 4).

<sup>188</sup> Celsius was also apparently exposed indirectly to Terra/Luna via loans to Three Arrows Capital, the fourth case study that will be reviewed in this chapter (Goswami 2023, 3).

<sup>189</sup> This would be particularly true to the extent that the collateral being offered by the borrowing platforms were virtual assets and tokens issued by those platforms, as opposed to cash and other traditional marketable securities that would constitute acceptable forms of collateral for regulated financial institutions. "The crypto world doesn't have any endogenous sources of cash. Crypto lenders like Celsius can't create dollars when they lend in the way that banks do, and they can't tap the Fed for liquidity. They can borrow from banks and financial markets if they have acceptable collateral, but crypto assets generally aren't acceptable" (Coppola 2023, 9).

<sup>190</sup> Celsius's CEO, Alex Mashinsky, was also sued by the New York Attorney General "alleging that Mashinsky defrauded hundreds of thousands of investors out of billions of dollars" in part because "Mashinsky publicly assured his customers that investing with Celsius was both safer and more lucrative than leaving their investments in a traditional bank" (Goswami 2023, 2).

market downturn,<sup>191</sup> **in addition to an asset-liability mismatch associated with short-term demand deposits being used to finance longer-term liabilities.** The latter, of course, is a common risk that traditional financial institutions face and which are monitored and managed through capital adequacy frameworks, something which would not have been imposed on Celsius as an unregulated lender.

A comparison can be made to the Global Financial Crisis. The catalysts leading to the GFC have been attributed to several factors, but it is largely accepted that the primary facilitator was exposure (or overexposure in this case) to the U.S. real estate market, which such exposure had not been properly accounted for, hedged, or both. In addition, credit default swaps (CDS) created an environment in which banks perceived they could take on higher amounts of subprime mortgage loans<sup>192</sup> because the effect of the CDS market was, ostensibly, to swap out a portion of this risk hence serving, at least theoretically, as a form of portfolio insurance. When the real estate market began to rapidly deteriorate from its peak, however, it became clear that CDS hedging programs were not sufficient to protect lenders against their aggregate exposure to this risk and the result was a cascading effect throughout the U.S. banking system that ultimately also had ramifications abroad, as has been previously touched upon (Corporate Finance Institute 2022).

In her April 2022 interview with Galaxy Brain, American University's Professor Allen likewise compared risks in the digital assets space to those presented by credit default swaps noting: "CDSs created a new, initially unlimited way to create

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<sup>191</sup> A similar conclusion can be made in the BlockFi and Voyager bankruptcies. See notes 184 and 187.

<sup>192</sup> Subprime loans are typically extended to borrowers who are deemed less than creditworthy, thus carrying higher risk to the lender. In exchange for the lender extending the credit in suboptimal conditions, the borrower typically pays a significantly higher rate of interest (Zywicki and Adamson 2008, 6). See also Glossary of Defined Terms.

leverage, which is another way of saying they used debt to acquire financial assets. In DeFi you see similar dynamics, especially that tokens can be created out of thin air. **Those tokens could then be used as collateral for loans that, in turn, can then be used to acquire yet more assets**" (Warzel 2022, 5) (emphasis added).<sup>193</sup> In comparison, Celsius did reportedly collateralize its loans "as a risk management hedge" (Pontem Network 2022, 4). Insofar as this collateral was composed of cryptoassets and digital asset tokens issued by the borrowing protocols, however, to the extent those protocols became compromised the value of that collateral would have suffered a similar fate.

A similar comparison can be made to the Savings and Loan Crisis (SLC) which preceded the GFC by a couple of decades. A cause of that crisis was also excessive risk taking following a period of high interest rates that created an asset-liability mismatch with a long-term loan book populated with lower, fixed-rate mortgages (Lawson and Engbirth 2021, 130). Many savings and loans tried to leverage the inflationary rate environment by offering high interest debt instruments to secure needed capital; however, their ability to service this debt began declining once inflationary conditions started contracting. This also had a negative impact on new mortgage lending which composed the core revenue generating activity of most such institutions (Corporate Finance Institute 2022).

While savings and loans were ultimately disbanded as a separate classification of financial institution in the United States as a result of the SLC, mortgage lending and commercial banking in general remain a critical component of the overall

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<sup>193</sup> Allen further cautions that this is "increasing the amount of risk – because the assets are essentially anything that somebody with programming knowledge who can mint a new coin can make up. You don't necessarily have to tie these assets to something physical" (Warzel 2022, 8).

financial services market.<sup>194</sup> Thus, it cannot necessarily be concluded that the Celsius business model alone was fundamentally problematic simply because the platform was dealing in digital assets. Rather, it appears the issue with its business model was principally operational and, more specifically, inadequate understanding of overall risk exposure and/or implementation of an effective risk management program (included regulatory compliance to the extent deficient).<sup>195</sup>

## 8.2 FTX.

Perhaps the biggest indication of serious challenges in the digital assets space was the November 2022 bankruptcy of Bahamian-based digital asset exchange, FTX, after rival exchange, Binance, began unloading its holdings of FTT, the digital token issued by FTX (The Straits Times 2022, 1-2).<sup>196</sup> Binance's move came after it was publicly reported through an independent source<sup>197</sup> that "the balance sheet of Alameda Research, FTX's sister company, was choked up with billions of dollars in FTT" although it has also been perceived "as a logical parting of ways" given that "a rift had formed" between the CEOs of Binance and FTX "who had differing views on

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<sup>194</sup> Those savings and loans that were not liquidated were acquired by bank holding companies and today there is no distinction in the U.S. marketplace between commercial banks and savings and loan institutions. The Federal Savings and Loan Insurance Corporation (FSLIC), which provided deposit insurance to savings and loans, was also liquidated because of the SLC such that all insured commercial banking deposits in the United States now fall under the jurisdiction of the Federal Deposit Insurance Corporation (FDIC) (Corporate Finance Institute 2022). The Resolution Trust Corporation (RTC) was established in 1989 to serve as the transitional resolution authority for the failed savings and loans prior to its own dissolution in 1995, at which time all remaining assets were transferred to the FDIC (Lawson and Engbith 2021, 130).

<sup>195</sup> Again, a similar conclusion can be reached with the BlockFi and Voyager bankruptcies. See notes 184, 187, and 191.

<sup>196</sup> Reportedly upwards in value of US \$500mm worth of FTT tokens (Kumar, Zhang, Choudhuri, and Lee 2022, 2).

<sup>197</sup> "Things began to sour for FTX when CoinDesk published a damning report about Alameda Research ...According to CoinDesk, Alameda Research relied heavily on FTX's native FTT token and made up the majority of assets on Alameda's balance sheet. This raised concerns about the intertwined nature of the two businesses and their potential to manipulate – and artificially inflate – the value of FTT" following which "the CEO of the crypto exchange Binance, announced his plans to sell Binance's FTT holdings, causing panicked investors to withdraw their funds from FTX" (Roth 2022, 3-4).

the approach to regulating crypto” (Khalili 2022, 3). Notwithstanding a public statement by Binance CEO, Changpeng Zhao, also known as CZ, that “the intention was to sell ‘in a way that minimizes market impact’” (Ibid), Binance’s actions “sent the price of FTT into an unmitigated free fall. Retail customers scrambled to withdraw money, not knowing that their original reserves were not actually held by FTX. As the price of FTT fell so did any potential for FTX to liquidate their token to compensate for customer funds” (Kumar, Zhang, Choudhuri, and Lee 2022, 2). Allegations have also been made that the FTT sell off was an intentional move by CZ “as an act of vengeance” after FTX’s CEO, Sam Bankman-Fried, “bad-mouthed Binance to regulators” (Roberts 2022, 2); however, “CZ has denied that he deliberately created a liquidity crisis at FTX” (Khalili 2022, 3).<sup>198</sup> At the time of collapse, FTX was second in size only to Binance among the world’s digital asset exchanges (Bourgi 2022, 2).<sup>199</sup> Indeed, at one point it appeared that Binance would step in to save the smaller rival, but shortly after “a rescue deal had been reached” it was publicly announced by Binance “that the deal was off, citing the results of corporate due diligence and news reports of mishandling of customer funds at FTX” (Khalili 2022, 2).<sup>200</sup>

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<sup>198</sup> Rumors also circulated that the move was intentional in order to allow Binance to acquire FTX at bargain basement prices: “In an act of ruthless domination, Binance CEO Changpeng “CZ” Zhao destroyed his rival by undercutting the value of FTX’s FTT tokens and pushing the company into insolvency” which leaves Binance “poised to acquire the pieces of FTX and cement its role as the biggest crypto exchange in the world” (Roberts 2022, 2). Despite being given such an opportunity, however, Binance did not go through with an acquisition (Khalili 2002, 3; Salmon 2022, 2; Roth 2022, 4). See also note 197.

<sup>199</sup> ESMA has noted that “the New York Stock Exchange and Binance (the largest trading platforms in the stock market and the crypto-asset market by volume) recorded total annual spot trading volumes of EUR 35 tn and EUR 8 tn respectively, until July 2022” (European Securities and Markets Authority 2022, 5).

<sup>200</sup> “Crypto exchange Binance...backed out of a plan to rescue FTX, its smaller rival, after due diligence revealed problems it said were ‘beyond our ability to help’” (Salmon 2022, 2; Roth 2022, 4). Binance also “cited ‘news reports regarding mishandled customer funds and alleged US agency investigation.’



In an opening statement before the Economic and Monetary Affairs Committee of the European Parliament during the month of FTX's insolvency, the Head of Risk Analysis and Chief Economist of the European Securities and Markets Authority (ESMA), Steffen Kern, summarized the FTX situation as follows: "The collapse is still under investigation by authorities, especially in the US and elsewhere, and ultimately, we do not know the details of what happened" (Kern 2022, 1). Kern further remarked: "The bankruptcy proceedings in the US are expected to take time, and many of the details of the case are yet to emerge" (Ibid, 3). Based on his knowledge of FTX, however, Kern offered that its business activities "included futures, options, and leveraged tokens" as well as "dealer and custodian services, including margin lending to clients and safekeeping of crypto assets" (Ibid, 2). Kern also noted that "FTX is understood to have been lending to Alameda Research" and "though precise details of the business model of Alameda, its role in the conglomerate of firms around FTX and its lending arrangements with FTX remain unknown" this secondary operation "appears to have been launched to carry out arbitrage trades, profiting from differences in asset prices" (Ibid). He additionally referenced "questions around accounting practices" and offered that FTX's overall governance "has been described by observers closer to the matter as highly suspect" (Ibid, 3).

The collateral damage from FTX's collapse was rapid, leading to the bankruptcy of digital asset lender, BlockFi, later that same month resulting from BlockFi's own

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That's because around the same time, a report from *The Wall Street Journal* indicated that FTX used about \$10 billion in customer assets to fund risky bets at Alameda Research, and *Bloomberg* published a report that US regulators are looking into whether FTX really did mishandle user funds" (Roth 2022, 4). See also notes 197 and 198.

exposure to FTX (Ibid; see also Hodder 2022, 4).<sup>201</sup> And BlockFi certainly has not been alone in suffering the consequences of meltdown. Several digital asset investors and service providers have announced either significant losses, an inability to access assets custodied and frozen on the FTX exchange, or the freezing of their own customer assets, such as in the case of Genesis Global, a liquidity provider to the digital assets space, after the table on liquidity provision was turned due to approximately US \$175 million of Genesis funds being frozen on the FTX platform (Ibid, 3-4; 4).<sup>202</sup> Interestingly, Kenneth Rogoff, a former chief economist at the International Monetary Fund and current Harvard University professor of economics and public policy, in commenting on FTX's demise, pointed out that a "vast majority of bitcoin transactions are done 'off-chain' in exchanges, not in the bitcoin blockchain itself" (Rogoff 2022, 2). Such exchanges, which he characterizes as "essentially crypto financial intermediaries" are, in his words, "vastly more convenient, require much less sophistication to use and do not waste nearly as much energy" (Ibid). Mr. Kern also referred to FTX as "a centralised crypto trading platform" in his opening statement to the European Parliament (Kern 2022, 2).

And yet, the most distinguishing feature of Nakamoto's Bitcoin platform is its resolution of the Byzantine Generals problem by offering an immutable, self-authenticating distributed ledger platform **that removes the need for traditional intermediaries**. Indeed, that is the underlying promise (and thus disruptive) potential of blockchain technology. As stated in a CoinDesk Opinion piece reflecting

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<sup>201</sup> And, once again, to add some irony to all of this, FTX was a creditor to BlockFi at one point after extending the lender a credit line a few months before both companies became insolvent. Reportedly, FTX's US \$400 million credit extension to BlockFi also granted the digital asset exchange the option to purchase the now imperiled lending platform (Finextra Research 2022, 2).

<sup>202</sup> Genesis reportedly ceased withdrawals on November 16, 2022 (Hodder 2022, 4).

on the FTX collapse: “Crypto was founded upon the idea of true individual ownership and self-sovereignty as a response to the 2008 financial crisis”. The author proceeds to lament “how often just one person’s actions can impact the fortunes of millions” which “is the exact opposite of how crypto is supposed to work”. The article goes on to conclude that all this just bolsters the argument that “decentralization is the only viable path forward” (Lavine and Lavine 2022, 3, 5). Ethereum founder, Vitalik Buterin, expressed a similar view when he contemporaneously stated his own opinion that the FTX collapse **reinforced the need for a return to the original principle of decentralization in the digital assets space** (Ibid, 3) (emphasis added).<sup>203</sup>

But decentralized platforms seemed to have struggled during the crypto bear market as well. As an example, it was reported that the DeFi platform, SushiSwap,<sup>204</sup> had proposed diverting all fees generated on the platform and otherwise split with users to SushiSwap’s treasury funds over the course of one year to plug what SushiSwap characterized as a “significant deficit...that threatens its long-term operational viability” (Malwa 2022, 2).<sup>205</sup> There is also a contrary assertion, however, that the “final winner” of the 2022 crypto meltdown are “decentralized

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<sup>203</sup> It has been noted that Nakamoto’s “white paper doesn’t mention the word decentralized once – but it’s obviously there by another name peer to peer” while in contrast Buterin’s “white paper mentions decentralization about 40 times” (Favole 2021, 2).

<sup>204</sup> SushiSwap “offers a yield farming platform” that “can be used to swap between currencies by tapping into liquidity pools filled by other users who are active in the DeFi ecosystem” (Ross 2022, 2-3). Users “can also become a liquidity provider...and earn the fees associated with the swaps” that liquidity is provided for (Ibid, 2).

<sup>205</sup> Despite this, it was also reported that existing treasury funds were sufficient to secure 18 months of operational expenditures, which has caused some users to question whether the situation had been “sensationalized” by the platform operators to highlight a false sense of peril in order to improperly or unfairly reallocate revenue (Malwa 2022, 2). In addition, the head of SushiSwap and the decentralized autonomous organization (DAO) that governs it have both been reported to have been subpoenaed by the SEC, although the details have not been disclosed (Napolitano 2023).

crypto platforms like Uniswap and Compound whose design ensures they are properly collateralized and can't be destroyed by the greed or folly of a single individual" (Roberts 2022, 2).<sup>206</sup> This notwithstanding, The Royal Gazette has reported that: "Even the so-called 'DeFi' areas of cryptocurrency investment, where investments are controlled by publicly available computer code rather than corruptible people, have experienced \$10 billion in fraud in the last year alone" (Walker 2022, 1).<sup>207</sup>

Meredith A.C. Challender, a lawyer with the firm of Kissel, Straton & Wilmer observed: "The fallout from FTX's collapse will be long and complex, with many more shoes to drop. The contagion may very well take down other crypto industry players" (Challender 2022, 2; see also Hodder 2022, 4).<sup>208</sup> Despite FTX contagion affecting cryptoasset markets generally,<sup>209</sup> however, **decentralized exchanges were a net beneficiary** – at least in the short run – "with trading volumes on decentralized platforms up 68%" in the month of FTX's collapse, "the highest since May" of 2022

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<sup>206</sup> "Uniswap and SushiSwap are very similar competing decentralized exchanges (DEXs) built on the Ethereum blockchain" (Ross 2022, 1). These exchanges are considered decentralized because "smart contracts automate market making, and all of the swap features are also handled automatically by code" (Ibid, 2). That said, the original founder of SushiSwap "committed a common scam known as a rug pull. This is when a developer takes investor funds from a project" (Daly 2021, 3). Although once a "new team was put together to run the project" its original developer "apologized to the community and returned all the crypto he took" (Ibid), the notion that DeFi removes incentives for bad actors has clearly not yet been proven or achieved.

<sup>207</sup> "Although proponents of cryptocurrency cite its 'trustlessness' as an advantage over fiat currencies...cryptocurrencies require different forms of trust. Specifically, users must trust that the cryptocurrency software itself is secure, that miners will not collude to attack the integrity of the blockchain, and that the governance process will not approve of a 'hard fork' that fundamentally alters the blockchain itself or other parameters of the cryptocurrency" (Ferranti 2022, 13).

<sup>208</sup> Sasha Hodder, a lawyer with the Cogent Law Group, echoed this sentiment noting: "It will take the bankruptcy proceedings many years to untangle the mess of fraudulent transfers" (Hodder 2022, 4). FTX's CEO, Sam Bankman-Fried, was indicted in the Southern District of New York on several counts, including wire fraud, commodities fraud, and securities fraud (Ibid). On November 2, 2023, the jury found him guilty on "two counts of fraud and five counts of conspiracy" (Marcus 2023, 1),

<sup>209</sup> Notably, the contagion has been mostly limited to the digital assets space: "One issue several regulators had warned about pre-FTX was the possible contagion risk posed by crypto becoming part of the broader financial system. So far that hasn't happened yet" (De 2022, 7).

(Godbole 2022, 3).<sup>210</sup> Decentralized exchanges have been characterized as offering “huge benefits over centralization: lack of counter-party risk, on-chain settlement and transparency” due to the self-executing nature of smart contracts, in addition to the common assertion that peer-to-peer networks make it “simply impossible to trade against your customers” (Lavine and Lavine 2022, 6).

But there are some industry players who **believe this to be short-lived** due to the unique challenges presented by DeFi exchanges, including “slower transaction speeds, pooling of assets, and order traceability features” along with “the absence of a limit order/stop loss feature on DEXes, their dependency on price oracles<sup>211</sup> that source data from centralized exchanges, vulnerability to hacks, exploits, the need for over-collateralization and systemic risks from the cascade of automated liquidations” (Ibid, 2).<sup>212</sup> In addition, it was noted that “management, governance and auditing of DeFi protocols without compromising too much on security and centralization is a big challenge” (Ibid, 3). Still others believe both are necessary for the digital assets markets to survive and thrive: “Decentralization and centralization operate on a spectrum: There’s decentralized autonomous organizations (DAOs) on

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<sup>210</sup> May 2022 was also the month that Celsius began its decline into bankruptcy, as noted previously.

<sup>211</sup> “A price oracle is a source of price data streamed onto the blockchain. Oracles bridge the off-chain world with the blockchain, by publishing off-chain price information on-chain...DEXes often have relatively low liquidity compared to centralized exchanges (CEXes). Thus, DEX prices may not be representative and are often more easily manipulated than CEX prices. Using an oracle resolves these issues, as the oracle brings the high-quality information from CEXes onto the chain” (Suresh, Latif, and Shah 2022). See also Glossary of Defined Terms

<sup>212</sup> An allegation that has been made against FTX is a lack of segregation of customer funds: “Rather than holding its customer funds, FTX inexplicably loaned them to sister company/hedge fund Alameda Research to support Alameda’s proprietary trading positions” (Challender 2022, 1; see also Hodder 2022, 2). It was reported in one twitter thread that CEO Bankman-Fried so much as admitted this, stating: “In general, balances were generally treated as effectively fungible with each other” (Hodder 2022, 3). And the CEO of FTX who replaced Bankman-Fried as a result of the insolvency proceedings noted: “All US and international customer assets were commingled with the Alameda trading platform” (Ibid, 2). In addition, the CEO of Alameda Research had been recorded on video prior to the collapse as acknowledging the absence of any implementation of a stop loss mechanism.

one side and centralized entities on the other side (Coinbase, for example) that benefit from decentralized technology. Both forms of organizing can, will, and must coexist for us to realize the full potential of blockchain and crypto technologies...In fact, the industry is so successful today because it is built on the back of decentralized technologies AND centralized organizations...Missing from the list of centralized entities that can help or harm the industry are governments. **Governments are the missing link to help blockchain and crypto technologies continue to grow**" (Favole 2021, 3-4).<sup>213</sup>

The FTX bankruptcy "has been compared to Lehman Bros. and Enron" although "it may very well dwarf both" (Challender 2022, 2). This is interesting as both Lehman Brothers and Enron were regulated entities in the United States – each of which were public companies trading on the New York Stock Exchange. Lehman was additionally regulated as an investment bank and was the fourth largest in the United States at the time of its own collapse (Corporate Finance Institute 2022, 1). Of the many challenges that ultimately led to Lehman's insolvency was its attempt to massage its financial position by entering into arrangements with third parties who agreed to assume certain unperforming/underperforming assets on a short-term basis under the guise of an arms-length purchase. In exchange, Lehman was able to remove these assets from its balance sheets while booking cash from the sale, thus appearing to be financially healthier than it actually was (Corporate Finance Institute 2022, 6).<sup>214</sup> In FTX's case, it was reported in the days prior to

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<sup>213</sup> "The most pernicious situation then, is neither fully decentralized organizations nor fully centralized ones, but organizations that masquerade as DeFi while succumbing to the very tendencies that DeFi is designed to fix" (Index Coop DAO 2022, 2).

