



# DIGITAL DELEGATION DOCTRINE: CENTRAL BANK DIGITAL CURRENCIES AND THE FUTURE OF THE SEPARATION OF POWERS

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## INTRODUCTION

Civilization generally and the market economy in particular are premised on human cooperation, often between unwitting third parties separated by great distances.<sup>1</sup> From the Roman law concept

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\*J.D., New York University School of Law, 2019 and Managing Editor of Development of the *New York University Journal of Law & Liberty*. This note is dedicated to my late grandparents Gus Newman and Winnie Newman – one an attorney and the other a computer scientist. I have sought, in part, to combine their endeavors here. I would like to thank my wife, Dr. Kyra Edson Solowey, and my parents, Dr. Debra Newman Solowey and Dr. Jeffrey Solowey, for their unwavering support. Special thanks as well to Max Raskin and William Gillis for their invaluable feedback on earlier drafts of this note, and to Mitchell Day, Nicholas Gallagher, and Cameron Sinsheimer for their untold contributions to this journal.

<sup>1</sup> F.A. Hayek, *The Fatal Conceit: The Errors of Socialism* 6 (University of Chicago 1988).

of the “mandatarius”<sup>2</sup> to the common law doctrines of contract and agency,<sup>3</sup> legal systems have sought to keep people to their word by invoking state power to enforce remedies or compel performance when some actors inevitably break their promises. Satoshi Nakamoto – the unidentified inventor of Bitcoin – did not want to rely on existing institutions built from the crooked timber of human nature nailed together with the traditional iron of law and state action.<sup>4</sup> His technology strove to at least improve on our historical solutions to the trust problem.<sup>5</sup> While Satoshi’s innovation has received significant commercial interest, with venture capitalists willing to “hurl bricks of cash”<sup>6</sup> at blockchain-based businesses, the trust and agency problems that Satoshi sought to solve are not only longstanding concerns of commercial and private law – but also of constitutional and public law.

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<sup>2</sup>Richard A. Epstein, *The Roman Law of Cyberconversion*, 2005 Mich. St. L. Rev. 103, 115-16 (2005) (Under Roman law, the party with a mandate in a gratuitous relationship based on trust to enter a contract and then assign those rights to the party that authorized the contract. “[I]f [the mandatarius] did not withdraw, then he could be sued for nonperformance of the basic obligation.”), archived at <https://perma.cc/5S4K-M7C6>.

<sup>3</sup>See Eric A. Posner, *Coase Lecture: Agency Models in Law and Economics* \*1 (University of Chicago Law School, John M. Olin Law and Economics Working Paper No. 92, Winter 2000), archived at <https://perma.cc/M8RJ-6Q3R>.

<sup>4</sup>Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (Bitcoin.org) (“Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model.”), archived at <https://perma.cc/Q2MW-6CBU>.

<sup>5</sup>Id.

<sup>6</sup>The adapted words of Erlich Bachman, Aviato founder. *Silicon Valley: Terms of Service* (HBO television broadcast Apr. 30, 2017). See also Annaliese Milano, *A16z, USV Lead \$12 Million Funding for CryptoKitties*, (Coindesk, Mar. 20, 2018), archived at <https://perma.cc/TW9W-BV8T>.

The duties of obedience, loyalty, and care owed to principals by agents<sup>7</sup> in business have been analogized to those owed to the people by their elected representatives within the state.<sup>8</sup> Moreover, a corporate board of directors' responsibility for "setting policy" and a corporate officer's responsibility for "carrying out [those] directives" parallels the relationship between Congress and the Executive Branch.<sup>9</sup> The same parallel could be drawn between a Board of Directors' oversight of corporate officers' fulfillment of fiduciary duties to shareholders and Congress's oversight of the Executive Branch.<sup>10</sup> While private cryptocurrencies seek to ameliorate the third-party trust problem in private transactions, a public digital currency would provide an opportunity to allay agency delegation and trust problems within the government. Specifically, a public digital currency could provide a new platform for addressing the separation of powers issues presented by congressional delegations of authority to administrative agencies and presidential control of agency officers.

Central Bank Digital Currencies, or CBDCs, have garnered attention as public analogues to private cryptocurrency innovations, and as instruments for new national monetary policy techniques. In addition to these potential applications, this paper will explore how a CBDC infrastructure could serve to both renew yet also potentially alleviate longstanding constitutional issues of overbroad delegations of congressional authority that leave administrative agencies with

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<sup>7</sup> William T. Allen and Reinier Kraakman, *Commentaries and Cases on the Law of Business Organization* 27, (Aspen 5th ed. 2016).

<sup>8</sup> See D. Theodore Rave, *Politicians as Fiduciaries*, 126 Harv. L. Rev. 671, 720 (2013), archived at <https://perma.cc/LN23-C2C3>.

<sup>9</sup> Richard A. Epstein, *Executive Power in Political and Corporate Contexts*, 12 U. Pa. J. Const. L. 277, 282 (2010), online at <https://perma.cc/R975-QNA5>. See also Richard A. Epstein, *Why the Modern Administrative State is Inconsistent with the Rule of Law*, 3 N.Y.U. J.L. & Liberty 491, 497 (2008), archived at <https://perma.cc/S3Y6-HVBL>.

<sup>10</sup> See Megan W. Shaner, *The (Un)Enforcement of Corporate Officers' Duties*, 48 U. Ca. Davis L. Rev. 271, 277 n 15, 305 (2014), archived at <https://perma.cc/ZP7X-3G2Y>. See also Brian D. Feinstein, *Congress in the Administrative State*, 95 Wash. U. L. Rev. 1187, 1190 (2018), archived at <https://perma.cc/PCJ8-7S6K>.

too little accountability and too much discretion. A CBDC framework could not only help to mitigate the arguable constitutional shortcomings of the central bank, the Federal Reserve, but also provides a test case for the resolution of agency delegation problems in government generally through the use of digital, public services.

Part I of this paper discusses the advent of CBDCs in light of the third-party trust problem. Part II explores the constitutional critique of the appointment and removal of officers within the Federal Reserve and independent agencies. Part III presents the parallels between the legal theory underlying the constitutional nondelegation doctrine and the computational theory underlying programming algorithms, and argues that CBDC technology provides an opportunity to operationalize and revitalize the classical nondelegation doctrine in practice. Part IV analyzes the application of algorithmic policymaking in the CBDC context and beyond, and addresses the persistence of the problem of policy interpretation by those executing law. Part IV concludes that a CBDC and concomitant algorithmic policy regime provide a model for mitigating, though not eliminating completely, the age-old trust problems inherent in public institutions.

### I. THE TRUST PROBLEM AND CENTRAL BANK DIGITAL CURRENCIES

In September 2008, in the midst of the worst recession since the Great Depression,<sup>11</sup> Lehman Brothers, the fourth-largest investment bank in the United States, filed for bankruptcy after more than a century and a half of operation.<sup>12</sup> A month later, with historic financial calamity as a backdrop, the unidentified Satoshi Nakamoto

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<sup>11</sup> U.S. Department of the Treasury, *The Financial Crisis Response in Charts 3* (2012), archived at <https://perma.cc/W8VF-FWK4>.

<sup>12</sup> Andrew Ross Sorkin, *Lehman Files for Bankruptcy; Merrill Is Sold*, (N.Y. Times, Sept. 14, 2008), archived at <https://perma.cc/7UQ7-5QP5>.

released the seminal white paper on “Bitcoin: A Peer-to-Peer Electronic Cash System.”<sup>13</sup> In that schematic for an “electronic payment system based on cryptographic proof instead of trust,” Nakamoto took direct aim at the status quo in banking and financial institutions. He rejected the typical solution to electronic payment of a “trusted central authority,” arguing that “[t]he problem with this solution is that the fate of the entire money system depends on the company running the mint, with every transaction having to go through them, just like a bank.”<sup>14</sup> Satoshi thereby identified a third-party trust problem presented by banks. This problem, in turn, implied the questions of whether a financial intermediary would remain true to its word in carrying out a transaction between two parties; whether the intermediary would adequately incentivize the parties to keep their own promises; and whether the intermediary would engage in self-dealing. Satoshi’s concern with having to trust the third-party mediating an exchange was a significant extension of a long history of economic and legal critiques of the money system, financial intermediaries, and central banks. Satoshi’s technology, however, introduced a new device, beyond the existing technique – law backed by the threat of force – to overcome the problem of transacting parties and intermediaries breaking their promises.

The lack of public, political, and scholarly trust in centralized banks is longstanding. In the wake of the same financial crisis that inspired Nakamoto, the foreword to a 2009 reprint of the 20<sup>th</sup> Century Austrian economist Ludwig von Mises’s *Theory of Money and Credit* observed that the sub-prime mortgage disaster was just the latest of many crises in a dismal cycle of irrational exuberance, devastating busts, and the same, oft-repeated central bank cure: massive monetary stimulus.<sup>15</sup> Invoking Mises’s historical Sound Money

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<sup>13</sup> Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (cited in note 4).

