

**CENTRAL BANK DIGITAL CURRENCY FOR THE CRYPTO-ECONOMY: AN EXPERIMENTAL PROPOSAL BASED ON THE EUROPEAN SINGLE MARKET AND INSTITUTION-BUILDING**

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ABSTRACT

This Article proposes a marriage or integration of two seemingly parallel economic and monetary spheres. These include first, the crypto-economy (which has sometimes been described as a sphere of economic and monetary activities that lies beyond the rule of law or reflecting a novel type of capitalism unshackled from current institutions), and second, the role of central banks, in particular the European System of Central Banks (“ESCB”). It argues that the crypto-economy can benefit from engaging with a programmable central bank digital euro, and that the ESCB would also benefit from being able to test a limited rollout of the central bank digital euro in the crypto-economy.

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## INTRODUCTION

An unregulated but thriving space, often known as the “crypto-economy,”<sup>1</sup> is increasingly populated with “decentralized application” (“dApp”) business developers innovating to promote peer-to-peer commerce supported by blockchain infrastructure.<sup>2</sup> The economic potential of the dApp economy can be mobilized with institutional

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1. See generally ANDREW ROMANS, *MASTERS OF BLOCKCHAIN AND INITIAL COIN OFFERINGS* (2018).

2. This is a type of distributed ledger built by appending blocks of data to form one complete ledger shared amongst all nodes. See generally MICHÈLE FINCK, *BLOCKCHAIN REGULATION AND GOVERNANCE IN EUROPE* (2018).

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support. This Article argues that support from the public sector can be beneficial and mobilizing, drawing upon the framework of regulatory capitalism.<sup>3</sup> We propose an integration of the dApp economy (which has sometimes been described as a sphere of economic and monetary activities that lies beyond the rule of law<sup>4</sup> or reflecting a novel type of capitalism unshackled from current institutions),<sup>5</sup> and the role of central banks, specifically the European System of Central Banks (“ESCB”). We focus on a particular starting point, that is, an enabling<sup>6</sup> legal framework for the dApp economy anchored upon the provision of a digital fiat currency issued by a central bank for investment.

This Article argues that central bank digital currency (“CBDC”) could be targeted at the dApp economy as a “limited rollout” for primary investment purposes. The CBDC has been discussed predominantly in relation to mainstream economic and financial activities, but challenges are recognized for its rollout as replacement for the physical circulation of cash. A limited rollout provides an experimental space for central banks and dApp economy developers, bridging a new technologically-developed economic space with a public sector institution of old. This Article suggests that the limited rollout can be tried in the European context, as the euro, being a common currency of the euro area, provides an excellent starting point for the building out of the dApp economy, which is generally regarded as borderless and global. Further, European policy-making is situated within an institutional framework that promotes the building of a Single Market for the European economy,<sup>7</sup> providing a leadership

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3. See *infra* Part II.

4. Thibault Schrepel, *Anarchy, State, and Blockchain Utopia: Rule of Law versus Lex Cryptographia*, in GENERAL PRINCIPLES AND DIGITALISATION (Hart Publishing 2020), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3485436](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3485436).

5. John Flood & Lachlan Robb, *Trust, Anarcho-Capitalism, Blockchain and Initial Coin Offerings* (Griffith U. L. Sch. Research Paper No. 17–23, U. Westminster Sch. L. Research Paper, 2017), <http://ssrn.com/abstract=3074263>.

6. Regulation enables economic activities to be carried out, organized, and legitimized. See generally Barak Orbach, *What is Regulation?*, 30 YALE J. ON REG. 1 (2012).

7. Consolidated version of the Treaty on the Functioning of the European Union art. 26, 2012/C 236/01, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12012E%2FTXT>.

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example of policy-making across borders and boundaries amongst tightly-coupled economies. This discussion also provides relevant insights for the United States. For the United States, the central bank digital dollar can provide a starting point for mobilizing the dApp economy, and leverage upon its still-accepted status as the global reserve currency.<sup>8</sup> The central bank digital dollar could also facilitate the building out of a federal framework for governing key aspects of the dApp economy, such as payment business regulation, securities and fundraising regulations, as well as exchange and market regulations. These aspects will be mapped out in the European example in Part III of this Article. Although this Article chooses to discuss the central bank digital euro in detail as the example for implementation of the CBDC for the dApp economy, the progression of the Article in relation to the development of the dApp economy, its market failures, and the role of a CBDC are generally applicable for policy thinking whether in Europe or beyond.

Part I provides a review of current policy thinking on the CBDC to be used in the mainstream economy. It is observed that central banks have moved from the “research” phase for digital currencies to a phase for exploring operationalization, despite the many challenges that were canvassed in the research phase not definitely addressed. Central banks seem intent on targeting CBDC for mainstream e-commerce, and possibly global trade and retail.<sup>9</sup> However, this Article urges central banks to consider aiming an experimental rollout of CBDC at the dApp economy in order to test demand, and the efficiency and security of its workings. Such a limited proposal is based on a win-win agenda for both central banks and developers in the dApp economy. Moreover, the genesis for central bankers’ interest in CBDC lies in the rise of cryptocurrencies that serve payment and other transactional functions in the dApp economy.<sup>10</sup>

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8. Kimberly Amadeo, *Why the US Dollar Is the Global Currency*, BALANCE (July 23, 2020), <https://www.thebalance.com/world-currency-3305931>.

9. BANK FOR INT’L SETTLEMENTS, CENTRAL BANK DIGITAL CURRENCIES: FOUNDATIONAL PRINCIPLES AND CORE FEATURES (2020), <https://www.bis.org/publ/othp33.htm> [hereinafter BIS].

10. Dirk Bullman, Jonas Klemm & Andrea Pinna, *In Search for Stability in Crypto-assets: Are Stablecoins the Solution?* (ECB Occasional Paper No. 230, 2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3444847](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3444847).

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Part II explains why the CBDC is especially relevant to the dApp economy. It discusses the market failures of self-governing solutions in the dApp economy—including reliance on private cryptocurrencies—and argues that a public sector solution in the form of CBDC can be enabling in nature. This Article also provides a survey of stablecoin developments and the landscape of risks surrounding them in relation to their currency functions in the dApp economy. The Article theoretically locates the issuance of CBDC for the dApp economy within the paradigm of regulatory capitalism and argues that this paradigm allows us to see how CBDC can play a key facilitative role in mobilizing the dApp economy for the benefit of mainstream users at scale. Part II argues that the CBDC is a public sector solution of an enabling nature, which is beneficial for mobilizing the dApp economy as a capitalist *and* governed order.

Finally, Part III explores how such CBDC should be issued and the implications for the institutional frameworks for governing the dApp economy. Part III discusses, using the central bank digital euro as an example, how a CBDC can be rolled out in an experimental manner in a regional market. As the CBDC would be an enabling or empowering institution for access to and mobilization of money, it paves the way for investment into the dApp economy in a manner consistent with institutional trust for a governed market order. It also paves the way for a blueprint for the broader institutional implications of governing the dApp economy, which can be a new and promising space for economic and financial mobilization. These insights, based on the experimental central bank digital euro, are potentially useful for global policy thinking.

#### I. DEVELOPMENT OF POLICY THINKING ON CENTRAL BANK DIGITAL CURRENCIES

A first question that may be asked in relation to CBDCs is whether they are needed at all. Privately-created money dominates money supply<sup>11</sup> in many developed economies and electronic forms of money transfer and payment have evolved from decades ago. The digitalization of payment currency has developed over time, from

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11. See generally MARY MELLOR, THE FUTURE OF MONEY: FROM FINANCIAL CRISIS TO PUBLIC RESOURCE (2010).

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payment cards to user-friendly forms of payment led by financial technologies (“fintechs”) in e-commerce and cashless real commerce.<sup>12</sup> The digitalization of money in payment cards catered to the rise of the consumption economy, as credit is bundled with payment, transforming the nature of relatively accessible consumer credit.<sup>13</sup> The rise of e-commerce further fueled demand for digital forms of payment and the rise of fintechs, the earliest of which may be Paypal,<sup>14</sup> to serve a globally-linked retail economy. Fintechs, however, have evolved to challenge the inefficiencies of payment and remittance monopolies,<sup>15</sup> galvanizing greater adoption of cashless transfers.<sup>16</sup> The continuous movement of innovation in the fintech space shows that we are not lacking in digital payment interfaces and the digitalization of money. Hence, it is queried as to why we may need a public good in the form of the CBDC as we foster an open and competitive space in electronic money and payment innovations.<sup>17</sup>

Earlier research into CBDC focused on how consumers demand money,<sup>18</sup> taking into consideration whether CBDC should replace

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12. Peter Gomber et al., *On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption and Transformation in Financial Services*, 35 J. MGMT. INFO. SYS. 220–265 (2018).

13. See generally Gillian Garcia, *Credit Cards: An Interdisciplinary Survey*, 6 J. CONSUMER RES. 327 (1980).

14. See Paypal, <https://www.paypal.com/uk/home>; see also Kerry L MacIntosh, *The New Money*, 14 BERKELEY TECH. L.J. 659 (1999) (for an early piece noting the need for digital money beyond credit cards for e-commerce); Lawrence J. Trautman, *E-Commerce, Cyber, and Electronic Payment System Risks: Lessons from Paypal*, 16 U.C. DAVIS BUS. L.J. 261 (2016).

15. See generally Iris H-Y Chiu, *A New Era in Fintech Payment Innovations? A Perspective from the Institutions and Regulation of Payment Systems*, 9 L. INNOVATION & TECH. 190 (2017).

16. See, e.g., The Business Research Company, <https://www.thebusinessresearchcompany.com/report/fintech-market>.

17. See The role of the Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No. 1093/2010, and repealing Directive 2007/64/EC (Payment Services Directive 2015).

18. Christian Barontini & Henry Holden, *Proceeding with Caution – A Survey on Central Bank Digital Currency* (BIS Paper No. 101, 2019), <https://ssrn.com/abstract=3331590>; Tanai Khiaonarong & David Humphrey, *Cash Use Across Countries and the Demand for Central Bank Digital Currency* (IMF

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physical cash. CBDC can be regarded as a cost-effective means to replace cash, which can be perceived as inefficient because of the need for its physical production and replacement, as well as risks in terms of its physical handling, relating to loss, theft, and counterfeiting.<sup>19</sup> Decreased demand for cash and consumer preference for electronic payments also seem to underlie the Swedish central bank's experiment with CBDC.<sup>20</sup> However, commentators raise the fear of financial exclusion for those used to cash and not familiar with digital interfaces.<sup>21</sup> In this manner, the financial inclusion rationale<sup>22</sup> for CBDC may be weakened. Indeed, central bankers,<sup>23</sup> in proceeding to an operational phase for CBDCs, have decided not to treat the CBDC as a substitute for cash, but to maintain the co-existence of CBDC and cash as a matter of principle in order to promote choice.<sup>24</sup> Thus, it can be argued that the public good perception of CBDC would not be the total digitalization of money, but rather, an attempt to possibly correct the market failures or to improve on market inefficiencies in relation to private sector-issued digital money and payment systems.

But what are the market failures or inefficiencies in relation to private sector-issued digital money? It can be argued that one area of market failure lies in the breakdown of trust between financial participants and institutions in relation to cross-border payments and remittances within the frameworks of anti-fraud and anti-money

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Working Paper, 2019), <https://www.imf.org/en/Publications/WP/Issues/2019/03/01/Cash-Use-Across-Countries-and-the-Demand-for-Central-Bank-Digital-Currency-46617> (demonstrating an opposing view, i.e., the need for physical cash amongst populations).

19. Craig Calcaterra, Wulf A. Kaal & Vadhindran Rao, *Stable Cryptocurrencies: First Order Principles*, STANFORD J. BLOCKCHAIN L. & POL'Y (2019), <https://ssrn.com/abstract=3402701>.

20. Dylan Love, *Sweden Is Testing Its New Central Bank Digital Currency*, COINTELEGRAPH (Feb. 20, 2020), <https://cointelegraph.com/news/sweden-is-testing-its-new-central-bank-digital-currency>.

21. Khiaonarong & Humphrey, *supra* note 18.

22. David Andolfatto, *Assessing the Impact of Central Bank Digital Currency on Private Banks* (Federal Reserve Bank of St. Louis Working Paper 2018-026B, 2018), <https://doi.org/10.20955/wp.2018.026>.

23. *See* BIS, *supra* note 9.

24. *Id.*

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laundering compliance.<sup>25</sup> For example, users of consumer credit cards have faced blocked payments or card freezes when attempting to make payment in a foreign jurisdiction or purchasing from an online retailer based overseas.<sup>26</sup> The needs of regulatory compliance for financial institutions, with rules against money laundering that entail strict liability,<sup>27</sup> promote skepticism due to each financial institution's own legal risk. This can result in the break-down of coordination amongst financial institutions, adversely affecting the smoothness of money flows. On the one hand, such hiccups in money flows serve to protect financial institutions from legal risk, but on the other, private sector financial institutions could improve on coordination in order to efficiently detect real instances of financial crime or fraud instead of false positives. The regulatory demands of anti-money laundering have resulted in a fragmented landscape of trust between international financial institutions such as banks and remittance providers. Banks in many jurisdictions are risk averse that regulatory compliance by correspondent financial institutions may be inadequate, therefore enhancing their regulatory risks. This has resulted in the decline of correspondent banking for higher-risk jurisdictions and potential financial exclusion in an indiscriminate manner.<sup>28</sup>

Even where policy initiatives have brought about architectural and standardization advantages, such as in the Single European Payments

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25. See generally Emily Lee, *Financial Inclusion: A Challenge to the New Paradigm of Financial Technology, Regulatory Technology and Anti-Money Laundering Law*, 6 J. BUS. LAW 473 (discussing some effects of de-risking by financial institutions due to anti-money laundering compliance). Effects of de-risking, such as exclusions and access problems, inevitably create barriers to efficiency in financial transactions, creating a balance that needs to be struck. *Id.*

26. Stephen Little, *One in four holidaymakers have had their credit card blocked whilst abroad*, MONEY PAGES (June 1, 2017), <https://www.themoneypages.com/latest-news/one-in-four-holidaymakers-has-had-their-credit-card-blocked-whilst-abroad/>.

27. See, e.g., U.K. Proceeds of Crime Act 2002, § 328 (example of a law that can be used to incriminate banks that engage in "arrangements" that facilitate money laundering. Although the mental elements of "know or suspect" is mentioned in the section, the threshold for suspicion is relatively low); see also *Lonsdale v National Westminster Bank Plc* [2018] EWHC 1843 (QB).

28. FINANCIAL STABILITY BOARD, FSB ACTION PLAN TO ASSESS AND ADDRESS THE DECLINE IN CORRESPONDENT BANKING (May 2019), <https://www.fsb.org/wp-content/uploads/P290519-1.pdf>.



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Area,<sup>29</sup> it is arguable that the efficiency of cross-border payments within the Single Market—especially the euro area—can be improved.<sup>30</sup> Expected smoothness in the outworking of payment services can particularly be put to the test where a payment services institution fails. For example, the failure of German payment services provider Wirecard resulted in uncoordinated approaches by different regulators, leaving consumers in markedly inconvenient positions.<sup>31</sup> The harmonization of laws and architecture may still run up against the fragmentation of national supervision and coordination if a regulated entity becomes mired in crisis.

The invention of bitcoin—the first private cryptocurrency that can be transferred in a cryptographically secure manner across a peer-to-peer network—in 2009<sup>32</sup> arguably opened up a space for the migration of financial transfers that could have been impeded in mainstream financial architecture. Doubtless the transfers of illicit money in bitcoin have been discussed at length,<sup>33</sup> and criminals are even demanding ransom in bitcoin in order to retrieve their ill-gotten gains pseudonymously,<sup>34</sup> yet, the availability of cryptocurrency blockchains

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29. Single Euro Payments Area (“SEPA”) Regulation (EU) No 260/2012. *See generally* JAKUB GÓRKA, TRANSFORMING PAYMENT SYSTEMS IN EUROPE (2016).

30. *See* European Association of Cooperative Banks (EACB), The European Banking Federation (EBF) & European Savings and Retail Banking Group (ESBG), Payments Policy for Europe: Direction for the Next Five Years (2020), <https://www.finextra.com/finextra-downloads/newsdocs/eccas-policy-paper-payments.pdf>.

31. Nicholas Megaw, *UK consumers dragged into Wirecard’s collapse*, FINANCIAL TIMES (June 29, 2020), <https://www.ft.com/content/dbel6ce4-f154-4985-a210-279fa1f53e24> (reporting on the freezing of customers’ accounts, which the FCA subsequently intervened into following customer complaints, and other fragmented scrambles in other countries following the German fintech company’s collapse); *see also* Stefania Palma, *Ex-Wirecard clients scramble to process payments in Singapore*, FINANCIAL TIMES (Oct. 12, 2020), <https://www.ft.com/content/3ed31549-a012-4bd4-a130-696790027b7e>.

32. Satoshi Nakamoto, *Bitcoin: A Peer to Peer Electronic Cash System* (2008), available at <https://bitcoin.org/bitcoin.pdf>.

33. Damodaran Appukuttan Nair, *The Bitcoin Innovation, Crypto Currencies and the Leviathan*, 9 INNOVATION & DEVELOPMENT 85–103 (2019); Braeden K Anderson, *Regulating the Future of Finance and Money: A Rational U.S. Regulatory Approach to Maximizing the Value of Crypto-Assets and Blockchain Systems*, 11 BOCCONI LEGAL PAPERS 1 (2018).

34. *AA v Persons Unknown and Bitfinex* [2019] EWHC 3556 (Comm).

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have also provided an enabling mechanism for those excluded from mainstream financial structures,<sup>35</sup> many through reasons beyond their control.<sup>36</sup> Further, private cryptocurrency offers choice where governments are perceived to misuse monetary policy.<sup>37</sup> Even in developed economies where interest rates have remained low for too long,<sup>38</sup> ordinary citizens can engage in the opportunities for saving in cryptocurrency, such as privately issued crypto stablecoins.<sup>39</sup>

Interest in the development of the CBDC can thus be attributed to the following context: the confluence of coordinative inefficiencies and market failures in payment and remittance operationalized by the conventional financial sector, and the rise of the programmable cryptocurrency that can be transferred from peer-to-peer wallets on permissionless blockchains that are not publicly policed.<sup>40</sup>

In connection with the public good analysis of the CBDC as overcoming market failures and inefficiencies in privately-supplied

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35. Armine Soufaih, *Revolutionizing International Remittance Payments Using Cryptocurrency and Blockchain-based Technology*, SOCIAL IMPACT RESEARCH EXPERIENCE (SIRE) 75 (2020), <https://repository.upenn.edu/sire/75>; Rajendra Kulkarni et al., *Cryptocurrency, Stablecoins and Blockchain: Exploring Digital Money Solutions for Remittances and Inclusive Economies* (66th Annual North American Meetings of the Regional Science Association International (13–16 Nov, 2019), Pittsburgh, PA, USA, 2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3511139](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3511139).

36. Jay Hao, *Financial Inclusion, Cryptocurrency and the Developing World*, COINTELEGRAPH (June 25, 2020), <https://cointelegraph.com/news/financial-inclusion-cryptocurrency-and-the-developing-world>.

37. Max Raskin, Fahad Saleh & David Yermack, *How Do Private Digital Currencies Affect Government Policy?* (Nat'l Bureau of Econ. Res. Working Paper No. 26219, 2019), <http://www.nber.org/papers/w26219>.

38. Nares Laopannarai, *Can the Fed's Prolonged Low-Interest Rates Lead Bitcoin to the Upside?*, SUPERCRIPTONEWS (Aug. 31, 2020), <https://www.supercryptonews.com/fed-prolonged-low-interest-rates-lead-bitcoin-to-the-upside/>.