<sup>214</sup> Specifically in the amount of US \$50 billion, which was the value of the disguised sale of assets (Corporate Finance Institute 2022, 6).

collapse that: “much of the balance sheet for Alameda Research, a quantitative trading firm, was composed of a large amount of the FTT token, which is issued by the cryptocurrency exchange FTX. Alameda and FTX share the same founder and ownership, so this immediately raised some questions about the figures these companies were reporting and in particular, whether this meant that either company had all the funds they claimed” (De 2022, 3).<sup>215</sup> In the Enron bankruptcy, it was also discovered that CEO, Kenneth Lay and CFO, Jeff Skilling had orchestrated an accounting scheme in an attempt to keep “billions of dollars of debt off the company’s balance sheet” (Ibid).

It has been asserted that the FTX scenario “is not necessarily a situation that regulation could have prevented” and that tokens, such as FTT, are “not problematic in and of themselves, some work just fine” (Challender 2022, 2). The same could be said of investment banks, subprime mortgages, credit derivatives, and publicly traded companies, the underlying premise of each which provides a legally sound function within a complex global financial services ecosystem, albeit the “failures of Enron and Lehman Brothers became catalysts for more robust risk management practices, stronger capitalization and deeper liquidity across banks and financial institutions” (Slazas 2022, 2). In other words, the problem “wasn’t the emergence of a new ‘trustless’ disintermediated financial system, **but one that repeated and**

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<sup>215</sup> It was also reported that the Financial Times was in possession of an Excel file belonging to FTX that “suggested FTX had less than \$1 billion in assets, against around \$9 billion in liabilities” (De 2022, 4). Reuters has separately reported: “Bankman-Fried had lent his trading company, Alameda, billions of dollars of FTX customer funds, collateralized by these FTT tokens, which were essentially invented as a way to offer trading discounts and other perks” for users of the platform (Bambysheva, Paz, del Castillo, and Ehrlich 2022, 2). And, according to ESMA “FTT had a total market capitalization of EUR 3bn prior to the FTX collapse. FTT is reported to have made up over a third of the value of the assets on Alameda’s books” and although Alameda had claimed “that FTT was valued at half its USD market price on the company books...the book value in fact reportedly exceeded the market value at the time” (European Securities and Markets Authority 2022, 3).

**accentuated the problem with the traditional system”** (Werbach 2022, 3) (emphasis added).<sup>216</sup> Hence, while a result of the FTX debacle is that “regulators in the United States as well as finance industry executives and crypto entrepreneurs are focused on the need for a workable set of rules and greater transparency” **nothing about the FTX collapse suggests that either digital assets or digital asset exchanges, whether decentralized or not, are necessarily inherently flawed** (Reuters 2022, 5).

Indeed, Nasdaq was contemplating moving forward with its own crypto custody operation earlier this year before shelving the plans citing “the shifting business and regulatory environment in the U.S.” (Macheel 2023, 1) and, additionally, “has provided trading and surveillance tech to crypto exchanges for several years” (Reuters 2022, 5).<sup>217</sup> Rather than avoiding participation in crypto-asset markets, its CEO, Adena Friedman instead supports “a balance in regulation between protection

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<sup>216</sup> Parallels can also be made to the 1929 Stock Market Crash: “In September 1929, British financier Clarence Henry was arrested for allegations of fraud. The event caused a crash on the London Stock Exchange that also changed the optimistic sentiment of American investors...On October 28, the Dow Jones Industrial Average (DJIA) lost 13% of its value. The next day, the decline continued when DJIA fell by another 12%. A panic sell-off of securities that could not be stopped ensued” (Corporate Finance Institute 2022, 3). The “optimistic sentiment of American investors” was previously attributable to “a strong public sentiment of an almost perpetual economy and stock market expansion” (Ibid, 2). A similar public sentiment also persisted in the period preceding the 1987 Stock Market Crash, although the severity of the crash has been attributed to algorithmic trading that was designed to “automatically execute stop-loss orders, selling out positions, if stocks dropped by a certain percentage. On Black Monday, the computerized trading systems created a domino effect, continually accelerating the pace of selling as the market dropped, thus causing it to drop even further” (Corporate Finance Institute 2022, 3-40). In FTX’s case, when “the value of their collateral (FTT token) essentially went to zero, Alameda and FTX institutional creditors clamored with margin calls” further accelerating the exchange’s spiral into bankruptcy (Kumar, Zhang, Choudhuri, and Lee 2022, 2).

<sup>217</sup> The decision to abandon the crypto custody plans was announced by Nasdaq’s CEO on a July 2023 earnings call. On that same call, the company offered reassurance to the markets that it continues to be “committed to supporting the evolution of the digital asset ecosystem in a variety of ways” including “delivery of comprehensive technology solutions across the trade life cycle and through our partnerships with potential ETF issuers to support tradable exchange listed products” (Macheel 2023, 1).



and innovation” (Ibid).<sup>218</sup> Meanwhile, JPMorgan has weighed in that “it expects there to be more urgency to get a consistent framework in place in the wake of FTX’s collapse” and that “**regulations are likely to be imported from the traditional finance system**” essentially harmonizing the two (Katte 2022, 4) (emphasis added).<sup>219</sup> “A large part of the reason crypto exchanges such as FTX collapse is because they do things **that would never be allowed in conventional finance**” (Walker 2022, 1) (emphasis added). “Efforts to put in place effective policies for crypto assets have become a key policy priority for authorities, amid the failure of various exchanges and other actors within the crypto ecosystem, as well as the collapse of certain crypto assets” (International Monetary Fund 2023, 2).

### 8.3 Terra/Luna.

Unlike FTX, the Terra/Luna case does provide a lens into relatively uncharted regulatory territory. As previously summarized, Terra was a USD pegged algorithmic stablecoin (also referred to as TerraUSD and trading under the ticker UST)<sup>220</sup> through its companion coin, Luna, that lost its peg and close to 99% of its value in May 2022 (Levi 2022, 2). The Terra network was originally launched by parent Terraform Labs and its founder Kwon Do-Hyung in 2018 “with plans to develop Chai, an e-commerce payments application” (Sandor and Genç 2022, 2; Levi 2022, 2; CFT Team 2023, 1). The vision behind Terra/Luna was “to create a price-stable cryptocurrency against major fiat currencies to facilitate transactions” (Sandor and

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<sup>218</sup> In particular, Friedman has been quoted as stating: “Now is the time for regulation to catch up and make sure that as we go forward, to have safety and soundness, but we also allow for innovation and a nimble ecosystem” (Reuters 2022, 5).

<sup>219</sup> “Regulators in major economies have been slow in effectively dealing with the crypto industry for a variety of reasons. This included its size relative to conventional finance, confusion about how to enforce existing laws and the challenge of dealing with so many products” (Walker 2022,1).

<sup>220</sup> See Graphic 11b).

Genç, 3) that would create “a price-stable crypto payment system to take on the biggest e-commerce platforms” (Ibid, 2). In 2020, the Anchor protocol was added to the Terra network which allowed platform investors to “earn a high yield on their deposits and also borrow against their crypto holdings” (Ibid, 4). As an NBER paper explains, however “newly issued UST were used to pay the interest on Anchor deposits and fund other activities” (Liu, Makarov, and Schoar 2023, 3-4), so that “as the amount of deposits skyrocketed, the level of subsidies required became increasingly unsustainable” (Ibid, 4).

In January of 2022, The Luna Foundation Guard (LFG) was organized “to buy bitcoin for UST’s reserve system” (Sandor and Genç, 5) that was intended in part to support the stablecoin during periods of extreme market volatility.<sup>221</sup> On May 7, 2022, “a series of large dumps of UST on Terra’s lending protocol Anchor and stablecoin exchange protocol Curve” resulted in the value of UST plummeting and losing its peg (Ibid, 6).<sup>222</sup> It has been reported that around this same time LFG attempted to enhance its reserves by purchasing bitcoin then worth approximately US \$1.5 billion in value (Levi 2022, 4). “The LFG audit report documents that during this period TFL and LFG spent a total of about \$2.5 billion (80, 071 BTC, 26, 281, 671

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<sup>221</sup> Three Arrows Capital, a crypto fund that is the subject of the fourth case study, was a lead investor in LFG along with Chicago-based Jump Crypto (Sandor and Genç 2022, 5)..

<sup>222</sup> “While it’s not clear what set off the sell-off in UST/Luna, there are some that blame a rate cut by Anchor from the ~20% interest it would pay for crypto deposits” just a few days earlier (CFI Team 2023, 5). Others have suggested that the sell-off “stemmed from growing concerns about the sustainability of the system” (Liu, Makarov, and Schoar 2023, 4). It is also worth noting that during the previous month “the value of LUNA experienced a decline in conjunction with a general downturn in the value of cryptocurrencies, thereby diminishing the relative market valuation of LUNA compared to UST” (Ibid, 6). Irrespective, the sell-off has been described as “the equivalent of a bank run, where depositors lost confidence in the tokens and all raced for the door at the same time” CFI Team 2023, 2). As the NBER paper concluded: “Once a few large holders of UST adjusted their positions on May 7<sup>th</sup>, 2022, other large traders followed suit. Blockchain technology enabled investors to closely monitor each other’s actions and amplified the speed of the run” (Liu, Makarov, and Schoar 2023, 4).

USDT, and 23,555,590 USDC) on purchases of UST and LUNA” (Liu, Makarov, and Schoar 2023, 300). On May 9, 2022, however, “[d]eposits on the Anchor protocol plunge” (Sandor and Genç 2022, 7) and UST loses its peg again.<sup>223</sup>

Shoring up reserves to support the stablecoin, while consistent with The Luna Foundation Guard’s purpose, was arguably inconsistent with the primary characteristic that made the Terra/Luna concept unique – the peg was supported algorithmically rather than through asset-based reserves (Wong 2022, 1).<sup>224</sup> “That algorithm – which was codified in blockchain-based computer code called smart contracts – was supposed to print and burn luna... to serve as a sort of shock absorber for UST’s price” (Wang and Kessler 2023, 4).<sup>225</sup> The intent was to ensure “price stability by reducing the number of coins circulating when the market price goes down and increasing the number of coins circulating when it goes up, called ‘rebasing’” and has been compared to **“how a Central Bank may act to defend the**

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<sup>223</sup> “Anchor offered rates of around 20% on deposits of UST” which was intended to create “significant demand for the token” and “keep UST’s price stable” (CFI Team, 4). As the NBER paper noted, however, “borrowing rates were not above lending rates” (Liu, Makarov, and Schoar 2023, 26) which meant that the protocol’s “yield reserve was depleting most of the time” (Ibid). Concern over the rate of subsidization required led “the Terra community to pass a proposal to gradually decrease the 19.5% interest rate to a more sustainable and market-driven level, starting on May 1, 2022” (Ibid, 5-6) and exposed a misalignment of incentives in the system. “Anchor was set up as a decentralized autonomous organization (DAO) with its own native governance token, ANC...Maintaining a high and subsidized deposit rate on Anchor benefited ANC holders by driving demand to ANC, increasing assets under management, and with it, the fees going to ANC holders. But...this also contributed to the risks building up in the system and reduced the going concern of LUNA” (Ibid, 26).

<sup>224</sup> “Stablecoins can be categorized on the bases of their working mechanisms – crypto-collateralized, algorithmic, and fiat-collateralized” but “one major concern” is that “their value only remains stable if there is not much fluctuation of buying and selling, so major dumps can have drastic consequences which destabilize the coin” (CFT Team 2023, 3).

<sup>225</sup> “This category of stablecoins uses complex algorithms to keep their prices stable by balancing funds held on the blockchain using smart contracts to control supply and demand and maintain price stability” (Ibid). Specifically, the algorithm is designed to automatically destroy the pegged asset – in this case the Luna coin – in order to maintain the desired value of the stablecoin (Bank of England 2022, 9.) In comparison, the two stablecoins whose circulation value surpassed that of Terra (USDT and USDC) both rely on traditional cash or cash-like reserves (Wong 2022, 7). See also note 85 and Graphic 11b).

**peg of their domestic currency in foreign exchange markets by buying or selling foreign assets”** (CFT Team 2023, 3) (emphasis added).

Subsequent enforcement action by the U.S. Securities and Exchange Commission, however, has asserted “that Terra’s stablecoin ecosystem relied on human-driven market-making operations – rather than autonomous bits of computer code – to stay afloat” (Ibid, 5). This has been supported elsewhere: “The main danger to the stability of the system was if users suddenly stopped holding UST and converted them to LUNA. While conversion of UST to LUNA reduces the UST supply, it also increases the LUNA supply and dilutes existing holders of LUNA. If this increase in the LUNA supply is expected to lead to a significant decline in the LUNA price, then any LUNA holder would be better off selling LUNA ahead of the conversion resulting in a so-called ‘death spiral’ of both UST and LUNA falling in tandem” (Liu, Makarov, and Schoar 2023, 5).

TerraUSD was ultimately re-pegged and now trades as TerraClassic<sup>226</sup> under the ticker USTC after “Terra validators voted to approve Do Kwon’s<sup>227</sup> plan to launch a new blockchain tagged ‘Terra 2.0’ without a stablecoin” (Sandor and Genç 2022, 8; Georgiev 2022).<sup>228</sup> That vote took place on May 25, 2022, and Terra 2.0 went live three days later (Sandor and Genç 2022, 8). Following the publication of the re-peg proposal, the value of UST increased by 40%, suggesting that the proposal was well-received by holders of the asset (Georgiev 2022). “Terra framed its eventual recovery as a proof-case for the success of its algorithm” but the SEC has expressed

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<sup>226</sup> Concurrently, “the original LUNA token was renamed Luna Classic (LUNC)” (CFT Team 2023, 6).

<sup>227</sup> Do Kwon is the name by which Terraform Labs founder Kwon Do-Hyung is commonly referred (Levi 2022, 2)

<sup>228</sup> Instead “Terra 2.0 focuses on using Luna to earn rewards for staking or purchasing digital art and paying fees” (Ibid, 2).

disagreement with the notion claiming that “the stablecoin was only able to recover as a result of a third party, which stepped in to covertly buy up Terra’s tokens to backstop the market sell-off” (Wang and Kessler 2023, 5).<sup>229</sup>

Interestingly, the options explored in the re-peg proposal included the application of traditional monetary policy techniques. This included quantitative easing (or QE) and quantitative tightening (or QT), as well as concepts such as “remittance corridors” and “tranches” the purpose of which would be to provide for a “regulated flow of capital” on and “economic stability” to the Terra Classic network (Andersen 2022, 16-18).<sup>230</sup> In sum, what sounds like **similar types of currency manipulation that central banks perform in the fiat system** to carry out monetary policy. In addition, an observation has been made that when UST briefly de-pegged from LUNA during the same month the previous year, the impact was significantly less and the peg was readily restored because “the outstanding supply of UST was much smaller in May 2021, which enable TFL to function as a lender of last resort” (Liu, Makarov, and Schoar 2023, 8), which is, perhaps not surprisingly, also precisely the role that central banks play in the traditional monetary system.

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<sup>229</sup> The third party was supposedly Jump Crypto, which “was active in the Terra ecosystem, frequently posting governance proposals and heavily invested in the project including building a Terra cross-chain bridge and co-leading a \$1 billion capital raise to seed the Luna Foundation Guard...which stewarded Terra’s multi-billion dollar bitcoin reserves” (Wang and Kessler 2023, 5; Sandor and Genç 2022, 5). Those reserves were ultimately “depleted in May 2022 in a failed attempt to restore UST’s dollar peg” (Ibid). “Over the period of the run, between May 23 through May 27, Jump made net purchases of over 62 million UST across at least two crypto asset trading platforms. In return, Jump allegedly received allocations of UST from TFL at a heavily discounted price of \$0.4 to compensate them for the stabilization trades” (Liu, Marakov, and Schoar 2023, 38). The SEC also alleges that the reserves were “siphoned to a Swiss bank account” controlled by Terraform Labs founder, Do Kwon (Sandor and Genç 2022, 5). A separate study asserts that of “the 26 addresses that swapped the highest amount of LUNA to UST...except for the addresses of Terraswap route and Jump trading, the top 26 addresses are all controlled by TFL” (Liu, Marakov, and Sandor 2023, 25). See also notes 221 and 222.

<sup>230</sup> The author of the re-peg proposal is reported to be a blockchain engineer (Georgiev 2022), although it is unclear whether that engineer was affiliated with parent company Terraform Labs, Jump Crypto, or either.

During her April 2022 interview with Galaxy Brain, just a month prior to Terra’s de-pegging, American University Professor Allen compared stablecoins to money market funds (MMFs) that also were faced with challenges during the GFC:

*“Money market mutual funds were created to be a functional equivalent of deposit accounts but in fact are an abstraction: a special accounting treatment that allows a share in a fund to be consistently valued at one dollar. But a share in an MMF is actually a share in a pool of assets with fluctuating prices, and so its value changes constantly. **If the value of an MMF share deviates too far from one dollar, shareholders will find their shares revalued below one dollar. When this happened in 2008 and investors pulled out of MMFs, it was analogous to the traditional bank runs.**”*

(Ibid, 5) (emphasis added).<sup>231</sup> Allen went onto to caution that “if something were to shake confidence in stablecoins and holders rush to exchange them back to fiat currency, there could be a similar kind of run dynamic (Ibid).”<sup>232</sup> The IMF has also warned about run risk “driven by doubts about their redeemability at 1:1 peg due to the value of their reserves or the speed at which reserves can be liquidated to

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<sup>231</sup> The IMF and ESMA have echoed this analogy. The IMF has described stablecoins “backed by noncash equivalent assets (for example, corporate bonds, commercial paper, or commodities)” as being “akin to money market funds prior to the reforms that followed the global financial crisis (International Monetary Fund 2021, 8). In turn, ESMA has observed that stablecoins “share similarities with that of deposit taking banks or e-money institutions, to the extent that for every dollar collected, a token is being issued, with the general expectation on the part of investors that they will be able to redeem at par” (European Securities and Markets Authority 2022, 11). In addition, ESMA has noted that “the third and fourth largest crypto-assets by market capitalization – Tether (USD 65bn) and USD Coin (USD 55bn) claim to have reserve assets that rival some of the largest money market funds” (Ibid).

<sup>232</sup> According to a Bank of England report, approximately 75% of all centralized digital asset exchange activity involves stablecoins (Bank of England 2022, 9). The bank has also noted that stablecoins “play a key role in DeFi applications, with some DeFi applications issuing their own currencies” (Ibid).

meet potential redemptions” (International Monetary Fund 2021, 9).<sup>233</sup> And ESMA has additionally commented on the Terra collapse as demonstrative of the contagion effects within crypto markets, noting that Tether also temporarily lost its USD peg as a result, while the values of non-stablecoins, bitcoin and ether dropped precipitously around the same time as well – a reaction that ESMA refers to as “confidence effects” (European Securities and Markets Authority 2022, 12).<sup>234</sup> This notwithstanding, ESMA acknowledges that the stablecoin market continues to grow noting: “Within the crypto-asset market, so-called stablecoins have recently established themselves as a distinct class, with a combined valuation growing from approximately EUR 5 bn in 2020 to EUR 152 bn in July 2022 (+ 3,000 %) – **five times as fast as the overall crypto-asset market growth (+ 600 %)**” (European Securities and Markets Authority 2022, 4) (emphasis added).

So, what to think of all this? In a contemporaneous blog post immediately following the collapse, Ethereum founder Buterin declared: “What we need is not stablecoin boosterism or stablecoin doomerism, but rather **a return to principles-based thinking**” (Odunayo 2022, 1) (emphasis added). And what he meant by “a return to principles-based thinking” is a stablecoin model in which users are “able to extract the fair value of their liquidity out of the asset” (Ibid, 2) by incorporating design features that reduce the risk of cross-contamination from poorly implemented pegging mechanics, similar to what occurred with the flawed

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<sup>233</sup> The IMF has additionally cautioned that asset-backed stablecoins may be marketed as “immediately redeemable at face value, but in some cases-especially during periods of market stress-some issuers may be able to defer redemption, offer in-kind redemption, or impose higher redemption fees” (International Monetary Fund 2021, 8).