<sup>14</sup> *Id.* at 2.

<sup>15</sup> Douglas E. French *Foreword to the 2009 Edition of Ludwig von Mises, The Theory of Money and Credit* 1, 1 (Ludwig Von Mises Institute 2009) (Yale Univ. Press 1953).

School principles, the foreword author reasoned that the stimulus would provide at best short-term symptomatic relief, and would inevitably prolong the disease, creating new bubbles and future pain.<sup>16</sup> Mises himself had defined the classical sound money principle as a restriction on the state's ability to debase the common currency of exchange.<sup>17</sup> He likened that limit to "the protection of civil liberties against despotic inroads on the part of governments" found in a constitution or bill of rights.<sup>18</sup>

In response to a low-growth recovery, an equally vehement policy critique under the banner of Modern Monetary Theory (MMT)<sup>19</sup> has put forward essentially the opposite view: we need greater stimulus not less. The MMT School turns counter-cyclical 20<sup>th</sup> century Keynesianism on its ear, advocating for stimulus in booms and busts alike without fear of ballooning government debt, which MMT proponents argue central banks can ameliorate by lowering interest rates to zero and printing money to buy government bonds.<sup>20</sup> More mainstream economic voices have their own concerns about contemporary central bank measures. Former Clinton Treasury Secretary and Obama National Economic Council Director Larry Summers has sounded the alarm on the limits of the Fed's existing tool kit, asserting that "countering recessions requires four to five percentage points of monetary easing" and "we are very unlikely to have anything like that much room for easing when the next recession comes."<sup>21</sup>

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<sup>16</sup> Id.

<sup>17</sup> Id. at 414 ("Thus the sound-money principle has two aspects. It is affirmative in approving the market's choice of a commonly-used medium of exchange. It is negative in obstructing the government's propensity to meddle with the currency system.").

<sup>18</sup> Id.

<sup>19</sup> Noah Smith, *Bigger Deficits for Bad Tax Cuts is a Bad Deal* (Bloomberg, Dec. 1, 2017), archived at <https://perma.cc/9F2W-ENJH>.

<sup>20</sup> Id.

<sup>21</sup> Lawrence H. Summers, *The Fed Thinks it Can Fight the Next Recession. It Shouldn't be so Sure.* (Wash. Post, Sept. 6, 2016), archived at <https://perma.cc/U4M2-X6PN>. See

Monetary and central bank policy disagreements abound. Ideas compete in the academic and popular presses, and in central bank meetings across the world. While the debate continues in traditional forums, new technologies, including digital money minting, hold the promise of democratizing access to tools once reserved to an elite few decision makers. Central bankers, marshaling small armies of PhDs that conclave at relatively far reach from political branches,<sup>22</sup> are perhaps the pinnacle of elite technocrats from Bern to the Bank of England and Frankfurt to the Federal Reserve. The advent of digital currencies coinciding with revived monetary policy debates produces a heady possibility of one of the greatest disruptions in recent economic history: placing the levers of large-scale currency creation and manipulation in the hands of decentralized private actors around the world. However, digital technology simultaneously holds the possibility of national banks devising and controlling their own Central Bank Digital Currencies,<sup>23</sup> which may be essential to developing new sovereign monetary tools to confront future economic downturns.<sup>24</sup>

Major central banks already use “digital, state-issued money” for base money in private banks’ deposit accounts at national reserve institutions.<sup>25</sup> This money is documented in the form of liabilities on

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also Lawrence H. Summers, *Why the Fed needs a new monetary policy framework* (Brookings, June 7, 2018), archived at <https://perma.cc/4NFC-E8V3>.

<sup>22</sup> See Michael D. Bordo, *Some Historical Reflections on the Governance of the Federal Reserve*, in John H. Cochrane and John B. Taylor, eds., *Central Bank Governance and Oversight Reform* 221 (Hoover 2016), archived at <https://perma.cc/2ZRH-HZAK>.

<sup>23</sup> See Max Raskin and David Yermack, *Digital Currencies, Decentralized Ledgers, and the Future of Central Banking* (National Bureau of Economic Research, Working Paper No. 22238, 2016), archived at <https://perma.cc/CVV6-396T>.

<sup>24</sup> See *Id.*; see also Michael D. Bordo and Andrew T. Levin, *Central Bank Digital Currency and the Future of Monetary Policy* \*21 (Hoover Institution Economics, Working Paper No. 17104, May 2017).

<sup>25</sup> Ben Dyson and Graham Hodgson, *Digital Cash: Why Central Banks Should Start Issuing Electronic Money*, *Positive Money* 2, 4 (2016).

a central bank's balance sheet,<sup>26</sup> a digital ledger predating the blockchain. A direct route to organizing a Central Bank Digital Currency would involve a central reserve bank providing this same type of deposit account to all citizens not just other banks.<sup>27</sup> A central bank could then issue "digital cash" directly into those computerized deposit accounts by documenting the digital cash pertaining to an individual citizen as a central bank liability on its digital ledger.<sup>28</sup>

After this digital money is issued, the citizen's ability to utilize her funds listed in a central bank deposit account would rely on an additional layer of infrastructure reminiscent of existing cashless payment systems, such as debit cards and mobile banking apps.<sup>29</sup> This layer could be either privately or publicly administered, though private administration would allow for competition in service provision and could build off of existing consumer technology.<sup>30</sup> The primary difference between this CBDC regime and the status quo in cashless payment would be the disintermediation of a commercial bank in the current fractional reserve banking system.<sup>31</sup> Whereas at present, consumers bank with private commercial banks who hold deposits at central banks according to legal reserve requirements,<sup>32</sup> a CBDC regime would give consumers a direct line to central bank deposits of their own.<sup>33</sup>

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<sup>26</sup> Id. at 4.

<sup>27</sup> Id. at 2.

<sup>28</sup> See Id.

<sup>29</sup> Id.

<sup>30</sup> Id.

<sup>31</sup> Raskin and Yermack, *Digital Currencies, Decentralized Ledgers, and the Future of Central Banking* at 11-12 (cited in note 23) ("In many ways, Fedcoin represents a revival of the 1933 'Chicago Plan,' a widely discussed academic proposal to end fractional reserve banking in order to restore public confidence during the Great Depression.").

<sup>32</sup> See Federal Reserve Bank of Atlanta, *Fractional Reserve Banking – An Economist's Perspective (Transcript)*, archived at <https://perma.cc/RK9G-S2HL>.

<sup>33</sup> See Dyson and Hodgson, *Digital Cash* at 18 (cited in note 25).



CBDC deposit accounts would give the central bank novel monetary tools. To stimulate aggregate demand beyond conventional adjustments to base rates of interest, central banks could directly increase the balances in citizens' accounts through injections of so-called "helicopter money."<sup>34</sup> Central bank digital deposit accounts would also allow central banks to implement negative interest rates to help better overcome the zero lower bound (ZLB), which has been said to constrain monetary stimulus when interest rates are already at or near zero percent.<sup>35</sup>

Central banks face no shortage of criticism with respect to their monetary policy decisions. CBDCs would put new measures in central bankers' arsenals to implement monetary policy and address economic crises. The Federal Reserve also faces criticism with respect to the constitutionality of its governance and of its scope of authority. CBDC technology could also enable a mechanism to improve central bank legitimacy and constitutionality.

## II. CENTRAL BANKERS, POLITICAL ACCOUNTABILITY, AND THE CONSTITUTION

"To put it bluntly: the Federal Reserve System as currently organized is unconstitutional under a straightforward application of

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<sup>34</sup> Dyson and Hodgson, *Digital Cash* at 8 (cited in note 25).