39. *See infra* Part II.

40. The Bank of England in particular has a pressing need to reform conventional payment systems, especially international remittance in order to address the fragmentation and break-downs between financial institutions leading to market failures. The development of the CBDC is seen as one avenue of exploration for reform. *See* Victoria Cleland, *Cross-border payments – innovating in a changing world* (Speech, Central Banks Payment Conference, Oct. 13, 2020), <https://www.bankofengland.co.uk/speech/2020/victoria-cleland-keynote-presentation-at-the-central-bank-payments-conference-2020>.

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payment services, CBDC could be supplied for payment in e-commerce and remittance, in *an account-based design*, i.e., where accounts are maintained directly at the central bank by retail users. The central bank takes on the role of payment intermediation in order to address the deficiencies of private sector services. In the euro area, this can be transformative for remittances. Users could make and receive transfers out of and into their CBDC accounts,<sup>41</sup> vis-à-vis other CBDC accounts held at the central bank, throughout the regional market of the euro-area, and across the borders of Member States. This is arguably revolutionary in supporting the freedom of movement in the Single Market in terms of human capital movement, e-commerce, peer-to-peer consumption, and even financial services, such as peer-to-peer crowdlending.

The European Central Bank's ("ECB") recent proposal to explore the operationalization of CBDC is based on the perceived benefits above.<sup>42</sup> In providing competition with mainstream payment services providers in this manner, the ECB envisages that there could be migration from mainstream payment services institutions. However, financial intermediaries who have hitherto been able to impose rents on the users of payment systems<sup>43</sup> especially on a cross-border basis would have to become competitive and seek improvement and innovation on their services. Central banks on the other hand may have to be prepared for increased management of user relations, especially with consumers.

Further, a central bank that adopts an account-based design benefits from being able to observe payment information and this assists in anti-money laundering surveillance, although at the price of privacy.<sup>44</sup> This likely presents a dilemma for users as at scale, the central bank can be in possession of significant amounts of data

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41. Harry Leinonen, *Electronic Central Bank Cash: To Be or Not to Be?*, 13 J. PAYMENTS STRATEGY & SYSTEMS 20 (2019).

42. EUROPEAN CENTRAL BANK, REPORT ON A DIGITAL EURO (Oct. 2020), <https://www.ecb.europa.eu/euro/html/digitaleuro.en.html>.

43. Tommaso Mancini-Griffoli et al.,  *Casting Light on Central Bank Digital Currency*, in CHRIS BRUMMER, CRYPTOASSETS: LEGAL, REGULATORY, AND MONETARY PERSPECTIVES (2019).

44. *Id.* Hossein Nabilou, *Testing the Waters of the Rubicon: The European Central Bank and Central Bank Digital Currencies*, J. BANKING REGULATION (2019), <https://doi.org/10.1057/s41261-019-00112-1>.

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regarding private money flows, and data security and handling can become of paramount importance and requiring accountability.<sup>45</sup> For example, the CBDC project rolled out by the Chinese government may be viewed with some concern due to the propensity for data collection and the exercise of forms of state control. The issuance of CBDC is in a pilot phase, limited to four Chinese provinces, and incumbent financial institutions such as large state-owned banks and major fintech institutions such as Tencent would be wallet providers for CBDC.<sup>46</sup> The issuance of CBDC may be a way of regularizing the uneven landscape in China with its large banking sector being digitally backward and the fintech sector becoming disproportionately important in credit creation, money supply, and investment services. However, an authoritative Chinese commentator<sup>47</sup> takes the view that CBDC would promote greater security of data and certainty of payments in retail use, indicating that the interest in CBDC could lie in achieving greater public sector control over flows of money that are being dominated by the unevenly regulated fintech sector in China.

Account-based designs could attract depositors, who would see central banks as fail-safe, and bank runs could be virtually abolished.<sup>48</sup> Commentators worry about whether this would adversely affect the credit creation role of banks or indeed this role may be pushed onto central banks.<sup>49</sup> However, others argue that CBDC issuance does not have to entail credit operations and financial customers would still need to turn to commercial banks.<sup>50</sup> Nevertheless, the possibility is raised that central banks may need to

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45. EUROPEAN CENTRAL BANK, *supra* note 42.

46. Staff, *China's central bank digital currency wallet is revealed*, LEDGER INSIGHTS (Apr. 16, 2020), <https://www.ledgerinsights.com/china-digital-currency-wallet-dcep-cbdc/>.

47. Qian Yao, *Central Bank Digital Currency: Optimization of the Currency System and Its Issuance Design*, 12 CHINA ECON. J. 1 (2019).

48. Markus K. Brunnermeier & Dirk Niepelt, *On the Equivalence of Private and Public Money*, 106 J. MONETARY ECON. 27 (2019); Alex Cukierman, *Welfare and Political Economy Aspects of a Central Bank Digital Currency* (Centre for Econ. Pol'y Res. Discussion Paper No. 13728, 2019), [https://cepr.org/active/publications/discussion\\_papers/dp.php?dpno=13728](https://cepr.org/active/publications/discussion_papers/dp.php?dpno=13728).

49. Young Sik Kim & Ohik Kwon, *Central Bank Digital Currency and Financial Stability* (Bank of Korea Working Paper, 2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3330914](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3330914).

50. Brunnermeier & Niepelt, *supra* note 48.

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invest “back” into commercial banks to support their roles in the private creation of money so that credit is available for economic development.<sup>51</sup> CBDC issuance can also provide competition in relation to the deposit-taking services provided by commercial banks and they may raise account interest rates to attract deposits.<sup>52</sup> In the alternative, to avoid disproportionate inflows into CBDC from the private sector, the remuneration of CBDC could be set at a decreasing level for high balances, including a negative tier beyond a certain threshold.<sup>53</sup>

It is arguable that the availability of a CBDC facilitates certain novel fiscal and monetary policies. Account-based CBDC designs provide novel benefits such as direct monetary policy, where central banks could make helicopter money drops or experiment further with negative interest rates in order to affect consumption behavior.<sup>54</sup> Fiscal policy can be integrated into account-based CBDC as CBDC can be issued based on government debt.<sup>55</sup> In light of the needs for economies battered by lock-down policies in the wake of the Covid-19 pandemic, CBDC has been discussed as part of possible fiscal stimulation policies.<sup>56</sup> It may be argued that fiscal policies are outside of the remit of central banks. However, a recent development in the United States in expanding the Federal Reserve’s role in combatting the adverse economic effects during the Covid-19 pandemic shows that central banks are regarded as important partner agencies in fiscal

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51. Kim & Kwon, *supra* note 49.

52. Andolfatto, *supra* note 22; Jonathan Chiu et al., *Central Bank Digital Currency and Banking* (Bank of Canada Working Paper, 2019), <https://ideas.repec.org/p/red/sed019/862.html>.

53. Ulrich Bindseil, *Tiered CBDC and the Financial System* (European Central Bank Working Paper No. 2351, 2020), <https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2351~c8c18bbd60.en.pdf>.

54. *Id.* See also Nabilou, *supra* note 44.

55. Michael Kumhof & Clare Noone, *Central Bank Digital Currencies – Design Principles and Balance Sheet Implications* (Bank of England Working Paper, 2018), [www.bankofengland.co.uk/working-paper/Working-papers](http://www.bankofengland.co.uk/working-paper/Working-papers) suggest that CBDC should not be convertible into bank deposits.

56. Nikhilesh De, *US Lawmakers Talk Digital Dollar, FedAccounts in Thursday Hearing*, COINDESK (June 10, 2020), <https://www.coindesk.com/watch-us-lawmakers-will-talk-digital-dollar-fedaccounts-in-thursday-hearing>.

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policies. The CARES Act 2020<sup>57</sup> provided for the Federal Reserve's powers to support not only liquidity in debt markets, but also lending to small and medium sized businesses. The Federal Reserve in the United States introduced the Main Street Lending Program ("MSLP") that provides support to small and mid-size non-financial firms hit by the pandemic.<sup>58</sup> The MSLP allows the Federal Reserve to set up special purpose vehicles to purchase participations in bank business loans, therefore supporting private financial sector lending to non-financial businesses, as long as they have been financially healthy prior to the pandemic. In effect, the U.S. Federal Reserve and the Treasury are legislatively empowered to act as guarantors while private sector banks underwrite and allocate credit.<sup>59</sup>

The concerns about the dominance and expanding remits of central banks in an account-based design may direct us to consider a bearer or token-based design of issuance.<sup>60</sup> In a bearer or token-based

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57. U.S. Coronavirus Aid, Relief, and Economic Security Act (CARES Act), H.R. 748, 116th Cong., § 3548 (2020).

58. See BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM, MAIN STREET LENDING PROGRAM (Sept. 8, 2020), <https://www.federalreserve.gov/monetarypolicy/mainstreetlending.htm>. The Program provides the following facilities: the Main Street New Loan Facility (MSNLF), the Main Street Priority Loan Facility (MSPLF), the Main Street Expanded Loan Facility (MSELF), the Nonprofit Organization New Loan Facility (NONLF), and the Nonprofit Organization Expanded Loan Facility (NOELF). Loans will be offered by banks, who retain 5 percent of the loan and sell the remaining 95 percent to one of three Main Street facilities (the New Loan Facility, the Priority Loan Facility, and the Expanded Loan Facility). These facilities vary by the type of loan such as loan size, borrower leverage, and whether the loan is new or expands an existing loan. All Main Street loans have a five-year maturity, deferring interest payments for one year and principal payments for two years, can be prepaid without penalty, and have a loan rate of LIBOR plus 3 percentage points. See William B. English & J. Nellie Liang, *Designing the Main Street Lending Program: Challenges and Options* (Hutchins Center for Fiscal and Monetary Policy Working Paper No. 64, 2020), <https://www.brookings.edu/research/designing-themain-street-lending-program-challenges-andoptions>.

59. Steve Cecchetti & Kim Schoenholtz, *The Fed Goes to War: Part 3*, MONEY & BANKING (Apr. 12, 2020), <https://www.moneyandbanking.com/commentary/2020/4/12/the-fed-goes-to-war-part-3> (arguing that the Fed should limit its involvement in the allocation of credit to the private nonfinancial sector).

60. Barontini & Holden, *supra* note 18 (discussing the types of CDBC, such as token-based and account-based).

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design, central banks would co-opt private sector institutions to provide custodial or transfer services for users. Users may interact with a commercially-provided user interface as a first port of call, although central banks may be involved in maintaining the overall architecture, such as expanding the range of accounts that may be maintained by intermediaries at the central bank.<sup>61</sup> The benefit of this would be a call to industry to innovate and provide the relevant custodial and transfer services, and this could enroll competition into a landscape of payment services, especially from the growing fintech sector. Further, the issuance of a CBDC provides the central bank with a new opportunity to engage with private sector providers to possibly redesign operational and architectural aspects, and this could help address in an *ex ante* manner potential inefficiencies that may arise and ensure better coordination amongst different intermediaries. If a token-based design for CBDC rollout facilitates new coordination between central banks, payment services providers, innovators, stakeholders, and the commercial sector, the opportunities for new forms of co-governance<sup>62</sup> can arise, i.e., the public and private sector participants are all incentivized and share in a common sense of responsibility to maintain and govern the payment networks and infrastructure. Such coordination can bring about more integrated and effective designs for users than if designs were generated either from the top-down or bottom-up.<sup>63</sup>

Although there can be remittance and e-commerce benefits from the issuance of a CBDC, whether account-based or token-based, it is questionable whether the benefits of investing in and overhauling operational and architectural aspects for either design (for central banks, existing and would-be payment services intermediaries, merchants, and possibly even retail users) would exceed the benefits of pursuing greater efficiencies and coordination in existing systems.<sup>64</sup>

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61. Alexander Kriwoluzky & Chi Hyun Kim, *Public or Private? The Future of Money* (Pol'y Dept. for Economic, Scientific & Quality of Life Policies, Directorate-General for Internal Policies for Econ. Committee, European Parliament, 2019), <https://www.europarl.europa.eu/cmsdata/207653/13.%20PE%20642.356%20DIW%20final%20publication-original.pdf>.

62. FINCK, *supra* note 2, at 171–180.

63. Markus K. Brunnermeier, Harold James & Jean-Pierre Landau, *The Digitalization of Money* (2019), <http://www.nber.org/papers/w26300>.

64. See Kriwoluzky & Kim, *supra* note 61.

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Interested central banks agree that the operationalizing of CBDC in the mainstream economy involves significant architectural transformations even with existing private sector support. First, the “back end” of CBDC in terms of issuance, plugging into commercial payment systems, as well as clearing and settlement, requires thinking in terms of new infrastructure that may be needed, especially if such infrastructure is to become decentralized to leverage upon blockchain technology.<sup>65</sup> Next, the “front end” also requires thinking in terms of user interface, ease and convenience of use, robust custodianship of users’ CBDC and resilience from data loss and cyberhacking, and the role of the central bank in such user relations.<sup>66</sup> Finally, the impact on existing providers of electronic money, deposit accounts, and even credit needs to be considered.<sup>67</sup>

One question still needs to be answered by central bankers keen on introducing CBDC into mainstream e-commerce and the retail economy: Is there demand among existing consumer users for such a currency format? Demand for CBDC such as in the euro area could come from direct remittance needs, especially where individuals work in a Member State not of their origin, as permitted under the European freedom of movement rules, and remit money regularly back to another Member State in the euro area. Disruptions for such remittances may cause inconvenience and hardship, and individuals could be incentivized to move away from their private sector current account provider to a CBDC account for such transfers.<sup>68</sup> However, it may be less likely that demand would come from the quarters of e-commerce in the European Single Market. The availability of the CBDC may impose cost on merchants while not necessarily meeting demand on users’ end. This is because CBDC is unable to meet users’ demand for credit-backed digital payment, and users may be better off relying on private credit providers, such as credit cards which have been vastly adapted for e-commerce. In light of extensive cost in operational and architectural overhauling, demand patterns in the

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65. EUROPEAN CENTRAL BANK, *supra* note 42; BIS, *supra* note 9.

66. *Id.*

67. *Id.* In this respect the BIS (2020)’s foundational principle for introducing CBDC is to do no harm while promoting co-existence with cash and innovation. This may extend to preserving financial stability in connection with private sector institutions and infrastructure, while not reducing the scope for innovation.

68. EUROPEAN CENTRAL BANK, *supra* note 42.



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retail universe should be studied carefully in considering what policy is best to combat inefficiencies and failures in payment systems.<sup>69</sup>

## II. THE PARTICULAR RELEVANCE OF CBDC TO THE DAPP ECONOMY

The mainstream introduction of the CBDC continues to entail many questions.<sup>70</sup> In light of the challenges surrounding a general rollout in the mainstream as canvassed above, this Article proposes that an optimal approach could be a limited rollout of CBDC, targeted at the dApp economy.<sup>71</sup> It may appear to be odd, in the face of mainstream discussions regarding how CBDC could transform the retail payment landscape, to turn our focus to the dApp economy. However, this neglected space in conventional CBDC discussions is arguably an optimal space for limited operationalization, as a rollout may be more technologically compatible with the architecture of the dApp economy and involves less of the operational challenges and dilemmas faced by central banks in a general rollout scheme.

Further, the dApp economy is an economic space still struggling to address its monetary order and is likely to benefit from an enabling institution such as the CBDC. The institution of the CBDC can provide a starting point for mainstream engagement with the dApp economy, and pave the way for building out the crypto-economy as a governed economic order. This vision is based on theoretical framing in the concept of regulatory capitalism.<sup>72</sup> The mobilization of the dApp economy can also be regarded as furthering the European Single Digital Market Strategy<sup>73</sup> and can be supported by both policy and law. The development of the dApp economy is of importance to the

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69. Sheila Dow, *Monetary Reform, Central Banks, and Digital Currencies*, 48 INT'L J. POL. ECON. 153 (2019).

70. EUROPEAN CENTRAL BANK, *supra* note 42; BIS, *supra* note 9.

71. *See generally* ANDREW ROMANS, MASTERS OF BLOCKCHAIN AND INITIAL COIN OFFERINGS (2018).

72. *See infra* Part III, Section C.

73. European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Mid-Term Review on the Implementation of the Digital Single Market Strategy: A Connected Digital Single Market for All* (SWD, 155 final, 2017), <https://ec.europa.eu/transparency/regdoc/rep/1/2017/EN/COM-2017-228-F1-EN-MAIN-PART-1.PDF>.

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European Union as many start-ups and innovative business ideas are arising in this space.<sup>74</sup> The need to incorporate disruptive technologies in the Digital Single Market initiative<sup>75</sup> has now been more explicitly articulated in the new action plan for the capital markets union.<sup>76</sup> The CBDC can be seen as part a facilitative mosaic for policy developments.

This Article proposes a limited rollout of the CBDC in the dApp economy to facilitate investment in dApp developments in particular. Such a limited rollout would occur in an economic space that is relatively “bounded,” as activities within this realm are currently not too porous to mainstream commerce. The limited rollout initiative can be contained and experimental, not significantly affecting or disrupting the rest of the economy. Further, the limited rollout is particularly beneficial for the crypto-economy and particularly efficient for central banks. The dApp economy is still endeavoring to develop private cryptocurrencies of sufficient monetary qualities, as will be discussed below. The CBDC enjoys established monetary qualities. Central banks would also benefit from discourse with private sector developers in relation to the CBDC’s programmability and robustness, lessons that can be relevant to further-reaching rollouts in the future. A limited rollout of the CBDC can take place in the dApp economy in order to observe uptake, demand, and operational issues.

#### *A. The Evolution of the dApp Economy*

The bitcoin blockchain was introduced in 2008 by a pseudonymous Satoshi Nakamoto<sup>77</sup> in order to allow private payments to be made securely and efficiently between individuals without needing to involve existing intermediaries in the banking and financial

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74. See, e.g., chainEurope, <https://www.chaineurope.org/blockchain-startups/> (providing a directory of all European blockchain start-ups).

75. See McKinsey & Co., *Shaping the Digital Transformation in Europe* (European Commission Working Paper: Economic Potential, 2020).

76. European Commission, *Capital Markets Union 2020 Action Plan: A Capital Markets Union for People and Businesses* (2020), [https://ec.europa.eu/info/business-economy-euro/growth-and-investment/capital-markets-union/capital-markets-union-2020-action-plan\\_en](https://ec.europa.eu/info/business-economy-euro/growth-and-investment/capital-markets-union/capital-markets-union-2020-action-plan_en) [hereinafter Capital Markets Union Action Plan].

77. Nakamoto, *supra* note 32.

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system. The global banking crisis in 2007 to 2009<sup>78</sup> loomed large in this context. Indeed, this development could be seen not only as a technological innovation, but as a statement of distrust of the prevailing financial institutions at that time.<sup>79</sup>

Purporting to be a private currency, bitcoin is most famously depicted in an exchange context, like in the following illustration. Imagine that Alice can send Bob bitcoins in order to discharge a payment obligation or to transfer value to Bob. How this is achieved is that Alice initiates a transfer of bitcoin which she owns, manifested by a string of digital data unique to the coins (which is known as the public key to the coins), by using a private key to which she is authorized (and which is mathematically related to the public key). As the transaction is private in nature, the integrity of the system can only be maintained if the double spend problem is prevented, i.e., that the system prevents Alice from being able to send the same coins to someone else again. The transaction is validated only by the community within the system—known individually as nodes—whose computers are connected to and have joined the bitcoin network.