<sup>234</sup> ESMA also pointed out that confidence effects or what it describes as “internal contagion risk” was observed following “the bankruptcies of several large CeFi platforms (beginning with Celsius), which coincided with an overall market drawdown of around 50 %” (European Securities and Markets Authority 2022, 13).

Terra/Luna model. This was not the case with the Terra/Luna model, he asserts, because the value of both was intrinsically linked with demand (Ibid). And that demand primarily came from the lending program that Terra creator, Terraform Labs (TFL), also administered through the Anchor protocol.

Anchor essentially loaned Terra deposits to borrowers in exchange for an exceptionally high interest return. Part of that interest rate was then credited to the accounts of Terra holders participating in the program. The loans were required to be collateralized by borrowers with Luna at a 2:1 rate (Lopatto 2022, 3-4; Wong 2022, 2-3).<sup>235</sup> Instead of dollar reserves to maintain Terra's USD peg, however, Luna was designed to algorithmically maintain a 1:1 peg through an arbitrage mechanism, in which each of Terra and Luna could be exchanged for the other. For example, if Terra was trading <\$1.00, it could be burned and exchanged for Luna to decrease the supply and raise the price. The reverse could occur when the value was >\$1.00 (Lopatto 2022, 3-4). "At the core of the peg mechanism is a *native swap* smart contract that allows users to exchange, say \$1 worth of a stablecoin, UST, for the dollar-equivalent amount of LUNA, and vice-versa. Thus, when UST is traded above \$1, users could buy LUNA, swap LUNA for UST, which amounts to burning (destroying) LUNA and mint (creating) new UST, and sell UST at a premium above \$1, pocketing the difference as profit. In contrast, when UST trades below \$1, users could buy UST, burn UST to mint new LUNA, and then sell LUNA with a profit" (Liu, Makarov, and Schoar 2023, 14-15).

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<sup>235</sup> "Another way to keep UST's price stable was to offer above-market interest rates through Anchor" which, in turn "lends out the UST (as well as other cryptocurrencies) to users who need tokens in order to earn staking rewards" (CFI Team 2023, 4).



Because the demand for Luna was directly related to borrower demand for TerraUSD both assets were positively directionally correlated. Thus, when unusual selling activity in Terra was detected on a digital asset exchange causing the value of UST to fall, customer redemption demand for TerraUSD deposits on the Anchor platform also increased. This not only resulted in downward pressure on Luna to satisfy the redemption requests (either through selling posted collateral or minting new coins diluting the value through increasing supply), but also reduced the UST lending capacity of Anchor, hence further eroding the demand and corresponding value of Luna (Odunayo 2022, 2; Wong 2022, 6): “At the Minsky moment when the market cap of Luna was below the market cap of UST, the value of Luna clearly was not enough to redeem all of the UST in circulation. In this case, UST was no longer a stablecoin, and the price of UST (as well as Luna) collapsed” (Wong 2022, 6). Or, in other words, “UST was backed by Luna, but the price of Luna was backed by its option value of converting to UST. When the confidence of this circular backing is shaken, the liquidity of algorithmic stablecoin becomes flighty” (Ibid, 7).

A comparison has been made to the Asian Financial Crisis in this scenario, **where in contrast the Hong Kong Dollar (HKD)’s peg against the US Dollar (USD) was successfully defended** against downward pressure by short-selling speculators after the Hong Kong Monetary Authority (HKMA) leveraged substantial USD reserves to aggressively buy up and stabilize the currency in the open market (China Global Television Network (CGTN) 2019).<sup>236</sup> The difference, of course, is that the **HKMA**

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<sup>236</sup> The HKD has been pegged to the USD since 1983 (China Global Television Network (CGTN) 2019). Reserves have been reported as “more than three times greater than the outstanding stock of currency” at the time of the HKMA’s actions, which resulted in trading activity in the equivalent of approximately 79 billion HKD/10 billion USD (China Global Television Network (CGTN) 2019; Wong

**had stable cash reserves on hand whereas Terraform Labs did not.** While Terraform Labs eventually established LFG to serve as a backstop in the case of extreme volatility that impaired the effectiveness of the algorithm, its reserves were in bitcoin (not USD), which was dropping in value during the same time that demand for Luna was waning.<sup>237</sup> Buterin has suggested that negative interest rates which “equilibrates to basically cancel out the USD-denominated growth rate built into the index” could be used in a stablecoin scenario “when it’s tracking a basket of assets, a consumer price index, or some arbitrarily complex formula” (Odunayo 2022, 3). But there may well be unintended consequences associated with this strategy akin to what the Hong Kong Monetary Authority experienced during the Asia Financial Crisis. As a result of the HKMA raising interest rates to deter speculators by increasing the cost of borrowing and, hence, the cost of the short sales, the local economy was impacted adversely which resulted in falling equity and real estate prices along with GDP, thus foiling the effort (China Global Television Network (CGTN) 2019).<sup>238</sup>

Buterin himself has acknowledged as much stating: “The stablecoin could still be fragile for other reasons (e.g., insufficient collateral ratios), or have bugs or governance vulnerabilities” while reinforcing that “steady-state and extreme-case soundness should always be one of the first things that we check for” (Odunayo

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2022, 6). Similarly, “the pegging mechanism behind UST and LUNA has some resemblance to the large literature in international finance on the causes and consequences of currency crises in countries with fixed exchange rates” (Liu, Makarov, and Schoar 2023, 9).

<sup>237</sup> “The bitcoin price dropped to a low of \$26,350.49 on 12 May 2022, the day when the US dollar index reached a then-20-year-high” (Henn and Willing 2023).

<sup>238</sup> It has been reported that at one point the interest rate increased by 300% overnight and that Hong Kong’s Hang Seng equity market was being sold short at the same time (China Global Television Network (CGTN) 2019).

2022, 3).<sup>239</sup> Or, as CK Zheng,<sup>240</sup> another crypto industry participant has observed “algorithmic stablecoins are a new innovation that may work, in theory, **if everything goes smoothly**” (Wolinsky 2022, 4) (emphasis added). The problem, as Buterin cautioned, is that everything does not always go smoothly. “Similarly, CK states that the stablecoin wasn’t stable, just as the AAA-rated collateralized debt obligations (CDO) based on the subprime mortgage market wasn’t” in comparing the unraveling of Terra/Luna with the general market meltdown associated with the Global Financial Crisis (Ibid, 5). “When the housing market got underwater, it basically wiped out the subprime housing market...When you have all these things

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<sup>239</sup> Governance vulnerabilities were also cited by the Federal Reserve Bank of Richmond to be a contributing factor in the Terra/Luna collapse when it noted “as the price of LUNA started collapsing, the stake of validators’ LUNA fell to almost zero, which meant that malign actors could become the dominant validators by acquiring a large amount of LUNA to stake at almost no cost. As a result, Terra had to halt its blockchain to reduce the risk of governance attacks, which further curtailed the pegging mechanism” (Wong 2022, 7). To further elaborate, Terra relied on a Proof of Stake consensus protocol as indicated in Graphic 11b). “In a PoS protocol, validators of transactions pledge their coins, which can be forfeited if the validator fails to verify transactions promptly or if their actions are found to be malicious” (Liu, Makarov, and Schoar 2023, 12). In addition, staking their coins “also permitted holders to propose and vote on governance proposals” (Ibid). It has been further pointed out that during the collapse “the complexity of the system put less sophisticated and poorer individuals at an informational disadvantage...Poorer and less sophisticated investors not only ran later and had larger losses, but a significant fraction of them attempted to buy into the run, hoping to ‘buy the dip’” (Liu, Makarov, and Schoar 2023, 4). This notwithstanding, it has also been acknowledged that the complexity of the system impeded effective risk assessment and mitigation even by those with significantly more knowledge of the protocol (Ibid). And, of course, information asymmetry and uneven advantages between larger and smaller investors and institutional and retail players is also well understood in traditional finance. Hence, an unlevel playing field is not exactly unique to crypto markets; however, an argument has been made that in the Terra/Luna case the “[d]ecentralized governance mechanisms added inefficiencies to the system and further exacerbated the instability” (Ibid). This would, at least ostensibly, seem to contradict the promise of DeFi and “undermine the advertised benefits” (Ibid, 3) given that “one of the main premises of Terra and permissionless blockchains more generally is the equal access and democratization of finance” (Ibid, 32). On the contrary, it has been asserted that at least in the case of the Terra/Luna/Anchor protocols “open access and the transparency of the blockchain do not compensate for differences in financial literacy and wealth and may even exacerbate them” (Ibid, 36).

<sup>240</sup> CK Zheng is a former Managing Director and Global Head of Risk and Valuation at Credit Suisse and is now a founder and Chief Investment Officer of ZX Squared Capital, a crypto hedge fund; <https://zx2.io/ck-zheng>.

together, one starts pumping the bubble...When the bubble bursts, the things you don't see in normal times are exposed...and that's how it's played out" (Ibid).

But even if algorithmic stablecoins cannot be executed in a manner that meets Buterin's test for "steady-state and extreme-case soundness" or Zheng's condition that "everything goes smoothly" there are other methods to maintain a peg. This includes overcollateralization via cash reserves (as was the case with the HKMA's successful defense of the HKD-USD peg), index benchmarking, or tracking a basket of currencies or other digital assets that would diversify the exposure of the stablecoin away from the positive directional correlation and demand interdependency (and, hence, circularity that ultimately befell Terra/Luna). Thus, perhaps what the Terra/Luna case instructs **is not so much that stablecoins as a concept are inherently problematic but rather that thoughtful stablecoin design is critical to successful operation.**<sup>241</sup>

#### 8.4 Three Arrows Capital.

As a refresh, Three Arrows Capital (or 3AC as it is colloquially referred) was a hedge fund investing in and arbitraging crypto assets until its insolvency in June 2022.<sup>242</sup> Prior to this, 3AC was one of the most respected digital asset managers in the industry, just as Celsius was embraced as the poster child for the decentralized finance story before its own insolvency the following month (Duggan 2022, 2; Wieczner 2022, 4). After almost ten years in operation, the demise of 3AC can in part be attributed to the subsequent failure of digital assets lender, Voyager Digital,

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<sup>241</sup> The Terra/Luna case "has been a prime topic of stablecoin regulators' and legislators' focus, and it's looking like they will be banned with mandates that stablecoins be backed 100% by reserves of fiat or highly liquid investments like short-term U.S. Treasuries" (Pymnts 2022, 3).

<sup>242</sup> The Chapter 15 bankruptcy was formally filed in the Southern District of New York on July 1, 2022 (Wieczner 2022, 19).

in July 2022 which counted 3AC among one of its customers.<sup>243</sup> In addition, 3AC's insolvency can in part be attributed to the previous failure of the TerraUSD algorithmic peg and the corresponding substantial loss in value of its companion coin, Luna, to which 3AC was invested on a leveraged basis (Duggan 2022 2; Wieczner 2022, 15-16).<sup>244</sup> In a subsequent interview with the Wall Street Journal Kyle Davies, who co-founded the fund in 2012 with partner Zhu Su, was quoted as stating: "The Terra-Luna situation caught us very much off guard" (Sigalos and Kharpal 2022, 3-4). And, not to be outdone, crypto platform BlockFi was also entangled in this mess after 3AC failed to meet a margin call on a loan it had outstanding with the now-defunct crypto lender and was itself forced to claim insolvency (Kharpal 2022, 3; Sigalos and Kharpal 2022, 4).<sup>245</sup>

To add more colour and irony to this picture, Sam Bankman-Fried, the CEO of now-bankrupt FTX, commented on 3AC's demise just a few months earlier stating: "I suspect they might be 80 percent of the total original contagion" adding that, although they were not the first digital asset service provider to go down, "they did it way bigger than anyone else did." That is, of course, until FTX's own implosion (Wieczner 2022, 4-5).<sup>246</sup> Bankman-Fried, himself indicted (and later convicted) in

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<sup>243</sup> In its bankruptcy filing, Voyager claimed a credit exposure to 3AC of US \$650 million (Ibid 2022, 4), large amounts of this which was possibly uncollateralized (Ibid, 13). Other sources indicate that 3AC's default involved US \$350 million in the stablecoin USDC, along with 15,250 bitcoin at prevailing market value (Kharpal 2022, 3; Sigalos and Kharpal 2022, 1). It has also been reported that, prior to Voyager's insolvency, the now also defunct Alameda Research had "committed \$500 million in financing to Voyager" and that "Voyager had already pulled \$75 million from that line of credit" (Sigalos and Kharpal, 3).

<sup>244</sup> 3AC's Luna holdings reportedly once worth about US \$500 million were thereafter reduced to a market value of around US \$600. It has also been reported that at the time of its demise, Three Arrows Capital was at a minimum levered 3:1 (Ibid, 18).

<sup>245</sup> For more information on BlockFi and Voyager, see notes 184, 187, 191, 195, and 201.

<sup>246</sup> Weeks after 3AC's insolvency creditors had filed more than US \$2.8 billion in claims (Ibid, 5). By comparison, at the end of 2020 3AC had approximately US \$2.6 billion in assets under management (AUM) against US \$1.9 billion in liabilities, which would have amounted to a net worth of US \$7 billion (Wieczner 2022, 11-12).

New York on numerous counts of fraud and conspiracy to commit fraud under securities, commodities, anti-money laundering, campaign finance, and other United States laws and regulations,<sup>247</sup> also opined: “We suspect that Three Arrows attempted to pledge some pieces of collateral to many people at once” and that he “would be pretty surprised if that was the entire extent of the misrepresentations here...I strongly suspect that they made more” (Ibid, 15; Hodder 2022, 4-5). And yet, FTX itself seems to also have been a creditor to 3AC (Sigalos 2022, 2). As noted previously, failed crypto lender Voyager Digital was apparently partially secured against the 3AC liabilities via a revolving line of credit with Alameda Research, an affiliate of the now defunct FTX, although the official company statement was that the 3AC default vis-à-vis Voyager “does not cause a default in the agreement with Alameda” (Andersen 2022, 2; Sigalos and Kharpal 2022, 3).

As a hedge fund in the digital assets space, 3AC was primarily executing on a currency arbitrage strategy in digital assets markets that it had previously deployed in traditional markets,<sup>248</sup> as well as making high stakes bets in other crypto projects – such as Terra/Luna<sup>249</sup> and the Grayscale Bitcoin Trust (GBTC),<sup>250</sup> a third-party

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<sup>247</sup> See note 208.

<sup>248</sup> “During this early phase, Three Arrows Capital focused on a niche market: arbitraging emerging-market foreign-exchange (or “FX”) derivatives – financial products tied to the future price of smaller currencies (the Thai baht or the Indonesian rupiah, for instance)” by “trolling the listings for mispricings and ‘picking them off,’ as Wall Street calls it, often pocketing just fractions of a cent on each dollar traded” (Wieczner 2022, 8). The arbitrage strategy was based on “mispriced quotes from different brokers, even if it resulted in gains of just ‘fractions of a cent on each dollar traded’” (Roth 2022, 2).

<sup>249</sup> In February 2022, 3AC “put \$200 million into a buzzy token called luna” just months before the May depegging of its companion stablecoin Terra, and the collapse in value of both (Wieczner 2022, 15-16). “Three Arrow’s holdings in luna, once roughly half a billion dollars, were suddenly worth only \$604” (Ibid, 16). See also notes 188, 221, and 244.

<sup>250</sup> “One of 3AC’s largest positions – and one that loomed large in its fate – was a kind of stock-exchange-traded form of bitcoin called GBTC (shorthand for Grayscale Bitcoin Trust). Dusting off its old playbook of capturing profits through arbitrage, the firm accumulated as much as \$2 billion in GBTC. At the time, it was trading at a premium to regular bitcoin, and 3AC was happy to pocket the difference” (Ibid, 12).

investment vehicle devoted exclusively to transactions in BTC (Roth 2022, 2; Wolinsky 2022, 4).<sup>251</sup> “With cryptocurrencies trading on exchanges around the world, the firm’s experience with arbitrage came in handy right away. One famous trading strategy was known as the ‘kimchee premium’ – it involved buying bitcoin in, say the U.S. or China and selling it at a higher price in South Korea, where the exchanges were more tightly regulated, resulting in high prices” (Wieczner 2022, 10).<sup>252</sup>

In addition, it is largely believed that the execution of 3AC’s strategy involved high amounts of leverage,<sup>253</sup> resulting in CK Zheng comparing its fate to that of Long-Term Capital Management (LTCM), a traditional fiat-denominated hedge fund that folded in 1998 after the U.S. Federal Reserve “stepped in, convincing more than a dozen Wall Street firms to coordinate and liquidate the hedge fund’s assets” (Wolinsky 2022, 2-4).<sup>254</sup> LTCM ‘s primary strategy is known as a convergence trade, essentially going long an undervalued asset and short an overvalued asset – typically in the same asset class – with the expectation that the prices will converge over time thus facilitating an exit of both trades at a profit. But, as Zheng noted “when the Asia financial crisis hit in 1997 and then Russia defaulted in 1998, LTCM’s convergence trades became problematic” (Ibid, 4). The anomalies in the market were adversely

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<sup>251</sup> “The GBTC position ate an ever-larger hole in 3AC’s balance sheet, and much of its capital was tied up in restricted shares in smaller crypto projects” (Ibid, 15).

<sup>252</sup> “Another crypto arbitrage might involve buying bitcoin at its current (or ‘spot’) price, while selling bitcoin futures, or vice versa, in order to harvest a price premium” (Wieczner 2022, 10).

<sup>253</sup> “But hedged strategies tend to spin off the most money when executed at scale, so Three Arrows began borrowing money and putting it to work. If all went well, it could generate profits that more than covered the interest it owed on the loan” (Ibid). But in the end, of course, all did not go well.

<sup>254</sup> While it has been observed that “it’s unclear just how much the crypto hedge fund was leveraged due to the relatively opaque nature of the crypto market” at the time of bankruptcy it has been estimated that “3AC was leveraged around three times its assets, but some suspect it could be magnitudes more” (Wieczner 2022, 18). In comparison, LTCM’s leverage is thought to have been approximately 25:1 (Wolinsky, 4).

affecting the convergence expectations, **meaning that the convergence trades were no longer profitable, and the excessive leverage deployed by the fund exacerbated the losses** (Ibid).

Thus, once again, like Celsius and FTX, what we have is **a traditional market operating model being executed in the digital asset space**. And the problems encountered, such as insufficient collateral, commingling client assets, poor overall risk management and governance, aggressive risk taking, and excessive leverage, **are not much different from issues that have plagued traditional financial markets**, as can be seen with numerous comparisons to previous events that share similar characteristics.<sup>255</sup> Or, as the Bank for International Settlements summarizes: “Many of the existing problems with intermediaries originate from well-known economic frictions that are inherent in financial markets, such as asymmetric information, adverse selection, moral hazard, etc.” (BIS Working Paper No. 1061 2022, 33) (emphasis added).

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<sup>255</sup> Similar to the allegations made against FTX/Alameda, “Three Arrows seems to have kept all the money in commingled accounts – unbeknownst to the owners of those funds – taking from every pot to pay back lenders” (Wieczner 2022, 18).



## Chapter 9

# Global Governance: A Look At Alternative Ways Forward

In a December 2022 interview, the Governor of the Reserve Bank of India, Shaktikanta Das remarked: “The term cryptocurrency, private cryptocurrency is a fashionable way of describing what is otherwise 100 per cent speculative activity. There is a talk that it should be regulated. How is it to be regulated? Somebody needs to explain” (Das 2022, 1). In contrast, the Bank of England has fairly observed: **“Many of the risks posed by cryptoassets and DeFi are similar to those managed by the existing regulatory framework in other parts of the financial system.** In some cases, the existing regulatory framework can be used to manage the risks. **In other cases, further development of the regulatory framework might be needed to**

reflect the differing nature of the underlying technology and its impact on business models or the system more generally” (Bank of England 2022, 14) (emphasis added). And it would appear that the previous case studies have demonstrated this to be true, with many of the crypto asset service providers **merely delivering traditional finance services** (i.e., lending, asset exchanges, and fund management) **via alternative technology platforms**,<sup>256</sup> while others are operating along seemingly novel paths not yet previously explored (e.g., stablecoins) but, in fact, have comparative examples in the existing monetary system that can be instructive (e.g., currency boards).<sup>257</sup> In short: **“Digital assets share enough similarities with traditional assets that it is possible for governments and legislative bodies to leverage existing regulatory frameworks”** (Slazas 2022, 3) (emphasis added).<sup>258</sup>

Recall again the Questions Explored:

- (i) can the digital asset and decentralized financial markets examined in this thesis co-exist with traditional assets and financial markets, and, if so,*
- (ii) are traditional or novel forms of regulation (whether financial or otherwise) needed or desirable for the digital asset and financial markets examined herein?*

For those segments of the digital assets markets **that are essentially traditional finance in the digital sphere**, the answer to each seems straightforward and clear:

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<sup>256</sup> “For instance, the responsibilities of a custodian (e.g., VASP) of cryptocurrencies are no different from its responsibilities for other financial instruments: safeguarding customer assets” (World Economic Forum 2021, 9).