<sup>35</sup> *Id.* at 6. See also Ben S. Bernanke, *How big a problem is the zero lower bound on interest rate?* (Hutchins Center on Fiscal & Monetary Policy at Brookings, Apr. 12, 2017) (Explaining that "the scope for rate cuts is limited by the fact that interest rates cannot fall (much) below zero, as people always have the option of holding cash, which pays zero interest, rather than negative-yielding assets." And positing, "Although the Fed was able to further ease monetary policy after 2008 through unconventional methods, the ZLB constraint greatly complicated the Fed's task."). But see Tyler Cowen, *Did the zero lower bound matter?* (Marginal Revolution, May 14, 2019), archived at <https://perma.cc/B26S-VEVG>, citing Davide Debortoli, Jordi Galí, and Luca Gambetti, *On the Empirical (Ir)Relevance of the Zero Lower Bound Constraint* (National Bureau of Economic Research Working Paper No. 25820, May 2019), archived at <https://perma.cc/3Z43-Z897>.

the recent U.S. Supreme Court precedent,” argued Peter Conti-Brown in 2015.<sup>36</sup> Specifically, Conti-Brown has contended that the Federal Reserve Act unconstitutionally insulates, in terms of both appointment and removal, the presidents of the Federal Open Market Committee (FOMC) from oversight by the President of the United States.<sup>37</sup>

Conti-Brown recounts that the inception of the modern Fed began after the 1907 Banking Crisis, when President Wilson engineered a compromise to bring the Federal Reserve System to life in the Federal Reserve Act of 1913.<sup>38</sup> The bargain was not unlike past negotiations conducted in the shadow of a federal system that seeks to reconcile a widely dispersed nation of both principled and self-interested localists with the demands of centralization.<sup>39</sup> The Act enshrined a federalized structure wherein 12 regional Reserve Banks would maintain autonomy and coexist with the Federal Reserve Board – since replaced with the Board of Governors – in Washington.<sup>40</sup> In the New Deal era, Congress devised the FOMC – “the Federal Reserve System’s monetary policy committee” – in

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<sup>36</sup> Peter Conti-Brown, *The Twelve Federal Reserve Banks: Governance and Accountability in the 21st Century* \*13 (Hutchins Center on Fiscal & Monetary Policy at Brookings, Working Paper No. 10, Mar. 2015), archived at <https://perma.cc/9WCH-CLHK>. Conti-Brown reiterated the “unconstitutionality of the Reserve Banks’ governance” in a contemporaneous law journal article. Peter Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 *Yale J. Reg.* 257, 303 (2015), archived at <https://perma.cc/CQM3-BHLR>.

<sup>37</sup> Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 *Yale J. Reg.* at 300-303 (cited in note 36).

<sup>38</sup> Conti-Brown, *The Twelve Federal Reserve Banks*, Brookings at 1 (cited in note 36); Federal Reserve Act, § 2, codified at 12 USC §§ 222-23, archived at <https://perma.cc/43KN-22QB>.

<sup>39</sup> See Conti-Brown, *The Twelve Federal Reserve Banks*, Brookings at 1, 7 (cited in note 36).

<sup>40</sup> *Id.* at 7, 12.

order to “centralize the [Reserve] Banks’ policies.”<sup>41</sup> With the Banking Act of 1935, the FOMC came to include the seven members of the Board of Governors along with five of the 12 regional Reserve Bank presidents on a rotating annual basis.<sup>42</sup> The presidents’ minority position on the FOMC remains in place today, with the president of the New York Reserve Bank enjoying a permanent place in one of the five Reserve Bank seats.<sup>43</sup>

The FOMC’s mandate is nothing short of setting national monetary policy: “The FOMC makes all decisions regarding the conduct of open market operations, which affect the federal funds rate . . . the size and composition of the Federal Reserve’s asset holdings, and communications with the public about the likely future course of monetary policy.”<sup>44</sup> According to Conti-Brown, “It is the presence of the Reserve Bank presidents on the FOMC that creates two separate constitutional problems,” one of appointment and one of removal.<sup>45</sup>

Where appointment is concerned, Conti-Brown argues that Reserve Bank presidents must be appointed by the President of the United States by and with the advice and consent of the Senate under the Constitution’s Appointments Clause, not by the current “circuitous process” involving the Reserve Bank’s board of directors.<sup>46</sup> This follows from Conti-Brown’s contention that in their

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<sup>41</sup> Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 Yale J. Reg. at 300 (cited in note 36).

<sup>42</sup> *Id.* at 300-30.

<sup>43</sup> Board of Governors of the Federal Reserve System, *Structure of the Federal Reserve System* (FederalReserve.gov, Oct. 28, 2016), archived at <https://perma.cc/AW9P-KN3D>. See also Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 Yale J. Reg. at 301 (cited in note 36).

<sup>44</sup> Board of Governors of the Federal Reserve System, *Structure of the Federal Reserve System* (cited in note 43).

<sup>45</sup> Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 Yale J. Reg. at 301 (cited in note 36).

<sup>46</sup> *Id.* at 301 citing U.S. Const. Art. II, § 2, cl. 2.

capacity as full voting members on the FOMC, Reserve Bank presidents, having only equals and no superiors, are thus properly considered principal officers under the standard articulated in *Edmond v. United States*, requiring that inferior officers be supervised.<sup>47</sup> What's more, even if Reserve Bank presidents were considered inferior officers, Conti-Brown argues that their appointment still violates the Appointments Clause, as they are not appointed by "the President alone," "the Courts of Law," or "the Heads of Departments," but rather by a board which is itself composed of multiple classes of directors, none of whom are appointed by the President of the United States.<sup>48</sup>

Where removal is concerned, Conti-Brown outlines how the multiple layers of insulation that protect Federal Reserve Bank presidents sitting on the FOMC from removal without cause by the President of the United States violates the separation of powers<sup>49</sup> and

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<sup>47</sup> *Id.* at 301 citing *Edmond v. United States*, 520 U.S. 651, 662-63 (1997) (Asserting, "Whether one is an "inferior" officer depends on whether he has a superior. It is not enough that other officers may be identified who formally maintain a higher rank, or possess responsibilities of a greater magnitude. If that were the intention, the Constitution might have used the phrase 'lesser officer.'" And concluding, that the "appointment [at issue] is in conformity with the Appointments Clause of the Constitution, since those judges are "inferior Officers" within the meaning of that provision, by reason of the supervision over their work exercised by the General Counsel of the Department of Transportation in his capacity as Judge Advocate General and the Court of Appeals for the Armed Forces.").

<sup>48</sup> *Id.* at 301-302 citing U.S. Const. Art. II, § 2, cl. 2. But see Daniel Hemel, *Maybe the Federal Reserve Banks Are Constitutional After All* (Notice & Comment, Apr. 4, 2016) (Arguing that if Reserve Bank presidents were considered inferior officers, their appointment could still be constitutional, as "Heads of Departments" can include multimember bodies and it is "at least arguable" that Congress actually "vested the appointment of Reserve Bank presidents in the Board of Governors" not simply the Reserve Bank board of directors), archived at <https://perma.cc/MM2A-3YMH>, citing *Free Enter. Fund v. Pub. Co. Accounting Oversight Bd.*, 561 U.S. 477, 512-13 (2010).

<sup>49</sup> Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 Yale J. Reg. at 302-303 (cited in note 36). See also Conti-Brown, *The Twelve Federal Reserve Banks*, Brookings at 18 (cited in note 36).

recent Supreme Court precedent in *Free Enterprise Fund v. PCAOB*, 561 U.S. 477 (2010).<sup>50</sup>

In the words of James Madison, cited by the Court in *PCAOB*, “if any power whatsoever is in its nature Executive, it is the power of appointing, overseeing, and controlling those who execute the laws.”<sup>51</sup> In *Myers v. United States*, the Supreme Court had held that an officer whom the President appointed by and with the advice and consent of the Senate could still be removed unilaterally by the President.<sup>52</sup> As stated by the *PCAOB* Court, in *Humphrey’s Executor v. United States*<sup>53</sup> the Court nonetheless went on to hold that “*Myers* did not prevent Congress from conferring good-cause tenure on the principal officers of certain independent agencies.”<sup>54</sup> *Humphrey’s*, however, had not resolved the question of whether the President may be “restricted in his ability to remove a principal officer, who is in turn restricted in his ability to remove an inferior officer, even though that inferior officer determines the policy and enforces the laws of the United States?”<sup>55</sup> The *PCAOB* Court addressed that issue in 2010. There, the Court found the Sarbanes-Oxley Act’s dual for-cause removal protection scheme for members of the Public Company Accounting Oversight Board (PCAOB) unconstitutional under Article II’s vesting clause.<sup>56</sup> Prior to the decision, PCAOB members could not be removed except “for good cause shown” as determined by the Securities and Exchange Commissioners,<sup>57</sup> who were themselves not subject to direct presidential control.<sup>58</sup> The

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<sup>50</sup> *Free Enterprise Fund v. Public Co. Accounting Oversight Board*, 561 U.S. 477 (2010).

<sup>51</sup> *Public Co. Accounting Oversight Board*, 561 U.S. at 492.

<sup>52</sup> *Myers v. United States*, 272 U.S. 52, 106 (1926).

<sup>53</sup> *Humphrey’s Ex’r v. United States*, 295 U.S. 602 (1935).

<sup>54</sup> *Pub. Co. Accounting Oversight Bd.*, 561 U.S. at 493 (citing *Humphrey’s Ex’r v. United States*, 295 U.S. 602 (1935)).

<sup>55</sup> *Pub. Co. Accounting Oversight Bd.*, 561 U.S. at 483.

<sup>56</sup> *Pub. Co. Accounting Oversight Bd.*, 561 U.S. at 496.

<sup>57</sup> *Pub. Co. Accounting Oversight Bd.*, 561 U.S. at 486.

<sup>58</sup> *Pub. Co. Accounting Oversight Bd.*, 561 U.S. at 495.

Court would approve one layer of insulation from presidential control but no more.