From the early days of bitcoin, anyone can be a node, and membership of the bitcoin blockchain is purportedly highly democratized. Nodes are responsible for and compete to validate transactions on the bitcoin blockchain, as validation is incentivized by the reward of new bitcoins. Validation is carried out on the blockchain, which is a network cumulative database that records all of the transactions in bitcoin, of which each node would have an identical copy. The distributed ledger is thus tamper-proof and fail-safe at the same time as it is highly challenging for nodes to alter the ledger unilaterally across all identical copies and there is no single point of failure for the ledger.

Furthering our previous illustration, when Alice and Bob complete their transfer and this transaction is “proposed” to nodes, the

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78. See FINANCIAL SERVICES AUTHORITY, *THE TURNER REVIEW: A REGULATORY RESPONSE TO THE GLOBAL BANKING CRISIS* (2009), [http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/18\\_03\\_09\\_turner\\_review.pdf](http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/18_03_09_turner_review.pdf).

79. Dan Bousfield, *Crypto-coin Hierarchies: Social Contestation in Blockchain Networks*, 19 *GLOBAL NETWORKS* 291 (2019); Moritz Hutten & Matthias Thiemann, *Moneys at the Margins: From Political Experiment to Cashless Societies*, in *BITCOIN AND BEYOND: CRYPTOCURRENCIES, BLOCKCHAINS, AND GLOBAL GOVERNANCE* (Malcolm Campbell-Verduyn ed. 2018).

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transaction is broadcast with the public key of the bitcoin sent and a digital signature. Nodes do not know Alice's private key, but need to verify if the digital signature is mathematically coherent with the public key of the bitcoins sent. Nodes may verify in a decentralized manner, and generally, several confirmations for one transaction would increase the chances of its validity. The validation of transactions is carried out by mining for "blocks," which are clusters of transactional data grouped together in order to constitute a valid and immutable section of ledger data that would be accepted by all. Miners compete to gather confirmed transactions within a time period, say 10 minutes, and verify them by running "seed inputs" into the hashing algorithm of the bitcoin blockchain until mathematical coherence is achieved for all the transactions in the block. Miners validate the integrity of transactions and assure that there is no double spending according to previous validated records in blocks. The new block is then hashed together with a "block header" that comprises the block's identification hash and the previous block's hash, and is timestamped in order to be added to the previous block. This mining protocol is known as "proof-of-work," which is derived from established cryptographic methodology. Nodes have to confirm the block before it is authoritatively added to the ledger, and the successful miner receives a reward for mining, which started at 25 bitcoins per block and gradually decreasing in an algorithmically determined manner. Decentralized competition provides the incentive-based mechanism for maintaining the distributed ledger, but the competitive process for mining can result in waste of "work" by other miners as well as perverse incentives in the competitive process such as attacks on other miners or hijacking of others' computational power.<sup>80</sup>

The bitcoin blockchain can be regarded as an efficient payment mechanism as miners take on average 10 minutes to verify a transaction, compared to days taken for international remittances through banks. It may also be regarded as an alternative payment or remittance system for unbanked peoples.<sup>81</sup> However, the cost-

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80. Yue Wang et al., *Pool Strategies Selection in PoW-Based Blockchain Networks: Game-Theoretic Analysis*, 7 IEEE ACCESS 8427 (2019).

81. Ignacio Mas & David Lee Kuo Chuen, *Bitcoin-Like Protocols and Innovations*, in HANDBOOK OF DIGITAL CURRENCY: BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA (David Lee Kuo Chuen ed. 2015).

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effective access to unbanked peoples potentially obscures a problem in relation to the distribution of cost in maintaining the network. Where payment systems are managed by centralized intermediaries, they bear the cost of maintenance of the network by charging fees to users, but users also get the benefit of institutional protections regarding mistakes and failures.<sup>82</sup> In a distributed payment network, the cost of maintaining the network is theoretically distributed across all nodes. However, users are spared from bearing the cost as miners are incentivized to undertake maintenance. Nevertheless, in order to ensure that the blockchain is maintained at an optimal level, the cost of validation cannot be too low, and this is evidenced by significant amounts of energy spent<sup>83</sup> by miners' computers solving the mathematic hash puzzles in order to identify valid transactions. The carbon footprint of such maintenance is arguably sub-optimal, and it also results in the undermining of democratization in the blockchain as mining pools or clusters become oligopolistic and powerful.<sup>84</sup>

Bitcoin is still not widely adopted as an alternative payment system to the real economy. Retailers who voluntarily accept cryptocurrency as payment remain a minority, and may be concentrated in markets where consumers are young and technology-savvy.<sup>85</sup> However, the invention of the bitcoin blockchain paved the

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82. See generally Chiu, *supra* note 15.

83. Jean Bacon et al., *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralized Ledgers*, 25 RICH. J.L. & TECH. 1 (2018) (documenting that about 200kw of energy is consumed to validate each transaction).

84. Francesca Musiani, Alexandre Mallard & Cécile Méadel, *Governing What Wasn't Meant to Be Governed: A Controversy-Based Approach to the Study of Bitcoin Governance*, in BITCOIN AND BEYOND: CRYPTOCURRENCIES, BLOCKCHAINS, AND GLOBAL GOVERNANCE (Malcolm Campbell-Verduyn ed. 2018); see also Malcolm Campbell-Verduyn & Marcel Goguen, *Blockchains, Trust And Action Nets: Extending the Pathologies of Financial Globalization*, 19 GLOBAL NETWORKS 308 (2019).

85. Nicole Jonker, *What Drives the Adoption of Crypto-Payments by Online Retailers?*, 35 ELECTRONIC COMMERCE RESEARCH & APPLICATIONS 100848 (2019). It remains to be seen if the adoption of mainstream payment services, such as Paypal that offers cryptocurrency custody and credit cards that may offer bitcoin rewards, may galvanize mainstream adoption, see <https://www.paypal.com/us/smarthelp/article/cryptocurrency-on-paypal-faq-faq4398>; BlockFi's credit card that promises cryptocurrency rewards. See BlockFi, <https://blockfi.com/bitcoin-card-crypto-rewards>.

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way for the development of the Ethereum blockchain, which is now an alternative economic space powered by its native cryptocurrency, ether. Indeed, for holders of bitcoin as the leading cryptocurrency, ether has become the most significant private cryptocurrency for the alternative space of crypto-commerce. Hence, the bitcoin-ether pair of exchange transactions has grown exponentially in value and volume.<sup>86</sup>

The Ethereum blockchain went live in July 2015. The achievement of the Ethereum blockchain is that it does not function principally as a payment ledger, unlike the case of the original bitcoin blockchain. Rather, it is an underlying infrastructure that supplies a ledger and a protocol token, ether, that codes in basic laws of functionalities that can then be used to execute more specific “smart contracts” in application tokens.

The Ethereum blockchain provides an infrastructure that has a relatively developed permissionless ledger<sup>87</sup> and protocol tokens<sup>88</sup> that code in basic laws of functionalities. These tokens are used to build more specific “smart contract”<sup>89</sup> code by dApp developers. The first protocol token—the ERC-20—which has since been improved by the Ethereum Foundation, is open source code that can be utilized by any dApp developer to build specific transactional code that stores, accesses and exchanges information, embeds entitlements, executes exchanges, and functions as the currency of the transaction.<sup>90</sup> DApp

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86. See, e.g., *Bitcoin (BTC)*, COINGECKO, <https://www.coingecko.com/en/coins/bitcoin/eth> (showing daily transactions hovering over \$500 million per day).

87. This means the network is open to participation by anyone.

88. These provide for the basic needs and functionalities for the blockchain infrastructure as a whole, and are differentiated from application tokens more specific to particular transactions. See Jonathan Rohr & Aaron Wright, *Blockchain-based Token Sales, Initial Coin Offerings, and the Democratization of Public Capital Markets*, 70 HASTINGS L.J. 463 (2019).

89. These refer to automated protocols for action execution. “Smart contracts” are not the same as binding contracts in the legal sense. See generally Eliza Mik, *Smart Contracts: Terminology, Technical Limitations and Real World Complexity*, 9 L. INNOVATION & TECH. 269 (2017).

90. Lawrence J. Trautman, *Bitcoin, Virtual Currencies, and the Struggle of Law and Regulation to Keep Peace*, 102 MARQ. L. REV. 447 (2018); Dragan Zelic & Nenad Baros, *Cryptocurrency: General Challenges of Legal Regulation and the Swiss Model of Regulation*, in CONFERENCE PROCEEDINGS OF 33RD INTERNATIONAL SCIENTIFIC CONFERENCE ON ECONOMIC AND SOCIAL DEVELOPMENT – “MANAGERIAL ISSUES IN MODERN BUSINESS” 168 (Heidelberg: Springer, 2018);

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developers would build out and sell *application* tokens<sup>91</sup> to participants who wish to join the dApp network and benefit from its peer-to-peer marketplace. In such networks/marketplaces, participants are free to transact with each other, powered by dApp tokens. Transactional validity and record-keeping are based on the consensus protocol for maintenance on the Ethereum blockchain, which is decentralized. Such consensus protocol has evolved since the days of the bitcoin blockchain.<sup>92</sup>

The ether is the native token of the Ethereum blockchain, just as the bitcoin is the native token of the bitcoin blockchain. However, bitcoin's functionalities are limited, and its script is narrowly comprised of transfer and recording functions. Compare this with the ERC-20 token, which is coded with more universal functional qualities such as transferring within allowance limits, from specified locations, approval protocols, and permitting access to data. These universal qualities allow coders to build upon the token code with more specific functions for particular commercial applications.<sup>93</sup> These applications or dApps can then offer new opportunities for economic and commercial activity, such as the sale of CryptoKitties over the internet.<sup>94</sup> Since 2015, business innovations have exploded in

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Sandra Díaz-Santiago, Lil María Rodríguez-Henríquez & Debrup Chakraborty, *A Cryptographic Study of Tokenization Systems*, 15 INT'L J. INFO. SECURITY 413 (2016) (arguing that multifunctional tokens are efficient).

91. These are usually sold as pre-development tokens. Such sales have raised much controversy in many jurisdictions. Jurisdictions like the United States choose to treat these as securities offers although there are distinctive characteristics different with these sales, and other jurisdictions treat these as regulated or otherwise on a case-by-case basis. See U.S. Securities & Exchange Commission, *Statement on Digital Asset Securities Issuance and Trading* (Nov. 16, 2018), <https://www.sec.gov/news/public-statement/digital-asset-securities-issuance-and-trading> [hereinafter SEC Guidance 2018]; see also Financial Conduct Authority, *Guidance on Cryptoassets: Feedback and Final Guidance to CP 19/3* (July 2019), <https://www.fca.org.uk/publication/policy/ps19-22.pdf>; Alex Collomb, Primavera de Fillippi & Klara Sok, *Blockchain Technology and Financial Regulation: A Risk-Based Approach to the Regulation of ICOs*, 10 EUR. J. RISK REGULATION 263 (2019).

92. Nakamoto, *supra* note 32.

93. Rohr & Wright, *supra* note 88 (describing the difference between protocol and application tokens).

94. CryptoKitties is a game available on the Ethereum blockchain. See CryptoKitties, available at <https://www.cryptokitties.co/>.

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the dApp economy, built on this framework. The Ethereum blockchain now hosts 90 percent of the dApp economy.<sup>95</sup>

*B. The Structures of the dApp Economy*

In the dApp economy, economic agents can act as prosumers,<sup>96</sup> selling virtual goods and services, as well as consuming these according to their needs. Economic relationships are no longer defined as business (or commercial, corporatized entities) vis-à-vis consumers. These economic relationships take place over blockchain-based platforms, built upon algorithmic processes that support precisely automated transactions (coded in digital “tokens”), and facilitate record-keeping in a decentralized manner.<sup>97</sup> Unlike in the sharing economy where online platforms are owned by corporations that extract rent and capitalize on the network effects and data flowing through their platforms,<sup>98</sup> blockchain-based platforms are usually developed in an open source manner.<sup>99</sup> Scholars have recognized the economic structuration offered by blockchains and the mode of exchange offered by tokenization bring about a new form of institutional technology for economic activity.<sup>100</sup>

It is remarkable that the Ethereum blockchain has fostered a thriving dApp economy despite the potential inconvenience and cost of decentralized coordination in transaction validation and ledger construction, and the constant need to rely on bottom-up processes to

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95. Matthias Fromberger & Lars Haffke, *ICO Market Report 2018/2019 – Performance Analysis of 2018’s Initial Coin Offerings* (2020), <https://ssrn.com/abstract=3512125>.

96. For example, economic agents can act on both the supply and demand sides of the market.

97. Discussed shortly in relation to the mining protocols.

98. THE LAW OF ORGANISATIONS AND GOVERNANCE: RESPONDING TO DISRUPTIVE BUSINESS MODELS AND DIGITAL TRANSFORMATION (Iris H-Y Chiu & Roger M. Barker eds., 2020).

99. Primavera de Filippi, *Translating Commons-Based Peer Production Values into Metrics: Toward Commons-Based Cryptocurrencies*, in HANDBOOK OF DIGITAL CURRENCY: BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA (David Lee Kuo Chuen ed. 2015).

100. See generally CHRIS BERG, SINCLAIR DAVIDSON & JASON POTTS, UNDERSTANDING THE BLOCKCHAIN ECONOMY: AN INTRODUCTION TO INSTITUTIONAL CRYPTOECONOMICS (2019).



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foster institutional support for the crypto-economy generally. The global value of the dApp economy is estimated to be at \$14 billion.<sup>101</sup> Further, transaction confirmations on the Ethereum blockchain average between 15 seconds and 5 minutes,<sup>102</sup> and each block of the ledger is mined at an average of under 20 seconds.<sup>103</sup> Other innovations have arisen to compete with the Ethereum blockchain to supply protocol infrastructure to facilitate dApp developments. These include blockchains such as Tron,<sup>104</sup> with its native currency as Trx; and Algorand,<sup>105</sup> with its native currency as the Algo. However, empirical research finds that much of the traffic on blockchains other than Ethereum are back and forth transfers and not genuinely productive economic activity.<sup>106</sup>

Although many dApps pertain to decentralized finance or “DeFi,”<sup>107</sup> which attempts to allow peer-to-peer transactions in finance to take place to avoid the rent extraction of financial intermediaries in the conventional economy,<sup>108</sup> a large number of dApps are commercial in nature, providing innovative virtual goods and services amongst peers. For example, the dApp economy facilitates the commoditization of new virtual goods such as the sale of CryptoKitties<sup>109</sup> or a piece of virtual real estate in gaming worlds such as Decentraland.<sup>110</sup> It is true that the sale of virtual art or

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101. Bullman, Klemm & Pinna, *supra* note 10.

102. Eth Gas Station Blog, *How long does an Ethereum transaction really take* (June 5, 2019), <https://ethgasstation.info/blog/Ethereum-transaction-how-long/>.

103. Etherscan, *Ethereum Average Block Time Chart*, <https://etherscan.io/chart/blocktime> (noting data from January 2020).

104. *See, e.g.*, Tron, available at <https://tron.network>.

105. *See, e.g.*, Algorand, available at <https://www.algorand.com>.

106. Daniel Perez, Jiahua Xu & Benjamin Livshits, *Revisiting Transactional Statistics of High-scalability Blockchains* 27–29 (ACM Internet Measurement Conference, 2020), <https://arxiv.org/abs/2003.02693>.

107. Sid Coelho-Prabhu, *A Beginner’s Guide to Decentralized Finance (DeFi)*, COINBASE (Jan. 6, 2020), <https://blog.coinbase.com/a-beginners-guide-to-decentralized-finance-defi-574c68ff43c4>.

108. Asia Blockchain Review, *Decentralized Finance: Defying the Global Financial System*, ASIA BLOCKCHAIN REV. (Aug. 16, 2019), <https://www.asiablockchainreview.com/decentralized-finance-defying-the-global-financial-system/>.

109. CryptoKitties, *supra* note 94.

110. *See, e.g.*, Decentraland, available at <https://decentraland.org>.

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participation in online gaming are not new phenomena, however, the blockchain-based infrastructure promotes economic relationships in a peer-to-peer fashion that supports new forms of “prosumerism.” Economic relationships can be made more multifaceted and complex as users can assume roles on both the supply and demand sides of the marketplace. For example, the marketplace for CryptoKitties can accommodate many individual artists, but users can add further value by breeding their kitties on the peer-to-peer gaming platform and selling them.

Prosumerism is even more pronounced in a few other novel business models. First, we turn to Iungo’s blockchain-based global wireless facility. We often need to remain connected to the internet while traveling, however, access to Wi-Fi may be patchy and mobile data can be expensive, especially overseas. Iungo’s<sup>111</sup> business plan utilizes a blockchain system to link up private users’ Wi-Fi networks, so that at scale, a comprehensive network of Wi-Fi access can be constructed across the globe, contributed by private users or peers. Participants on Iungo’s platform can rent out their Wi-Fi access facilities to ad hoc users on-the-go. Participation in this system is tokenized by the ING token, which allows access to the global Wi-Fi network and enables transfer of value. This system is built using the Ethereum smart contract template and is not directly built upon the Ethereum blockchain. This enables an “inner economy” powered by token-holders’ supply and demand, which would not be affected distortions caused by holders of ether.<sup>112</sup> Iungo’s peer-to-peer global wireless internet access platform is novel and useful, and overcomes the jurisdictional oligopolies for mobile internet access that has sustained a market for expensive mobile data roaming charges. At scale, such a model can potentially become a peer-to-peer constructed global utility.

Second, Golem<sup>113</sup> is a peer-to-peer service marketplace that brings together participants who have idle computing power and users who wish to borrow others’ computing power to engage in computing tasks that require significant capacity. Users who need access to

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111. See, e.g., Iungo, available at <https://iungo.network>.

112. See, e.g., ING Tokens, IUNGO, <https://iungo.network/ing-tokens/> (discussing ING tokens).

113. See, e.g., Golem, available at <https://golem.network>.

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significant computing power may include graphic artists or small animation studios that require significant computing power to render sophisticated graphics. Such tasks can usually be performed using expensive graphics processors, or by borrowing a host of computers joined together to supply the capacity needed on the user's computer. Golem provides such a peer-to-peer worldwide network for the supply and demand side. Moreover, participation in this economy is again tokenized, so that the GNT token provides access, and matching of tasks with suitable nodes' computing systems. Tasks are also subject to automated "sharding," i.e., to divide the task among a number of nodes in order to maximize the capacity needed for the task and ensure no single point of failure. In this manner, the task is efficiently and effectively achieved and value creation is distributed among a number of nodes, creating an egalitarian system.

It may be argued that Golem's business model is not new, as there are commercial server farms that rent out computational capacity to others. Golem's novelty lies in its scaling up to a global marketplace by the standardization and commoditization of its arrangements via tokenization, without necessarily an underlying relational fabric.

Next, we also observe that peer-to-peer cloud storage services may take off at the scale of a global marketplace. Key players in this field include Storj,<sup>114</sup> Maidsafe,<sup>115</sup> and Filecoin.<sup>116</sup> Peer-to-peer cloud storage services allow individual users, i.e., peers to provide and rent out spare hard disk capacity in order to store other users' files. This meets the need of cloud storage for users who are looking for off-site storage of their files, currently provided by technological giants such as Apple, Google, or Amazon. Peer-to-peer cloud storage services would not be using the robust servers that technological corporate giants have, but would be relying on the construction of a vast joint-up space provided by individual contributors who join the network. Such a business model potentially disrupts oligopolies in this space, providing choice and price competition, and arguably a more secure and private means of storage. Peer-to-peer cloud storage systems enable protocols that "shard" files in order to distribute and replicate copies of data across nodes. In this manner, nodes do not have access

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114. *See, e.g.*, Storj, available at <https://storj.io>.