<sup>257</sup> The Bank of England has observed: “Stablecoins could emerge as an alternative to commercial bank deposits, or grow in importance as a means of transacting as DeFi grows” (Bank of England 2022, 16). The bank has also noted: “Some stablecoins intend to replace or substitute existing payment systems, and would transact in their own coin issuance rather than central or commercial bank money” (Ibid, 20).

<sup>258</sup> “Broadly speaking, the types of concerns and risks to consumers of cryptocurrency products and services will typically be the same as for existing financial services” (World Economic Forum 2021, 9).

Yes and Yes, provided certain **necessary conditions** are met. And those conditions would be consistent with FSB recommendations that policy approaches be “technology neutral” by applying “the appropriate regulatory framework in the same manner as they would apply it to entities **performing the same functions or activities, and posing the same risks**” (Financial Stability Board 2022, 31) (emphasis added).<sup>259</sup> This would also align with the EU’s Markets in Crypto-Assets (MiCA) Regulation.<sup>260</sup> Specifically, “**MiCA is limited in scope**, applicable to crypto-assets that do not meet existing qualifications under EU financial services legislation” (Xreg Consulting 2023, 5).<sup>261</sup> MiCA exempts “those crypto-assets that fall within the scope of other legislation” (Ibid, 7).<sup>262</sup> In other words, *“these exemptions do not necessarily indicate that the relevant activity is unregulated but rather that the activity is caught by other EU financial services legislation”* (Ibid, 8).<sup>263</sup>

Reflecting on the case of FTX: “Many are using this debacle as a chance to call for the industry to become subject to heightened regulatory scrutiny, but actually,

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<sup>259</sup> “The FSB’s central recommendation to follow the principle of ‘same activity, same risk, same regulation’ is behind the development of national regulatory approaches” (Ding, Khan, Lands, MacDonald, and Zhao 2022 (2022, 12; citing Financial Stability Board 2022, 12).

<sup>260</sup> “The services covered by MiCA are largely similar to MiFID regulation and trigger a licensing requirement for CASPs” (Huertas, Blumenfeld, Traum, and Talvitie 2022, 14). MiFID is an acronym for the EU’s Markets in Financial Instruments Directive which is applied to traditional financial services providers in the EU, while CASPs is an acronym for crypto-asset service provider. See also Glossary of Defined Terms.

<sup>261</sup> Those crypto-assets within scope would consist of “**electronic money tokens (EMTs) or asset-referenced tokens (ARTs)**, and **crypto-assets that are neither ARTs or EMTs**” that are not otherwise exempt (XReg Consulting 2023, 5).

<sup>262</sup> Namely “a) **financial instruments** (as defined under the Markets in Financial Instruments Directive II (MiFID II) Article 4(1)(15)); b) **deposits** (as defined under the Deposit Guarantee Schemes Directive Article 2(1)(3)); c) **structured deposits** (as defined under MiFID II Article 4(1)(43)); d) **funds** (as defined by the PSD2 in Article 4 (25)); e) **securitisation** (as defined under the Securitisation Regulation Article 2 (1)); f) certain **insurance, pension, and social security products**” (Ibid, 7-8; citing to Directive 2014/65/EU, Directive 2014/49/EU, and Regulation (EU) 2017/2402).

<sup>263</sup> “The MiCA rules mandate crypto firms obtain a licence in order to offer any services within the EU. They must also comply with the EU’s money laundering and terrorist financing rules” (Pratt 2023, 2). MiCA was ratified by the European Parliament by overwhelming majority on April 20, 2023, “with 517 voting in favour and just 38 voting against” and is “now set to be implemented in stages as of July 2024” (Ibid).

we have existing rules against fraud, and it looks like those rules will be enforced after all” (Hodder 2022, 5).<sup>264</sup> And this, of course, was referencing the indictments against FTX’s founder, Bankman-Fried, in a scenario involving a centralized cryptocurrency exchange that, operational and governance failures aside, **primarily differed from traditional exchanges precisely because it was operating in the digital assets space.**<sup>265</sup> Thus, the regulatory implications for the FTX model appear clear based on the “duck test”.<sup>266</sup> “A comprehensive regulatory framework is needed, but much of the underpinning already exists and can extended from the regulation of traditional assets” (Vince 2022, 3).<sup>267</sup>

The irony of FTX is that the platform was regulated in several jurisdictions, including under the Digital Assets and Registered Exchanges Act, 2020 (DARE Act) in

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<sup>264</sup> The fallout from co-mingled client assets, poor disclosure and missing internal controls should remind us that while the case of characters and products may change, the script of financial market disorder remains painfully familiar” (Vince 2022, 2).

<sup>265</sup> “Crypto assets have existed for more than a decade, but efforts to put in place effective public policies toward them have moved to the top of the global policy agenda only recently. This is partly because crypto assets, after years of being niche products, are now being held and in some instances used more widely. The growth in their market capitalization has been volatile, and their interconnectedness with the financial sector has increased. Amid the decline in crypto asset valuations, the failure of various exchanges (such as FTX) and other actors within the crypto ecosystem, as well as the collapse of certain crypto assets (like Terra USD), have intensified the need for effective policies toward these assets” (International Monetary Fund 2023, 5). See also note 209.

<sup>266</sup> That test being, if it walks, talks, and looks like a duck, then regulate it as such. “In essence, as Indiana poet James Whitcomb Riley wrote over 100 years ago: ‘When I see a bird that walks like a duck and swims like a duck and quacks like a duck, I call that bird a duck’” (Gensler 2018, 12). Or, in other words, if by replacing the listed assets with fiat currencies the business model would invoke licensure or other regulation, then the mere fact that the listed assets are digital should not change the regulatory paradigm. There is no need to reinvent the wheel when the adaptation of existing regulation will suffice. “Although technology has evolved, certain established concepts should apply to all market participants and assets regardless of their technological wrapper. These include good governance, client asset segregation, clear record-keeping, security and technology standards, capital and liquidity requirements, limits on extreme leverage, anti-money laundering protections, strong risk management and regulatory guardrails” (Vince 2022, 2-3).

<sup>267</sup> “Crypto firms and exchanges would be required to have controls and accurate disclosures and reporting standards, and also separate the customer’s assets from the institution’s own assets, to prevent what happened with FTX from occurring ever again” (Richmond 2023, 2).

the Bahamas,<sup>268</sup> with the Commodity Futures Trading Commission (CFTC) in the United States, where certain affiliated operations were licensed as designated markets makers, swap execution facilities and derivatives clearing organizations,<sup>269</sup> as well as in Japan and Australia.<sup>270</sup> Additionally regulated was Three Arrows Capital. In fact, 3AC was reprimanded by the Monetary Authority of Singapore (MAS) on June 30, 2022, “for providing false information and for managing more assets than it was allowed to under Singapore rules” (Huang 2022, 2)<sup>271</sup> And while Celsius was

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<sup>268</sup> Effective as of December 4, 2020, “DARE applies to any organizer, issuer, founder, purchaser or investor (as defined by DARE) that participates in the formation, promotion, maintenance, organization, sale or redemption of an initial token offering (“**ITO**”) as well as any legal entity carrying on a digital asset business, irrespective of any physical location from which the activity is carried out” (Allen and McWeeney. 2021, 2-3). DARE is implemented by the Securities Commission of the Bahamas, which is empowered under the legislation with “regulation, monitoring and supervising the issuance of digital assets and those persons conducting digital asset businesses in or from within The Bahamas; the development of rules, guidance and codes of practice with regard to the conduct of digital asset businesses and ITOs; the approval and regulation of digital asset businesses; the regulation of initial and subsequent token offers; and, enforcing the provisions and any violations of DARE” (Ibid, 3). That said, DARE has been criticised as providing “a veneer of respectability but does not put crypto businesses such as the exchanges on the same footing as conventional finance” (Walker 2022, 1).

<sup>269</sup> More specifically, “LedgerX, at that time doing business as (d/b/a) FTX US Derivatives LLC, a subsidiary of FTX US” (Kelleher 2022, 6). Indeed, there has been criticism of the CFTC as a result: “If the CFTC had been acting like an independent regulator, skeptically asking the key questions and reviewing the key documents, at least some of FTX’s deficiencies and failures (lack of corporate governance, compliance and controls; commingling of funds; gross mismanagement; conflicts of interest; improper relationship with affiliates like Alameda; etc.) could have – and should have – been identified and remedied or enforcement action could have been taken” (Ibid).

<sup>270</sup> “Japan, in particular, required exchanges to segregate customer deposits, holding them with a third-party bank or trust” and “also has an external watchdog that requires exchanges to be audited annually” (McLellan 2023, 2). On April 25, 2003, the Securities Commission of The Bahamas “published the Digital Assets and Registered Exchanges (DARE) Bill 2023 for consultation. The DARE Bill 2023 expands the definition and list of digital asset business activities and includes robust consumer and investor protection, risk management, and market innovation and development provisions. The Bill strengthens financial and reporting requirements for digital asset businesses and requirements related to: 1) custody and custodial wallet services; 2) operating a digital asset exchange; 3) providing advice on and management of digital assets; 4) provision of staking services; and 5) a comprehensive approach to the regulation of stablecoins.” (Securities Commission of The Bahamas 2023, 1).

<sup>271</sup> “3AC, which obtained its registered fund management company status from the MAS in August 2013, was allowed to serve up to 30 qualified investors and manage assets of no more than \$250 million” (Huang 2022, 2). In September 2021, “3AC transferred management of the only fund it managed to an offshore entity in the British Virgin Islands, where it is incorporated. It resumed management of a portion of the fund’s assets in February but told the MAS on April 29 that it intended to cease fund management activity in Singapore from May 6” (Ibid).

unregulated, there are indications that perhaps it should have been, at least in the view of one U.S. regulator: “The Department believes Celsius has been engaged in an unregistered securities offering by offering cryptocurrency interest accounts to retail investors. Celsius also lacks a money transmitter license” (State of Vermont Department of Financial Regulation 2022, 2).<sup>272</sup>

But what about those aspects of the market that are more novel and, hence, not so straightforward or clear? From the case studies above, we see this in at least one example - the creation of bridge assets, known as stablecoins, that carry features of both digital assets and fiat currency.

### 9.1 Stablecoins as Vehicle Currency

As we’ve seen from the Terra/Luna case, there is a market for digital assets that combines the utility of decentralization with the stability of traditional fiat currency – the stablecoin. Stablecoins play a unique role in the digital assets ecosystem because **they exhibit characteristics of both centralized and decentralized finance** and, thus, provide the benefits of both.<sup>273</sup> As a digital asset, stablecoins are designed to transact across DeFi networks while, at the same time, possessing the stability (at least in theory) and security of a secondary measure of value (often sovereign issued currency) to which they are pegged. “Existing stablecoins employ a range of stabilization methods, with most of them relying to some extent on secondary market trading to maintain stability” (Financial Stability Board 2022, 10).<sup>274</sup> Across

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<sup>272</sup> The Department went on to state that “[d]ue to its failure to register its interest accounts as securities, Celsius customers did not receive critical disclosures about its financial condition, investing activities, risk factors, and ability to repay its obligations to depositors and other creditors” (State of Vermont Department of Financial Regulation 2022, 2).

<sup>273</sup> The stablecoin “arrangement involves both ‘on-chain’ (on the blockchain) and ‘off-chain’ (off the blockchain) activities and entities” (Ding, Khan, Lands, MacDonald, and Zhao 2022, 3).

<sup>274</sup> Stabilisation methods may include “reserve assets, over-collateralisation, algorithmic protocols, or a combination of these mechanisms” (Financial Stability Board 2022, 10).

DeFi protocols “stablecoins are acting as a substitute for fiat currency in the crypto-ecosystem through their use in purchasing, settling, trading, lending and borrowing other crypto-assets. They also serve as collateral in crypto-asset transactions, notably for facilitating trading, lending, and borrowing of crypto-assets” (Financial Stability Board 2022, 9). And most importantly, **they serve as a bridge between the digital asset markets and traditional fiat markets**, which is a necessary requirement for full and optimal integration.

The Bank of Canada has also recognized that it is “likely cheaper and more efficient for exchanges to manage their liquidity in fiat-referenced cryptoassets rather than fiat currency for the following reasons:

- crypto blockchain transactions can settle faster than fiat currency transactions
- blockchains operate continuously while many fiat payment systems are limited to banking business hours
- some exchanges may not have the banking relationships needed to support certain fiat currencies”<sup>275</sup>

(Ding, Khan, Lands, MacDonald, and Zhao 2022, 7-8). In addition, “keeping money in fiat-referenced cryptoassets may offer investors greater flexibility **since transfers between centralized exchanges and digital wallets can be done without exiting the crypto environment**” (Ibid, 8) (emphasis added).<sup>276</sup> Due to these benefits, the use

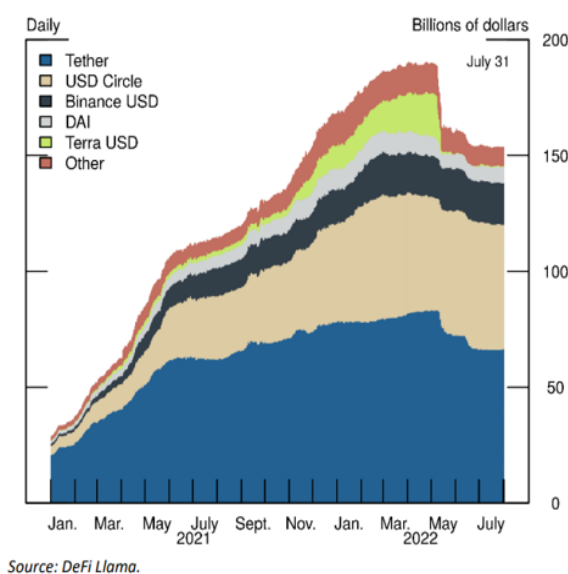
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<sup>275</sup> Referencing the Binance digital asset exchange which purportedly “does not support trading in US dollars” (Ibid, 14, FN 8).

<sup>276</sup> “The provision of wallet services to users of a stablecoin could be custodial or non-custodial (also known as ‘hosted’ or ‘un-hosted’). In a custodial wallet arrangement, a third-party intermediary provides custody of the user’s private keys and/or crypto assets. In this case, users do not need to generate and store private keys themselves, and instead typically identify themselves by logging into

of stablecoins has rapidly accelerated over the last two years.<sup>277</sup> “For now, stablecoins are the main option for those commercial (and retail) transactions where holders wish to sidestep most of the volatility of traditional cryptos, though bitcoin has some presence” (Pymnts 2022, 4). Graphic 12 offers a visual of the market capitalization of the most widely-used stablecoins:

**Graphic 12: Stablecoin Market Cap**



Notwithstanding their increasing popularity, if the Terra/Luna collapse has informed anything, it’s the importance of intelligent stablecoin design.<sup>278</sup> “Whether purporting to use reserve assets, over-collateralization, algorithmic protocols, or a combination of these mechanisms, most stablecoins enable arbitrage activities of market participants and to a considerable extent rely on them to maintain the stablecoin’s value against the reference asset(s)” (Ibid, 10). As we have seen,

the intermediary’s platforms and instructing the intermediary on transactions to be made according to the terms agreed” (Ibid, 15).

<sup>277</sup> Specifically, “more than thirty-fold between the beginning of 2020 and the middle of 2022 (Ibid, 2) and, additionally, “have taken an increasingly large share of cryptoasset trading volumes and now account for around 50% of the total” (Ibid, 9).

<sup>278</sup> Terra’s collapse has emphasized the importance of clarifying existing stablecoins’ redemption rights and strengthening stabilization mechanisms” (Financial Stability Board 2022, 10).



however, that stabilization mechanism may no longer work as anticipated in times of considerable market anomalies and stress which, indeed, was the case with UST.<sup>279</sup> So what to do? As the FSB has observed “given the changing and diverse use of stablecoins, jurisdictions have been pursuing different regulatory approaches, treating them as banking activities, securities, payment systems, or none of the above” (Financial Stability Board 2022, 11).

In the United States, “the President’s Working Group on Financial Markets (PWG) released a report in 2021 calling for Congress to pass a law requiring that stablecoins register as insured depository institutions. This would subject them to the same regulatory requirements as banks, including governance and risk management expectations, capital and liquidity requirements, and resolution planning and recovery requirements” (Huertas, Blumenfeld, Traum, and Talvitie 2022, 22). In 2022, several pieces of legislation were brought before the U.S. Senate. Senator Bill Hagerty’s legislation, introduced March 31, 2022, is branded the “Stablecoin Transparency Act” while Senator Pat Toomey introduced the “Stablecoin Transparency of Reserves and Uniform Safe Transactions Act of 2022”, otherwise known as the “Stablecoin TRUST Act of 2022”, first in April of 2022 and then again towards the end of the year with revisions (Lindrea 2022, 2-3).<sup>280</sup> And yet

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<sup>279</sup> “DeFi requires stablecoins with low volatility and fairly stable collateral values to function properly. Unfortunately, we are not currently quite there yet” (Chiu, Kahn, and Koepl 2022, 5).

<sup>280</sup> Senator Toomey “also serves as the ranking member of the U.S. Banking Committee” (Lindrea 2022, 2). “The US Senate Banking Committee has jurisdiction over the banking industry and financial institutions” in the United States (Mourya 2022, 1). U.S. Senate Banking Committee Chair, Sherrod Brown, has publicly called for United States’ securities and commodities regulators to ban crypto: “We want them [the SEC and CFTC] to do what they need to do at the same time, maybe banning it, although banning it is very difficult because it would go offshore, and who knows how that would work” (Mourya 2022, 1-2). In contrast, Senator Toomey issued a letter to the Director and Acting Chairman of the FDIC on August 16, 2022, based on concerns “that the Federal Deposit Insurance Corporation (FDIC) may be improperly taking action to deter banks from doing business with lawful

a third bill, the Responsible Financial Innovation Act of 2022 (RFIA) was introduced by Senators Cynthia Lummis and Kirsten Gillibrand in June of 2022.

The Toomey bill would “only apply to ‘payment’ stablecoins that can be directly converted to fiat by the issuer, such as the U.S. dollar, not commodity-like or algorithmically-backed stablecoins” (Ibid, 2). In addition, the bill “would permit non-state and non-bank institutions to issue stablecoins, as long as they obtain a federal license created and issued by the U.S. Office of the Comptroller of the Currency (OCC), and as long as the stablecoins are backed up by ‘high-quality liquid assets’” (Ibid). Further, the bill would also exempt “stablecoin issuers from U.S. securities laws, so long as they don’t offer interest-bearing products or services or otherwise act like an investment or advisory firm” (Ibid). The Hagerty bill, in contrast, “would categorize the issuance of stablecoins as securities under U.S. securities laws and fully collateralized security repurchase agreements would need to be set in place” (Ibid, 3) while the Lummis-Gillibrand bill “would set forth 1:1 reserve requirements as well as disclosure requirements” and “creates a special purpose charter” for stablecoin issuers as an alternative path to full insured depository institution registration” (Huertas, Blumenfeld, Traum, and Talvitie 2022, 22).<sup>281</sup>

The “first major piece of crypto legislation” that has been brought before the current 118<sup>th</sup> Congress “is proposing that the Federal Reserve’s board of governors

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cryptocurrency-related (crypto-related) companies” (Toomey 2022, 1). The previous month, Toomey had also directed a letter to the SEC Chairman claiming the Commission “has pursued a capricious and ineffective approach to consumer protection known as regulation-by enforcement that is chilling financial innovation and contributing to significant financial losses for unsuspecting American consumers” (Toomey 2022, 1).