<sup>59</sup>Conti-Brown argues that the President's inability to remove Reserve Bank presidents from the FOMC is similarly unconstitutional. In fact, he asserts, that where *PCAOB* dealt with two layers of removal protection, the FOMC arguably involves three layers of insulation for Reserve Bank presidents on the committee.<sup>60</sup> Authority to remove a Reserve Bank president is simultaneously lodged in two separate boards: the DC-based Board of Governors and the Reserve Bank board of directors.<sup>61</sup> It is not clear which board a court would give ultimate removal authority.<sup>62</sup>

If a Reserve Bank president were ultimately removable by the Reserve Bank board of directors, the President of the United States "would have to reach through three layers" to remove her from the FOMC.<sup>63</sup> First, the U.S. President would have to go through the Board of Governors, where Governors themselves are removable only "for cause."<sup>64</sup> The Board of Governors would then have to go through the Reserve Bank board of directors, where director removal by the Board of Governors is limited by the requirement that "the cause of such removal" be "forthwith communicated in writing" to the removed individual.<sup>65</sup> According to Conti-Brown, this "'cause' language is a term of art" interpreted by the Supreme Court as a

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<sup>59</sup> *Pub. Co. Accounting Oversight Bd.*, 561 U.S. at 483-84.

<sup>60</sup> See Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 *Yale J. Reg.* at 300, 303 (cited in note 36).

<sup>61</sup> *Id.* at 302.

<sup>62</sup> *Id.* at 303.

<sup>63</sup> *Id.*

<sup>64</sup> *Id.* at 302 n 200 citing 12 U.S.C. § 242. See also Board of Governors of the Federal Reserve System, *Who are the members of the Federal Reserve Board, and how are they selected?* (Federal Reserve Board, Apr. 3, 2019) ("Once appointed, Governors may not be removed from office for their policy views."), archived at <https://perma.cc/V7W4-E66M>; Hemel, *Maybe the Federal Reserve Banks Are Constitutional After All*, Notice & Comment (cited in note 48).

<sup>65</sup> *Id.* at 302 n 201 citing 12 U.S.C. § 248(f).

removal restriction.<sup>66</sup> Third and finally, the Reserve Bank board of directors could get rid of the Reserve Bank president at will.<sup>67</sup> In this scenario, a Reserve Bank president on the FOMC is insulated by two layers of cause-related protection followed by a final at-will layer. Even if ultimate removal authority resided with the Board of Governors, whose removal of “any officer or director of any Federal reserve bank”<sup>68</sup> requires the articulation of cause, that would still implicate an impermissible two layers of cause-related protection.<sup>69</sup>

Daniel Hemel offers thoughtful counterarguments to Conti-Brown’s analysis of the FOMC’s appointment and removal problems. Regarding appointment, Hemel contends that Reserve Bank presidents are not necessarily “Officers of the United States” subject to the Appointments Clause, and questions, *inter alia*, whether FOMC members actually “exercise[] ‘significant authority pursuant to the laws of the United States.’”<sup>70</sup> Conti-Brown nonetheless replies that managing open-market operations, “making decisions about . . . the very value of the nation’s ‘faith and credit,’” and filling a role that “no other entity – private or public – can legally or functionally” involves wielding eminently “significant” authority.<sup>71</sup>

With respect to removal, Hemel pushes on the phrasing of the notice of “cause” provision for Reserve Bank officers’ removal by the Board of Governors. What Conti-Brown found to be a term of art indicating for-cause removal, Hemel argues is a simple notice

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<sup>66</sup> *Id.* at 302 citing *Humphrey's Executor v. United States*, 295 U.S. 602 (1935).

<sup>67</sup> Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 *Yale J. Reg.* at 303 (cited in note 36).

<sup>68</sup> *Id.* at 302 n 201 citing 12 U.S.C. § 248(f).

<sup>69</sup> See *id.* at 303.

<sup>70</sup> Hemel, *Maybe the Federal Reserve Banks Are Constitutional After All*, Notice & Comment (cited in note 48), citing *Buckley v. Valeo*, 424 U.S. 1, 126 (1976).

<sup>71</sup> Peter Conti-Brown, *The Case for the Federal Reserve Banks’ Constitutionality is Uneasy Indeed* (Notice & Comment, Apr. 22, 2016), archived at <https://perma.cc/3J4Z-JEJ>.

procedure effectively tantamount to at-will removal.<sup>72</sup> This statutory interpretation is key. Hemel notes, “If the word ‘cause’ implies some sort of limitation on the reasons for which the governors can remove a Reserve Bank president, then the statute might indeed raise constitutional problems.”<sup>73</sup>

With this interpretive debate, the constitutionality of FOMC insulation remains a question, and, as Hemel himself writes: that “constitutional question most certainly matters to the Fed’s legitimacy. For that reason, defenders of the Fed cannot so easily wave off the charge that the FOMC’s current structure is unconstitutional, even if federal courts are unlikely to upset the status quo.”<sup>74</sup>

To be clear, Conti-Brown himself does not see a path in which the constitutionality of the FOMC’s structure comes before the Supreme Court. Descriptively, he believes standing issues would prevent judicial review, and normatively he writes that he is a “judicial agnostic, leaning judicial atheist” as to whether judicial intervention is even the right way to resolve the constitutional deficiency.<sup>75</sup> Moreover, he has written that Congress is the

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<sup>72</sup> “With respect to removal, 12 U.S.C. § 248(f) allows the Board of Governors to fire any of the Reserve Bank presidents. Specifically, § 248(f) authorizes the Board of Governors: ‘To suspend or remove any officer or director of any Federal reserve bank, the cause of such removal to be forthwith communicated in writing by the Board of Governors of the Federal Reserve System to the removed officer or director. . . .’” Hemel, *Maybe the Federal Reserve Banks Are Constitutional After All*, Notice & Comment (cited in note 48).

<sup>73</sup> Hemel, *Maybe the Federal Reserve Banks Are Constitutional After All*, Notice & Comment (cited in note 48).

<sup>74</sup> Id. (Hemel also notes, “If [Reserve Bank presidents] are principal officers, then the Constitution requires them to be appointed by the (U.S.) President with the advice and consent of the Senate – a requirement clearly not satisfied here.” He nonetheless finds the presidents to be “inferior Officers” if they are in fact officers at all.)

<sup>75</sup> Conti-Brown, *The Case for the Federal Reserve Banks’ Constitutionality is Uneasy Indeed*, Notice & Comment (cited in note 71).



appropriate venue for a corrective measure with respect to the FOMC.<sup>76</sup>

Conti-Brown's argument, though, reaches beyond formal concerns to address the greater political and legal questions of the Fed's independence from political control.<sup>77</sup> In his words, "The unconstitutionality of the Reserve Banks' governance highlights the way that law, politics, and custom interact to create a separate policy-making space for the Federal Reserve."<sup>78</sup> That separateness speaks to the question of whether the Fed, said to be the single most important federal agency<sup>79</sup>, ought to be politically accountable to the people's democratically elected leaders.

To many, the answer to that question is a resounding no, and the insulation of the FOMC as a quintessential independent agency is the key feature, not a bug, of its legal structure, designed to protect a technocratic redoubt from the factional passions of populists and special-interests alike. In fact, some argue that the Fed is still not insulated or independent enough, either from elected officials' implicit demands based on their hopes for national economic performance and employment rates, or from financial interests practicing the art of regulatory capture.<sup>80</sup>

Adam White has deftly responded to Conti-Brown's work, noting, "One can support both 'Hamiltonian' insulation of the Fed's

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<sup>76</sup> See Peter Conti-Brown, *Is the Federal Reserve Constitutional?* (Law & Liberty, Sept. 1, 2013), archived at <https://perma.cc/ZW79-LBET>.

<sup>77</sup> See Conti-Brown, *The Institutions of Federal Reserve Independence*, 32 Yale J. Reg. at 273, 307 (cited in note 36) ("Removability restrictions around the Reserve Bank presidents, on the other hand, owe much to law. The legal structure of the FOMC essentially prevents the President from meddling with Reserve Bank participation on that Committee, despite how central monetary policy has become.").

<sup>78</sup> *Id.* at 303.

<sup>79</sup> David Zaring, *Law and Custom on the Federal Open Market Committee 1* (Columbia Symposium on Administrative Law and Financial Regulation Working Paper, 2014), archived at <https://perma.cc/UW28-4QZQ>.