115. *See, e.g.*, Maidsafe, available at <https://maidsafe.net>.

116. *See, e.g.*, Filecoin, available at <https://filecoin.io>.

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to entire pieces of information that may compromise privacy and the downtime or failure of any one node is unlikely to compromise the sending and retrieval of files.<sup>117</sup> Further, peers on the supply side are paid for their services, which opens up a “sharing economy” for economic mobilization of individuals. However, encryption is usually the responsibility of users before they send files off to storage on the relevant networks.

The above examples show novel ideas that can potentially scale up to global marketplaces for services that may have been thought to be most efficiently provided by corporatized institutions with powerful servers. The dApp economy provides opportunities for new economic mobilization<sup>118</sup> as individual users can now commoditize their Wi-Fi facilities, idle computing power, or storage space. New value chains can be created and captured by new economic actors.<sup>119</sup> Such global marketplaces are a further development from the “sharing economy” phenomenon that has brought about new commoditization and economic mobilization since the 1990s.<sup>120</sup>

### C. *The Problems with the Monetary Order of the dApp Economy*

The dApp economy is facilitated by private cryptocurrencies. The first private cryptocurrency—bitcoin—has continued to survive its notoriety,<sup>121</sup> volatility,<sup>122</sup> and express pronouncements by many that it

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117. Seline Jung, *Filecoin v. Sia, Storj & MaidSafe: The Crowded Push for Decentralized Storage*, TOKEN REPORT (Aug. 3, 2017), <https://medium.com/tokenreport/filecoin-v-sia-storj-maidsafe-the-crowded-push-for-decentralized-storage-7157eb5060c9>.

118. Daivi Rodima-Taylor & William W. Grimes, *Cryptocurrencies and Digital Payment Rails in Networked Global Governance: Perspectives on Inclusion and Innovation*, in BITCOIN AND BEYOND: CRYPTOCURRENCIES, BLOCKCHAINS, AND GLOBAL GOVERNANCE (Malcolm Campbell-Verduyn ed. 2018) (extending insights beyond the cryptocurrency system).

119. See generally Alain Yee Loong Chong et al., *Business on Chain: A Comparative Case Study of Five Blockchain-Inspired Business Models*, 20 J. ASS'N FOR INFO. SYS. 1308 (2019).

120. See generally ARUN SUNDARAJAN, *THE SHARING ECONOMY: THE END OF EMPLOYMENT AND THE RISE OF CROWD-BASED CAPITALISM* (2016).

121. Henrik Karlström, *Do Libertarians Dream of Electric Coins? The Material Embeddedness of Bitcoin*, 15 Distinktion: Scandinavian J. SOC. THEORY 23, 24–36 (2014); Damodaran Appukuttan Nair, *The Bitcoin Innovation, Cryptocurrencies and the Leviathan*, 9 INNOVATION & DEV. 85, 86–103 (2019).

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does not function as good money,<sup>123</sup> in relation to its utility being a unit of account, a store of value, and a medium of exchange. Although bitcoin has become much more of a speculative asset<sup>124</sup> due to its potential to achieve high prices, the most important private cryptocurrency in the dApp economy is ether. Ether has not been subject to the same levels of commoditized inflation as bitcoin, but it also suffers from sub-optimal monetary qualities that may ultimately affect its role as currency in the dApp economy. In this light, CBDC may address the weaknesses of the monetary order of the dApp economy and provide for the needs of its scaling up, appealing to the possibility of mainstream mobilization.

The dApp economy has grown in spite of its monetary order of unregulated crypto-currencies. However, its scalability and wide accessibility may be hampered by a continuation of the existing state. CBDC, if programmable into the blockchain protocols for the dApp economy, can pave the way for the galvanization of commerce and investment. DApp businesses can appeal more directly to mainstream consumers used to fiat currencies, and possibly draw in greater participation. Both businesses and consumers may also prefer the greater familiarity and predictability of the digitalized fiat currency in relation to it being a store of value, a unit of account, and a medium of exchange. Fundraising by dApp developers conducted in CBDC can also be more generally appealing to mainstream retail and institutional investors.

Private cryptocurrencies are unlikely to meet the needs of scale, certainty, and consumer protection in an expansion of the dApp economy. This is because of (1) the lack of governance of the commons of cryptocurrencies affects their key role as a medium of exchange, and (2) the commoditization of cryptocurrencies adversely affects their roles as supplying a unit of account and store of value, which in turn adversely affects their role as a medium of exchange.

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122. See generally Marc Gronwald, *Is Bitcoin a Commodity? On Price Jumps, Demand Shocks, and Certainty of Supply*, 97 J. INT'L MONEY & FINANCE 86 (2019).

123. Emiliios Avgouleas & William Blair, *The Concept of Money in the 4th Industrial Revolution – A Legal and Economic Analysis* (Feb. 17, 2020), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3534701](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3534701).

124. See generally Gronwald, *supra* note 122.

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Hence market-based solutions, such as stablecoins, are being developed. However, as we shall discuss, there are functional and regulatory risks abound for stablecoins.

*1. Weaknesses of Private Cryptocurrencies as Money*

Private cryptocurrencies' weaknesses lie in their commoditization as well as in how their payment functions are governed. As discussed above, cryptocurrency blockchains are supported by protocols for transaction validation and ledger construction. Although these protocols are regarded as essential "governance" structures, many blockchain networks do not offer much more by way of governance institutions beyond those. For example if payment is effected in private cryptocurrency where transactions have on-chain and off-chain legs,<sup>125</sup> disputes that arise in the off-chain leg are not accommodated within internal governance institutions in the blockchain-based network, and users face the problem of the irreversibility of payment.<sup>126</sup> Private law systems may meet users' redress needs in a blockchain-based cryptocurrency transaction but there would be differences among different jurisdictions<sup>127</sup> where private law is applied. Crucially, there could be disputes as to which body of private law may apply based on the location of the transaction, which could comprise a number of on-chain and off-chain legs.

Further the governance of blockchain networks is still being developed in terms of clarifying users' involvement and rights.<sup>128</sup>

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125. Meaning that elements of the transaction cannot simply be performed and completed on-chain, such as where verification of information pre-transaction is required, or where ex-post delivery of goods or performance of services are required physically.

126. See Jared Arcari, *Decoding Smart Contracts: Technology, Legitimacy, & Legislative Uniformity*, 24 FORDHAM J. CORP. & FINANCIAL L. 363, 365 (2019).

127. See generally BLOCKCHAINS, SMART CONTRACTS, DECENTRALISED AUTONOMOUS ORGANISATIONS AND THE Law (Daniel Kraus, Thierry Obrist & Olivier Hari eds., 2019) (discussing extensively the differences in how private law is applied in different jurisdictions for users' redress needs in a blockchain-based cryptocurrency transaction); see also THE LAW OF CRYPTOCURRENCIES (David Fox & Sarah Green eds., 2019).

128. This is an emerging and fragmented landscape, as different dApp communities may adopt different governance rules, and even democratic set-ups can be susceptible to majoritarian control. See Phillip Hacker, *Corporate Governance*

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Blockchain networks foster clusters of power among code developers<sup>129</sup> and miners<sup>130</sup> that can undermine the democratic ethos of permission-less blockchains. If there is abusive or undesirable behavior on a blockchain, for example in the face of a collusive “51% attack”<sup>131</sup> on the blockchain to seize power, the default mode of governance is that selective clusters of users may pursue a hard fork, so as to deviate from the chain and create a separate chain/community. Forking can create uncertainties as to participants’ transactions and assets and it is not necessarily the go-to solution for governing anti-social behavior. Blockchain networks require the development of more sophisticated governance mechanisms and protocols, and reliance on forking can be regarded as relatively “primitive.” The underdevelopment of governance affects rights, obligations, and responsibilities surrounding the core payment function on blockchain networks.

Next, the commoditization of cryptocurrencies began with bitcoin. It was not invented to serve a parallel crypto-economy, but was meant to compete with fiat currency payment systems. Thus, private exchanges arose all over the world<sup>132</sup> in order to offer exchange between bitcoin and fiat currencies. The value for such exchange became determined by social and community sentiment<sup>133</sup> and

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*for Complex Cryptocurrencies? A Framework for Stability and Decision Making in Blockchain-Based Organizations*, in REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES (Philipp Hacker et al. eds., 2019); Wessel Reijers et al., *Now the Code Runs Itself: On-Chain and Off-Chain Governance of Blockchain Technologies*, TOPOI: 1–11 (2018).

129. Christian Catalini & Joshua S. Gans, *Initial Coin Offerings and the Value of Crypto Tokens* (MIT Sloan Res. Paper No. 5347–18, 2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3137213](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3137213).

130. Bronwyn E. Howell, Petrus H. Potgeiter & Bert M. Sadowski, *Open-Source or Open-Slather? Governing Blockchain Applications as Common-Pool Resources* (TPRC47: The 47th Conference on Comm., Info., and Internet Pol’y, 2019), <https://ssrn.com/abstract=3427166>.

131. The 51% attack is a scenario where at least 51% of nodes on the permissionless blockchain collude in order to bring about a seizure of power. See Muhammad Saad et al., *Exploring the Attack Surface of Blockchain: A Systematic Overview 1* (2019), <https://arxiv.org/pdf/1904.03487.pdf>.

132. See, e.g., Coinbase, Bitfinex, and Binance.

133. See Nic Carter, *Cryptoasset Valuation*, in CRYPTOASSETS: LEGAL, REGULATORY, AND MONETARY PERSPECTIVES (Chris Brummer ed. 2019); but see Udo Milkau & Jürgen Bott, *Digital Currencies and the Concept of Money as a*

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speculation,<sup>134</sup> as rudimentary institutions such as capped supply and capped mining rewards do not provide a sufficient informational or institutional environment to regulate prices efficiently.<sup>135</sup> Bitcoin became highly commoditized and its price volatile, mimicking, in several researchers' findings, the prices of exhaustible commodities such as oil.<sup>136</sup> The commoditization of bitcoin has invariably affected other cryptocurrencies even if they have been developed for different purposes. Even newer cryptocurrencies that are geared towards being fundamentally functional, such as ether, have joined the same market for interchangeability with bitcoin, altcoins, and fiat currencies.

The commoditization of the monetary order of the dApp economy can adversely affect cryptocurrencies' roles as units of account and store of value, incentivizing even more speculative trading in them and exchange activity. Volatile prices of cryptocurrencies means that the "real" value of a virtual good or service in the dApp economy is fluctuating constantly, rendering the unit of account function meaningless. Both producers and consumers would constantly be trading in and out of their holdings in order to manage value, resulting in more financialized behavior than is necessary for sustaining commerce. This environment can deter the scalability of the dApp economy as mainstream users may not be willing or able to undertake efforts in order to compensate for the poor monetary qualities of cryptocurrency, and choose not to participate in the commercial aspects of the dApp economy entirely. It may be counter-argued that users can also be drawn to the state of the monetary order, as they can both experience commercial transactions in crypto goods and services while managing the investment aspect of the coins they hold. However, going by F. A. Hayek's assumption that economic agents ultimately want price stability,<sup>137</sup> and the fact that central banks

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*Social Agreement*, 12 J. PAYMENTS STRATEGY & SYS. 213 (2018) (noting the social underpinnings do not confer on such currencies stability, and volatility can still result in how the community perceives and uses the currency, e.g., for illicit purposes).

134. *See generally* Gronwald, *supra* note 122.

135. *See* Nabilou, *supra* note 44.

136. *See generally* Gronwald, *supra* note 122.

137. F.A. HAYEK, DENATIONALISATION OF MONEY: AN ANALYSIS OF THE THEORY AND PRACTICE OF CONCURRENT CURRENCIES (Inst. of Economic Affairs, London, 1976).



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around the world safeguard this as their main mandate, it is unlikely that most users would enjoy the price volatility of their coins meant for transactional purposes,<sup>138</sup> even if a number of them would also desire price volatility for investment arbitrage.

## 2. Stablecoins as Market-based Response

Bottom-up solutions have been developed to satisfy this impossible coincidence of wants—both price stability for crypto commerce and price volatility for crypto investment. These are in the form of stablecoins. Stablecoins are designed to maintain their market values within certain parameters, therefore providing for their price stability.

The ECB<sup>139</sup> has surveyed two key stablecoin techniques, including: (1) maintaining stable values as pegged to or based on collateral, such as certain fiat currencies or even a basket of fiat or crypto-currencies; and (2) maintaining stability by automated protocols that respond to excess demand or supply of coins, therefore performing central-bank like monetary functions. Protocols could be coded to trigger airdrop when supply needs to be boosted. If contraction of supply is desirable, protocols can be coded to incentivize users to “lock” or sell coins for a fee in order to build up “reserves,” and reserves can be used to purchase coins on the market for lock-up or burning in order to reduce the monetary supply.<sup>140</sup>

The first technique would give rise to stablecoins as hedging instruments for cryptocurrency users. However, stablecoins may not be well integrated as programmable currency in the blockchain protocol. The second technique requires more complex programming for the native currency of the blockchain.<sup>141</sup> Empirical research has

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138. Avgouleas & Blair, *supra* note 123.

139. Bullman, Klemm & Pinna, *supra* note 10.

140. This is the model for Basis, a stablecoin, but Basis has since shut down in December 2018. See Brady Dale, *Basis Stablecoin Confirms Shutdown, Blaming 'Regulatory Constraints,'* COINDESK (Dec. 13, 2018), <https://www.coindesk.com/basis-stablecoin-confirms-shutdown-blaming-regulatory-constraints>.

141. Ingolf Gunnar Anton Pernice et al., *Monetary Stabilisation in Cryptocurrencies - Design Approaches and Open Questions* (Crypto Valley Conference on Blockchain Technology, IEEE, 2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3398372](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3398372).

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found the second technique to be less than successful in achieving stability in value.<sup>142</sup> For example, Ampleforth<sup>143</sup> is an algorithmically-managed stablecoin whose values are adjusted by demand-side information that is constantly updated. However, although it purports to be self-adjusting and uncorrelated with bitcoin and ether's market volatility, its own price has fluctuated in a similar pattern to the more volatile cryptocurrencies. Further, Yam—a “decentralized finance” experiment attempting to offer an algorithmic stability mechanism for its coin against the U.S. dollar, was initially greeted in the crypto-economy with much hope. However, a serious bug was ultimately discovered shortly after a successful round of token offering, leading to the entire project being written off.<sup>144</sup>

Stablecoins based on collateralization are much more popular, but their relationships with fiat currencies and other financial assets means that they would not be left in a regulatory lacuna.<sup>145</sup> Such regulatory developments have arguably been triggered by the proposed introduction of Libra—which has now been rebranded as Diem—by a consortium led by Facebook.

Libra is to be issued by the Libra Association based in Geneva, Switzerland, of which Facebook is a founding member.<sup>146</sup> The Association's initial plan was to develop a global payments blockchain that facilitates payment in a private stablecoin. The

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142. There is evidence of increasing refinement and innovation. See David Cerezo Sánchez, *Truthful and Faithful Monetary Policy for a Stablecoin Conducted by a Decentralised, Encrypted Artificial Intelligence* (Sept. 2019), <https://arxiv.org/abs/1909.07445>.

143. See, e.g., Ampleforth, available at <https://www.ampleforth.org>.

144. Jamie Redman, *Defi Implosion: YAM Token Market Cap Plummets to Near Zero Founder After Claims He 'Failed,'* BITCOIN.COM (Aug. 13, 2020), <https://news.bitcoin.com/defi-yam-token-market-plummets-near-zero-founder-failed/>.

145. Financial Stability Board, *Addressing the Regulatory, Supervisory and Oversight Challenges Raised by “Global Stablecoin” Arrangements* (Apr. 14, 2020), <https://www.fsb.org/wp-content/uploads/P140420-1.pdf>.

146. Libra was recently renamed as “Diem.” See The Diem Association, *Announcing the name Diem. Executive leadership in place in preparation for launch*, DIEM (Dec. 1, 2020), <https://www.diem.com/en-us/updates/diem-association/>; see also Nikhilesh De, *Libra Rebrands to 'Diem' in Anticipation of 2021 Launch*, COINDESK (Dec. 1, 2020), <https://www.coindesk.com/libra-diem-rebrand>. This Article uses the terms Libra and Diem interchangeably.

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stablecoin would be issued in return for fiat currency that is held in a reserve backed by low-risk assets such as deposits and government securities in order to ensure each Libra coin would be fully backed and stable in value.<sup>147</sup> The reserve would be managed by asset managers and custodians subject to the Association's oversight. Transactions in Libra would be validated by the founding members who are the validator nodes on the blockchain. Despite this set-up being a blockchain, it would be centrally managed by the Association, which extracts rent from users on an ongoing basis. This would not be fully distributed unlike in other private cryptocurrency blockchains. The attraction for the dApp economy would be if Libra could be a stablecoin programmable with existing blockchain protocol. Nevertheless, although Libra is written as open source code and dApp developers are welcome to adopt it, they are likely to converge upon the programming language for Ethereum as the network effects of the Ethereum blockchain merely reinforce these. Libra is also more likely regarded as shackled to the old corporate economy.

As Facebook is in a position to galvanize 2 billion users to participate in Libra, the potential scalability has drawn regulators' attention to it. Financial Stability Board Chair Randall Quarles and Bank of England Governor Mark Carney have warned that the use of Libra could generate systemic risk,<sup>148</sup> a warning that has not been aimed at the crypto-economy so far.<sup>149</sup> Researchers have modeled the potential for stablecoins like Libra to attract substantial inflows of retail funds and warn of severe risks to bank funding as well as investor protection and financial stability risks if the management of stablecoins should experience impaired balance sheets or a liquidity

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147. See The Diem Association, *Economics and the Reserve*, DIEM, [https://libra.org/en-US/about-currency-reserve/#the\\_reserve](https://libra.org/en-US/about-currency-reserve/#the_reserve) (noting the recent name change and that the content of the Libra White Paper v2.0, which was published in April 2020, may differ based on regulatory approvals or other considerations, and may evolve over time).

148. Kiran Stacey & Caroline Binham, *Global regulators deal blow to Facebook's Libra currency plan*, FINANCIAL TIMES (June 25, 2019), <https://www.ft.com/content/0c1f3832-96b1-11e9-9573-ee5cbb98ed36>.

149. Mark Carney, Letter as Chair of the Financial Stability Board to the G20 Finance Ministers and Central Bankers (Mar. 13, 2018), <http://www.fsb.org/wp-content/uploads/P180318.pdf>.

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run.<sup>150</sup> Coming under enormous regulatory pressure, Facebook has tweaked its Libra business model.<sup>151</sup> It now proposes to issue Diem tokens against major fiat currencies to be used in a permissioned payment system across the globe. This may mean that the payment system would function more like an international remittance system rivaling other social media-based payment systems, such as the Chinese WePay. This would make the Diem system more removed from being likely to interface with the dApp economy.<sup>152</sup> The Financial Stability Board<sup>153</sup> (“FSB”) has also now explicitly encouraged financial regulators all over the world to subject stablecoins to regulation, in particular those with large market impact, whether by categorizing within existing financial regimes or introducing law reform.

The European Commission has now issued a proposal<sup>154</sup> to regulate “asset-referenced” stablecoins, treating them as a *suis generis* type of financial product. Their offers would be subject to authorization and mandatory disclosure, and issuers are subject to prudential requirements and regulatory standards in terms of how reserves are managed, audited, disclosed, and how holders’ rights are defined and protected. Collateralized stablecoins in the market would need to prepare for regulatory compliance and it is uncertain if their

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150. Mitsutoshi Adachi et al., *A Regulatory and Financial Stability Perspective on Global Stablecoins*, EUROPEAN CENTRAL BANK (May 5, 2020), [https://www.ecb.europa.eu/pub/financial-stability/macprudential-bulletin/html/ecb.mpbu202005\\_1~3e9ac10eb1.en.html#toc1](https://www.ecb.europa.eu/pub/financial-stability/macprudential-bulletin/html/ecb.mpbu202005_1~3e9ac10eb1.en.html#toc1).