<sup>281</sup> It is worth noting that all bills not enacted during the Congressional session in which they are introduced must be reintroduced during a subsequent Congressional session in order to remain active (The Law Library of Congress 2020). The 117<sup>th</sup> Congress during which each of these bills were drafted and/or introduced adjourned on January 3, 2023.

be given oversight of nonbank entities and digital asset firms looking to issue stablecoins” and “lays out a series of stricter rules around the issuance of dollar-pegged digital assets across both the federal and state level, as well as establishes requirements for interoperability, reporting and enforcement” (Pymnts 2023, 1)<sup>282</sup> Authorized collateral would include “U.S. currency, central bank reserve deposits, Treasury bills with a maturity of 90 days or less, as well as certain repurchase agreements backed by Treasury bills with the same maturity period” (Ibid, 3).<sup>283</sup> The bill also provides that “stablecoin issuers must publish the monthly composition of the issuer’s reserve portfolio on the website of the issuer” in addition to requiring that “redemption requests, which are when stablecoin holders trade in their tokens for the national currency backing it, must be executed in a timeframe no ‘longer than one day’ after” the date the redemption request is received (Ibid). The draft was apparently well received by the crypto industry with Jeremy Allaire, CEO of USDC issuer Circle, heralding it as “an extraordinary moment for the future of the dollar in the world, and the future of currency on the internet” (Ibid, 2). It also appears to have been the predecessor to the “Clarity for Payment Stablecoins Act of 2023” that was subsequently approved by the House Financial Services Committee in July of 2023 (Davis Polk 2023, 1).<sup>284</sup> Other related bills pending before Congress are set forth in Graphic 13 on the page following:

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<sup>282</sup> The bill is a “discussion draft, titled ‘A bill to provide requirements for payment stablecoin issuers, research on a digital dollar, and for other purposes’” (Pymnts 2023, 1).

<sup>283</sup> This is noted to be “essentially a codification of the model that stablecoins including USDC, USDT and BUSD already follow” (Ibid, 3).

<sup>284</sup> In the July bill, sponsored by U.S. Representative Patrick McHenry who also serves as Chairman of the Financial Services Committee, the website disclosures must be made monthly and include the aggregate number of issued payment stablecoins in circulation but the redemption requirements have been revised from one day to the more commercial approach of “timely” (DavisPolk 2023, 6; <https://www.davispolk.com/insights/client-update/>)

Graphic 13: Table of U.S. Congressional Crypto Legislation				
Bill Number	Bill Title	Sponsor	Date	Vote Results
H.R. 4763	Financial Innovation and Technology for the 21st Century Act (Financial Services Committee)	Rep. French Hill	July 26	House Financial Services: 35-15
H.R. 1747	Blockchain Regulatory Certainty Act	Rep. Tom Emmer	July 26	House Financial Services: 29 - 21
H.R. 2969	Financial Technology and Protection Act of 2023	Rep. Zach Nunn / Rep. Jim Himes	July 26	House Financial Services: 50-0
S. 2226	National Defense Authorization Act for Fiscal Year 2024 (S.A. 1087 Manager's Amendment)	Sen. Jack Reed	July 27	On July 27, a Senate vote Passed the Manager's Amendment to the NDAA by 94-3 that included Bank Secrecy Act provisions for crypto.
H.R. 4763	Financial Innovation and Technology for the 21st Century Act (House Agriculture Committee)	Rep. G.T. Thompson	July 27	House Agriculture Committee: Voice Vote
H.R. 4766	Clarity for Payment Stablecoins Act of 2023	Rep. Patrick McHenry	July 27	House Financial Services 34-16
H.R. 4841	Keep Your Coins Act of 2023	Rep. Warren Davidson	July 27	House Financial Services: 29-21

Source: Scorecard of key crypto legislation before Congress (Brett 2023, 7).

Outside the U.S., the International Organization of Securities Commissions published a joint report with the Committee on Payments and Market Infrastructures (CPMI)<sup>285</sup> in July 2022, “providing clarity on the application of Principles for Financial Market Infrastructures to stablecoin

<sup>285</sup> “The CPMI is a member of the Financial Stability Board (FSB) and participates in the FSB’s work to coordinate and promote the implementation of effective regulatory, supervisory and other financial sector policies” (Bank for International Settlements website; <https://www.bis.org/>).

arrangements...intended to assist national authorities in determining whether a stablecoin arrangement is systemically important” and, additionally “proposes guidance on aspects related to governance, framework for the comprehensive management of risks, settlement finality and money settlements” (Ibid 2022, 12). Nearby in the United Kingdom, “the House of Commons voted to give HM Treasury (HMT) the power to make cryptoassets a regulated financial instrument...within the scope of the existing provisions of the Financial Services and Markets Act 2000” in October 2022, as captured “in the Financial Services and Markets Bill 2022 (FSMB), which also covers measures to bring stablecoins under the existing financial services legislation” (Ibid 2022, 23). The FSMB ultimately resulted in the Financial Services and Markets Act 2023, which received Royal Assent to its passage by the UK Parliament on June 29, 2023 (Travers Smith 2023).

And last but not least, in Asia the Republic of South Korea, where Terraform Labs co-founder Kwon Do-Hyung is a national, has focused increased attention on the regulatory environment for stablecoins following the failure of Terraform’s Terra-Luna stablecoin concept, with the Bank of Korea asserting that digital assets “pose a threat to financial stability as they may undermine its monetary sovereignty and policies if the fiat-pegged cryptocurrencies become widespread payment instruments” and consequently that “it needs the authority to monitor and supervise stablecoins” (Park 2022, 1-2). In addition, just across the East Sea, Japan has “passed legislation that defines the legal status of stablecoins and introduces a regulatory framework for them by amending the Payment Service Act and other relevant laws to promote financial innovation and to ensure user protection and

AML/CFT compliance. This new regulatory framework will come into force by June 2023” (Financial Stability Board 2022, 32)<sup>286</sup> and thus is now in effect.

But while these efforts to increase the regulatory wrapper around stablecoins may ultimately prove successful at addressing some of the structural concerns that have arisen, for those who may continue to “worry over the liquidity of these stablecoins and whether they can ‘truly’ be believed to have \$1 to \$1 parity with a USD dollar (an example of just one model)” there remains yet another option – “bank to bank digital currency” otherwise known as “central bank digital currency” (Pymnts 2022, 2).<sup>287</sup>

## 9.2 Central Bank Digital Currencies

As a research paper published by the CATO Institute explains: “Currently, when consumers deposit money into their bank accounts, the deposits are liabilities of the banks. In other words, a bank owes a customer the money deposited in that customer’s account and is responsible for transferring it. In the case of a CBDC, however, the money would be a liability of the central bank” (Anthony and Norbert 2023, 1). In the case of retail CBDCs, there would be “a direct link between citizens

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<sup>286</sup> Under the Japanese law “issuers of digital-money type stablecoins are restricted to banks, fund transfer service providers, and trust companies as these institutions are under stringent regulations. Each of these institutions is subject to requirements to ensure redemption, as follows: (i) Banks issue stablecoins as deposits. They are already subject to prudential regulations and stablecoin holders are protected by deposit insurance in the same manner as conventional bank deposits; (ii) Fund transfer service providers issue stablecoins as claims on outstanding obligations. They are required to secure the obligations through either money deposits with official depositaries, bank guarantees, or entrusted safe assets (such as bank deposits and government bonds); (iii) Trust companies issue stablecoins as trust beneficiary rights. They are required to hold all the trusted assets in the form of bank deposits. On the other hand, stablecoins other than digital-money type stablecoins are regulated in the same manner as unbacked crypto-assets or security tokens under the existing regulatory frameworks in accordance with their product structures. However, the Financial Services Agency of Japan (the ‘JFSA’) may designate this type of stablecoins as digital-money type stablecoins in case they are widely used as a means of payment” (Financial Stability Board 2022, 32).

<sup>287</sup> “There is growing interest from many governments in developing their own digital currency – a decision motivated by the decline of cash and the ability to create an alternative to cryptocurrencies and stablecoins” (Lee 2022, 2).

and the central bank—a radical departure from the existing American system in which private financial institutions provide banking services to retail consumers” (Ibid). In contrast, wholesale CBDCs would be limited to specific institutions authorized to transact directly with the central bank issuing the currency. The New York Federal Reserve Bank’s Project Cedar is “a multiphase research effort to develop a technical framework for a theoretical wholesale central bank digital currency (wCBDC)” (FRB NYIC Project Summary 2022, 1). Phase I of the project “examined the potential application of distributed ledger technology (DLT), specifically blockchain, to enhance the functioning of wholesale cross-border payments” (Federal Reserve Bank of New York 2022, 3). The results of the Phase I experiment “showed that blockchain-enabled cross-border payments can be faster, simultaneous, and safer” (Ibid, 1).

Additionally, IMF Managing Director, Kristalina Georgieva has observed: “Central banks are rolling up their sleeves and familiarising themselves with the bits and bytes of digital money – we don’t quite know how far and how fast they will go. What we know is that central banks are building capacity to harness new technologies – to be ready for what may lie ahead” (Vinaykumar 2022, 2). The IMF estimates that “roughly 100 countries are now looking at CBDCs” (Ibid).<sup>288</sup> As further stated by Georgieva: “If CBDCs are designed prudently, they can potentially offer more resilience, more safety, greater availability, and lower costs than private forms of digital money. That is clearly the case when compared to unbacked crypto assets that are inherently volatile. And even the better managed and regulated stable coins

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<sup>288</sup> Some countries, such as the Bahamas, are already circulating a CBDC (VinayKumar 2022, 2). See Graphic 2a) and 2b).

may not be quite a match against a stable and well-designed central bank digital currency” (Ibid). There are others, however, who view CBDCs with more than a little bit of skepticism.

For example, Professor Jim Kung-Soo Liew at Johns Hopkins Carey School of Business has stated that “CBDCs give too much power to the country that originated them...and few folks in the U.S. want the Treasury to monitor all of their transactions” (Achenbach 2022, 8). “Other concerns revolve around the role of a central bank as a wholesale lender of first resort. State-controlled credit could potentially be susceptible to political pressure for sector-focused lending” (Mookerjee 2021, 9). Georgieva also concedes that: “Privacy concerns are a potential deal breaker when it comes to CBDC legislation and adoption” and that “careful design and policy considerations will underpin trust in CBDCs” while further noting **“that trust must be anchored in credible central banks with a history of delivering on their mandates”** (Vinaykumar 2022, 3) (emphasis added). Perhaps a slippery slope for a market which has largely arisen and developed predominantly from that very lack of trust, which the IMF acknowledges:

***“CBDCs will not solve underlying weaknesses in central bank credibility or other issues, such as a government’s undisciplined fiscal policies, that affect the value of a national currency. When a government runs large budget deficits, the presumption that the central bank might be directed to create more money to finance those deficits tends to raise inflation and reduce the purchasing power of central bank money, whether physical or digital. In other words, digital central bank money is only as strong and credible as the institution that issues it”***



(International Monetary Fund 2022, 10) (emphasis added). And, of course, there is the undeniable question of cybersecurity because “if the central bank gets hacked, then the whole system could be fatally compromised...A central bank would definitely be too big to fail” (Mookerjee 2021, 9).

Furthermore, there are very real concerns surrounding the contribution retail CBDCs may have to the disintermediation of commercial banks – in this case by central banks – which private digital currencies were precisely designed for. “Over 97% of the money in circulation today is from checking deposits – dollars deposited online and converted into a string of digital code by a commercial bank” (Ibid, 1). As the IMF notes: “Commercial banks are crucial to creating and distributing credit that keeps economies functioning smoothly...If commercial banks were starved of deposits, a central bank could find itself in the undesirable position of having to take over the allocation of credit, deciding which sectors and firms deserve loans” (International Monetary Fund 2022, 8-9). That said, should central banks ultimately choose not to go down a CBDC path or limit CBDC adoption to wholesale markets, **it will eliminate or restrict an alternative bridge to fiat convertibility between the traditional and digital asset markets**, potentially creating an environment where overall monetary and financial stability is more difficult to monitor and manage. It will also likely increase the need to ensure **a properly regulated stablecoin market**<sup>289</sup>

As already explored with the various proposals introduced before the U.S. Congress over the last two sessions, **stablecoin regulation could assume different**

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<sup>289</sup> “Where they are not regulated, stablecoins can circumvent controls on free capital movement while complicating macroeconomic management by the central bank” (International Monetary Fund 2022, 52).

**forms depending on the underlying purpose and use case** with the Hagerty bill applying securities-style regulation, the Toomey bill applying banking-style regulation, the Lummis-Gillibrand bill proposing an entirely different special purpose charter, and brand new draft legislation introduced this year looking to the Federal Reserve for comprehensive oversight of “nonbank entities and digital asset firms” (Pymnts 2023, 1). This has evolved into the McHenry bill which “grants state regulators primary supervision, examination and enforcement authority over the state stablecoin issuers, leaving the Federal Reserve Board (FRB) with secondary, backup and enforcement authority for ‘exigent’ circumstances” (DavisPolk 2023, 2). Should the McHenry bill prevail which, like the Toomey bill, proposes “bank-like regulation for federal qualified nonbank payment stablecoin issuers” (Ibid), then “stablecoins themselves become the banks that crypto assets were meant to replace” (International Monetary Fund 2022, 53). This would, in turn, perhaps beg the question as to whether stablecoins are needed in the first place, particularly if wholesale CBDC is on offer.<sup>290</sup>

For example, the Bank of Canada has recognized “the obvious issue” with stablecoins, that being “to ensure their stability” (Chiu, Kahn, and Koepl 2022, 29-30). But there may nonetheless remain market interest in alternatives, such as stablecoins, for reasons associated with concerns over privacy, transaction limits, and access rights that have been raised as consumer risks associated with CBDCs.<sup>291</sup>

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<sup>290</sup> “Regulation as a bank is the most invasive form of financial regulation and imposes very high compliance costs. For the business models of many cryptocurrency issuers, this may be the functional equivalent of banning cryptocurrencies” (Adler, Howard B. and Alex J. Pollock 2022, 3).

<sup>291</sup> Additionally, a 2022 Bank of Canada Staff Discussion Paper has reported on a comparative analysis to traditional payment arrangements and concluded that stablecoins not only “can offer end users greater control over their privacy” but also “more rapid innovation” and “the potential to increase payment speeds” (Ho, Darbha, Gorelkina, and Garcia 2022, 5-6).

In other words “consumers may push back against increased government oversight of their financial activities to favor stablecoins over institutional alternatives” (Giokas 2023, 6). Thus, another option that has been considered is whether “central banks could simply ensure that the issuers of stablecoins have access to their balance sheets” allowing stablecoins “to operate as a narrow bank where the issued coins are fully backed by deposits at the central bank” (Chiu, Kahn, and Koepl 2022, 30). According to the SEC’s claims in its complaint against Terraform Labs and founder Do Kwon, Terra Classic survived only because another industry player with which Terraform had close business ties was able to provide it with the emergency liquidity it so desperately needed (Wang and Kessler 2023, 5).<sup>292</sup>

An analogy can be made to the 2001 Argentine financial crisis when “Argentina was suffering a deep recession, large levels of debt, twin deficits in fiscal and current accounts, and the country had an overvalued currency but devaluation was not an option.” (Kiguel 2011, 1). This was due to a Convertibility Law, which was put into place when “Argentina adopted the currency board in March 1991 to put an end to a long history of large macroeconomic imbalances and high inflation” (Kiguel 1999, 2). One of the features of the law was that “the foreign exchange rate market was fully liberalized. This implied that any change in the nominal exchange rate had to be approved by Congress imposing a constraint on the central bank...to unilaterally deviate from the announced policy” (Ibid, 12). Another constraint imposed by the law was to restrain “the central bank from financing any fiscal deficit, except through the purchase of government bonds at market prices” (Ibid). In addition, the

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<sup>292</sup> See note 229.

law dictated that any “increase in holdings of government bonds by the Central Bank could not exceed 10% per year” (Ibid, 13). As a result, “under this monetary regime the central bank has only a limited ability to act as lender of last resort, as it only has a few monetary instruments to manage the liquidity of the financial system in the short run” (Ibid).

With the challenges the country faced in 2001 and limited policy options available to it, “the Argentine government was forced to introduce a so-called ‘fence’ to control the outflow of deposits” such that “people could only transfer funds within the banking system but they were not allowed to get cash” (Kiguel 2011, 1). If this sounds quite familiar, perhaps it’s because of the obvious similarities to the moratorium on withdrawals that were placed on the deposit accounts of Celsius investors in June 2022 a few weeks before it declared insolvency<sup>293</sup> (and may well have happened to TerraUSD investors too had a third-party liquidity provider not come to the rescue). Hence, the benefits of a central bank as lender of last resort solution are that it **“would clearly remove any ambiguity with respect to the backing of the coin”** as well as “foster private innovation” (Chiu, Kahn, and Koepl 2022, 30) (emphasis added). To achieve this result, however, it is recognized that some form of regulatory oversight would be necessary to mitigate the possibility that stablecoins “could otherwise be used as a means for regulatory arbitrage” (Ibid).

Another solution proposed by the Bank of Canada “is for a central bank to issue a CBDC that can be tokenized and transacted on public blockchains. DeFi

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<sup>293</sup> See note 190.

applications would then have access to **a standardized, riskless settlement asset**" (Chiu, Kahn, and Koepl 2022, 30) (emphasis added). This type of solution would equate closely to a retail CBDC: "In a CBDC world, the digital code for each virtual currency unit will be held in a digital wallet and transferred seamlessly by the wallet-holder to other people's digital wallets" (Mookerjee 2021, 2). Importantly, a retail CBDC is different from digital representations of deposits at commercial banks "which is a liability of the issuing bank, even though it is in theory convertible into paper cash on demand – a feature predicated on that cash being available to the bank in physical form" (Ibid, 5) because a CBDC, in contrast **"will also be a direct liability of the central bank**, just as paper dollars or yuan currently are" (Ibid, 4) (emphasis added). But, as previously noted, there are many issues surrounding CBDCs still to resolve, such as user privacy, accessibility, transferability, network security, and disintermediation of the traditional banking system, that most likely makes the road to a retail CBDC solution a long and winding one indeed.<sup>294</sup>

A quicker way to get there would be through tokenized business to consumer (B2C) bank deposits that are then linked business to business (B2B) to wholesale CBDCs: "Tokenized deposits are digital representations of deposits held at a financial institution, **convertible into easily transferable and accessible blockchain tokens**" (Giokas 2023, 2) (emphasis added). This would not eliminate the risk associated with fractional reserve banking and the customer's credit exposure to the depository institution, as retail CBDC would do,<sup>295</sup> but it would offer an

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<sup>294</sup> See also Giokas 2023, 3.

<sup>295</sup> "There are no 'runs' on the central bank, which eliminates the necessity of protecting depositors from bank runs through insurance plans. And at the level of the overall banking system, all liquidity (and credit) risk are spread across the entire population, not just each individual's bank's depositor base" (Mookerjee 2021, 5).

alternative bridge to digital asset networks which indirectly benefits from central bank liquidity through the financial institution's own access. Furthermore, unlike stablecoins, those deposits would be insured no different than cash deposits.

Returning to BIS General Manager Carstens, recall his statement **that technological advances provide an opportunity for a “superior representation of central bank money” which retains the features of “trust, transparency, legal backing and finality”** (Carstens 2021, 8) (emphasis added). He has also acknowledged that the work on CBDCs “shows that while disruptive innovation can be a threat, it can also be an opportunity” (Ibid, 10).<sup>296</sup> In Carstens view then, the opportunity for a “superior representation of central bank money” would be a central bank digital currency. In an attempt to reassure CBDC skeptics, he has also stated that “a CBDC does not have to entail an Orwellian Big Brother, where the central bank sees each and every transaction” (Carstens 2021, 11), a concern which has been expressed by those championing decentralized peer-to-peer networks as preferable to sovereign-issued and central bank digital currency.<sup>297</sup> In fact, he has emphasized that “decisions on data privacy” are “not just a technical issue, but an

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<sup>296</sup> Independently, the Bank of England has concluded: “New forms of digital money could also increase the resilience of the financial system by providing an alternative to traditional modes of payment. And there is a possibility in the future that new technology to support new forms of digital money could be designed to be more operationally resilient than existing technology. For example, the decentralised nature of DLT removes the central point of failure associated with traditional payment systems, which could enable high levels of availability and resilience” (Bank of England 2021, 13).

<sup>297</sup> As an example of this counter perspective, a November 14, 2022, opinion piece points to China as being “one of the first countries interested in developing and launching its own CBDC” and additionally notes that it is “a country that devotes a great amount of resources to controlling every aspect of its citizens’ lives” (Crypto Economy 2022, 3). The author further states that “central bank currencies have a completely opposite objective to traditional cryptocurrencies” and cautions that CBDCs are a “Trojan Horse” hiding “[l]imits, controls, possible censorship, taxes” and other undesirable outcomes (Ibid, 5).

important policy issue that transcends the financial sphere” and thus “[c]entral banks will need to listen to societies in this respect” (Ibid).