<sup>80</sup> See Bordo at 234-35 (cited in note 22).

lending and monetary activities” from political accountability yet also support “‘Madisonian’ republican accountability for [the Fed’s] regulatory activities,” such as supervising banks and monitoring systemic financial risk.<sup>81</sup> Yet White also writes, “the Fed’s policies aren’t exclusively technocratic” but “necessarily implicate value-laden policy judgments,” and “[w]hen it comes to questions of value” that is where the people are the competent appraisers.<sup>82</sup>

These questions of political control of central bank policy will only become more important under a prospective CBDC or “Fedcoin”<sup>83</sup> regime. The very benefits of such a CBDC – disintermediation of third parties, the enhanced ability to impose a negative interest rate below the zero lower bound, and the capacity to deliver helicopter money – would take the Fed’s operations from a largely abstract concept in the minds of many Americans and make them connected to the contents of American pockets and wallets like never before. If the Fed is beaming helicopter drops of Fedcoin to your smartphone’s banking app or nibbling away your hard-earned Fedcoin savings with negative interest rates, the Main Street and Wall Street temptation to influence the Fed’s policy through political channels may become insurmountable. Add to that the passionate critiques of monetary policy from the Sound Money and MMT camps, and it is hard to see a world in which the arrival of a CBDC does not add fuel to the fire of an ever more relevant political battle over Fed insulation and policy.

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<sup>81</sup> Adam White, *The Fed Knows Prices, But the Founders Knew Real Values* (Notice & Comment, Apr. 7, 2016) (“The modern Federal Reserve wears ‘five hundred hats,’ as Conti-Brown felicitously puts it.”), archived at <https://perma.cc/Y82D-WKWN>, citing Peter Conti-Brown, *The Power and Independence of the Federal Reserve* 127 (Princeton University Press 2016).

<sup>82</sup> Id.

<sup>83</sup> Raskin and Yermack at 10, citing J.P. Koning, *Fedcoin* (cited in note 23).

### III. NONDELEGATION DOCTRINE, ALGORITHMS, AND ACCOUNTABILITY

The advent of CBDCs will likely enlarge contentious questions regarding central bank independence, but it will also provide an opening to refine answers thereto. While the introduction of a CBDC could inflame tensions between those wary of political capture and those wary of political unaccountability, the nature of the CBDC-enabling technology itself will also create an opportunity to revive in practice a dormant<sup>84</sup> doctrinal solution to the very problem of political oversight of agency policy administration.

As this section will explore, there are close parallels between the fundamental principles of algorithmic computer programming and those of the classical nondelegation doctrine in constitutional law. The amenability of CBDCs to an algorithmic monetary policy regime makes them a potential platform for the instantiation of nondelegation precepts in the relationship between Congress and the Federal Reserve.

As Adam White has observed, the doctrines of agency independence and nondelegation are historically related.<sup>85</sup> White notes, "In *Morrison v. Olson*, for example, the Court's comfort with the Independent Counsel's structural independence was justified in part by the IC's 'limited jurisdiction and tenure,' with no 'policymaking or significant administrative authority.'" <sup>86</sup>

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<sup>84</sup> "The Supreme Court has not invalidated a congressional statute on nondelegation grounds since 1935." Gary Lawson, *The Rise and Rise of the Administrative State*, 107 Harv. L. Rev. 1231, 1240 (1994).

<sup>85</sup> "Indeed, [doctrines of independence and nondelegation] are discussed in relative isolation despite the fact that they arose in the same constitutional and political moment—the Supreme Court's review of the first New Deal. An[d] they are discussed in relative isolation despite the fact that, in the Court's own decisions, the delegation question lurks in the background of the independence question, and vice versa." Adam White, *The Fed Knows Prices, But the Founders Knew Real Values*, Notice & Comment (cited in note 81).

<sup>86</sup> Id citing *Morrison v. Olson*, 487 U.S. 654 (1988).

Conceptually, the doctrines of agency independence and nondelegation both address the scope of agency autonomy, though they apply different glosses to the problem. In broad strokes, the post-New Deal doctrine of independence takes independent agency autonomy as a goal,<sup>87</sup> whereas the classical nondelegation doctrine views executive agency autonomy as something to constrain.<sup>88</sup>

In Federalist No. 10, the masterful disquisition on “curing the mischiefs of faction,” James Madison wrote:

The apportionment of taxes on the various descriptions of property is an act which seems to require the most exact impartiality; yet there is, perhaps, no legislative act in which greater opportunity and temptation are given to a predominant party to trample on the rules of justice. Every shilling with which they overburden the inferior number, is a shilling saved to their own pockets.<sup>89</sup>

Madison’s insights on human nature’s predilections for selfish taxing and spending apply with equal force to coining and discounting digital money. His conceptions of impartiality, justice, and uniform rules inform the aspiration of so-called independent agencies, like the Fed and FCC, whose characteristic insulation from direct presidential control is said to make their institutional design less

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<sup>87</sup> “The idea is that an agency could be created that would be insulated from short-term political pressures so that it could adopt public policies based on expertise that would yield better public policy over the long term. Thus, the New Dealers hoped to create apolitical agencies that would be guided by information and not politics.” Rachel Barkow, *Insulating Agencies: Avoiding Capture Through Institutional Design*, 89 *Tex. L. Rev.* 15, 20 (2010), archived at <https://perma.cc/E3H9-4LB7>.

<sup>88</sup> “As the Supreme Court has long said, the conventional [nondelegation] doctrine requires Congress to supply something like an ‘intelligible principle’ to guide and limit executive discretion.” Cass R. Sunstein, *Nondelegation Canons*, 67 *U. Chi. L. Rev.* 315, 318 (2000), archived at <https://perma.cc/9K7N-SRZ2>.

<sup>89</sup> The Federalist No. 10 (James Madison).

political and more publicly-oriented.<sup>90</sup> In the words of Paul R. Verkuil, that independent agencies are also frequently organized as “collegial bodies” – commissions or boards – makes them “more concerned with the values of fairness, acceptability and accuracy than with the single dimension of efficiency.”<sup>91</sup>

Madison’s analysis further speaks to a concern about how much trust to impart in institutions, which also underlay Satoshi Nakamoto’s challenge to the traditional banking system in his Bitcoin thesis. That trust problem is a self-dealing problem: will the institution make decisions and tradeoffs for the benefit of internal constituencies, external interest groups, or consumers and the public at large? This agency problem is also central to the historical administrative law doctrine of nondelegation, which sought to limit the extent to which Congress could outsource facets of policy setting power to Executive agencies.<sup>92</sup>

Where presidential removal doctrine originates in Article II’s vesting of “[t]he Executive power” in the President, nondelegation doctrine originates in Article I § 1’s vesting of “[a]ll legislative powers herein granted . . . in a Congress of the United States.”<sup>93</sup> This doctrine is not only concerned with the Constitution’s text, but also with the structure of government and separation of powers enshrined therein. The Congress represents and is politically accountable to the people

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<sup>90</sup> See Paul R. Verkuil, *The Purposes and Limits of Independent Agencies*, 1988 DUKE L. J. 257, 259-61 (1988), archived at <https://perma.cc/WM4F-NWTU>.

<sup>91</sup> *Id.* at 260-61.

<sup>92</sup> See Sunstein, *Nondelegation Canons*, 67 U. Chi. L. Rev. at 320-21 (cited in note 88) (“[T]he requirement of legislative clarity might also seem to be a check on the problems of factional power and self-interested representation, two of the problems most feared by the framers. Indeed, the nondelegation doctrine might be taken as a central means of reducing the risk that legislation will be a product of efforts by well-organized private groups to redistribute wealth or opportunities in their favor.”).

<sup>93</sup> U.S. Const. Art. I, § 1. See also Lawson, *The Rise and Rise of the Administrative State* 107 Harv. L. Rev. at 1238-39 (cited in note 84).

and therefore possesses “[a]ll legislative powers.” While the Article II Executive Branch is to apply and execute duly enacted legislation, it was not supposed to become a legislature unto itself. Some discretion in the application of law to circumstance is necessary and inevitable, but too much discretion – if agencies were to make it up as they went along – would render legislation essentially meaningless and the law no advanced guide to behavior.<sup>94</sup>

The canonical nondelegation case, *J.W. Hampton, Jr., & Co. v. United States*,<sup>95</sup> concerned the constitutionality of a Congressional delegation under the Tariff Act, which authorized the President to adjust tariff rates on competing international imports.<sup>96</sup> Specifically, the section of the Act at issue provided for the President to investigate the differences in costs of production between American and foreign products in order to, in conjunction with the Tariff Commission, adjust duties up or down and thereby equalize the cost of production between US and foreign goods.<sup>97</sup> The Court held that where, as there, Congress laid down an “intelligible principle to which the person or body authorized to fix such rates is directed to conform, such legislative action is not a forbidden delegation of legislative power.”<sup>98</sup> It was effectively under *J.W. Hampton’s*

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<sup>94</sup> Justice Cardozo asserted, “[L]aw as a guide to conduct is reduced to the level of mere futility if it is unknown and unknowable.” Daniel E. Troy, *Retroactive Legislation* 18 (1998). See also Lawson, *The Rise and Rise of the Administrative State* 107 Harv. L. Rev. at 1239 (cited in note 84) (“A governmental function is not legislative, however, merely because it involves some element of policymaking discretion: it has long been understood that some such exercises of discretion can fall within the definition of the executive power. The task is therefore to determine when a statute that vests discretionary authority in an executive (or judicial) officer has crossed the line from a necessary and proper implementing statute to an unnecessary and/or improper delegation of distinctively legislative power.”).