151. Hannah Murphy & Izabella Kaminska, *Facebook’s Libra overhauls core parts of its digital currency vision*, FINANCIAL TIMES (Apr. 16, 2020), <https://www.ft.com/content/23a33fcb-1342-4a18-be39-504e8507f752>.

152. Nick Statt, *Facebook is shifting its Libra cryptocurrency plans after intense regulatory pressure*, VERGE (Mar. 3, 2020), <https://www.theverge.com/2020/3/3/21163658/facebook-libra-cryptocurrency-token-ditching-plans-calibra-wallet-delay>.

153. Financial Stability Board, *Regulatory, Supervisory and Oversight Challenges Raised by “Global Stablecoin” Arrangements* (Oct. 13, 2020), <https://www.fsb.org/2020/10/regulation-supervision-and-oversight-of-global-stablecoin-arrangements/>.

154. European Commission, *Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-Assets, and Amending Directive (EU) 2019/1937* (Sept. 2020), [https://ec.europa.eu/finance/docs/law/200924-crypto-assets-proposal\\_en.pdf](https://ec.europa.eu/finance/docs/law/200924-crypto-assets-proposal_en.pdf) [hereinafter European Commission Proposal 2020].

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business models would be radically affected, and whether users and issuers would find access to collateralized stablecoins too costly.

The Commission's proposal purports to capture stablecoins collateralized against fiat currencies, commodities, and even crypto-assets. Popular stablecoins such as Tether, dai, and Diem would be affected. To date, the stablecoin with the greatest market capitalization<sup>155</sup> is Tether collateralized against U.S. dollar and euro reserves, and also the Chinese yuan.<sup>156</sup> Tether Limited, its issuer would need to be authorized and be subject to approval based on a number of conditions, in order to make its stablecoin available to purchasers from the European Union. These conditions include inter alia, regulatory vetting of enterprise governance, repute of management and controllers, and continuing regulatory requirements in relation to minimum capitalization of at least €2 million or 2 percent of its reserves, as well as continuing organizational, business continuity, holder protection, audit, and complaint handling regulations.

Holders of tether treat it largely as an investment product to hedge against bitcoin, and perhaps they may welcome the regulatory standards. However, it is queried if issuers can charge an "investment management" cost, a revenue model that does not currently exist. Tether Limited currently benefits from trades in tether pairs such as on its allegedly related Bitfinex crypto-exchange.<sup>157</sup> Further, regulating asset-referenced stablecoins would adversely affect their potential to become a means of payment, as e-money tokens are regulated differently and subject to either bank or electronic money issuer regulation in the European Union.<sup>158</sup> Such a regulatory design is arguably aimed at corporatized issuers, like the Diem Association,<sup>159</sup> and based excessively on assumptions regarding the dominance of activities of investment management.

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155. See Tether, COINMARKETCAP, <https://coinmarketcap.com/currencies/tether/> (displaying data as of Sept. 27, 2020).

156. See, e.g., Tether, available at <https://tether.to>.

157. Michael Kapilkov, *Bitfinex Is Constantly Printing More Tether, None of It Has Ever Been Burned*, COINTELEGRAPH (May 27, 2020), <https://cointelegraph.com/news/bitfinex-is-constantly-printing-more-tether-none-of-it-has-ever-been-burned>.

158. European Commission Proposal 2020, *supra* note 154.

159. See The Diem Association, *supra* note 147.

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The Commission's proposal would pose challenges for dai—a stablecoin issued by MakerDAO. Users are able to create dai by locking up an amount of ether in a smart contract that creates a vault. Dai is a collateralized stablecoin against ether and other Ethereum-based tokens, soft-pegged against the U.S. dollar.<sup>160</sup> In order to compensate for the volatility of ether, users need to adjust their levels of collateralization based on the ether-USD volatility. Fluctuations in ether would mean the need to over-collateralize in order to maintain the holdings of dai or else an automated protocol can be triggered to liquidate the collateral in the vault. It has been reported that the collateralization ratio can be as high as 300 percent.<sup>161</sup> However, it seems that MakerDAO development of dai is not only as a hedging instrument against ether volatility, and its business model seems dissimilar from Tether's which advances trading in pairs and Tether's hedging function. MakerDAO encourages users of dai not to trade in and out of dai for speculation, but to hold dai, by saving in an app with a savings rate.<sup>162</sup> Further, automated protocols stabilize dai against speculation by incentivizing nodes to make markets in dai to moderate levels of demand.<sup>163</sup> As a whole, these aspects advance the purposes of dai becoming a trust-building and self-sustaining private cryptocurrency. Although its collateralization and stabilization protocols are now crucial to its credibility, it can be argued that dai's stability mechanisms premised upon collateralization may be a transition phase. It is necessary now for dai to be transformed from ether, the productive cryptocurrency of the Ethereum blockchain. However, if sufficient dai enter into circulation so that the value of dai may be maintained by protocols regarding demand and circulation, then the value of collateralization may become moot. This would be similar to the uncoupling of established fiat currencies from being backed by gold. In sum, dai's ultimate development could lie in its

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160. *The Maker Protocol: MakerDAO's Multi-Collateral Dai (MCD) System*, MAKER FOUNDATION, <https://makerdao.com/en/whitepaper#use-of-the-mkr-token-in-maker-governance>.

161. Amani Moin, Emin Gün Sirer, & Kevin Sekniqi, *A Classification Framework for Stablecoin Designs* (Cornell U. & AVA Labs, 2019), <https://arxiv.org/pdf/1910.10098.pdf>.

162. *Id.*

163. *Id.*

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adoption as the trusted stable private cryptocurrency on the Ethereum blockchain.

In regulating dai narrowly as a financial asset focused on reserve and investment management, and subject to investors' rights of valuation and redemption, regulators are likely to force compliance that may undermine the multifaceted features of the stablecoin, such as the payment and savings aspects. The European Union's regulatory proposal seems likely to hamper the crypto-economy's bottom-up efforts in developing its monetary order. Further, MakerDAO would also face difficulties in securing authorization under the proposal as it may not be a legal organizational form recognized in any Member State. Decentralized Autonomous Organizations ("DAOs")<sup>164</sup> purport to be hierarchically flat, governed by automated protocols and do not subscribe to a corporate structure. In this manner, the imposition of "management-like" duties upon "responsible persons" in the DAO may be ill-fitting.

The regulatory risk for stablecoins pose challenges for their seamless adoption in the monetary order of the crypto-economy, although well-intentioned investor protection objectives underpin their regulation. The FSB's announcement and the European Union's regulatory proposal show that regulatory attention is very much focused on the stablecoin as a financial product and emphasis is placed on the familiar financial risks that entail from the selling, conduct of business, risk management, and governance aspects relating to the stablecoin. Hence, the stablecoin is not looked at in terms of its functions in the dApp economy. This narrow approach to stablecoins would unlikely resolve the needs of the dApp economy in terms of its monetary order.<sup>165</sup>

In light of the regulatory risks that surround private stablecoins, it may be argued that developing a digitally programmable fiat currency for the dApp economy may be the preferred way forward. In the United States, two registered money service businesses Circle and Coinbase, which is also a cryptocurrency exchange, have launched a

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164. Christopher Jentzsch, *The History of the DAO and Lessons Learned*, SLOCK.IT BLOG (Aug. 24, 2016), <https://blog.slock.it/the-history-of-the-dao-and-lessons-learned-d06740f8cfa5>; see also Ori Oren, *ICO's, DAO'S, and the SEC: A Partnership Solution*, 2018 COLUM. BUS. L. REV. 617, 619 (2018).

165. See generally Iris H-Y Chiu, *Pathways to European Policy and Regulation in the Crypto-economy*, 10 EUR. J. RISK & REG. 738 (2019).

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“USD Coin,” i.e., a digital version of the U.S. dollar to be fully programmable in blockchain-based applications.<sup>166</sup> This could arguably be the ultimate stablecoin for the U.S. market or even the global market, given the reserve currency status of the U.S. dollar. However, such a digital currency is likely the equivalent of electronic money in the European Union,<sup>167</sup> and the soundness of the USD Coin depends on the solvency of the issuer as it is a claim upon the issuer. CBDC would be superior in quality to privately issued electronic fiat money.

It can be queried whether algorithmically-managed stablecoins may be the way forward for the dApp economy to implement a private means of cryptocurrency payment that remains unregulated but is able to meet users’ needs in terms of monetary qualities. Under the E.U. Commission’s proposal, algorithmically-managed stablecoins would unlikely fall within the stringent regulatory regime for asset-referenced stablecoins, but their offers may need to comply with offer regulation which demands mandatory disclosure in a white paper. Such regulation would however not be a regime of continuous investment management regulation, like that imposed on asset-referenced stablecoin issuers. This Article is sceptical that algorithmically-managed stablecoins may be able to meet users’ needs’. In order to meet users’ needs of monetary stability, even if it is relative and not absolute stability, we may turn to major global currencies to discern the underpinnings for their relative stability.<sup>168</sup> Major global currencies are managed by central banks, many of which are committed to price stability, even if their mandates can be influenced by policy needs from time to time.<sup>169</sup> This is largely due to

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166. See, e.g., Circle, available at <https://www.circle.com/en/#>.

167. Electronic Money Directive, Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No. 1093/2010, and repealing Directive 2007/64/EC [hereinafter E.U. Electronic Money Directive].

168. Mark Sobel, Major foreign exchange pairs hold steady, OFFICIAL MONETARY & FINANCIAL INST. FORUM (OMFIF) (May 29, 2020), <https://www.omfif.org/2020/05/major-foreign-exchange-pairs-hold-steady/>.

169. See generally Jeffrey A. Frieden, *Real Sources of European Currency Policy: Sectoral Interests and European Monetary Integration*, 56 INT’L ORGANISATION 831 (2002).



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the underpinnings of free and open trading, usually in large, deep, and liquid markets. Although currency trading has been dogged by manipulation scandals,<sup>170</sup> swift enforcement,<sup>171</sup> and the forces of broad and liquid markets, trading provides balance to the price formation of major global currencies. A key risk in the price formation for algorithmically-managed cryptocurrency is whether and how the underpinnings for stability management may be manipulated. In the case of Ampleforth, for example, the purported relative stability of the coin is maintained by reflecting demand side information. It is questioned whether demand side information can be manipulated, especially by large holders, whose incentives in using these tokens, for example as swap assets, could affect their demand behavior. Market manipulation, even in large and deep securities markets, is often regulated by prohibitive standards and regulatory enforcement.<sup>172</sup> If algorithmically-managed cryptocurrencies are neither supported by large and liquid trading markets or the regulation of market manipulation, their credibility may not be scalable. However, it is a chicken-and-egg problem for such cryptocurrencies, as large and liquid trading markets for them are generally developed after they are able to achieve scalability and widespread adoption.

Although the European Union's proposal to regulate asset-referenced cryptoassets would not apply to algorithmically-managed stablecoins, hence sparing them of the onerous obligations akin to investment management regulation, all cryptoassets offered in the European Union would be subject to public offer and mandatory disclosure regulation.<sup>173</sup> In particular, mandatory disclosure is required of the technological protocols and how they work, in relation

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170. Sebastian Chrispin, *Forex scandal: How to rig the market*, BBCNEWS (May 20, 2015), <https://www.bbc.com/news/business-26526905>.

171. Daniel Schäfer, Caroline Binham & Kara Scannell, *Regulators slap \$4.3bn fines on six banks in global forex probe*, FINANCIAL TIMES (Nov. 12, 2014), <https://www.ft.com/content/aa812316-69be-11e4-9f65-00144feabdc0>.

172. See, e.g., Regulation (EU) No. 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation) and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC, art. 12 (focusing on strict liability for effects caused by abnormal trading practices) [hereinafter E.U. Market Abuse Regulation 2014]; see also *Winterflood Securities Ltd & Ors v The Financial Services Authority* [2010] EWCA Civ 423.

173. See *infra* Part III, Section C, subd. (2).

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to framing the expectations and rights of users. It is queried whether algorithmically-managed stablecoins may be susceptible to complex programming that needs to be adjusted during development, and are less susceptible to either comprehensive disclosure (which jeopardizes regulatory compliance with the cryptoasset offer regulations) or may attract investors' *ex post* litigation for deviations, even if made with good intentions as part of code development. The European Union's fitting of algorithmically-managed stablecoins within a general cryptoasset definition that caters more for utility-type tokens poses regulatory hazards for these coins. At this juncture, this Article doubts that algorithmically-managed stablecoins would provide the ultimate privately-driven solution to the dApp economy's monetary order.

In this light, CBDC can be considered in terms of its enabling effect in the dApp economy, in relation to providing dApp developers and users with a choice that mitigates their financial risk and is supportive of the dApp economy's development. This would be premised upon partnership between the public and private sector, such as with Ethereum developers, in developing CBDC's programmability.

Some dApp developers may, however, hold the view that the dApp economy should *not* be integrated with the mainstream economy and should be "sovereign resistant."<sup>174</sup> DApp developers may prefer an "anarcho-capitalist ethos"<sup>175</sup> that allows them to carve out an economic space unshackled from conventional economic, legal, political, and social institutions.<sup>176</sup> In this manner, the issuance of a CBDC programmable for the dApp economy may be unwelcome as the dApp economy may be perceived to be a space described by Schrepel<sup>177</sup> as deliberately designed to facilitate choice for those who wish not to be subject to the rule of law. However, this may not be a universal view held in all quarters. First, in a survey of token offerings made by dApp developers, it mentions that developers could offer a

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174. Brady Dale, *Libra Scales Back Global Currency Ambitions in Concession to Regulators*, COINDESK (Apr. 16, 2020), <https://www.coindesk.com/libra-scales-back-global-currency-ambitions-in-concession-to-regulators>.

175. *See generally* Flood & Robb, *supra* note 5.

176. *See generally* Schrepel, *supra* note 4.

177. *Id.*

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choice of acceptance in fiat or cryptocurrency.<sup>178</sup> This demonstrates that some developers would like to appeal more broadly to investors.<sup>179</sup> Second, the popularity of collateralized stablecoins against fiat currencies reflects the underlying need of dApp developers to mitigate cryptocurrency volatility and the adverse impact on them. The reliance on leading fiat currencies reflects the inherent unsustainability in simple resistance against conventional institutions. In putting to the test the win-win proposal for dApp developers and central banks keen on implementing a CBDC, this Article proposes that a limited rollout to enable CBDC to support investment in the dApp economy is an appropriate first step. We would be able to observe at least the following effects for further development: (1) the effects of CBDC upon payment competition in the dApp economy; (2) mainstream demand for investment and consumption in the dApp economy; (3) the integration of the crypto-economy into the mainstream; and (4) the levels of growth in dApp enterprises and of what types.

The market-based governance of the dApp economy is unlikely to foster a solution to its monetary order that would appeal broadly to social trust. Social trust is more effectively supported by institutional qualities beyond merely market-based governance. We argue that CBDC mediates the institutional connection to the dApp economy that is needed for its further development and mobilization. The trajectory towards growth, development, and mobilization in the dApp economy is an inevitable one as more prosumers are keen to join the space. In this manner, it would be increasingly untenable for this space to be fringe and unregulated, institutionally disembodied or incompatible. If a household experiments with culinary exploits and treats its private members and neighbors, it may be *ad hoc* and unregulated. But where it gains popularity and scale, and its culinary exploits are accessed by more and on a regular basis, it would be untenable not to consider if it should be recognized as a restaurant, therefore needing to conduct itself with a measure of institutionally expected standards of safety and hygiene. In an analogous manner, the fringe and experimental

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178. Sabrina Howell, Marina Niesser & David Yermack, *Initial Coin Offerings: Financing Growth With Cryptocurrency Token Sales*, NAT'L BUREAU OF ECON. RES. (Sept. 2019), <http://www.nber.org/papers/w24774>.

179. *Id.*

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nature of the dApp economy has progressed to a point of significant growth and development, and maturation would likely be facilitated by reconciling with institutional framing. We argue that issuing CBDC for the specific purpose of investment in the dApp economy is a crucial starting point. By situating the policy for CBDC within a broader theoretical framework of regulatory capitalism, it explains the need for any capitalist order that is well-functioning to be governed appropriately.

*D. CBDCs as Lynchpin for the Development of the DApp Economy:  
The Paradigm of Regulatory Capitalism*

The broader theoretical framework for the role of CBDCs is regulatory capitalism, which explains why apparently free-market or private sector-led activity is inextricably connected with and underpinned by public sector institutions, notably institutions of law and regulation. The scaling up, mobilization, and galvanization of the dApp economy needs social acceptance and penetration into the mainstream. Public sector institutions, such as the legal tender status of the CBDC, are able to provide facilitative support and regulative underpinnings that are essential for social trust.

In the history of Anglo-American capitalism, the promotion of free and liberal markets is seen to be necessary for individual freedoms and success, but free markets have been underpinned by regulatory capitalism. “Regulatory capitalism” is defined as a symbiotic division of “labor” between the state and the private sector where the role of the state in economic policy is that of “steering” while the private sector is responsible for “rowing.”<sup>180</sup> *Rowing* depicts the work of actual service provision and technological innovation that is carried out by the private sector as commercial and business activity, while *steering* refers to setting policy in order to influence, govern, or incentivize behavior or output in relation to *rowing*.<sup>181</sup> The objectives of regulation are to steer away from the problems that unbridled markets give rise to, such as market failures and providing collective goods. Such intervention nevertheless supports markets so

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180. See David Levi-Faur, *The Global Diffusion of Regulatory Capitalism*, 598 THE ANNALS OF THE AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE 12 (2005); JOHN BRAITHWAITE, *REGULATORY CAPITALISM* (2008).

181. See generally BRAITHWAITE, *supra* note 180.

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that they can work optimally. Regulatory capitalism arguably provides a theoretical underpinning for the building of the European Single Market too, opined by some as a neo-liberal project but crucially embedding the unique ordoliberal ethos<sup>182</sup> that places the flourishing of innovative economic activity within social order and well-being.

In this manner, policy and design of regulation for the dApp economy is targeted at integrating such economic developments within an institutional fabric. This does not mean that a “coherentist” approach<sup>183</sup> is taken in reconciling, interpreting or extending existing bodies of law and regulation to the dApp economy however ill-fitting, such an approach being counterproductive to the building up of this economic sphere and facilitating its orderly development. The recognition that policy is needed for steering the rowing activities of the dApp economy means that we can consider its needs as the starting point for the establishment of appropriate legal institutional architecture. This starting point in no way ensures that legal or regulatory outcomes are final and not experimental. As Michèle Finck argues,<sup>184</sup> legal innovation is often necessary to accompany significant technological innovation and disruption.

It is acknowledged, however, that regulators often approach an innovation with their “baggage” of assumptions that have been applied to existing industry business models, processes, or products. This may be due to an unchanging mandate or scope of jurisdiction conferred upon regulators, compelling regulators to fit innovations within their ontologies, rather than to determine if sufficient novelty has developed to warrant different taxonomies and approaches.<sup>185</sup> It is arguable that the spirit of regulatory capitalism is not shackled to such incremental assumptions. As Cristie Ford argues, innovation can be “sedimentary” or “seismic,” referring to the scale of different, impact of change, and structural effects that types of innovation can bring

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182. See generally ORDOLIBERALISM, LAW AND THE RULE OF ECONOMICS (Josef Hien & Christian Joerges eds., 2017) (discussing ordoliberal ethos).