More specifically, Carstens acknowledged China’s e-CNY model, which is designed to “periodically record all user data from private intermediaries” and noted that European and American market participants “report in surveys being more worried about their privacy” (Ibid, 12). For the latter, he has pointed out that “there are also technical designs that allow the central bank to be shielded from knowing identities, or even from having access to retail transaction data” (Ibid). Carstens also expressed an opinion that “CBDCs without identity (purely token-based CBDCs) will not fly” based on concerns that anonymity in transactions would create risks associated with anti-money laundering, countering the financing of terrorism, and tax evasion, while inhibiting financial inclusion through digital identification and authentication of individuals and transactions not currently participating in traditional financial systems (Ibid, 13).<sup>298</sup> In his view, such a result would potentially create “destabilising cross-border effects, allowing large and sudden shifts of funds between economies” (Ibid).

Carstens has further stated that CBDC adoption “should not be seen primarily as a reaction to the emergence of cryptocurrencies or the announcement of corporate stablecoin projects” (Ibid, 17).<sup>299</sup> Instead, he defends the actions of central banks as “proactively researching a new form of money and how it could improve retail

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<sup>298</sup> Often referred to as the “unbanked”.

<sup>299</sup> “Part of China’s motivation for introducing a CBDC is to reduce the country’s dependence on Alipay and WeChat, which currently account for 94% of online transactions, \$16 trillion in value. It also helps reduce the threat from independent digital currencies such as Bitcoin, which could potentially threaten governments’ ability to manage their economies, not a prospect that a Chinese government would view with equanimity” (Mookerjee 2023, 2).

payments in the digital area, in line with central bank mandates”<sup>300</sup> and attempts to reassure that **“CBDCs will be an additional payment option that coexists with private sector electronic payment systems and cash”** (Ibid) (emphasis added). But perhaps the IMF summarized the evolution of the digital asset markets and potentially conflicting central bank interests even more clearly when it stated:

*“As recently as a century ago, private currencies competed with each other and with government-issued currencies, also known as fiat money. The emergence of central banks decisively shifted the balance in favor of fiat currency...Still, **privately intermediated payment systems are likely to gain in importance, intensifying competition between various forms of private money and central bank money in their roles as mediums of exchange. If market forces are left to themselves, some issuers of money and providers of payment technologies could become dominant. Some of these changes could affect the very nature of money – how it is created, what forms it takes, and what roles it plays in the economy**”*

(International Monetary Fund 2022, 9) (emphasis added).<sup>301</sup>

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<sup>300</sup> It was noted earlier in his speech that “digital central bank money for wholesale purposes already exists, in the form of central bank reserves” and that “privately issued wholesale digital currencies, also called utility tokens or wholesale stablecoins, are not separate currencies per se” given their reliance “on central banks for the finality of clearing and settlement” (Carstens 2021, 5).

<sup>301</sup> Barclays research has also pointed out that: “Governments have never had a monopoly on the provision of money. Private systems--unbacked by the government or deposit insurance—regularly sprang up in the past, often to service discrete communities. In the US in the 1800s, for example, railroad and canal companies paid workers in paper ‘scrip,’ redeemable for goods at sponsored stores. More commonly, banks issued their own currency that circulated as money. In theory, this paper could be redeemed in gold and silver. By the time of the Civil War, there was a mass of private issue paper in circulation and analysts published books to identify counterfeits and to assess the discount to face value on each issuer’s notes” (Abate, Davies, and Gapen 2021, 1-2).



Notwithstanding the foregoing, a CBDC with respect to any country outside of The Bahamas, Jamaica, Nigeria, the eight countries in the Eastern Caribbean<sup>302</sup> and any new entrants that already have such a currency in place, **is not necessarily a foregone conclusion in any form or at any time.**<sup>303</sup> “Governments won’t easily give up monetary control **but a CBDC won’t be a reality in the U.S. anytime soon and there is still a long way to go in launching one in Europe** despite the political will to do so” (Giokas, Yiannis 2023, 5) (emphasis added). As Richard Turrin, author of the 2021 book, “Cashless: China’s Digital Currency Revolution” aptly stated in a December 2022 podcast: “You invent Bitcoin, you put it out there and you say, people. Do with it what you want...So the launch of Bitcoin could be very quick because all they had to do was make the coin. So people think cryptocurrency is easy. You make a coin and you throw it out there. When China makes the digital Yuan it can’t just throw it out there and say, Hey everybody, you figure out how to use it. It has to be tightly integrated into society” (2022, 2-3).<sup>304</sup>

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<sup>302</sup> Specifically, (i) Anguilla, (ii) Antigua and Barbuda, (iii) Dominica, (iv) Grenada, (v) Montserrat, (vi) Saint Kitts and Nevis, (vii) Saint Lucia, and (viii) Saint Vincent and the Grenadines. In a ninth, Sint Maarten, a retail CBDC concept is currently inactive; <https://www.atlanticcouncil.org/cbdctracker/>

<sup>303</sup> As the IMF has pointed out: “There is no universal case for CBDCs because each economy is different. In some cases, a CBDC may be an important path to financial inclusion – for instance, where geography is an obstacle to physical banking. In others, a CBDC could provide an essential backup in the event that other payment instruments fail” (Georgieva 2022, 2). In a 2020 Working Paper, the IMF additionally acknowledged that: “The issuance of CBDC will naturally also raise questions under tax law, private law (including property law), contract law, payment systems and settlement finality law, insolvency law, privacy and data protection law, and private international law”, as well as “important questions under central bank and monetary law” (Bossu, Wouter, Masaru Itatani, Catalina Margulis, Arthur Rossi, Hans Weenink, and Akihiro Yoshinaga 2020, 5, 41).

<sup>304</sup> It is noteworthy that China banned all other forms of cryptocurrency in 2021. “The Civil Code (2020) recognizes cryptocurrency as inheritable property. However, China has banned cryptocurrency exchanges and mining operations...China is placing more emphasis on central bank digital currency, namely the digital yuan, which is currently in development” (World Economic Forum 2021, 22). “The Chinese approach reflects the belief that currency must be a state monopoly and the official currency must have no private competitors” (Adler, Howard B. and Alex J. Pollock. 2022, 2). As another source has pronounced: “It’s a big deal. Money is the life blood of society...Any changes in the nature of money impacts millions of individuals acting independently, creating unforeseen situations, some of them may be quite harmful. Yes, the technology is there to create a CBDC

Which brings us back to the Questions Explored:

- (i) can the digital asset and decentralized financial markets examined in this thesis co-exist with traditional assets and financial markets, and, if so,*
- (ii) are traditional or novel forms of regulation (whether financial or otherwise) needed or desirable for the digital asset and financial markets examined herein?*

For digital assets that are designed to function as transaction currency within decentralized ecosystems, an investment or hedging asset, or bridge between digital and fiat assets (i.e., stablecoins), the answer to each seems straightforward and clear: **Yes** and **Yes**, provided certain **necessary conditions are met. In the case of stablecoins, this would require functional regulation**, such as the proposals currently under consideration in the U.S. Congress, with guardrails similar to those imposed by MiCA on crypto-asset service providers, namely “minimum requirements with respect to their governance, the safekeeping of the assets, complaint handlings, outsourcing, wind-down plans, information disclosure, and last but not least, prudential requirements” (Hansen 2023, 10). **For sponsors of central bank digital currency** separate from digitalized bank deposits **certain concerns such as security, privacy, access, and transaction limits must be sufficiently addressed** in the design and implementation, as outlined previously. A good place to experiment would be a wholesale CBDC for use with member banks where design and feasibility can be tested and improved upon without concern for

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overnight, but have we thought about it long enough, and hard enough to jump into a new definition of national money?” (Samid 2022, 2).

broader-scale impact. Project Dunbar and Project mBridge are examples of this type of experimentation happening already.<sup>305</sup>

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<sup>305</sup> For more information on Project mBridge, see note 27. For cross-border distributed ledger collaboration projects generally, see note 46.

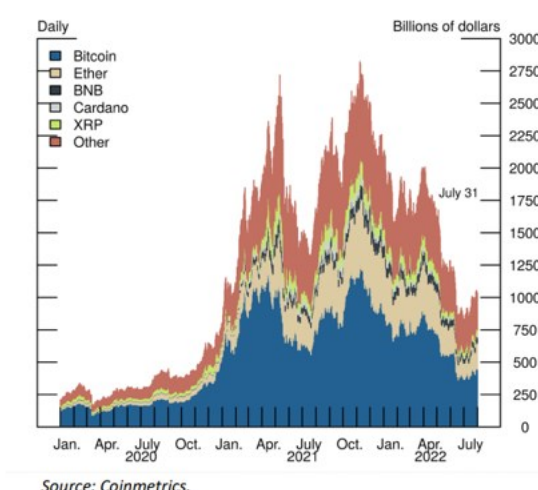
## Chapter 10

### Synthesis and Conclusion

The Managing Director of the IMF has acknowledged that: “The history of money is entering a new chapter. Countries are seeking to preserve key aspects of their traditional monetary and financial systems, while experimenting with new digital forms of money” (Georgieva, 2022, 3). As reported by the Financial Times: “With a majority of institutional investors interested in tokenization, distributed ledger technology may represent the next financial frontier...**We should embrace digital asset innovation, and align it to established rules and measured regulatory principles** in order to protect customers and promote resiliency” (Vince 2022, 3) (emphasis added). And elsewhere it has been stated: “Digital assets are a class that has already become part of the fabric of our financial system...**Digital assets are already part of our future**” (Slazas 2022, 2-3) (emphasis added). A report by

consulting firm PwC reinforces this noting: “Despite the onset of the ‘crypto winter’ at the beginning of 2022, **public interest in digital assets remains high**...Institutional investors are also increasingly entering the space and the number of crypto based funds is steadily increasing” (Huertas, Blumenfeld, Traum, and Talvitie 2022, 6) (emphasis added). Graphic 14 provides a visual representation of the total market capitalization of crypto-assets between January 2020 and July 2022:

**Graphic 14: Digital Asset Ecosystem**



However, Commissioner McGuinness perhaps summed it up best during her Banque de France speech: “This new ecosystem holds both opportunities and risks for financial firms, the financial system and the wider society. So we need to address the risks if we want to benefit from the opportunities. But I think all of us here are certain of one thing. **The old ways of finance and banking are already being overtaken by new digitalized means and solutions**” (European Commission 2022, 11) (emphasis added).<sup>306</sup> As Gita Bhatt, editor of the IMF’s quarterly Finance &

<sup>306</sup> This sentiment is also supported by the views of the World Economic Forum: “In the current fragmented ecosystem, with initiatives making use of different protocols and differing technologies,

Development publication, queried in the September 2022 edition: **“The future of money is undoubtedly digital. The question is, What is it going to look like?”** She additionally pronounced: “It’s too early to tell how the digital landscape will evolve. But with the right policy and regulatory choices, **we can imagine a future with a mix of government and privately backed currencies**” (International Monetary Fund 2022, 2) (emphasis added). Given the rapid development of digital asset and decentralized financial markets over the last decade and increasing interest in and experimentation by sovereigns with associated risks and appropriate governments solutions, this future is not so difficult to see.

PwC has similarly asserted: “The digital asset ecosystem has reached a turning point. While traditional financial institutions have experimented with distributed ledger technology (DLT) in some shape or form, crypto native firms are the ones defining and transforming the sector through innovation. As adoption of the technology grows, **the two will meet somewhere in the middle**” (Huertas, Blumenfeld, Traum, and Talvitie 2022, 6) (emphasis added).<sup>307</sup> And this will likely include the regulatory approach as well.<sup>308</sup> “The shift from digital businesses to the

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a commonality of rules and standards could significantly help with the adoption and use of cryptocurrency services. However, it should not do so at the expense of innovation and the improper use of data as it relates to privacy. The public and private sectors should work together to find solutions that could give rise to a successful approach” (World Economic Forum 2021, 11).

<sup>307</sup> “The changes in the financial industry and the waves of digitalization brought new players to the value chain introducing alternative and more attractive financial solutions. These new players are very adaptive to new technologies and not hesitant to provide crypto services to their customers. This is changing the competitive landscape for banks” (Mulhim 2021, 8).

<sup>308</sup> In December 2022, it was reported that “Bitcoin Group (ADE), a holding company focusing on the blockchain and cryptocurrency industries...agreed to buy all of Germany’s Bankhaus von der Heydt for 14 million euros (US\$15 million) in cash and 150,000 shares. The acquisition will give the company control of one of the world’s oldest banks and a holder of a full banking license in Germany. The transaction is expected to be completed by third-quarter 2023” (Reback 2022, 2).

Digital Asset Economy<sup>309</sup> – combined with Invisible Finance<sup>310</sup> – is not only a major challenge for banks. These two interconnected developments have huge implications on every industry and will create significant challenges for governments, central banks, and regulators” (Zwiefler and Rockermeier 2022, 11). The World Economic Forum has further observed that digital assets “will continue to gain traction in the global economy across retail and institutional use cases, as individuals, businesses and banks adopt cryptocurrencies for investment, payment and an array of other utilities. **They touch every aspect of financial activity and regulation**, including market conduct, taxation rules and consumer protection” (World Economic Forum 2021, 26) (emphasis added). As a result, the WEF encourages the development of “tailored regulatory frameworks that **create an environment conducive to the adoption** of cryptocurrencies and development of crypto-based commerce **alongside mechanisms to protect the integrity, security and stability of the financial system** and its actors” (Ibid) (emphasis added).

To reduce the pain points in the regulatory approach from the standpoint of both regulators and industry, it makes sense to first apply existing regulatory paradigms on the “same activity, same risk, same regulation” basis as recommended by the Financial Stability Board.<sup>311</sup> This should be readily accomplished for crypto funds, exchanges, and custodial and lending businesses operating via a more

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<sup>309</sup> The Digital Asset Economy “consists of any product or service that is either directly or indirectly (digital twin) created or delivered in digital form” (Zwiefler and Rockermeier 2022, 3).

<sup>310</sup> “Invisible Finance enables Creators to integrate Financial Services into their products and services. The (non-financial) product or service include all the potential financial capabilities for maximizing the customer experience. From a customer perspective, the product or service is inseparable from the Financial Services functionality to buy, use, securitize, and sell said product or service. The creator of the product or service is the one face of the customer for all aspects of buying, using, and selling – covering non-financial and financial aspects” (Ibid, 7).

<sup>311</sup> Former FDIC Chair Sheila Bair vocalized a similar stance to The Financial Times after the November 2022 FTX collapse (Pymnts 2022, 1-2).

traditional centralized finance model notwithstanding their focus on the digital assets space. However, there are “unique characteristics of cryptocurrencies that drive their adoption” which “also make them difficult and, in some cases, impractical to regulate” and which “financial regulations for a fiat-based economy are inadequate to monitor and guide cryptocurrency activity in the financial system” (Ibid). For stablecoins and central bank digital currencies that will, in part, serve as a bridge between the digital assets markets and sovereign currency markets, novel regulatory approaches may be required to address the financial stability risks inherent to this bridge.<sup>312</sup> **Key among these approaches will be to ensure that stablecoins will function at times of market stress in the manner for which they were designed**, in which case thought must be given to whether there should be regulatory tolerance for stablecoins **that are not linked to a major market fiat currency or basket of major market fiat currencies irrespective of the level of collateral**.<sup>313</sup> That said, it has been recognized that “[t]here are also opportunities to improve the quality of the collateral that can be used” to back stablecoins, including the potential “to tokenize standard collateral such as government-issued

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<sup>312</sup> “Regulators should seek to balance the material risks of cryptocurrencies (which in some cases are not significantly different from conventional financial services) with the potential benefits and regulatory opportunities. There is an opportunity not only to eliminate critical risks to end users and financial integrity through adequate regulatory coverage, but to increase financial access through careful regulation. Of particular focus should be the issues of de-risking, financial inclusion and digital identity in providing a new means of addressing the policy goals of payment integrity and inclusion (World Economic Forum 2021, 16).

<sup>313</sup> Dai is a stablecoin “backed by Ether (ETH) and other cryptocurrencies, for example USDC. The value of Dai is pegged to the US dollar and is based on over-collateralization, specifically a 33% haircut” (Chiu, Kahn, and Koepl 2022, 10). On March 11, 2023, however, it was reported that “the algorithmic stablecoin DAI has been knocked off its peg” and “has hit an all-time low of 88 cents” (Reynolds 2023).



securities” which may allow for a prudential solution to alternative approaches in stablecoin design (Chiu, Kahn, and Koepl 2022, 30).<sup>314</sup>

In contrast, in the decentralized markets that are designed to operate through programmable currencies, smart contracts, and consensus mechanisms, careful thought should be given as to whether a more laissez-faire “buyer beware” approach can be taken with proper disclosures, anti-fraud protection, and possibly even accredited/institutional investor and/or suitability standards for participation. This would not only be in harmony with what is required for traditional private market instruments in the United States and elsewhere in the world, but also allow DeFi platforms a bit more room to breathe and mature into their intended purpose knowing that customers have an alternative path to participation through the fully regulated CeFi platforms (or traditional TradFi markets for fiat denominated transactions) and that any financial stability risks **are being effectively managed at the intersection**.<sup>315</sup> “Since cryptocurrency originated as a libertarian revolt against the government monopoly on money, this approach is consistent with its founding ideas. If people want to risk their money, they ought to be allowed to do so. However, they must understand what they are doing.”<sup>316</sup> All parties should

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<sup>314</sup> As the Bank of Canada notes “the introduction of a wholesale central bank digital currency (CBDC) and the tokenization of government securities provide alternatives that could alleviate these shortcomings” (Chiu, Kahn, and Koepl 2022, 5). They have also pointed out that “one can create other synthetic tokens to replicate the income flows of real-world assets such as a stock index or standardized derivatives” (Ibid, 10).

<sup>315</sup> “Over-regulation or under-regulation can lead to regulatory arbitrage as players seek to establish businesses in more advantageous jurisdictions. It should be noted, however, that this does not mean entities are necessarily looking for more deregulated jurisdictions. Actually, large venture capitalists (VCs) and institutional players are usually looking for jurisdictions that will allow more clarity and security for the development of their businesses. As such, a balanced approach to regulation is necessary across jurisdictions” (World Economic Forum 2021, 25).

<sup>316</sup> Meaning “it needs to be combined with required full, audited financial statements and disclosures about risks and important matters such as assets and redemption policies” (Adler and Pollock 2022, 4).

understand that Big Brother is not protecting them when they hold or speculate in cryptocurrency” (Adler and Pollock 2022, 4).<sup>317</sup>

This project is reflective of research primarily conducted through the end of calendar year 2022, with some research supplementation in 2023. In addition, most source material is dated within the current decade to ensure the coverage is timely and relevant. That said, **the state of digital assets and decentralized financial markets continues to rapidly evolve**. While it was necessary for pragmatic reasons that there be an end date to research accumulation and analysis to allow for conclusions to be reached, it is always difficult (and some would say impossible) to predict the future.<sup>318</sup> But many things seem impossible until they are not. Most people in the 18<sup>th</sup> Century would not have understood the concept of the modern-day automobile, the first patent for which was secured in the 19<sup>th</sup> Century.<sup>319</sup> Similarly, those alive in the 19<sup>th</sup> Century would have had difficulty grasping the idea of commercial airplanes, as the Wright Brothers successful experiment with air flight did not occur until the beginning of the 20<sup>th</sup> Century. And even the Wright Brothers

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<sup>317</sup> “The parts of crypto that are fully centralized should be regulated like any other intermediary. The parts that sit in the middle (as FTX did) should be regulated by a mix of traditional rules and new ones that take advantage of the underlying tech, like proof of reserves. Only after we concede these points can we make a credible case for why things like DeFi should only be regulated by code and economic incentives” (Malekan 2022, 6).

<sup>318</sup> “Much like the development of internet communication protocols, the vast potential for its uses and applications is difficult to predict and the technological and economic particularities of cryptocurrencies render it difficult to automatically apply existing legal frameworks and definitions” (World Economic Forum 2021, 7). “The crypto industry is lobbying to push for clear regulations, as it sees regulations as a positive development that will skyrocket the industry” (Mulhim 2021, 4). “After the complete collapse of FTX, even the most ardent crypto maximalists seem to have conceded that some form of reasonable regulation is needed in order to propel the space forward and prevent the worst excesses of fraud and fraudsters” (Hansen 2023, 16).

<sup>319</sup> Benz Patent Motor Car, model no.1, patent no. 37435; <https://www.mercedes-benz.com/en/innovation/milestones/benz-patent-motor-car/>

could probably not have imagined that mere decades later, the 20<sup>th</sup> Century would produce not only space travel but also a man on the moon!