<sup>95</sup> *J.W. Hampton, Jr., & Co. v. United States*, 276 U.S. 394 (1928).

<sup>96</sup> See John F. Manning & Matthew C. Stephenson, *Legislation and Regulation* 400 (2d ed. 2013).

<sup>97</sup> *J.W. Hampton, Jr., & Co. v. United States*, 276 U.S. 394, 401 (1928).

<sup>98</sup> *J.W. Hampton*, 276 U.S. at 409.

intelligible principle standard that the Supreme Court last gave bite to the nondelegation doctrine, striking down portions of the National Industrial Recovery Act in *Schechter Poultry v. United States* and in *Panama Refining Co. v. Ryan* in 1935.<sup>99</sup>

*J.W. Hampton* provided one of the most straightforward examples of permissible delegation. Congress wanted the production costs of US and foreign goods equalized, and it gave the Executive ongoing authority to fact-find and rate-set to realize that express prescription. Congress essentially gave the agency, the Tariff Commission, a series of numerical problems to be solved in sequence: i) find  $Y$ , the difference between Production Cost of American Good  $X$  and Production Cost of Foreign Good  $X$ ; ii) where  $Y > 0$ , find the difference,  $Z$ , between  $Y$  and the existing Tariff,  $T$ ; iii) sum  $Z$  and  $Y$  to produce new Tariff,  $T'$ .<sup>100</sup>

Donald Knuth, a founding father of modern computer science and author of the magisterial *The Art of Computer Programming*, describes an indispensable programming method, not unlike a permissible Congressional delegation, as “a finite set of rules that gives a sequence of operations for solving a specific type of problem.”<sup>101</sup> Where a set of rules has the features of finiteness,

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<sup>99</sup> See Cynthia R. Farina, *Statutory Interpretation and the Balance of Power in the Administrative State*, 89 Colum. L. Rev. 452, 484 (1989) citing *A.L.A. Schechter Poultry Corp. v. United States*, 295 U.S. 495, 541-42 (1935); *Panama Refining Co. v. Ryan*, 293 U.S. 388, 430 (1935).

<sup>100</sup> “First. It seems clear what Congress intended by section 315. Its plan was to secure by law the imposition of customs duties on articles of imported merchandise which should equal the difference between the cost of producing in a foreign country the articles in question and laying them down for sale in the United States, and the cost of producing and selling like or similar articles in the United States, so that the duties not only secure revenue, but at the same time enable domestic producers to compete on terms of equality with foreign producers in the markets of the United States.” *J.W. Hampton*, 276 U.S. at 404.

<sup>101</sup> Donald E. Knuth, *1.1 Algorithms*, *The Art of Computer Programming*, Volume 1: Fundamental Algorithms (3d ed. 2014) (1997), archived at <https://perma.cc/Q473-CS94>.

definiteness, input, output, and effectiveness, Professor Knuth labels it an algorithm.<sup>102</sup> A statute with the same features would satisfy the classical nondelegation doctrine's intelligible principle standard.

Under Knuth's definition, inputs are quantities that are both "given to [the algorithm] initially before [it] begins, or dynamically as the algorithm runs," and an output is a quantity with a "specified relation to the inputs."<sup>103</sup> These features were clearly present in the tariff setting example where there were initial "duties fixed in [the] act,"<sup>104</sup> as well as dynamic variables in the production costs of domestic and foreign goods. Those costs could be fed into the computational sequence to produce a new duty per the rules provided. The new duty, in turn, could also be fed back into the rate setting method for future adjustments based on ongoing changes in production costs. Knuth defined the algorithmic feature of effectiveness with a heuristic, stating that an "algorithm is also generally expected to be effective, in the sense that its operations must all be sufficiently basic that they can in principle be done *exactly* and in a finite length of time by someone using pencil and paper."<sup>105</sup>

The arithmetic in the tariff setting process in *J.W. Hampton* would have satisfied the pencil and paper heuristic. There were few other computational technologies available in 1928. Whether the tariff setting process at issue in *J.W. Hampton* would have satisfied an exactness criterion, however, is more complicated. The Court in *J.W. Hampton* noted, "[I]t may be that it is difficult to fix with exactness this difference" in production cost.<sup>106</sup> The Court might have been concerned with either the difficulty of ascertaining the actual empirical difference between foreign and domestic production costs or the difficulty in providing a sufficient definition of production

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<sup>102</sup> *Id.*

<sup>103</sup> *Id.*

<sup>104</sup> *J.W. Hampton*, 276 U.S. at 401.

<sup>105</sup> Knuth (cited in note 101) (emphasis added).

<sup>106</sup> *J.W. Hampton*, 276 U.S. at 404, 413.



cost, or both. Nonetheless, the Court was satisfied that the delegation regarding that difference was still “perfectly clear” and therefore legitimate.<sup>107</sup> While ascertaining production costs could be a somewhat open-ended exercise from a scientific perspective, in practice it does not have to be. An economist could simply define a basket of constituent factors with which to measure production costs that is robust enough to be useful. Businesses run on economic models and Generally Accepted Accounting Practices that are sufficient to generate goods, services, and profits without first having to achieve absolute metaphysical confidence in the boundaries of their definitions of terms. Once determined, the concrete figures those practices yield could be used in an algorithm’s operations and should thus satisfy the exactness criterion of Knuth’s “effectiveness” definition.

A key question is whether a rule laid down would provide enough specificity to serve up a variable that could be operated on, and therefore for that rule to be considered a legitimate step in an algorithm. Here, Knuth’s effectiveness criterion merges with his finiteness and definiteness criteria. For Knuth, achieving finiteness meant an algorithm must terminate after a limited number of steps. Definiteness referred to the precise articulation of each particular step in the algorithm: “the actions to be carried out must be rigorously and unambiguously specified for each case.”<sup>108</sup> The Court’s ultimate conclusion in *J.W. Hampton* was that in spite of the difficulty in fixing the production cost difference with “exactness,” the delegation was nonetheless “perfectly clear and perfectly intelligible,” and therefore constitutionally valid.<sup>109</sup> The description of perfect clarity and intelligibility suggests that the delegation was narrow and bounded enough for an agent to perform a specific function; it was not an open-ended delegation that effectively gave

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<sup>107</sup> *Id.*

<sup>108</sup> Knuth (cited note 101).

<sup>109</sup> *J.W. Hampton*, 276 U.S. at 404, 413.

the agent the power to legislate out of whole cloth. In other words, the delegation was definite (clear) and finite (intelligible) enough.

The *J.W. Hampton* Court's criteria for constitutional delegation and Knuth's criteria for an algorithm are remarkably similar. Both sets of standards are concerned with whether a set of instructions is limited enough to be applied in practice without begetting supplemental machinations: whether after having been laid out in advance those instructions can produce results without, in the case of nondelegation, requiring ongoing agency re-legislation, or, in the case of algorithms, ongoing programmer intervention.

While a classical constitutional delegation and an algorithm seek to adhere to principles that are essentially alike, they are composed of different languages: English (or another natural language) in the case of the former and a computer programming language or mathematical notation in the case of the latter. Knuth identified the fundamental possibility that natural language risked creating gaps between notation and meaning in a way in which mathematical notation and computer-programming languages would not:

The algorithms of this book will hopefully meet this [definiteness] criterion, but they are specified in the English language, so there is a possibility that the reader might not understand exactly what the author intended. To get around this difficulty, formally defined *programming languages* or *computer languages* are designed for specifying algorithms, in which every statement has a very definite meaning. Many of the algorithms of this book will be given both in English and in a computer language.<sup>110</sup>

That a single snippet of natural language can give rise to multiple potential meanings is a fundamental problem of statutory interpretation and to a great extent law in general. The problem bedevils textualists and purposivists alike. It contributes to the

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<sup>110</sup> Knuth (cited in note 101).

possibility of slippage between a legislature's prescription and an agency's execution. The advent of CBDCs, however, opens the possibility of supplementing, or substituting, natural language instructions in law with more definite, computer-readable instructions, at least in certain use cases. This development could help to overcome the constitutional and agency challenges heretofore described: the problem of ensuring independence while observing the separation of powers' checks and balances – seen in the appointment and removal context; and the problem of delimiting the authority entrusted to agents – seen in the classical nondelegation context.

The evolution of the nondelegation doctrine involved the Court searching for the appropriate line dividing proper and improper delegations.<sup>111</sup> Historically, a “gravity of the subject matter” factor gave way to a “legislative’/’nonlegislative distinction,” which, in turn, gave way to the intelligible principle standard.<sup>112</sup> In the case of a CBDC, the underlying technology provides its own readily apparent and operable nondelegation standard in the form of a properly constructed algorithm. The “algorithm standard,” in turn, is already eminently compatible with the forerunning intelligible principle standard.