183. See ROGER BROWNSWORD, LAW, TECHNOLOGY AND SOCIETY 191–196 (2019) (referring to a legal mindset that seeks to first fit new phenomena within the frameworks of existing legal ontologies).

184. See generally Michèle Finck, *Blockchains: Regulating the Unknown*, 19 GERMAN L.J. 665 (2018).

185. See Syren Johnstone, *Taxonomies of Digital Assets: Recursive or Progressive*, 2 STAN. J. BLOCKCHAIN L & POL’Y 1 (2019).

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about for the economy and society.<sup>186</sup> Regulators need to be able to respond to either and a “coherentist” approach is not assumed in furthering regulatory capitalism.

Other scholars argue that innovation often entails “boundary” challenges for law and regulation as unregulated entities perform the equivalent of regulated activities or regulated entities undertake new and unregulated activities, raising questions for an appropriate institutional response.<sup>187</sup> In the dApp economy, there is also potential “smashing” of boundaries as unregulated entities undertake new and innovative unregulated activities which nevertheless attract concerns in relation to how the commons of such activities need to be governed.<sup>188</sup> Hence, the theoretical location of the dApp economy in regulatory capitalism does not mean the stultification of innovation by the extension of stale laws or regulations to novel phenomena. Rather, an opportunity arises for new negotiation of the social contract regarding the integration of this space into the social and economic fabric.

Next, we turn to the mechanics of introducing the CBDC in the dApp economy using the central bank digital euro as a proposed experiment in the European Single Market.

### III. CENTRAL BANK DIGITAL EURO AS AN EXPERIMENT FOR LIMITED ROLLOUT IN THE DAPP ECONOMY OF THE SINGLE EUROPEAN MARKET

The most significant economic activity in the dApp economy is fundraising for dApp development projects, known as “initial coin offerings” (“ICOs”). Developers of a dApp business project typically offer tokens in return for cryptocurrency from supporters. These are the application tokens envisaged to be used on the dApp when the

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186. See CRISTIE FORD, INNOVATION AND THE STATE: FINANCE, REGULATION, AND JUSTICE 166–236 (2017).

187. See, e.g., Charles A. E. Goodhart & Rosa M. Lastra, *Border Problems*, 13 J. INT’L ECON. L. 705 (2010).

188. A commons is relevant for blockchain-based networks as there may be collective goods apart from the protocols relating to transaction validation and ledger construction that require addressing, such as dispute resolution. See Sinclair Davidson, Primavera De Fillippi & Jason Potts, *Blockchain and the Economic Institutions of Capitalism*, 14 J. INSTITUTIONAL ECON. 639 (2018). See generally ELINOR OSTRÖM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990).

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project finally goes live. Token offerings are “pre-incorporation” in nature, meaning that they are held ahead of any business development. The fundraising is premised upon a business idea and developers’ plans as to how the idea should be technologically executed. This is a novel point in time for business fundraising, as securities fundraising is usually premised upon a degree of maturity of the company and even venture-capitalists that fund start-up stages are facing usually an already-incorporated company with perhaps some initial operations.<sup>189</sup>

Tokens confer a variety of consideration in return for supporters’ funds. For example, utility tokens confer on subscribers a future right to use or enjoy certain services,<sup>190</sup> and resemble a pre-sale of yet-to-exist rights or services. However, these come in a different variety in terms of whether they may be user-based, or include other participation rights.<sup>191</sup> “Fun” tokens may confer a benefit to the community at large or to another without consideration.<sup>192</sup> Investment tokens confer on subscribers a right to participate in a form of investment and risk being classified as falling foul of existing financial markets or securities regulation.<sup>193</sup>

The pre-sale of tokens comes close to resembling established practices for corporate fundraising, which is regulated under many jurisdictions’ securities regulation regimes. However, it can be argued

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189. Bob Zider, *How Venture Capital Works*, HARVARD BUS. REV. (1998), <https://hbr.org/1998/11/how-venture-capital-works> (noting the relative rarity of venture capital funds investing in start-up and very young stages of companies); Dirk Engel & Max Keilbach, *Firm-level Implications of Early Stage Venture Capital Investment — An Empirical Investigation*, 14 J. EMPIRICAL FINANCE 150 (2007).

190. Zider, *supra* note 189.

191. See generally Carol Goforth, *Securities Treatment of Tokenized Offerings under U.S. Law*, 46 PEPPERDINE L. REV. 405 (2019).

192. Dirk Zetzsche et al., *The ICO Gold Rush: It’s a Scam, it’s a Bubble, it’s a Super Challenge for Regulators* (University of Luxembourg Law Working Paper No. 11/2017, UNSW Law. Res. Paper No. 17–83, University of Hong Kong Faculty of Law Res. Paper No. 2017/035, European Banking Institute Working Paper Series 18/2018, Harvard Int’l L.J. Vol. 63, No.2, 2017), <http://ssrn.com/abstract=3072298>.

193. U.S. Securities & Exchange Commission, *Report of Investigation Pursuant to Section 21(A) of the Securities Exchange Act of 1934: The DAO* (July 25, 2017), <https://www.sec.gov/litigation/investreport/34-81207.pdf> [hereinafter SEC Report]; SEC Guidance 2018, *supra* note 91.

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that ICOs are a different beast altogether,<sup>194</sup> and such pre-sales are necessary in order to generate interest in and support for the project under development, which would ultimately become a distributed marketplace dependent on network effects.<sup>195</sup> Such pre-sales may also co-opt users into a space of co-developing the experimental software for the blockchain-based business in order to fix its bugs and refine it for ultimate launch.<sup>196</sup> Most developers insist that such sales are characterized as sales of future goods or services.<sup>197</sup> Needless to say, the investor protection concerns in this phenomenon have drawn securities regulators' attention to the area.<sup>198</sup>

The U.S. Securities and Exchange Commission ("SEC") has in particular taken a stringent approach to classifying most token offers as securities offers.<sup>199</sup> The European Commission has also proposed to treat offers of crypto-assets as financial assets that should be subject to a regime of mandatory disclosure and civil liability for misleading or false information.<sup>200</sup> The advent of regulatory treatment of this area makes it timely for thinking about a different way forward. The regulatory approaches may be regarded as being too path-dependent on assumptions and approaches appropriate for different business models and products. There is arguably insufficient consideration of

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194. Philipp Hacker & Chris Thomale, *Crypto-Securities Regulation: ICOs, Token Sales and Cryptocurrencies under EU Financial Law*, 15 EUROPEAN CO. & FINANCIAL L. REV. 645 (2018); Lewis Rinaudo Cohen, *Ain't Misbehavin': An Examination of Broadway Tickets and Blockchain Tokens*, 65 WAYNE L. REV. 81 (2019).

195. Wulf A. Kaal, *Crypto-Economics- The Top 100 Token Models Compared* (2018), <https://ssrn.com/abstract=3249860>.

196. Saman Adhami, Giancarlo Giudici & Stefano Martinazzi, *Why do Businesses Go Crypto? An Empirical Analysis of Initial Coin Offerings*, 100 J. ECON. & BUS. 64 (2018) (noting that these types of ICOs are most likely to succeed).

197. See, e.g., The SAFT Project, available at <https://saftproject.com/> ("SAFT," or Simple Agreement for Future Tokens, has been developed as a template for ICO offerings clarifying that sales are of tokens for future use); see also Jiri Chod & Evgeny Lyandres, *A Theory of ICOs: Diversification, Agency, and Information Asymmetry* (2018), <https://ssrn.com/abstract=3159528>.

198. Iris H-Y Chiu, *Decrypting the Trends of International Regulatory Competition in Crypto-finance*, 7 EUR. J. COMP. L. & GOVERNANCE 297 (2020) (comparing securities regulators' responses to token offerings in a range of different jurisdictions).

199. SEC Guidance 2018, *supra* note 91.

200. European Commission Proposal 2020, *supra* note 154.



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the pre-development nature of token sales and the likely unsuitability of a mandatory disclosure regime for regulation, premised upon assumptions that all information is clear and conveyable to potential investors. Further, although the European Commission purports to mobilize crypto-asset offers by allowing developers to market offers across the European Union if they comply with the regulation, there is little thought in whether such mobilization would work if investors need to access private cryptocurrency to engage with the offers. Hence, what is missing is arguably regulatory thinking for an enabling institution that bridges investors' with dApp developers' needs. Drawing upon the theoretical framing of regulatory capitalism allows us not only to think of the regulative aspects of the dApp economy as a new economic order but also the enabling aspects in law and regulation.<sup>201</sup> This Article proposes that a key enabling institution is a starting and limited issuance of CBDC as tokens in exchange for investors' cash, for the specific channeling of investment to dApp developers raising finance for project development.

This limited proposal serves a few objectives. First, it is poised to map demand possibly at uneven levels across the euro area for CBDC in relation to the dApp economy. Second, it supports and mobilizes policy thinking on the "securities regulation" of token offerings, but not in a siloed manner, as relevant regulators and the central bank could take advantage of such an intersection to engage in interagency dialogue and knowledge exchange with each other, ultimately supporting the evolution of new institutional responses or architecture.<sup>202</sup> Third, as dApp developments are aimed towards becoming a live business, the facilitative role of CBDC for investment into the crypto-economy brings about further intersections with a wider mosaic of business and commercial law and regulation, in order to serve wider economic facilitation purposes as well as regulative purposes. In other words, the starting point of CBDC as facilitating investment into a predevelopment dApp economy galvanizes and mobilizes the policy mosaic for the dApp economy.

This Article proposes that CBDC should be issued in a token-based design for a limited rollout. CBDC should be issued as digital

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201. See generally Barak Orbach, *What is Regulation?*, 30 YALE J. REGULATION ONLINE 1 (2012).

202. See *infra* Part III, Section C, subd. (4).

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tokens against physical or digital cash tendered by individuals for the purposes of investing in the crypto-economy. In this manner, the public sector provides the facilitating institution of the CBDC while the private sector provides both the opportunities for dApp economy investment and the rise of private sector industries such as token custodial services that would implement the limited rollout policy. It is envisaged that such service providers would be subject to regulation, as discussed below.

CBDC should not be issued under an account-based design in the limited rollout proposal. In an account-based design, the central bank would have to provide a fundamentally new service akin to a brokerage account for investors, raising issues of customer-protection roles as custodial agents and brokerage functions vis-à-vis dApp issuers. Further, as the CBDC should be an enabling mechanism for dApp economy investment, it is best that such investment interfaces be provided by private sector services so that the investing public may not be confused as to the central bank's role and mistakenly treat the central bank as warranting the quality of such investments. In this manner, the limited rollout proposal also supports the European Commission's overall policy of building out a pan-European digital market, especially in terms of capital formation. In playing a mobilizing role for the dApp economy, the limited rollout of CBDC supports the building of the dApp economy within the Commission's new action plan for the Capital Markets Union.<sup>203</sup> In this new action plan, the Digital Finance Package<sup>204</sup> is a building block to help small and medium sized enterprises gain access to fundraising outside of the traditional bank finance channels, while at the same time promoting digital transformation in the Single Market.

In a token-based design, an investor would have to show that the exchange for CBDC is for investment purposes, and custodial agents would hold issued CBDC on trust for their respective account-holders in order to commit the funds to regulated dApp issues. These custodial services can generate the public and private key pairs for each investor's account and receive CBDC credited by the central bank for

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203. Capital Markets Union Action Plan, *supra* note 76.

204. See European Commission, *Communication: Digital Finance Package* (Sept. 24, 2020), [https://ec.europa.eu/info/publications/200924-digital-finance-proposals\\_en](https://ec.europa.eu/info/publications/200924-digital-finance-proposals_en) [hereinafter Digital Finance Package].

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investors' tendered cash. They then facilitate the investment transactions for investors. They would also be tasked with the functions of anti-money laundering due diligence, custodial safekeeping, and transfer for investments to be made. In such a set-up, central banks would be relieved of direct service provision and some of the onerous implications, but there should be overall regulatory policy to subject custodial services to regulation and supervision.<sup>205</sup>

In this manner, custodial agents also act like brokers, which makes such a role unique and different from conventional financial intermediaries. These service providers are envisaged to have custodial, payment and brokerage functions; yet bundled in new ways. They would also have responsibilities engaging with central banks, investors, and the relevant dApp issuers. Custodial providers in the private sector need to develop the requisite cryptographic expertise and customer service interfaces. Expertise can be developed from current wallet providers for cryptocurrencies. Existing payment services institutions may also see the market opportunity to foray into providing these services and many of them are already overseen by national central banks in the euro area.<sup>206</sup> Regulatory and supervision implications would arise, but alongside new business opportunities and innovation.

The proposal above clearly shows that where the CBDC paves the way as an enabling mechanism in investing in the dApp economy, other regulatory policy issues are engaged, such as subjecting custodial agents to regulatory supervision and standards. The

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205. See, e.g., Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (recast), art.16(8) (describing organizational requirements including custodial regulation) [hereinafter E.U. Markets in Financial Instruments Directive (MiFID 2014)].

206. The European Banking Authority maintains a register of national central banks that also authorize and oversee payment services providers under the Payment Services Directive. The primary responsibility of national central banks in payments regulation and supervision is described as based on an intergovernmental ethos of power and responsibility in the European Union, such that payment oversight power is not concentrated in the ECB. See Dermot Hodson, *De Novo Bodies and the New Intergovernmentalism: The Case of the European Central Bank*, in *THE NEW INTERGOVERNMENTALISM: STATES AND SUPRANATIONAL ACTORS IN THE POST-MAASTRICHT ERA* (Christopher J. Bickerton, Dermot Hodson & Uwe Puetter eds., 2015).

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regulatory policy agenda can thus be “built out” more holistically, integrating the investment, commercial and financial needs of the crypto-economy. This is a more optimal vision of outworking for regulatory capitalism in the dApp economy than an incremental approach that seeks minimal disruption with existing regulatory ontologies.

In this manner, it may be criticized that the European Commission’s proposals to regulate crypto-asset offerings and service providers are too limited and draw excessively from existing regulatory frameworks without necessarily providing a good fit with crypto-economy needs. Crypto-asset offerings would be regulated via the mandatory disclosure of a prescribed white paper, subject to investor civil litigation for false or misleading disclosure. “Crypto-assets” are defined as a digital representation of value or rights, with reference to electronic storage and transfer via distributed ledger technology. The Commission established three regulatory regimes for crypto-assets, and a regime for “crypto-asset service providers” in general. Crypto-assets that are collateralized stablecoins, or “asset-referenced, as well as those that electronically reference fiat currencies, or known as “e-money” tokens are regulated differently from the rest of crypto-assets.

Crypto-assets other than “asset-referenced” or “e-money” crypto-assets can be publicly offered across the European Union, regulated by way of legal entity registration in any Member State and the publication of a prescribed white paper, which contains mandatory disclosure. However, exemptions are made for offers not exceeding €1 million in 12 months, or made to a small number of natural person investors not exceeding 150, or made to professional investors only. If the crypto-assets are obtained by gratuitous helicopter drops, or by mining, or are unique and non-fungible in nature, they are not subject to the public offer regulatory regime.

As many ICOs raise over €1 million,<sup>207</sup> the low threshold for exemption is unlikely useful for many dApp developers. Although the prescribed white paper is less onerous than the well-developed

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207. Kate Rooney, *A blockchain start-up just raised \$4 billion without a live product*, CNBC (May 31, 2018), <https://www.cnbc.com/2018/05/31/a-blockchain-start-up-just-raised-4-billion-without-a-live-product.html>.

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mandatory disclosure regime of prospectus disclosure for securities,<sup>208</sup> the categories of transparency required are ideologically derived from such established regimes, i.e., in relation to developers' information, legal entity information, or information regarding rights of holders, among others. The mandatory disclosure regime is accompanied by market discipline in terms of civil responsibility for inaccurate or misleading disclosure. For pre-development dApps where the information environment is tentative, this can be an onerous obligation subjecting developers to significant legal risk.

Crypto-asset service providers would be regulated under an umbrella category, subject to prudential requirements, mandatory insurance support, general rules of conduct of business—such as fair treatment of customers and management of conflicts of interest—as well as organizational and governance requirements pertaining to business continuity and cybersecurity. There is a lack of thinking as to what manners of service providers, especially novel ones may arise in the dApp economy, and a blanket extension of conduct regulation may not be appropriate, especially if these service providers have no direct dealing with users or may be decentralized in governance.

The proposed regulatory approach outlined above shows that the European Union may embark on regulating the financial and payment aspects of the crypto-economy in a manner highly derived from existing regulation and in a siloed manner, ignoring the commercial and economic contexts of the crypto-economy. Hence, this Article argues for a different regulatory policy approach that should first be focused on enabling economic development, accompanied by appropriate governance. This Article also suggests that the CBDC can fulfill such an enabling function and pave the way for developing a broader framework of governance in engagement with dApp economy participants.

It may be queried why CBDC is needed as private e-money providers can issue programmable digital fiat currencies for investment or payment in the dApp economy, such as the USD Coin issued by registered money service business Circle in the United States. The USD Coin is fully programmable in Ethereum blockchain-

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208. See Regulation (EU) 2017/1129 of the European Parliament and of the Council of 14 June 2017 on the prospectus to be published when securities are offered to the public or admitted to trading on a regulated market, and repealing Directive 2003/71/EC, art. 6 [hereinafter Prospectus Regulation].

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based applications.<sup>209</sup> The European Commission's proposal, however, treats such an issuance as e-money regulated under bank or electronic money issuer regulations,<sup>210</sup> therefore ignoring the potential of integration into the dApp economy, or at least failing to account for such integration and regulatory implications. Moreover, CBDC would be programmed and "signed" by the ESCB and is not a claim upon a private sector issuer (which is what privately issued electronic money amounts to) whose risk of insolvency the recipient runs. It may nevertheless be argued that as e-money issuers are regulated prudentially, the risk faced by customers of issuer failure is small. However, despite prudential regulation, if we rely on e-money creation by the private sector for the limited rollout proposal, e-money providers can engage in leverage generation<sup>211</sup> for speculative instead of genuine investment purposes, and may fuel bubbles in token prices.

The limited rollout of CBDC for investment can galvanize development in the dApp economy and bring us a step closer towards the institutional interface between the dApp economy and the mainstream economy. Such an enabling role for the CBDC must, however, be accompanied by more holistic and complex thinking in relation to substantive regulation and regulatory architecture. Before this Article turns to these issues, it will briefly canvass the legal mandate for the central bank is able to accommodate CBDCs. It will argue that the legal mandate for the ESCB is able to accommodate the limited rollout proposal in the euro area. This is appropriate for an experimental rollout and there is also empirical evidence regarding dApp development interest in the euro area.<sup>212</sup>

#### *A. The Legal Framework for Issuance of CBDC for the Euro Area*

The ECB has the exclusive right to issue euro banknotes as legal tender in the euro-area.<sup>213</sup> In practice, national central banks ("NCB")

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209. See Circle, *supra* note 166.

210. See generally E.U. Electronic Money Directive, *supra* note 167.

211. *Id.* art. 6 (noting credit creation can be undertaken by electronic money institutions).

212. Fromberger & Haffke, *supra* note 95.

213. European Union, Consolidated Version of the Treaty for the Functioning of the European Union, Oct. 26, 2012, OJ L. 326/47-326/390 art. 128, available at <https://www.refworld.org/docid/52303e8d4.html> [hereinafter TFEU].