**The evolution of technology can be rapid and the capacity and extent of human ingenuity unexpected.** This has certainly been no less true in the Information Age, with the latter half of the 20<sup>th</sup> Century bearing witness to the first integrated circuit silicon computer chip, which formed the foundation of the mainframe computer, then the personal computer, and eventually the internet. The beginning of the 21<sup>st</sup> Century has delivered social media, smart phones, open-source software applications, and mass distributed storage capacity throughout a decentralized server network known as “the cloud”. More recently, distributed ledger technology has created self-authenticating blockchains upon which digital assets can be created and transacted for a variety of purposes, the use cases of which in many, if not most, instances remain experimental.

It would be a mistake to write off this technology or limit an understanding of its potential utility to what has already been experimented with while constrained by the limitations of the environment within which those experiments have been conducted. This is what one writer has referred to as “the ‘horseless carriage’ fallacy” describing a cognitive error which occurs from a belief that “a new technology will change one big thing but leave everything else unchanged” (Hammond 2022, 1).<sup>320</sup> The degree to which highly experienced and credentialed industry veterans in both the private and public sectors continue to see the potential of this technology, despite cases where its application has been flawed if not

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<sup>320</sup> This same author also observes: “The automobile didn’t simply replace horse-drawn carriages, spurring a wave of equine technological unemployment. The automobile changed everything, including our institutions” (Hammond 2022, 1).

downright fraudulent, is telling.<sup>321</sup> **That said, there no doubt remains significant regulatory, credibility, and other barriers to full-scale adoption which have yet to be overcome.** But this doesn't mean that eventually we won't get there.<sup>322</sup>

The genesis of this project began in 2021 concurrent with the rapid increase in use and valuation of the crypto-asset market that has been largely attributed to the unique conditions resulting from the Covid-19 pandemic. The subsequent year fundamentally changed this growth trajectory and birthed the use cases which became the primary focus of the underlying research. This project then took an unexpected turn from its initial conception of examining the meteoric rise of crypto-asset markets to the resulting analysis of a series of catastrophic crashes that have been instrumental in informing the direction of these markets moving forward. Indeed, as the end of 2023 draws ever nearer there remains a genuine difference of opinion in the public debate as to whether digital assets and decentralized financial markets are an achievable, sustainable, and/or worthwhile endeavor.

The scope of this project has been an exploratory one covering (however brief given its inherent limitations), the why (*raison d'être*), the what (technological underpinnings), and the how (application and use) of digital assets and decentralized financial markets, relying on the contemporaneous research set forth in the Bibliography which has been intentionally curated to reflect a diverse range

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<sup>321</sup> "In fact, many prominent investors and thought leaders believe it is only a matter of time before every asset class, financial instrument, contract, and even property will be captured, traded, and stored on the blockchain" (McCracken 2022, 6).

<sup>322</sup> As one DeFi proponent has put it "we need to stop relearning the hard lessons of history. Direct democracy doesn't work, too much leverage is deadly, systems tend towards hierarchies, and financial institutions need to manage risk. Disrupting the old ways can only come from a place of awareness, not ignorance. If you haven't studied the reasons why fiat currencies came to be, then you can't have an informed opinion of Bitcoin. And if you aren't an expert on banking, then you shouldn't be building DeFi" (Malekan 2022, 7).

of scholarship and perspectives, including government, industry, academia, non-governmental organizations, universities, and trade groups. The objective of this project has been to offer a general framework from which to critically approach an evaluation of these markets in order to address the Central Research Issues and answer the Questions Explored. Those answers are based on an analysis of the underlying research as tested against the real-life examples highlighted in the Recent Case Studies, which were purposely selected to represent separate and distinct use cases involving lending activities, exchange operations, stablecoins, and investment management. A separate case study on the application of bitcoin as a fiat substitute has also been annexed at the end of this thesis to offer the reader an independent analysis of the monetary policy considerations for sovereign use cases.

The purpose of this project has been to synthesize and supplement existing literature, discussion, and analysis of the still nascent emerging and evolving digital asset and decentralized financial markets in order to contribute to a better understanding of these markets as they were, as they are, and as they might be, with particular emphasis on existing and potential impact to existing monetary structures and the broader financial markets in the most expansive definition of such. It is also intended to offer further consideration and insight into potential avenues available to ensure responsible and prudential integration of decentralized and centralized financial markets without stifling the potential benefits of innovation.

For those segments of the digital assets markets that are essentially traditional finance in the digital asset sphere, the **necessary conditions to be met** would be those that are consistent with “technology neutral” approaches to applying “the

appropriate regulatory framework in the same manner as they would apply it to entities performing the same functions or activities, and posing the same risks” in traditional markets (Financial Stability Board 2022, 31).<sup>323</sup> For those segments of the digital assets markets that function as a transaction currency within the ecosystem, an investment or hedging asset, or bridge between digital assets and fiat assets (i.e., stablecoins), the **necessary conditions to be met** include both functional and prudential regulation depending on the asset’s use case (e.g., custody, saving and investment, or lending).

A replacement for sovereign currency outside of central bank control (i.e., fiat substitute), is not a likely outcome in the foreseeable future given the volatility, scarcity, governance, replication, and policy implementation challenges associated with the most viable option currently offered by the Bitcoin protocol and its native asset, BTC, as is explored further in the El Salvador Case Study annexed following the conclusion of this thesis. A far more probable scenario is that central banks will sponsor instead a digital currency separate from digitalized bank deposits that can provide many of the same benefits of both purely decentralized digital assets and their stablecoin counterparts. The **necessary conditions to be met** in this case would be solutions for privacy, security, accessibility, transferability, and general credibility, the latter to which all of the other concerns relate.

Of course, subsequent innovations, adaptations, and extraneous events may very well **materially alter the analysis** and, in turn, **generate different conclusions**. The beauty of hindsight is that it is always perfect vision. Or, as McKinsey

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<sup>323</sup> “The FSB’s central recommendation to follow the principle of ‘same activity, same risk, same regulation’ is behind the development of national regulatory approaches” (Ding, Khan, Lands, MacDonald, and Zhao 2022 (2022, 12; citing Financial Stability Board 2022, 12).

summarized in a discussion paper on the changing world order: “**What could this new era look like? The die is not yet cast.** While there is a current direction of travel, there are also complex unresolved questions, which will determine how the situation plays out” (McKinsey & Company 2022, 3) (emphasis added).<sup>324</sup> Nonetheless, if this project has offered any bit of illumination to the reader regarding its subject matter, for better or for worse, than its purpose will be humbly accepted as having been achieved.

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<sup>324</sup> “We are reminded most of the aftermath of the oil shocks in the early 1972, which shared features resonant with today: an energy crisis, a negative supply shock, the return of inflation, a new monetary era, rising multipolar geopolitical assertion, resource competition, and slowing productivity in the West. The aftershocks came in many waves and took almost 20 years to resolve” (McKinsey & Company 2022, 2; see also Bradley 2022, 2).

# Annex

## El Salvador Case Study

This tiny Central American country with significant fiscal challenges dollarized its economy replacing its national currency, the colón, in 2001 (Hanke and Hofmann 2022, 2; The Daily Forkast 2021, 5). Twenty years later the Salvadoran government legally authorized bitcoin use as a fiat alternative (Hanke and Hoffman 2022, 3; Rosen 2022; The Daily Forkast 2021, 3). In the months leading up to bitcoin legalization, the Salvadoran president, Nayib Bukele, announced at a conference in Miami that if one percent of the digital currency was invested in the country, “that would increase our GDP by 25%” (The Daily Forkast 2021, 4). Bukele went onto state that “70% of El Salvador’s population doesn’t have a bank account” and thus bitcoin adoption was a “moral imperative” in addition to “a way to grow the country’s economy, providing access to credit, savings, investment and secure transactions” (Ibid). And he added that “Salvadorans overseas sent around US\$6 billion in



remittances to their home country from places like the United States every year” (Ibid, 5),<sup>325</sup> while noting that these transactions “are currently processed by intermediaries such as Western Union, which take cuts of as much as 20%” (Ibid).<sup>326</sup> Indeed, to promote adoption the country created an app called Chivo “that offers no-fee transactions, allows for quick cross-border payments, and requires only a mobile phone plus an internet connection” (Sigalos and Kharpal 2022; see also Hanke and Hofmann 2022).<sup>327</sup> The IMF has further reported that “the government provides a one-time endowment of the equivalent to US\$30 in Bitcoins to every Salvadoran *Chivo* user” in addition to assuming all transaction fees (International Monetary Fund 2022, 28).<sup>328</sup>

Thus, Bukele indicated that an objective behind legalizing bitcoin was to **“increase in the equivalent of billions of dollars every year” the amount of such overseas remittances** which actually reaches the pockets of Salvadoran residents (Ibid) (emphasis added). However, Bukele also referenced the inflationary impact of monetary stimulus brought about by the Covid-19 pandemic which increased the amount of U.S. currency in circulation, as well as inflationary pressures in economies reliant on the dollar, including El Salvador.<sup>329</sup> As such, another objective was **“to**

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<sup>325</sup> Remittances are estimated to account for more than 20% of the country’s GDP (Sigalos and Kharpal 2022).

<sup>326</sup> Despite this, the World Bank has separately maintained that “the cost of traditional wire transfers in El Salvador is the lowest in all of Latin America and the sixth-lowest in the world.” (Hanke and Hofmann 2022, 4).

<sup>327</sup> Deutsche Bank research has estimated that access to a mobile phone with an internet connection would cover a little less than 65% of the country’s population (Sigalos and Kharpal 2022).

<sup>328</sup> The IMF has also noted that “a trust fund, *FIDEBITCOIN*, endowed with US \$150 million has been established to guarantee the conversion” of bitcoin to USD (International Monetary Fund 2022, 29). According to the IMF “*Chivo* operates by default in U.S. dollars, but can accept Bitcoins, if offered, at the time of each transaction, and holds balances in U.S. dollars and Bitcoin” (Ibid, 28).

<sup>329</sup> The stimulus expanded the dollar economy by US \$5 trillion over a 15-month period from February 2020 to May 2021, a 32% increase over the previous dollar supply (The Daily Forkast 2021, 5).

authorize the circulation of a digital currency with a supply that cannot be controlled by a central bank and is only altered in accordance with objective and calculable criteria” (Ibid, 5-6) (emphasis added).<sup>330</sup> In fact, the text of the authorizing legislation clearly states: “In order to promote the economic growth of the nation, it is necessary to authorize the circulation of a digital currency whose value answers exclusively to free-market criteria” (Ibid, 6).

The International Monetary Fund has reported its research findings on cryptoization in the developing world concluding the following:

- *“Weak central bank credibility and a vulnerable banking system **can trigger asset substitution** as domestic residents seek **a safer store of value**. Dollarization pressures are a persistent risk for several emerging market and developing economies. **The crypto ecosystem can help domestic residents convert some of the headwinds of traditional dollarization—such as exchange rate restrictions and challenges in accessing and storing foreign assets—into tailwinds.** For example, global crypto exchanges or other less secure methods, such as P2P transfers, **can be used to bypass capital flow management measures;** private wallets **can act as a form of offshore bank account to store wealth**”.*

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<sup>330</sup> Bitcoin’s supply has been pre-determined and fixed at 21 million, which is its most distinguishable feature from other digital assets that may be used for payments or otherwise traded in a currency-like form. It is also the reason why supporters of Nakamoto’s protocol believe that it can serve as an effective inflation hedge (Ibid, 6). This notwithstanding, the substantial fall of bitcoin’s value during the previous year has been largely attributed to the same inflationary pressures that also eroded bond and equity prices calling into question the currency’s efficacy as an inflation hedge (Duggan 2022, 3).

- ***“Inefficiencies in payment systems and limited access to financial services can also be a driver of dollarization. One prominent example of inefficiencies is the lack of interoperability among various domestic payment systems, which can be a problem for remittances as well as trade. Given the large share of unbanked people in some emerging market and developing economies, remittances often take place through cumbersome cash-based methods, such as those of post offices and other transfer operators. The payment rails of crypto assets can make some of these services faster and cheaper, especially through the integration of stablecoins, which allow for a stable unit of account”***

(International Monetary Fund 2021, 11) (emphasis added). The IMF also notes, however, that the effects of dollarization, **whether via crypto assets or otherwise**, “can impede central banks’ effective implementation of monetary policy and lead to financial stability risks through currency mismatches on the balance sheets of banks, firms, and households.”<sup>331</sup> This can be further amplified by liquidity risks, as **central banks are not able to provide liquidity backstops in foreign units of account**” (Ibid, 12) (emphasis added).<sup>332</sup>

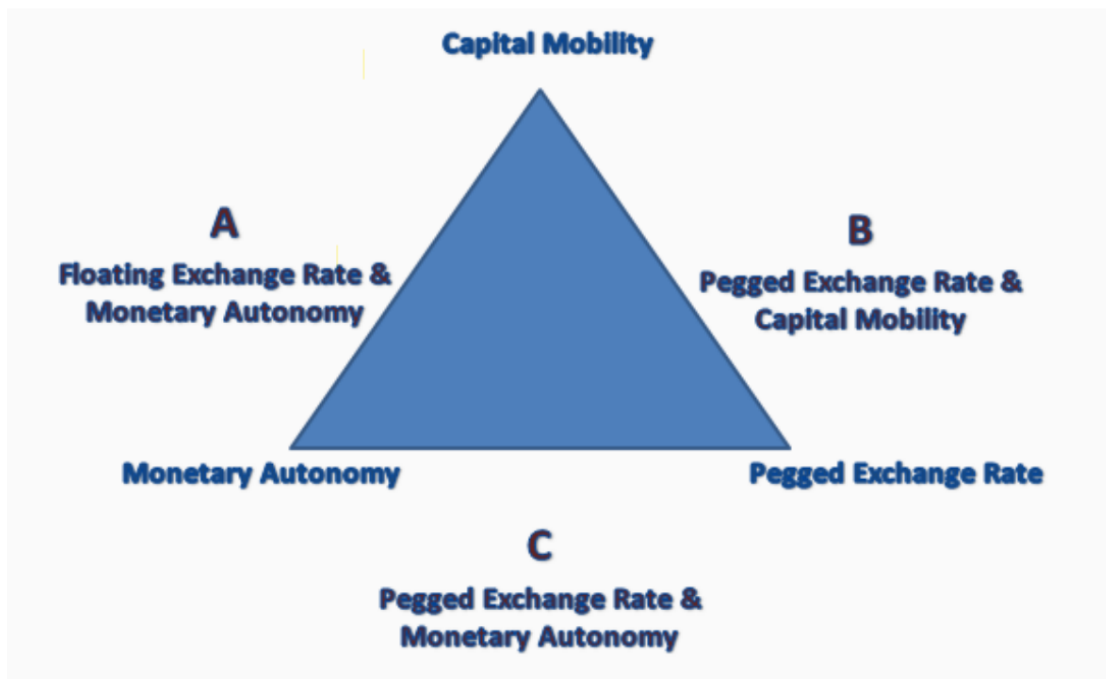
The IMF’s position is consistent with the macroeconomic theory known as the Mundell-Fleming trilemma represented by Graphic 15 on the page following:

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<sup>331</sup> The IMF defines dollarization as “the de facto adoption of a foreign currency (not necessarily the dollar) or asset that displaces the domestic currency, driven by the preferences of the economy’s residents. The primary driver of the adoption can be a new means of payment and unit of account (currency substitution) or a safer store of value (asset substitution)” (International Monetary Fund 2021, 11; FN 22). See also Glossary of Defined Terms.

<sup>332</sup> This was clear during the 1997 Asian Financial Crisis: “On July 2, 1997, the Thai government ran out of foreign currency. No longer able to support its exchange rate, the government was forced to float the Thai baht, which was pegged to the U.S. dollar prior. The currency exchange rate of the baht thus collapsed immediately” (Corporate Finance Institute 2022, 1).

**Graphic 15: Mundell-Fleming Policy Trilemma**



*Source: Brookings 2013.*

As The Economist explains: “The policy trilemma, also known as the impossible or inconsistent trinity, says a country must choose between free capital mobility, exchange-rate management and monetary autonomy. Only two of the three are possible” (The Economist 2016, 2). In other words, “there is more scope for addressing shocks with monetary policy in a country with floating exchange rates – or with strong controls on international capital flows – than for a country with a pegged currency and open capital markets” (Klein and Shambaugh 2013). In addition, it’s not entirely clear that the Bitcoin protocol is facilitating a “free market” as alluded to earlier. Indeed, ESMA has pointed out there may be “significant inequality in the distributions of certain assets (i.e. 2 % of wallets possess 94 % of all Bitcoins), which has implications in terms of liquidity but also market integrity (i.e.

in the case of large orders distorting price formation)” (European Securities and Markets Authority 2022, 6).

Given the above and the two years that have elapsed during El Salvador’s own dollarization (or cryptoization, as the case may be) experiment with bitcoin, it is worth exploring how the country is faring. According to the National Bureau of Economic Research, the adoption of bitcoin as legal tender **has not had a marked impact on the way remittances are directed to El Salvador**, with a mere 1.6 percent attributable to BTC as of February 2022, several months after the country’s so-called “Bitcoin law” went into effect (Ibid; see also Sigalos and Kharpal 2022) (emphasis added).<sup>333</sup> In addition, El Salvador is purported to hold 2,301 bitcoin on its national balance sheet – presumably as a form of reserves – the value of which would have plummeted significantly over the course of 2022 consistent with the general deterioration of the crypto markets.<sup>334</sup> That said, the country’s Finance Minister, Alejandro Zelaya, is apparently not flummoxed with this loss, which has been estimated as the equivalent of US \$40 million, stating: **“Forty million dollars does not even represent 0.5% of our national general budget”** (Rosen 2022, 3) (emphasis

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<sup>333</sup> Interestingly, a Deutsche Bank study attributes this, in part, to the complexity associated with exchanging BTC for USD finding that “people who send and receive remittances frequently use informal brokers to convert local currency to and from bitcoin” which requires a certain degree of technical expertise (Sigalos and Kharpal 2022), although the IMF has stated that this feature is provided via the app: “If a Chivo user receives Bitcoins in a transfer/payment, they will be automatically converted into U.S. dollars, unless the default setting in his wallet is changed by the user. If the user decides to hold Bitcoins, the user is responsible for capital losses/gains resulting from fluctuations in the Bitcoin-U.S. dollar exchange rate” (International Monetary Fund 2022, 29). The IMF has also noted that due to this “Chivo has amassed a sizeable number of clients, 3.8 million, although it is unclear how many are using Bitcoin in their transactions or holding balances in Bitcoin” (Ibid). According to the IMF “September 2021 surveys indicated at most 27 percent of the population were willing to use Bitcoin along the U.S. dollar, of which only 3.7 percent were willing to use solely Bitcoin in transactions” (citing to an IUOP/UCA survey), and “[d]ata from remittances inflows show that by October 2021 about 4 percent of those transfers occurred in Bitcoin” (Ibid, FN 37).

<sup>334</sup> Other sources state the held amount as 2,381 bitcoins at an original aggregate purchase price of US \$100 million from the country’s treasury assets (Hanke and Hofmann 2022, 5).

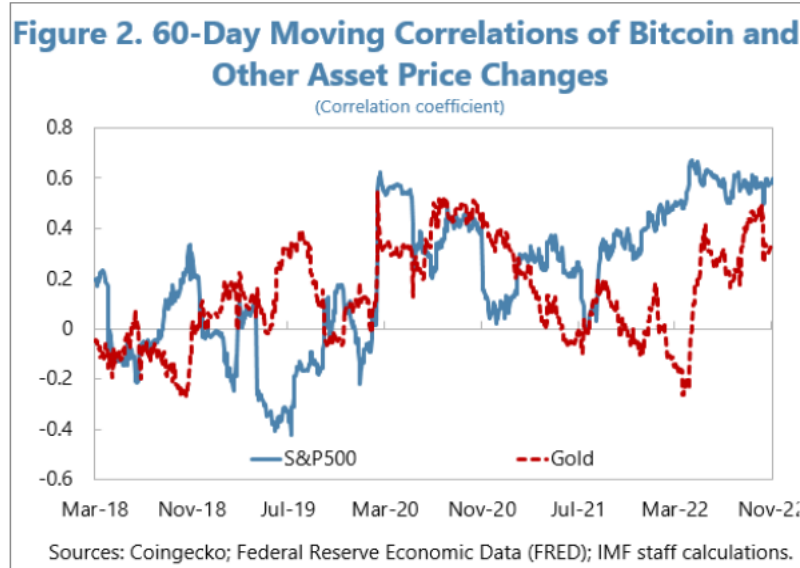
added).<sup>335</sup> Zelaya has also publicly stated his belief that the risk to El Salvador from holding such a position “is extremely minimal” while President Bukele, has publicly tweeted about the country adding to its bitcoin exposure during previous occasions when the price has materially slipped (Ibid).