#### IV. CENTRAL BANK DIGITAL CURRENCIES AND ALGORITHMIC POLICY

The administrative state is riddled with constitutional issues regarding agency personnel management and open-ended delegations. The case of the central bank provides a particularly relevant example of how algorithmic policymaking can allow Congress to apply general rules to emergent facts without having to worry as much about the constitutionality of an independent

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<sup>111</sup> Farina, *Statutory Interpretation and the Balance of Power in the Administrative State*, 89 Colum. L. Rev. at 481 (cited in note 99).

<sup>112</sup> *Id.* at 481, 483-84.

agency's structure for hiring and firing, or about constraining the discretion Congress delegates to an agent. The central bank is a fitting case study, given that the constitutionality of its personnel structure is already a subject of debate; the quantitative nature of its policy portfolio lends itself to algorithmic governance; the digitization of the subject of its authority – money and the regulation of the money supply – is already being explored; and the centrality of money to every other aspect of government suggests a digital currency could lay a foundation for algorithmic policy methods in other public sector services.

The idea of an algorithmic central bank policy controlling the size of the money supply predates the contemporary CBDC field. John Nash and Milton Friedman had previously discussed the possibility of “algorithmic currency, issued according to a mathematically fixed policy rule, to usurp the role of central banks and discretionary monetary policy.”<sup>113</sup> The definite, finite, and exact characteristics of algorithmic currency creation would appeal to Friedman, whose “monetarist” theory of macroeconomics advocated for a “constant money growth rule.”<sup>114</sup> Friedman argued such a rule would help prevent the errors of “activist monetary policy,” given the constraints of imperfect knowledge, and would avert the hazards of significant fluctuations in the stock of money.<sup>115</sup> In its pure form, this rule “would require the money stock to grow at a constant rate and prohibit cyclical adjustments.”<sup>116</sup> As seen in the preceding discussion of the parallels between algorithms and nondelegation principles,

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<sup>113</sup> Raskin and Yermack at 1-2, citing Babbage, 2011, *Virtual Currency: Bits and Bob*, *The Economist*, (June 13, 2011) (cited in note 23).

<sup>114</sup> Edward Nelson, *Friedman and Taylor on Monetary Policy Rules: A Comparison*, Federal Reserve Bank of St. Louis Review 95, 98 (2008), archived at <https://perma.cc/TAE2-DXQH>.

<sup>115</sup> *Id.* at 99.

<sup>116</sup> Bennett T. McCallum, *Monetarist Principles and the Money Stock Growth Rule 1* (Nat'l Bureau of Econ Research, Working Paper No. 630, 1980), archived at <https://perma.cc/SK9J-DULK>.

algorithms succeed in cabining discretion, a clear goal of Friedman's. However, while algorithmic monetary policy would align with the philosophical priors of Friedman's monetarism, it could also be used to implement other monetary policy regimes as well.

The macroeconomist John Taylor has argued that Friedman's constant money growth rule is "extremely undesirable," and has preferred an activist interest rate rule instead.<sup>117</sup> Taylor, nonetheless, distinguishes activist policy from discretionary policy, and finds it possible to implement the former without succumbing to or requiring the latter.<sup>118</sup> Taylor's monetary prescriptions are amenable to algorithmic articulation given that they are, at core, a system of "simple rules."<sup>119</sup> Taylor has been a strong advocate for a rules-based approach, likening it to a "checklist" in medicine in contrast to a doctor deciding to "wing it."<sup>120</sup> This view is in part connected to his contention that "for an independent agency of government there has to be limits."<sup>121</sup> Nonetheless, Taylor has still accepted that monetary policy should be adaptable enough to accommodate changing circumstances, such as money demand shocks.<sup>122</sup> While circumstances are in flux, Taylor argues that the responses to such shocks ought to be "systematic," with policy based on models of "structural relationships."<sup>123</sup> Rather than simply laying down

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<sup>117</sup> Nelson at 98 (cited in 114).

<sup>118</sup> Id. 99-100.

<sup>119</sup> Id. 100.

<sup>120</sup> *Transcript: John Taylor Presentation and Q&A at Boston Fed* (Wall St. Journal, Oct. 15, 2017), archived at <https://perma.cc/L9WS-W3S5>. For a synopsis of the opposite treatment, see Alex Tabarrok, *Firefighting: A Plea for Discretion* (Marginal Revolution, Apr. 24, 2019) (Summarizing that Bernanke, Geithner, and Paulson "come down solidly on the side of technocracy and discretion rather than democracy and rules."), archived at <https://perma.cc/GZ8F-J7VU>, citing Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., *Firefighting: The Financial Crisis and its Lessons* (Penguin Books 2019).

<sup>121</sup> Id.

<sup>122</sup> Nelson at 101-102 (cited in note 114).

<sup>123</sup> Id. at 102.

constants or making policy up from moment to moment, Taylor advocates for preset rules that could nonetheless react to dynamic inputs. While Taylor's vision is markedly different from a constant money growth rule, its potential to be applied algorithmically is still conceivable given its penchant for simple rules and reliance on mathematical functions to counteract deviations from targets, such as variables like inflation.<sup>124</sup>

Devising and adhering to a computer-readable policy in algorithmic format would, in keeping with the distinction Taylor identified, not require choosing a constant policy over an activist policy, but would rather mean choosing a rule-bound policy over a discretionary one. Such a rule-based policy would also not require, in an absolute sense, a computer-readable algorithmic format. Rather, a non-discretionary policy could, in theory, be entrusted to an agency staff, so long as the agency and the legislature delegating authority bought into a rule-based policy regime resembling the application of a rigorous *J.W. Hampton*-like intelligible principle standard. One of the critical differences, though, between a computer-readable algorithmic delegation and a conventional delegation is that the former would not necessarily require such agency buy-in. In fact, if and where government use cases lend themselves to algorithmic policy, a computer readable set of rules would not *necessarily* require agents as we currently know them.

The conventional medium for policy execution is an institution with moving human parts. An algorithmic policy medium would be a program running on the servers that constitute the CBDC digital infrastructure. If the output of such a monetary policy is digital cash and the input variables are quantitative, such as predetermined macroeconomic metrics of inflation and aggregate demand, monetary policy could not only be stated algorithmically, but also coded digitally as a software application. For instance, the issuance of helicopter drops of Fedcoin or the level of CBDC interest rates

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<sup>124</sup> Id. at 95.

could be conditioned on macroeconomic input variables crossing certain thresholds or exhibiting particular patterns. These conditions could be written as computer code, where certain inputs trigger corresponding outputs in changes to the CBDC supply, thereby automating a significant aspect of monetary policy. With each deposit of digital, helicopter cash or basis point change in the rate of interest affecting citizens' computerized deposit account holdings, software would be executing law and rendering policy.

Lawrence Lessig articulated the distinction between traditional laws emanating from Washington, DC – “East Coast Code,” as he called it – and the code of computer programmers writing software instructions – “West Coast Code.”<sup>125</sup> Given the fact that West Coast Code informed the architecture of the emerging digital infrastructure, and that this structure both opened and closed possibilities for digital action, Lessig also promoted the idea that “code is law.”<sup>126</sup> In the case of an algorithmic monetary policy manipulating the digital money supply, the reverse formulation would be true as well and it could be said that “*law is code*.”<sup>127</sup> The question for governing purposes, then, is who will write the code? Of course, the agency, such as the central bank, could be the

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<sup>125</sup> Lawrence Lessig, *Code 72-3* (Version 2.0, Basic Books 2006) (1999), archived at <https://perma.cc/X4Q4-EQFC>.

<sup>126</sup> *Id.* at 5.

<sup>127</sup> See Primavera De Filippi and Samer Hassan, *Blockchain Technology as a Regulatory Technology: From Code is Law to Law is Code* (21:12 First Monday, Dec. 5, 2016) (“In this paper, we describe the shift from the traditional notion of ‘code is law’ (i.e., code having the effect of law) to the new conception of ‘law is code’ (i.e., law being defined as code).”), archived at <https://perma.cc/8YBD-EK9H>. For more variations on this theme see also Daniel Castro, *Law is Code* (Center for Data Innovation, Feb. 13, 2014) (“The converse, i.e., ‘law is code,’ is also true: the laws of our society ultimately shape the design of our computer systems.”), archived at <https://perma.cc/7I6X-N6WL>; William Li et al, *Law is Code: A Software Engineering Approach to Analyzing the United States Code*, 10 J. of Business & Tech. L. 297 (2015) (“In this Article, we take a quantitative, unbiased, and software engineering approach to analyze the evolution of the United States Code from 1926 to today.”), archived at <https://perma.cc/7HYJ-75RS>.

governing body that writes computer algorithms. That administrative agencies are the main home of public sector technical expertise suggests significant historical and structural reasons for the research, development, and hard coding of algorithmic policy to take place within administrative agencies.