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undertake such issue subject to the ECB's approval, as the ECB has limited institutional facilities for organizing banknote production and distribution.<sup>214</sup> In relation to coins, NCBs are primarily responsible for issuing them.<sup>215</sup> This system ensures that although the ECB has centralized authority over the monetary functions in the euro area, decentralized implementation is carried out based on the existing institutional facilities as being most practical and efficient.

It may be queried whether the issuance of digital euros should be regarded as "banknotes" or "coins." One also notes that tokens issued by dApp developers in fundraising have also been called "coins." The difference between banknotes and coins in Article 128 of the Treaty for the Functioning of the European Union ("TFEU") relates to difference in denomination. This difference in denomination is meaningful as the physical representation of notes and coins differ. Physical representation is currently differentiated according to denomination, i.e., banknote for €5 and above in terms of denomination, and coin for €2 and below.<sup>216</sup> Where digital currency is concerned, the digitalization of form cuts across the need for differentiating between denominations and consequent production.

Although the use of language reflects the assumption of physical representation, it is arguable, on a teleological basis,<sup>217</sup> that the digital versions of euros would still fall to be interpreted as digital euro banknotes or coins depending on denomination. Article 128 can be interpreted teleologically as including physical as well as digital

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214. See generally CHRISTOS V. GORTSOS, EUROPEAN CENTRAL BANKING LAW: THE ROLE OF THE ECB AND NATIONAL CENTRAL BANKS UNDER EUROPEAN LAW 281–329 (2020); Martin Seidel, *The Constitutional Design of the European Central Bank* (CESifo DICE Report, 2012), <https://www.econstor.eu/bitstream/10419/167064/1/ifo-dice-report-v10-y2012-i1-p14-20.pdf>.

215. TFEU, *supra* note 213, art. 128(2).

216. See Decision of the European Central Bank of 19 April 2013 on the denominations, specifications, reproduction, exchange and withdrawal of euro banknotes (recast) (ECB/2013/10) (2013/211/EU), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013D0010> [hereinafter European Central Bank Decision].

217. Frank Elderson, *Legal Interpretation within the ESCB: Is there Method in It?*, in LIBER AMICORUM & PAOLO ZAMBONI GARAVELLI, LEGAL ASPECTS OF THE EUROPEAN SYSTEM OF CENTRAL BANKS 235–257 (European Central Bank, 2005).

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representations of the same subject matter.<sup>218</sup> However, within the confines of the TFEU, it is arguably not possible to treat digital currency issued by the central bank as a species outside of “banknote” or “coin.”

The express competence for minting coins on the part of NCBs may constrain the interpretation of Article 128, meaning that there is only scope for the ECB to directly issue CBDC in denominations of €5 and above. However, as banknote denomination is a policy decided by the ECB,<sup>219</sup> the policy to denominate €5 and above in the form of banknote can be reconsidered by the ECB. It is also possible for the ECB to issue separate decisions for denominations of physical banknotes and coins, alongside digital banknotes and coins,<sup>220</sup> with the digital banknote having a lower range of denominations than the physical range. It can be questioned whether digital banknotes can be denominated in low ranges, phasing out coins entirely. This is permissible under the TFEU as coin issuance seems discretionary for NCBs. Further as Article 128 envisages that both the ECB and NCBs can issue banknotes under the ECB’s authorization, defining lower ranges of denominations for digital banknotes does not adversely affect competence between the ECB and NCBs. The potential issuance of low-denominated digital banknote euros would also meet the needs of the crypto-economy as many tokens trade in secondary markets in fractions of a U.S. dollar.

Although digital banknotes can be defined in lower denomination ranges and can equally be issued by the ECB directly or by NCBs, this Article supports a decentralized system where NCBs could be the primary issuers, subject to the overall oversight and approval of the ECB, in relation to the broader policy relating to issuing CBDC in the limited rollout proposal. This would also entail little change in

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218. See Nabilou, *supra* note 44.

219. European Central Bank Decision, *supra* note 216.

220. Cf. Advocate General Giovanni Pitruzzella’s opinion in Advocate General’s Opinion in Joined Cases C-422/19 Press and Information Johannes Dietrich and C-423/19 Norbert Häring v Hessischer Rundfunk (arguably supporting separate provision for the CBDC and its status as legal tender); see also Press Release No. 119/20, Court of Justice of the European Union, According to Advocate General Pitruzzella, EU law provides that creditors have an obligation in principle to accept cash in euros for the payment of monetary debts (Sept. 29, 2020), <https://curia.europa.eu/jcms/upload/docs/application/pdf/2020-09/cp200119en.pdf>.



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practice from the present dominant role of NCBs issuing physical banknotes and coins.

It may be queried whether by analogy with electronic money, CBDC is therefore not “legal tender.” Although the Electronic Money Directive provides for recognition and regulation of electronic money without specifying legal tender, scholars argue that the implicit assumption of the Directive is that it must deal with legally recognized currencies in the European Union on the basis of the assumptions of stable value made in the Directive and the obligations issuers are imposed with in relation to the exchange or redemption of electronic money.<sup>221</sup> Whether CBDC is technically legal tender would unlikely affect its favorable perception at a practical level. The advantage of legal tender is that creditors are obliged to accept legal tender in discharge of a debt. This advantage is not highly applicable in the context of the limited rollout proposal. In the investment context, investors make an offer to buy tokens which issuers accept, and issuers are free to set conditions of acceptance such as payment by CBDC or other cryptocurrency. CBDC issuance should be geared towards incentivizing not forcing its adoption. However, if a policy choice to make CBDC indisputably legal tender is made, in view of the ECB’s interest in rolling out more widely for e-commerce and retail payment, it becomes more imperative for the ECB to consider issuing a decision on the denominations of digital banknotes so that lower ranges can meet the definition of “legal tender” under the TFEU.

*B. Institutional Structure for Issuance of CBDC in the European System of Central Banks*

Although the ECB has exclusive competence to issue euro “banknotes,” and we argue that digital banknotes can be defined to be in lower denomination ranges, in practice, the ECB and NCBs work closely together in issuing euro banknotes, and NCBs undertake much of the issue anyway. This Article argues that it is structurally optimal for NCBs to take on the primary responsibility for issuing CBDC.

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221. Anton N. Didenko & Ross P. Buckley, *The Evolution of Currency: Cash to Cryptos to Sovereign Digital Currencies*, 42 *FORDHAM INT’L L.J.* 1041 (2019).

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At a decentralized level, NCBs may face different levels of demand for CBDC as there is an uneven level of interest and participation in the dApp economy across Europe. Although the dApp economy spans global borders, developers commonly start as a socially close-knit group in particular geographically-precise locations,<sup>222</sup> such as the Silicon Valley in the United States. In Europe, Switzerland, Germany, Lithuania, and the United Kingdom are highly popular jurisdictions where token offerings have been based,<sup>223</sup> and other euro area countries such as France and Spain are popular too. In this manner, due to different levels of demand across the euro area, NCBs can be well-placed to discover locally-generated needs. Further, the limited rollout proposal supports investment in the dApp economy and regulatory oversight of this is carried out by national agencies dealing with capital formation and investment regulation. There is no pan-European investment markets regulator, as the European Securities and Markets Authority (“ESMA”) is a body overseeing and coordinating national regulators who remain at the forefront of regulatory tasks. NCBs can work with national securities regulators in mapping the developments in the dApp economy and developing regulatory policy, as discussed below.

This does not mean that CBDC issuance should be carried out in a fragmented manner. The ESCB is the institutional architecture that maintains coordination and coherence in NCBs’ actions as steered by the ECB. The ECB’s leadership is required for a number of specific considerations below.

First, the ECB must decide for what purpose the CBDC should be programmed. Should the CBDC be programmed for an alternative protocol infrastructure, so that the ESCB takes on the role of providing competing blockchain infrastructure in the dApp economy? This initiative could be similar to the state-backed blockchain protocol initiative in China,<sup>224</sup> where an “official” infrastructure is offered alongside privately constructed ones. The benefit of such an infrastructure could be the implicit promise for maintenance and

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222. Bousfield, *supra* note 79.

223. See generally Wulf A. Kaal, *Initial Coin Offerings: The Top 25 Jurisdictions and their Comparative Regulatory Responses (as of May 2018)*, 1 STANFORD J. BLOCKCHAIN L. & POL’Y 41 (2018).

224. See, e.g., Blockchain-based Service Network, available at <https://bsnbase.io/g/main/index>.

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robustness underwritten by the public sector, and choice for entrepreneurs. It should also be considered whether such an innovation should be made open source and available for adoption or should result in proprietary rights subject to licensing for the ESCB. Making technological provision open source likely increases and encourages uptake although making it proprietary and subject to licensing may allow a regulatory channel to be constructed so as to select and supervise adopters and users. In the alternative, should the ESCB work with the private sector so that CBDC is programmed to be compatible with infrastructure protocol such as the Ethereum blockchain? This is arguably preferred as the Ethereum blockchain enjoys significant network effects for dApp enterprise development. Further, developing programmability of the CBDC with experienced private sector innovators may yield useful insights for technological learning for the public sector and public-private coordination for policy developments in the future. These decisions need to be decided at the level of the ESCB overall orchestrated under the ECB, and it would be beneficial for the ECB to take leadership in a unified form of engagement with the private sector.

Policy centralization at the ECB level also arguably matches with the broader purpose of the CBDC, which pursuant to Article 127 of the TFEU, relates to the ECB's support of general economic policies in the European Union with a view to contributing to the achievement of its objectives.<sup>225</sup> This includes the Digital Single Market, which is intended to promote cross-border e-commerce and the Digital Finance Package<sup>226</sup> supporting the single capital market.<sup>227</sup> The limited rollout proposal does not offend the needs for institutional independence and stature.<sup>228</sup> However, it paves the way for innovation in regulatory coordination and architecture, as the enabling institution of the CBDC lights the way for complementary policy development to support and govern the dApp economy. We turn to sketch out a blueprint for key

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225. TFEU, *supra* note 213, arts. 3, 127.

226. Digital Finance Package, *supra* note 204 (outlining policy umbrella for the European Commission's proposal to regulate cryptoassets).

227. European Commission Proposal 2020, *supra* note 154.

228. *See generally* HAROLD JAMES, MAKING THE EUROPEAN MONETARY UNION (2012); Werner Bonefield, *Ordoliberalism and Political Theology: On the Government of Stateless Money*, in *ORDOLIBERALISM, LAW AND THE RULE OF ECONOMICS* (Josef Hien & Christian Joerges eds., 2017).

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aspects of wider policy and regulatory thinking for mobilizing the dApp economy as a governed capitalist order.<sup>229</sup>

*C. A Brief Blueprint for the Regulatory Design and Architecture  
Implications for Supporting and Regulating the dApp Economy in the  
European Single Market*

The enabling role of the CBDC paves the way for regulatory rethinking of the implications for the scope and design of appropriate policy to address the needs of the dApp economy, and how regulatory architecture at the national and E.U. levels may be adjusted in response. In other words, the facilitative role of the CBDC paves the way for development of a regulatory capitalist order that engages with the roles of the public sector, in terms of providing regulatory governance, and the private sector, in relation to innovation and growth. The role of the public sector can further involve issues surrounding the fitness of existing regulatory institutions, reform of substantive regulatory law, and the mandates of existing regulatory agencies.

This Section discusses the contours of such implications in four respects:

1. The rise of new intermediaries for facilitating investment in the dApp economy;
2. The need for a complementary regime of ICO regulation, which need not be the same as fully-fledged securities regulation;
3. The need to consider more broadly business and commercial policy for the dApp economy as business projects become live and economic activity in the dApp economy takes shape; and
4. The need to consider how national central banks and relevant regulatory agencies may interact and coordinate to address the policy needs of the dApp economy, and how such interactions and coordination are further advanced through the E.U. institutional levels involving the ECB and relevant European agencies, such as the regulatory

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229. See IRIS H-Y CHIU, REGULATING THE CRYPTO-ECONOMY (Oxford: Hart, forthcoming 2022) (developing detailed proposals for regulating the dApp economy).

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bodies in the European System for Financial Supervision.<sup>230</sup>

*1. The Rise of New Intermediaries for Facilitating Investment in the dApp Economy*

Under the limited rollout of CBDC proposal for investment into the dApp economy, a key new market player that would arise is the custodial agent for token-based CBDC. These custodial agents on the one hand serve bank-like functions but they are not banks because they are not envisaged to have full intermediation and money-creation functions.<sup>231</sup> They would have duties and responsibilities to national central banks with whom they exchange investors' cash for CBDC, to their customers, in terms of brokerage-like functions, and also to token issuers in relation to anti-money laundering due diligence and transfer functions. The existing industry of wallet services for cryptocurrency may be appropriate for developing such services, and many wallet services are provided by cryptocurrency exchanges.<sup>232</sup> It would be important for policy-makers to engage with the private sector in order to understand current business models and to signal as to impending regulatory developments, and both the opportunities and compliance needs for service providers in this area. Regulatory obligations are already imposed under the fifth Anti-Money Laundering Directive,<sup>233</sup> but regulatory policy should be further tailored to specific risks of these services in relation to multi-way accountability to central banks,

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230. The System is comprised of the European Banking Authority, the European Securities and Markets Authority, the European Insurance and Occupational Pensions Authority, and a joint committee of the three to look at cross-sectoral issues. See Regulation (EU) 1093/2010 (establishing the European Banking Authority).

231. See generally PETER BOFINGER, *MONETARY POLICY: GOALS, INSTITUTIONS, STRATEGIES, AND INSTRUMENTS* (2001) (discussing custodial agents for token-based CBDC).

232. See generally Sarah Jane Hughes & Stephen T. Middlebrook, *Advancing a Framework for Regulating Cryptocurrency Payment Intermediaries*, 32 *YALE J. ON REG.* 295 (2015).

233. See Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU, art. 2.

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token issuer regulators, and investors. In this manner, this Article argues that the European Commission's proposal to regulate crypto-asset service providers is too broad-brush as no meaningful distinction is made amongst many novel types of services arising in the crypto-economy space. There are nevertheless useful aspects such as custodial duties akin to brokers,<sup>234</sup> and customer due diligence standards akin to under the Payment Services Directive.<sup>235</sup>

Further, it should be considered whether custodial agents may participate or diversify into investment services such as advisory services regarding the quality of token offers, and how those should be overseen. The Commission's proposed regulation for service-providers treats all manners of service providers in a group to be subject to similar prudential and conduct of business regulation. There is a need to consider how risks pertaining to different activities can be further understood for regulatory treatment.

In light of the rise of secondary trading markets for tokens,<sup>236</sup> the International Organization of Securities Commissioners ("IOSCO") has proposed that regulators consider regulating these marketplaces in view of investor protection issues such as standards of trading, market abuse, and market transparency.<sup>237</sup> The European Commission's proposal reflects these, but these assumptions are made on the basis that trading exchanges are centralized in nature. Innovation in the crypto-economy and the arrival of decentralized exchanges<sup>238</sup> may pose challenges to narrowly-defined regulatory categories. Regulatory capitalism in this space could be reflected by more intense engagement with private sector innovators and business developers, moving away from ontological assumptions with conventional financial service providers, so that regulatory policy can be

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234. See E.U. Markets in Financial Instruments Directive (MiFID 2014), *supra* note 205, art. 16(8).

235. E.U. Electronic Money Directive, *supra* note 167, art. 97 (relating to strong customer authentication).

236. Such as Poloniex.com, Tokenmarket.net, and IDEX.com.

237. BOARD OF THE INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSIONS, ISSUES, RISKS AND REGULATORY CONSIDERATIONS RELATING TO CRYPTO-ASSET TRADING PLATFORMS (Feb. 2020), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD649.pdf>.

238. See, e.g., Uniswap, available at <https://uniswap.org> (facilitating liquidity pools).

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dynamically informed. Further, new intermediaries facilitating investment into the dApp economy also include token rating services, which are currently unregulated.<sup>239</sup> The extent of investor reliance on them should be subject to observation in considering if regulatory standards are needed. The operation of pan-European service provision by intermediaries in this space also gives rise to implications for intersections between national agencies for regulation and supervision or elevation of such supervision to the European agency level.<sup>240</sup>

### 2. *The Need for a Complementary Regime of ICO Regulation*

As proposed earlier in this Article, ICOs should be regulated differently from securities offerings as they are pre-development in nature,<sup>241</sup> and raise different information asymmetry and investor protection risks. Although researchers have empirically observed that the quality of voluntary disclosure in ICOs, in the form of white papers, is sub-optimal in most cases, mandatory disclosure regulation under securities regulation may not be the appropriate regime for ICOs.<sup>242</sup>

ICOs usually take place with perhaps no relevant track record for investors to observe, and the informational environment for investors may be unprecedentedly thin. This is not necessarily an issue of information asymmetry, i.e., that issuers have more information held to their chests than available to investors. This is an environment of information anemia as both issuers and investors are wading into a

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239. Such as ICObench.com and ICOratings.com. See Jongsub Lee, Tao Li & Donghwa Shin, *The Wisdom of Crowds and Information Cascades in Fintech: Evidence from Initial Coin Offerings* (2018), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3226051](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3226051) (describing the usefulness and predictive power of ratings); Thomas Bourveau et al., *Information Intermediaries in the Crypto-Tokens Market* (2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3193392](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3193392). However, some commentators are of the view that the ratings services provide flawed ratings even for crypto-businesses that do not need to use a blockchain. See Chen Feng et al., *Initial Coin Offerings, Blockchain Technology, and White Paper Disclosures* (2019), <https://ssrn.com/abstract=3256289>.

240. See *infra* Part III, Section C, subd. (4).

241. Collomb, de Fillippi & Sok, *supra* note 91.

242. Zetzsche et al., *supra* note 192.

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speculative venture with much information to discover. Hence there may be a case for less reliance on extensive mandatory disclosure regulation, and to supplement with a regulatory regime that provides for more investor control so as to monitor the development of the project.

There may be a case for regulatory design that facilitates post-sale investor monitoring. Post-sale monitoring is important as ICOs result in a frontloading phenomenon whereby dApp issuers get all of the proceeds for development before anything is started.<sup>243</sup> Regulation can be aimed at mitigating developers' agency risk, especially behavioral sub-optimality associated with investment frontloading that exacerbates such risk, as well as to allow investors to observe the outworking of business viability and investment value risks. Regulatory design can include staged financing and escrow arrangements, which is proposed by Usha Rodrigues as similar to the kind of contractually agreed post-investment monitoring carried out in a venture capital investment in a start-up company.<sup>244</sup> Such a regulatory design would involve different obligations from under securities regulation, and possibly new intermediaries with new obligations in relation to staged financing monitoring and custodial safeguarding of funds.

Regulatory thinking for ICOs has developed in a rather siloed manner and in response to fears of regulatory arbitrage. For example in the United States, since the SEC's investigative report that the initial coin offering made by the DAO was an unregistered securities offering,<sup>245</sup> the "securities" definition could be applied in an extensive manner to ICOs. The SEC's guidance<sup>246</sup> has developed further to capture tokens with trading and appreciative characteristics even if these exist alongside functional or potentially functional characteristics (for projects under development).<sup>247</sup> The more

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243. Xin Deng, Yen-Teik Lee & Zhengting Zhong, *Decrypting Coin Winners: Disclosure Quality, Governance Mechanism and Team Networks* (2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3247741](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3247741) (discussing the frontloading phenomenon).

244. See generally Usha R. Rodrigues, *Financial Contracting with the Crowd*, 69 EMORY L.J. 397 (2019).

245. SEC Report, *supra* note 193.

246. *Id.*

247. Rohr & Wright, *supra* note 88.



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dominantly functional tokens are, in comparison to their tradeability or potential to provide gain as “financialize” items, the more likely they are not securities. A number of indicators are suggested by the SEC in order to determine if tokens are closer to the end of the financialized spectrum or the functional end, such as whether centralized efforts exist to develop the project and arrange for tokens to be traded, as opposed to ministerial functions for the blockchain system. It would also be relevant whether the token is offered more broadly (presumably to attract investment interest) or more narrowly to a targeted market interested in functionality.