It is thus additionally worth noting the possibility that the country’s own exposure to bitcoin is intended as a means to diversify its currency risk rather than replace it, assuming just enough exposure to potentially benefit the country’s fiscal position significantly during crypto bull markets while retaining sufficient dollar reserves to meet sovereign debt payments in environments, such as the one recently presented, where the value of the country’s bitcoin holdings would presumably have been materially less than the aggregate purchase price. As Graphic 16 on the page following indicates, there may be diversification benefits to holding bitcoin in addition to more traditional reserve assets, such as gold, and broader market indices:

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<sup>335</sup> El Salvador reportedly has USD reserves of approximately \$3.4 billion, which approximates to about 12% of its GDP (Muci and CoinDesk 2022). This amount is significantly greater than the January 2023 scheduled \$600-800 million sovereign debt payment previously noted, which is likely why the default estimate was stated to be less than 50% with contributing factors that are independent of the country’s success or lack thereof with their bitcoin experiment.

## Graphic 16: Bitcoin Correlations



Source: International Monetary Fund 2023.

That said, El Salvador's overall debt burden is estimated to amount to the equivalent of 90% of the country's GDP,<sup>336</sup> so it's unclear whether this approach is sustainable over the long run absent reliably outsized returns from its bitcoin reserves (Muci and CoinDesk 2022).

Consistent with this, S&P Global Ratings asserted in September 2022 that it could downgrade El Salvador's credit rating even further (from an already low CCC+) if the country did not take decisive and effective action to reduce its debt load. Around the same time, Fitch did downgrade the country's debt rating to CC noting that a default was "probable". These sentiments, however, likewise appear to hinge on factors separate from the country's stance on bitcoin, with Fitch indicating that "the ratings reflected long-standing difficulties in predicting policy responses, low economic output, persistently low investment and little flexibility due to the dollarization of the economy, **which has persisted since El Salvador introduced**

<sup>336</sup> Other sources estimate closer to 87% (Sigalos and Kharpal 2022).

**bitcoin as legal tender alongside the U.S dollar”** (Giraldo, Morland, and Adler 2022) (emphasis added).<sup>337</sup> In other words, it was not the country’s adoption of bitcoin that was contributing to an adverse credit outlook but rather **the adoption of bitcoin failing to alleviate the other poor structural components of El Salvador’s economy** that was cited as a concern.<sup>338</sup> Hence, while bitcoin adoption may not have led El Salvador down a more stable path fiscally, it perhaps is a bit premature at this stage to suggest that adoption has imperiled the country.

As a London School of Economics policy fellow puts it: **“Ultimately, El Salvador’s problems are just tangential to currency”** adding that what the country really needs to do is “raise taxes, cut spending, start being much more disciplined, convincing markets that they’re sustainable” and concluding vis-à-vis the country’s bitcoin experiment “it’s a big nothing burger” (Sigalos and Kharpal 2022) (emphasis added).<sup>339</sup> Furthermore, it has been noted that El Salvador’s \$375 million BTC investment, while likely worth far less these days, remains “comparatively small” relative “to an economy of \$29 billion” (Ibid). And, of course, the experiment could wind up with an entirely different story to tell if the value of bitcoin continues to rise as it has in 2023. The important takeaway is that the El Salvador case is, indeed,

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<sup>337</sup> In contrast, it has also been posited that dollarization has been stabilizing for the country on the basis that “inflation has averaged just a hair over 2 percent since 2001 – the lowest in Latin America over that period” and that “growth has outpaced the Latin American average, and exports have risen steadily and at a faster rate than most countries in the region” (Hanke and Hofmann 2022, 2-3).

<sup>338</sup> The World Bank has estimated 1.9 GDP growth for El Salvador in 2023 (Sigalos and Kharpal 2022).

<sup>339</sup> This same academic also suggested that El Salvador’s bitcoin adoption was generally unsettling to the financial markets, including the IMF, and directly contributed to significantly higher rates on third party financing to the country (Sigalos and Kharpal 2022), which may seem contradictory to the IMF’s own views expressed earlier in which bitcoin was acknowledged as potentially useful for some of the challenges the country faces. The IMF has further stated, however, that it “recommends narrowing the scope of the Bitcoin law” while at the same time “strengthening the regulation and supervision of the new payment ecosystem” (International Monetary Fund 2022, 35). This recommendation follows the IMF’s findings that due to “Bitcoin’s high price volatility, its use as a legal tender entail significant risk” (Ibid).



an experimental one. **The country did not go all in.** Adopting bitcoin as legal tender was not in replacement of the U.S. dollar.<sup>340</sup> Rather, it has been more like a pilot to determine whether adoption could (i) contribute positively to the fiscal position of the country through both potentially reducing dollar dependency and capitalizing on upward movements in bitcoin markets as a treasury investment or balance sheet hedge, and (ii) improve the living standards of its population by providing an alternative and perhaps more efficient means of engaging in cross-border remittances. Almost two years in, **it does not appear to have impacted either in any material way**, although the IMF has cautioned against El Salvador’s legalization policy.<sup>341</sup>

While bitcoin may not yet have proven to be a viable substitute for fiat in the case of El Salvador,<sup>342</sup> digital assets have demonstrated utility as a means of exchange in the world of decentralized financial markets in part because of their ability to be transacted independently of traditional centralized monetary systems. Take the example of Peru. Although the country has not legalized bitcoin or any other digital payment mechanism as an alternative to its national currency, the Sol: “Peruvians are fast adopting crypto as a hedge against inflation and political

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<sup>340</sup> Specifically, the bitcoin law did not replace the U.S. dollar as an official currency in the country and the Chivo app accommodates both BTC and USD; convertibility of the former to the latter which is also reserved against by the Salvadoran government via the FIDEBITCOIN trust fund. See note 328.

<sup>341</sup> “By adopting Bitcoin as legal tender considerable risks are introduced to financial stability, financial and market integrity, and consumer protection. In addition, a public backstop to ensure free convertibility from Bitcoin into U.S. dollars creates a contingent liability. If the use of Bitcoin increases significantly, it can risk the dollarization regime that has proven to be a successful nominal anchor for the economy” (International Monetary Fund 2022, 30). This notwithstanding, the IMF has also acknowledged that “digital payment systems like Chivo have the potential to make payments more efficient, thereby enhancing financial inclusion and supporting growth” while also warning that bitcoin’s “price volatility makes it inefficient as means of payments, unit of account or store of value” (Ibid), the three prongs of which are generally considered to represent the proper attributes of money (Harvey, Ramachandran, and Santoro 2021, 8).

instability” including out of concern that the country “would impose capital controls, FX restrictions or a devaluation” (Pymnts 2022, 2-3).<sup>343</sup> Alvaro Castro Lora, a Peruvian lawyer who founded the Peruvian Blockchain Association, asserts that Peruvians have “started to invest in crypto precisely because its decentralization is a shield against state intervention” (Ibid, 3).

In its 2022 Global State of Crypto Report, survey research by digital asset exchange Gemini supports this theory, citing “countries that have experienced 50% or more devaluation of their currency against the USD over the last 10 years were more than 5 times as likely to say they plan to purchase crypto in the coming year” (Gemini 2022, 4; see also Pymnts 2022, 5). According to Gemini, 41% of survey participants in Brazil “where the local currency has been devalued by more than 200%” reported owning crypto (Gemini 2022, 4).<sup>344</sup> In Argentina it has been asserted that crypto adoption “is twice that of neighbors like Brazil, Mexico and Peru, but its inflation is five to 10 times worse” with “the tumbling peso and legal limitations on buying U.S. dollars with them...driving crypto’s broader use” (Pymnts 2022, 1).<sup>345</sup> So popular, in fact, that on May 4, 2023 “Argentina’s central bank banned payment providers from offering crypto transactions alleging it intends to reduce the country’s payment-system exposure to digital assets” (Pereira 2023, 2; see also Di Salvo 2023, 1). Outside of the government, bitcoin has been heralded “as a savior

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<sup>343</sup> U.S. dollars are also widely accepted in Peru; however, the cost to exchange USD for Sol is apparently quite high due to exchange rates quoted by local banks (Pymnts 2022, 3). As of December 31, 2022, the value of 1 Peruvian Sol (PEN) was approximately 0.2630 USD (about 3.80:1).

<sup>344</sup> Gemini’s research results are represented as “based on surveys conducted in 20 countries among 29,293 adults” participating, including 1,700 in Brazil (Gemini 2022, 3).

<sup>345</sup> The legal limit on Argentinian purchases of USD is purportedly \$200 per month, although there is also evidence of non-crypto facilitated black markets that allow for circumvention of this limit (Elliott 2022, 1; Pymnts 2022, 3).

for ordinary Argentínians who cannot save or are being pushed into poverty because of the collapse of the peso” (Di Salvo 2023, 3).<sup>346</sup> But is this necessarily a good thing?

Gresham’s Law “is a monetary principle based on observation in economics that in currency evaluation, when two coins are equal in face value but unequal in intrinsic value...the one having less intrinsic value tends to remain in the market circulation, whereas the other disappears to be hoarded” (Gordon 2023, 1). In other words, the principle behind Gresham’s Law has just the opposite effect of what might otherwise be assumed – which is that “bad money drives out good” rather than the other way around (Ibid, 2). Thus, if bitcoin is determined to be the “good money” replacing whatever the “bad” local currency supply is (e.g., the Argentinian peso), Gresham’s Law states that the “bad” money will continue in circulation for transactions and other means of exchange and bitcoin will be hidden away in savings thus having little to no effect on the money supply. This might be a good thing for individuals who are concerned about the erosion of their purchasing power; however, it will do very little to allay concerns about the overall health of the local economy, which was exactly what happened when Argentina restricted access to local money following a fiscal crisis in 2001 that “resulted in a monetary crunch and led to a collapse of economic activity – **especially in the informal sector which mainly works on cash** – and to widespread social unrest” (Kiguel 2011, 1) (emphasis added).<sup>347</sup> Well before the country’s current economic woes,<sup>348</sup> the Financial Times reported in May 2022 that “decades of distrust in the banking system, high inflation,

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<sup>346</sup> “The currency has fallen almost 50% against the United States dollar in the past year” (Pereira 2023, 4).

<sup>347</sup> The 2001 Argentine financial crisis is also discussed in section 9.2 of this thesis.

<sup>348</sup> Argentina “right now suffers from one of the worst inflation rates in the world: It soared past 100% last month for the first time in three decades” (Di Salvo 2023, 3).

and strict limits on how many pesos can be converted into more stable currencies like the dollar have increasingly pushed savers towards cryptocurrencies” (Elliot 2022, 1; see also Pymnts 2022, 4).<sup>349</sup>

Champions of bitcoin in particular note its “defined and unalterable finite maximum supply of 21 million” (Craig 2022, 3). This is the feature that proponents argue confer on bitcoin characteristics similar to gold: “Gold has historically been the base-layer monetary asset that societies have used in most instances. It’s an easily identifiable and durable mineral that can be melted, divided and reconstituted with virtually zero loss” (Ibid, 2). And some would argue even superior to gold: “Bitcoin is a base-layer monetary network that is more scarce than gold...It is highly divisible, immediately verifiable with zero error and durable for the remainder of time” (Ibid, 3). It is precisely this scarcity feature that proponents claim provides bitcoin its defense against inflationary principles to which fiat currencies are subject because the supply can never increase.

And yet, the reason the major world economies no longer follow the gold standard is also notably due to its scarcity factor. “When the Great Depression hit, the people of England panicked, and started trading in their paper money for gold.

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<sup>349</sup> Others have countered the inflation argument, observing that trading activity is mostly for investment purposes rather than inflation hedging (Ibid). It is important to note, however, that these two concepts are not necessarily at odds, e.g., Treasury Inflation-Protected Securities (TIPS) are inflation-indexed bonds that can serve both as an investment as well as inflation hedge. That said, for a digital asset such as bitcoin to be effective as such a hedge, its correlation with other assets that are affected adversely by inflation (e.g., stocks, bonds) should either be low or negative. Instead, an IMF podcast “explores how crypto assets and equity markets, which showed little correlation before the pandemic, since began to move much more closely together” (Adrian and Iyer 2022, 2). In addition, a Research In International Business and Finance publication Pre-proof references that “some studies have concluded Bitcoin can be a hedge against future inflation, though it may not be a safe haven” while other studies “find a positive link between Bitcoin and forward inflation rates and no clear evidence of any inflation hedging capacity of Bitcoin during times of increasing forward inflation expectation” (Ma, Tian, Hsiao, and Deng 2021, 4).

It got to the point where the Bank of England was in danger of running out of gold” (Goldstein and Kestenbaum 2011, 2). The Bank of England ultimately abandoned the gold standard, which had long been “the unquestioned anchor of the global monetary system” in 1931 (Ibid, 2-3). The United States followed suit two years later after its own bank run scare (Ibid, 3-4). “Going off the gold standard gave the government new tools to steer the economy. If you’re not tied to gold, you can adjust the amount of money in the economy if you need to” (Ibid, 5).

In addition, the value of a currency is derived from more than its scarcity or supply factor; it’s also dependent on demand: “When something that is limited is in high demand, it increases in value” (Wankum 2022, 2). In the case of bitcoin, that demand is apparently based on the merits of its protocol: “The Bitcoin network is a transaction processing system. From transaction processing comes the ability to exchange money, namely bitcoin, the network’s native currency, which represents the value of the underlying system. It is both a payment network and an asset. Backed by the most resilient computer network in the world” (Ibid, 1). Assuming this to be true for the moment, the question necessarily turns to whether there are barriers to entry for competing systems that offer similar features.<sup>350</sup> And, if not, **does this then create just a different risk of functional depreciation from what is well accepted to accompany fiat currency**, with the ability of central banks to increase and contract the money supply? Returning to Gresham’s Law, what

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<sup>350</sup> “Early copy-cats of Bitcoin have faded from prominence, and Bitcoin has reached overwhelming dominance” (Pines 2021, 13). Perhaps, but given that the Bitcoin protocol is only now hitting its fifteen-year anniversary mark, it is well worth considering whether other copy-cats, and perhaps superior ones, may reassert themselves in the future: “Bitcoin is a novel monetary asset, with only 13 years of market behavior and technical functioning under its belt. While it has been extraordinarily reliable as a network...it is hard to rule out ‘unknown unknowns’ that could emerge in the future and threaten the stability or functioning of the network” (Ibid, 51).

happens when a small segment of the bitcoin user population hoards a proportionally high amount of the bitcoin money supply, as is already presumed by many to be the case?<sup>351</sup> In fiat markets, public policy can be implemented to address these issues but it's not so clear how such matters will be dealt with on the network.<sup>352</sup>

According to the World Economic Forum “current cryptocurrency systems appear to lack features that are critical for sovereign monetary regimes in order to manage and control the financial stability of a country. As cryptocurrencies **generally lack an adjustable monetary policy, they cannot respond in the same way to monetary and price stability risks due to shocks to demand for cryptocurrency by adjusting the supply.** Similarly, shocks to the supply of cryptocurrency are not mitigated by a monetary authority that could otherwise affect demand to stabilize the price” (World Economic Forum 2021, 7) (emphasis added).<sup>353</sup> As was discussed previously, the Bank for International Settlements has

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<sup>351</sup> The so-called “Bitcoin whales”. As the IMF notes: “Bitcoin and the innovative blockchain technology that underpins it promised to decentralize and democratize financial services...The problem was that speculators soon piled into the market. Instead of spending bitcoins and other crypto assets, speculators simply hoarded them in the hope that prices would rise ever higher” (International Monetary Fund 2022, 52).

<sup>352</sup> “The Bitcoin protocol is open source. Updates are made by rough consensus via a power balance between economic nodes and miners (within and across different geographic jurisdictions)” (Pines 2021, 50). For a definition of nodes, see Glossary of Defined Terms.

<sup>353</sup> It has been stated that cryptocurrencies, like bitcoin, “can adjust their parameters such as inflation and mechanism for consensus via their underlying blockchain to create different value propositions” (Harvey, Ramachandran, and Santoro 2021, 12). To the extent that this is, in effect, merely supplanting one set of decisionmakers for another, however, it's worth questioning how this will achieve better outcomes than a sovereign's ability to alter the money supply “through monetary policy to achieve financial or political goals” (Ibid, 10). This would be particularly true in the case of sovereigns with democratic processes and officials elected or appointed through those processes to be empowered with such authority. Additionally, the OECD has reported that: “Weaknesses were also exposed in the use of “Proof of Stake (POS) as the consensus mechanism for transaction validation in times of stress, allowing for governance attacks at a very low cost when the price of the native crypto-assets drops significantly. Adoption of POS may also contribute to accumulation of liquidity transformation risk” (Organization for Economic Cooperation and Development (OECD) 2022, 5). In the words of SEC Commissioner, Jaime Lizárraga “many of the problems in traditional

proposed regulating developers and validators as a means of addressing governance issues associated with DeFi platforms (BIS Working Paper No. 1061 2022). Perhaps through such regulation, basic standards of competency can be imposed to ensure that decision-makers have the requisite professional judgment to address the complexities of the issues on which they are called upon to decide. Fundamentally, it is worth questioning then whether this approach **would simply return these platforms full circle to a level of centralized decision-making and control that is contrary to their original design and purpose.**<sup>354</sup>

In addition, the volatility of bitcoin and the risk that users may eventually abandon the network (just as AOL users proved temporal to the pioneering internet search engine when something better came along) leaves the “store of value” argument somewhat unconvincing. “The emergence of cryptocurrencies such as Bitcoin initially seemed likely to revolutionize payments...However, their volatile prices, and constraints to transaction volumes and processing times, have rendered cryptocurrencies ineffective” (International Monetary Fund 2022, 8). “Similar to gold, bitcoin is likely too volatile to be a reliable inflation hedge over short horizons. While theoretically decoupled from any country’s money supply or economy, in the brief history of bitcoin, we have not experienced any inflation surge. So there is no empirical evidence of its efficacy” (Harvey, Ramachandran, and Santoro 2021, 12, FN 10).

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finance that proponents of digital assets claimed that the industry would solve are still present in today’s ecosystem” (Lofchie 2022, 3).

<sup>354</sup> “While there is significant heterogeneity across countries in the specific corporate governance rules, academic research has shown that private solutions even in competitive financial markets cannot generally resolve governance issues, and the recourse to the legal system is a crucial prerequisite for a well functioning financial system...But this reliance on legal enforcement clashes with the maxim of decentralized finance that tries to avoid placing trust in any actor or institution, including the legal ones” (BIS Working Paper No. 1061 2022, 42).

And now that global macroeconomic conditions are reflecting significant inflationary conditions, the empirical evidence of bitcoin's efficacy in counteracting those conditions **has been underwhelming**. "Some experts, including David Yermack, a professor of finance at the New York University Stern School of Business, say crypto's free fall started after investors began selling off digital assets in response to the Federal Reserve's interest rate hikes" (Lynn 2022, 3). And the interest rate hikes were a response to, well, inflation (Lynch 2022, 1). "The decline in crypto-asset prices amid a broader market downturn for risk assets showcases the correlation of these markets with traditional risky asset classes, such as equities, which intensified during the downturn. The initial sell-off occurred against a backdrop of rising inflation expectations in late 2021 and the beginning of 2022, coinciding with a rise in gold prices, further indicating the investor perception of crypto-assets such as Bitcoin as inflation hedges cannot be justified" (Organization for Economic Cooperation and Development (OECD) 2022, 4).

Had El Salvador completely replaced its national currency with bitcoin as opposed to merely allowing it as an alternative means of exchange to the U.S. dollar, the country's fiscal position today would look very different – and not in a good way. While the country's experiment has proven rather benign, all things considered, **this is precisely because the country was at least astute enough to take a cautious approach** and not dive into the deep end of untested, and potentially dangerous, waters. It introduced only a nominal amount of bitcoin on its balance sheet relative to its overall treasury reserves and designed the Chivo app to recognize the country's dollarized fiat as the default currency with USD reserves in place to back automatic BTC to USD conversion transactions where the country retains the foreign



exchange risk. So, while bitcoin may continue to have utility on the Bitcoin network, which itself may have utility in increasing the efficiency of and improving the delivery of financial transactions and other services, bitcoin (or any other digital asset for that matter) as a replacement for sovereign issued currency **has not yet proven its case**.<sup>355</sup> In the words of the IMF “the major reserve currencies, especially the dollar, are likely to retain their dominance as stores of value because that dominance rests not just on the issuing country’s economic size and financial market depth but also on a strong institutional foundation that is essential for maintaining investors’ trust. **Technology cannot substitute for an independent central bank and the rule of law**” (International Monetary Fund 2022, 10) (emphasis added).

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<sup>355</sup> “It is not at all clear to me that Bitcoin BTC is the universal and utopian money of the future” (Birch 2022, 2).

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