Were law as code writing to take place within administrative agencies, the delegation picture might look, in a number of respects, like it already does today. Congress could be in the business of laying down intelligible principles for administrators to follow when filling in details based on the facts on the ground and the agents' specialized knowledge. Furthermore, within the agency, there would still be a handoff of authority between the policy expert devising the model for the relationship between macroeconomic inputs and CBDC outputs and the software engineer who translates those instructions into the programming language used on the CBDC platform. That handoff could even present new challenges to the ability of agency leaders to supervise the work of their subordinates. The potential opacity of computer programming to a policy expert might even make deviations from instructions harder to identify where the policy expert is not fluent in computer programming languages and processes.

With that said, algorithmic policy, even where written within administrative agencies themselves, could still help limit agent discretion. While the handoff between the policy expert and the software engineer is a potential opportunity for deviation from a policy prescription, where the policy medium is a software program and not a vast array of human actors, the opportunities for such deviations down the chain of command could become fewer. Where there are fewer points of departure between policymaking and execution, such as the primary handoff between policymakers and coders, that translation would be easier to police for consistency than would be multiple layers of human actors. The assumption that the chain of command in digital policy execution would be shorter might prove inaccurate. Nonetheless, the main constraining influence of algorithmic policy lies in the fact that it is inherently rule-based and prescribed in advance. In the case of the Federal Reserve, an algorithmic policy would realize Taylor's vision of checklist-like



foreordained monetary operations that substitute for transient and discretionary policymaking.

Furthermore, while the aforementioned historical and structural inertia makes it likely that natural-language law to computer code translation would take place in administrative agencies, it is possible that a computerized policy medium could help Congress reclaim its constitutional primacy in lawmaking. If Congress were to legislate through algorithmic policy delegations, this would change the terrain with respect to agency appointment and removal issues. Were administrators to become the support staff for a CBDC infrastructure as opposed to arguable Officers of the United States wielding “significant authority,” this would help to resolve the separation of powers issues that confront bodies like the FOMC. Unlike officers subject to presidential control, administrative employees are protected from termination without cause by longstanding civil service laws.<sup>128</sup> An illustrative, yet far less likely, extreme form of this trend might see administrative staffs themselves reduced where algorithmic policy methods through a digital medium allow Congress to write code primarily executed by machines instead of people.

Where questions of the seemingly improbable are concerned, how would Congress, yes that Congress that can hardly pass a budget, attain the capacity to legislate in computer code? Within Congress, writing laws is already subordinated from Senators and Representatives to their legislative staffs. Software engineers could be added to the ranks of legislative aides. In the *J.W. Hampton* tariff example, Congress had written a law that was essentially a quantitative formula: find the difference in costs of production between domestic and foreign goods and add that to the tariffs on foreign goods to equalize domestic and foreign production costs. In-

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<sup>128</sup> See Gerald E. Frug, *Does the Constitution Prevent the Discharge of Civil Service Employees?*, 124 U. PA. L. REV. 942, 945-46 (1976).

house Congressional software engineers could make similar such instructions computer-readable, if there were a corresponding digital infrastructure to receive those instructions. Of course, as discussed above, the inherent possibility for slippage between a policy devised in natural language and its execution in computer code would remain. The less quantitative and more qualitative the policy, the more pronounced those issues of interpretation and slippage would become.<sup>129</sup>

With highly-quantitative policy prescriptions, however, digital execution is not beyond the realm of conceivability. *J.W. Hampton* dealt with duties on imported merchandise. A robust digital infrastructure for the assessment of duties on goods crossing the border – such as via container tracking<sup>130</sup> – that is interoperable with the CBDC system could allow a Congressionally desired tariff program to debit from importers' digital reserve accounts directly into Uncle Sam's Treasury. A more immediate application for digital

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<sup>129</sup> Among the less quantitative and more qualitative forms of policymaking, law as code would be far more difficult if not impossible to implement. Values like fairness and reasonableness and abstract ideas like justice and equity would, almost certainly, so defy any straightforward translation of natural language into computer code as to render the law as code project in those cases not only impossible but also undesirable. Moreover, areas of law that require the specifically human assessment of mental and emotional states, such as *mens rea*, intent, and remorse, would also confound the application of law as code. With that said, a representative political system trusts the legislature to manifest the people's qualitative value judgments in the public law, including, at times, with quantitative rules. The opening to distill qualitative ideas into inappropriate quantitative representations and thereby fall into the practice of scientism would also be a risk of a law as code project. See Tyler Cowen and Russ Roberts, *Russ Roberts on Life as an Economics Educator* (Conversations with Tyler, June 5, 2019), archived at <https://perma.cc/C45D-UGAU>, citing Friedrich A. Hayek, *The Pretense of Knowledge* (Nobel Prize Lecture, Dec 11, 1974), archived at <https://perma.cc/VF3V-AHXT>.

<sup>130</sup> See Deep Patel, *UPS bets on blockchain as the future of the trillion-dollar shipping industry*, TECHCRUNCH, Dec. 15, 2017, archived at <https://perma.cc/E6ES-4X4D>.

tariff setting could lie in taxes on foreign direct investment (FDI).<sup>131</sup> FDI denominated in the CBDC and entering the digital coffer of a Federal Reserve private account holder could have a fraction of that investment debited as it clears into the company's account. In a pre-digital era, the imposition of a tariff – even one as straightforward as that in *J.W. Hampton* – required the legwork of executive agents. In a digital world, with ever-increasing data aggregation and the ability to code models that construct proxy indicators therefrom, a model for a variable such as the production cost of good X could be coded and embedded as an input in a program that controls the contents of CBDC accounts.

Were writing legislation to become coterminous with writing software for an underlying CBDC and greater digital public infrastructure, a portion of human administrative agents executing policy could be replaced by an automated system. The gravity of presidential control issues would be diminished where agency personnel no longer exercised discretionary executive authority or even had as many agency jobs to fill. Nondelegation questions would also be diminished where legislation directly instantiated the execution of an algorithmic policy through an electronic medium without an intervening human exercising interpretive judgment. Law would be code for a digital infrastructure that controlled real-world outcomes, such as in central bank activity or tariff setting and collection.

However, even if such significant developments as a public digital infrastructure atop a CBDC platform were to be realized, there would remain a certain conservation of the agent delegation and trust problem. Wherever instructions need to be interpreted or translated, such as from natural language to computer code, an agent would be exercising some degree of interpretive choice, and deviation from intended instructions would be possible. That

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<sup>131</sup> See Organization for Economic Co-Operation and Development, *Tax Effects on Foreign Direct Investment*, OECD Policy Brief (2008), archived at <https://perma.cc/SN6S-D4VS>.

remains true whether the translator is housed within Congress or within an Executive department.

## V. CONCLUSION

Over the years, nondelegation principles have been applied less as a freestanding doctrine and more as “a canon of statutory construction.”<sup>132</sup> There are a number of reasons for why this has come to pass. Where the judiciary is concerned, it has been argued that “the Court believes – possibly correctly – that the modern administrative state could not function if Congress were actually required to make a significant percentage of fundamental policy decisions.”<sup>133</sup> Congress’s own behavior could be explained by forces from the historical – the complexity of the modern world and the New Deal, hand-in-hand, reshaped the nature of government agencies – to the game theoretical – legislators have electoral incentives and scheduling constraints that lead them to pass the buck, or may even collude<sup>134</sup> with agencies to augment their own discretionary power.

Another interpretation is that to achieve a robust yet adaptable regulatory state that could apply general rules to specific situations, 20<sup>th</sup> Century technology and institutions offered no other device but delegating authority to agents for implementation, fact finding, and enforcement. For specific regulatory problems, a CBDC infrastructure, however, could offer a way to observe the constraints of the classical nondelegation doctrine in practice. Algorithmic congressional prescriptions for policy execution would have the advantages of helping to overcome the constitutional problems in the

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<sup>132</sup> Manning & Stephenson at 399-400 (cited in note 96). See also Sunstein, *Nondelegation Canons* 67 U. Chi. L. Rev. 315 (cited in note 88).

<sup>133</sup> Lawson, *The Rise and Rise of the Administrative State* 107 Harv. L. Rev. at 1241 (cited in note 84).

<sup>134</sup> Neomi Rao, *Administrative Collusion: How Delegation Diminishes the Collective Congress*, 90 N.Y.U. L. Rev. 1463, 1504-1506 (2015), archived at <https://perma.cc/Q9G9-E5DE>.

appointment and removal critique of independent agencies as well as in open-ended, congressional delegations. Nonetheless, as long as specialization leads human actors to rely on one another, agency relationships will leave some room for interpretation, self-dealing, or abuse. A Central Bank Digital Currency and accompanying algorithmic policy regime provide a framework for mitigating, though probably not eliminating completely, the ancient trust problems that inhere in governments instituted among people.