The SEC’s presumption of functionality versus financialization for characterizing tokens as securities can arguably be misplaced as tokens likely have both sets of characteristics. Financialization need not undercut the functional characteristics that exist in an asset, as we think about residential property as being both fully functional and financialized in many developed economies. Further, it seems unduly restrictive to prevent tokens from being successful both functionally and financially. In light of significant regulatory uncertainty for ICOs, developers have turned to new legal mechanisms, such as a Simple Agreement for Future Tokens (“SAFT”)<sup>248</sup> that provides a template for token offers to be made only to accredited investors in the United States, therefore exempting developers from having to register with the SEC as a public securities offer.<sup>249</sup> The SEC’s approach is likely to funnel ICOs down “safe” exemptions in relation to small offers such as Regulation A or A+ or Regulation D<sup>250</sup> for accredited investors. This may severely curtail retail participation. As dApp businesses are fundamentally peer-to-peer networks that provide opportunities for anyone to join in the enterprise efforts as well as

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248. See, e.g., The SAFT Project, *supra* note 197.

249. See Regulation D Offerings, U.S. Securities & Exchange Commission, INVESTOR.GOV, available at <https://www.investor.gov/introduction-investing/investing-basics/glossary/regulation-d-offerings>.

250. *Id.* See also Regulation A, U.S. Securities & Exchange Commission, SEC.GOV, available at <https://www.sec.gov/smallbusiness/exemptofferings/reg-a>. Regulation A+ is the SEC’s implementation of Title IV of the JOBS Act. See Press Release, U.S. Securities & Exchange Commission, *SEC Adopts Rules to Facilitate Smaller Companies’ Access to Capital* (Mar. 25, 2015), <https://www.sec.gov/news/pressrelease/2015-49.html>.

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financialized prospects,<sup>251</sup> the prevention of retail participation in the name of retail investor protection ironically leads to the result of their marginalization from an innovative economic frontier. This may be contrary to the ethos and intentions of dApp developers. Further if developers are forced to fundraise in private markets, the demographics of the dApp economy can be radically shaped by involving largely financiers instead of economic actors from a diverse landscape.

In the European Union, early mover Member States like Malta have taken a different approach to ICOs and treat tokens offered as *suis generis* financial products. This is also now reflected in the European Commission's proposal. In 2018, the Maltese Virtual Financial Assets Act 2018 was passed to provide a legitimate channel for ICOs to be legally offered in Malta. Virtual assets cover the scope of digital tokens that are not merely for consumption, payment, or are financial instrument falling within European legislation definitions.

The Act requires an issuer of virtual assets to be a legal person in Malta, and a white paper with items of mandatory disclosure are to be filed and published. A summary that is in plain language and more narrative in nature should also be published for ease of use by retail investors. This mimics the E.U. securities regulation regime in the Prospectus Regulation<sup>252</sup> and forms the same basis for the European Commission's proposal to regulate crypto-assets.<sup>253</sup> The Act provides for some general principles for the conduct of issuers, such as the management of conflicts of interest, conducting business with integrity, due care, skill and diligence and under proper control,<sup>254</sup> which have also found their way into the European Commission's proposal. It is uncertain if these duties are ongoing in nature or apply to the point of marketing and sale of tokens to investors. These duties are also relatively open-ended and it is uncertain if any regulatory enforcement supports such duties. The Maltese regime perhaps relies

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251. Alyse Killeen, *The Confluence of Bitcoin and the Global Sharing Economy*, in HANDBOOK OF DIGITAL CURRENCY: BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA (David Lee Kuo Chuen ed. 2015).

252. See Prospectus Regulation, *supra* note 208.

253. European Commission Proposal 2020, *supra* note 154.

254. Malta Virtual Financial Assets Act § 9 (2018), cap. 590, available at [http://www.justiceservices.gov.mt/Download Document.aspx?app=lom&itemid=12872&l=1](http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12872&l=1).

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more significantly on investment limits for investor protection. Investments in ICOs are limited to €5,000 per retail investor. Investment limits arguably allow the regulator to mitigate regulatory risk since investor losses are capped. This is close to the United Kingdom's regulatory regime for equity crowdfunding, which limits retail investor outlay to 10 percent of net investible assets.<sup>255</sup> Investor limits can be perceived as an investor protection measure that protects against consumer detriment, while reducing the need for too many regulatory standards to be imposed on issuers, or in the case of equity crowdfunding regulation, on platforms. Investors may also pursue civil liability for a white paper which contains untrue, misleading, inconsistent, and inaccurate statements.<sup>256</sup> The Maltese Act requires an issuer to appoint a Virtual Financial agent that would be responsible for the anti-money laundering compliance side of fundraising, in relation to the standards of due diligence consistent with the European legislation on anti-money laundering. On the whole the Maltese regime, and arguably the Commission's proposal, seem to offer a light version of the European Union's "gold standards" for securities regulation. However, Malta's regime for investor limits is not replicated in the Commission's proposal.

Unlike the Maltese regime that aims at investor protection by capping investment, the Commission's approach is to import the consumer protection tenet of cooling-off rights by allowing for a mandatory 14-day period for withdrawal by investors. In comparison to the Maltese regime for disclosure and civil liability, the Commission's proposal may be more onerous with more prescriptions. Nevertheless, the passport for making an offer throughout the European Union may be attractive to investors.

However, it is uncertain if the Maltese and Commission's recent templates, heavily derived from securities regulation, cohere with the needs of the blockchain-based community. First, if the "issuer" to be incorporated is the developer, the developer may not wish to be formalized as a company and be subject to a state's company law rules. This is because in some dApp projects such as Filecoin<sup>257</sup> and

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255. See FINANCIAL CONDUCT AUTHORITY, FCA HANDBOOK, COBS 4.7.10, <https://www.handbook.fca.org.uk/handbook/COBS/4/7.html> [hereinafter FCA HANDBOOK].

256. *Id.* COBS 4.2.

257. See Filecoin, *supra* note 116.

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Decentraland,<sup>258</sup> the developers envisage withdrawal from the project in due course as it becomes mature, so that the blockchain can be left entirely into the hands of the community of participants to operate and maintain. The need to incorporate and maintain ongoing compliance with company or securities rules may be disincentivizing.

Next, if the tokens are to be offered over the blockchain platform, then would such a platform be regarded as the “legal entity” that needs to be duly registered or incorporated in any E.U. Member State, as required under the E.U. regime? How should a blockchain platform be treated in terms of legal organization? Blockchain systems are often regarded as peer-to-peer marketplaces and not legal persons such as corporations. The corporation is a hierarchical legal person and does not reflect relational realities in the blockchain system. If there is indeed a regulatory lacuna in relation to the treatment of the community of participants that comprises the blockchain system, would such enterprises not be able to attain “legal entity” status, except perhaps in Malta, as only Malta offers a tailor-made legal organizational regime for blockchain platforms?<sup>259</sup> If a blockchain platform were to forcibly be fit into an existing organizational category in a Member State, would token-holders have clarity in relation to the governance of the system and their rights? In a peer-to-peer blockchain system, there is no ready ascertainment of the management organ. Would miners or core developers be regarded as taking on that role and the enormous responsibilities that normally attach to management?<sup>260</sup> It remains unclear if token-holders are the equivalent of shareholders of incorporated companies and whether the rights, duties, and liabilities established in corporate law jurisprudence should apply. These questions are currently not answered by either the Commission nor Member States.

Derivative regulatory approaches to regulating token offerings potentially miss the unique features of such fundraising and fail to meet their purposes. Changing regulators’ perspectives from a regulative focus to one that considers the enabling and mobilizing

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258. See Decentraland, *supra* note 110.

259. See generally Malta Innovative Technological Arrangements and Services Act (2018), cap. 592, available at <https://legislation.mt/eli/cap/592/eng/pdf>.

260. Angela Walch, *In Cod(ers) We Trust*, in REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES (Philipp Hacker et al. eds., 2019).

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aims for the dApp economy would entail a difference in approach toward regulatory policy—toward being more holistic and engaged with the new economic structures that are being revealed in the dApp economy. In this manner, the uniqueness of ICOs as pre-development funding can be recognized and policy-makers can consider a more bespoke regulatory regime, as outlined above.

### 3. *The Need to Consider More Broadly Business and Commercial Policy for the dApp Economy*

As dApp developers plan to develop blockchain-based networks into live businesses, these new businesses and their structures, as well as their commercial operations may raise questions in relation to regulatory arbitrage and institutional fit. In the sharing economy space, well-canvassed examples of regulatory arbitrage include Uber, which has resisted being categorized as a taxi service<sup>261</sup> and as an employer of drivers who may indeed work full-time hours for Uber.<sup>262</sup> Prosumers on blockchain-based networks may avoid being regulated like business entities providing similar services, but may also not benefit from consumer protection.<sup>263</sup> These regulatory lacunae need to be considered in relation to how standards and expectations may be safeguarded while allowing prosumers to engage in commercial freedoms and innovation. Such business and commercial regulatory policy is likely to span a number of sectors. In particular, financial regulators would need to consider how dApp businesses attempting to decentralize financial services such as in creating swaps, or providing lending should be treated in the “DeFi” space.<sup>264</sup> This area is burgeoning with innovation and needs to be considered in relation to

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261. See generally Michèle Finck, *Distinguishing Internet Platforms from Transport Services: Elite Taxi v. Uber Spain*, 55 COMMON MARKET L. REV. 1619 (2018).

262. See generally Brishen Rogers, *Employment Rights in the Platform Economy: Getting Back to Basics*, 10 HARVARD L. & POL’Y REV. 480 (2016).

263. See Florian Möslein, *Conflicts of Laws and Codes: Defining the Boundaries of Digital Jurisdictions*, in REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES (Philipp Hacker et al. eds., 2019); see also U.K. Consumer Rights Act 2015, §§ 49, 57, <https://www.legislation.gov.uk/ukpga/2015/15/notes> (may apply).

264. Wulf A. Kaal, *Digital Asset Markets Evolution* (forthcoming, Journal of Corporation Law, 2020), <https://ssrn.com/abstract=3606663>.

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mitigating regulatory arbitrage<sup>265</sup> while not discouraging useful disruptive innovation.<sup>266</sup>

#### 4. *The Need to Consider Regulatory Intersections and Coordination at National and E.U. Levels*

The broader regulatory blueprint for the dApp economy would likely involve regulatory intersections and coordination at national levels and between national and E.U. levels.

The intersection between national central banks and financial regulators such as securities regulators may not be unfamiliar, as euro area Member States with single regulators,<sup>267</sup> or single regulators under the central bank's auspices<sup>268</sup> could look at constructing coordinative channels or organizing internally within the central bank such joined-up capacity. Member States with disparate regulators<sup>269</sup> with their own remits and turfs to maintain may face more challenges in terms of being path dependent. They may prefer to fit novel dApp economy issues into existing regulatory categories, such as how the United States with its disparate regulators have taken an approach of "coherentism"<sup>270</sup> rather than regulatory reform towards the phenomena raised by the dApp economy.<sup>271</sup> That said, in considering

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265. See Usha Rodrigues, *Semi-Public Offerings? Pushing the Boundaries of Securities Law* (U. Georgia School of L. Legal Stud. Res. Paper No. 2018–30, 2018), <https://ssrn.com/abstract=3242205>.

266. Joseph Bower & Clayton Christensen, *Disruptive Technologies: Catching the Wave*, HARVARD BUS. REV. 43–53 (1995).

267. Such as Germany, Denmark, Finland, Austria, Sweden, Latvia, and Poland.

268. Such as Hungary, Czech Republic, Ireland, Lithuania, and Slovakia.

269. Such as sectoral regulators between banking, insurance and investment/securities regulation, e.g., Italy, France, Spain, Belgium, Cyprus, Greece, The Netherlands, Estonia, Luxembourg, Malta, Portugal, Romania, Bulgaria, Croatia, and Slovenia.

270. See BROWNSWORD, *supra* note 183, at 191–196 (discussing "coherentism" as a regulatory mindset that seeks excessively to fit new developments into existing ontologies by default instead of considering the need for reform).

271. See generally Chiu, *supra* note 198. See also M. Todd Henderson & Max Raskin, *A Regulatory Classification of Digital Assets: Towards an Operational Howey Test for Cryptocurrencies, ICOs, and Other Digital Assets* (2019 Columbia Bus. L. Rev. 444, U. Chicago Coase-Sandor Inst. L. & Econ. Res. Paper No. 858, U.

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the innovative product of cryptocurrency exchange-traded funds, the SEC has now signaled willingness to work with other agencies, namely the Office of the Comptroller of Currency and the Commodities and Futures Trading Commission to explore how regulatory ontologies or even reform can be developed to cope with innovation that challenges existing regulatory boundaries.<sup>272</sup>

European level agencies can be particularly well-placed to orchestrate high-level inter-agency linkages and coordination. The European System of Financial Supervision (“ESFS”), which comprises the European Banking Authority (“EBA”), European Securities and Markets Authority (“ESMA”), European Insurance and Occupational Pensions Authority (“EIOPA”), the Joint Committee of the agencies and the European Systemic Risk Board (“ESRB”) constituted under the ECB, provides inter-agency linkages and opportunities for inter-agency learning, dialogue and coordination, and overcomes the apparently siloed appearance of each agency’s mandate.<sup>273</sup> Although regulatory linkages are constructed for specific purposes, inter-agency coordination at the E.U. level and through to national level bodies, are not institutionally unfamiliar. Perhaps new inter-agency liaison structures extended from the Joint Committee of the ESFS can serve as a model for regulatory intersections and coordination involving E.U. level agencies and national level agencies. The Joint Committee currently addresses common objectives, such as anti-money laundering and consumer protection, both of which are relevant to the dApp economy.

It may be queried whether the ECB and NCBs, which maintain a stature of independence for the ESCB’s mandates, should be engaged in such new policy and regulatory intersections and coordination. However, with the expansion of the ECB’s remit in the Banking Union, Otmar Issing, for example, opines that “serving the Union’s wider economic policies” provides a basis for institutional dynamism

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Chicago, Pub. L. Working Paper No. 683, 2019), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3265295](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3265295).

272. Jackie Noblett, *Cryptocurrency ETFs under active consideration, says SEC Chair*, FINANCIAL TIMES (Oct. 15, 2020), <https://www.ft.com/content/9f2c1303-678e-486e-b3f1-d4f234f85f47>.

273. See generally Iris H-Y Chiu, *Power and Accountability in the EU Financial Regulatory Architecture: Examining Inter-agency Relations, Agency Independence and Accountability*, 8 EUROPEAN J. LEGAL STUD. 68 (2015).

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for the ECB,<sup>274</sup> as the ECB, though independently instituted for specific tasks, is not insular in nature from the wider institutional context for digital transformation in the Single Market,<sup>275</sup> including the Digital Finance Package<sup>276</sup> that supports the Capital Markets Union in the European Union.<sup>277</sup> Further, the Banking Union has brought coordinative channels between the Single Supervisory Mechanism and the EBA.<sup>278</sup> Further intersection with the ESFS would be optimal in order to address the enabling and regulative needs of the dApp economy. The ESCB and the ESFS can be connected for policy deliberation on dApp economy mobilization and regulation. This can also lead to new considerations such as whether new regulatory bodies may be needed, such as the new Maltese Digital Innovation Authority.

The kind of interagency and multi-stakeholder approach adopted in the Digital Single Market strategy<sup>279</sup> can also provide some inspiration for a way forward for organizing regulatory intersections and coordination for policy thinking about the dApp economy. Hazards can be sounded in terms of the inefficiencies of “too many cooks” and the lack of definite outcomes after protracted processes of

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274. Otmar Issing, *The European Central Bank*, in SVERIGES RIKSBANK AND THE HISTORY OF CENTRAL BANKING (Rodney Edvinsson, Tor Jacobson & Daniel Waldenström eds., 2018).

275. See generally Bonefield, *supra* note 228.

276. Orbach, *supra* note 201.

277. See Capital Markets Union Action Plan, *supra* note 76; European Commission Proposal 2020, *supra* note 154.

278. See generally THE EUROPEAN BANKING UNION AND THE ROLE OF LAW (Gianni Lo Schiavo ed. 2019). For critical discussions of the relationship between the SSM and EBA, see Eilis Ferran & Valia Babis, *The European Single Supervisory Mechanism* (2013), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2224538](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2224538); Concetta Brescia Morra, *From the Single Supervisory Mechanism to the Banking Union. The Role of the ECB and the EBA* (2014), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2448913](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2448913); but see Guido Ferranini & Luigi Chiarella, *Common Banking Supervision in the Eurozone: Strengths and Weaknesses* (ECGI Working Paper, 2013), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2309897](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2309897) (positive discussions).

279. European Commission, *The “Principles for Better Self-and Co-Regulation,”* (2018), <https://ec.europa.eu/digital-single-market/en/best-practice-principles-better-self-and-co-regulation>.



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listening to every voice.<sup>280</sup> Nevertheless, Finck's vision of "co-regulation"<sup>281</sup> is arguably necessary due to the novelties and complexities posed by the new needs of the dApp economy. From national levels to European levels, regulatory linkages and capacity need to be considered, in terms of how harmonization or indeed appropriate decentralization can steer policy initiatives. Such coordinated regulation can pave the way for inspiring other jurisdictions with multifaceted regulatory architectures, such as in the United States, to consider reorganizing and regrouping architectural linkages in response to new economic dynamism.

## CONCLUSION

The dApp economy is an innovative and exciting business space that is creating economic value despite the lack of regulatory institutions that support it so far. Indeed, regulatory proposals offered by the European Commission in relation to stablecoins and crypto-asset offerings in the European Union may be too path dependent and fail to meet the innovative needs of the dApp economy. This Article proposes that regulation has a facilitative role to play in mobilizing this economic space and galvanizing its scaling up and interface with the conventional mainstream economy. The starting point of such a facilitative regulatory regime could lie in the issuance of a central bank digital currency that addresses the weaknesses of the monetary order in the dApp economy. The European Single Market is an apt place for the rollout of a central bank digital euro, based on the high levels of dApp activities in the European Union and its ability to support harmonized policies across borders within the Single Market.

The issuance of a CBDC in the European Single Market can provide a departure point for the building out of the dApp economy by more enabling regulatory institutions, including more appropriate fundraising governance and other complementary policies for service providers and new intermediaries. Regulatory institutions, both of a facilitative and governing nature, are needed to support and mobilize new economic actorhood, service provision and social trust, and

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280. Staff, *Europe's digital single market: Incumbents rule – The European Union's online reforms help the old more than the new*, ECONOMIST (Sept. 17, 2016), <https://www.economist.com/business/2016/09/17/incumbents-rule>.

281. FINCK, *supra* note 2, at 171–180.

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acceptance of developments in the dApp economy. Siloed regulative developments could be counterproductive without the holistic integration of an enabling institution for the dApp economy. Crucially, the enabling “starting point” argued for in this Article, i.e., the limited rollout of CBDC for investment in the dApp economy, would underpin substantive policy thinking and considerations regarding regulatory intersections and coordination at the levels of national and E.U. regulatory architecture. This is consistent with a co-regulatory and multi-stakeholder approach to policy building pursued in the E.U. Digital Single Market Strategy. This experiment in the European Union is also likely to yield lessons for regional and international coordination, which is important for the global and borderless nature of the dApp economy.