

CIGI Papers No. 285 – October 2023

# Is CBDC Evolutionary or Revolutionary?

## What Economic History Can Teach Us

Pierre L. Siklos





CIGI Papers No. 285 – October 2023

# Is CBDC Evolutionary or Revolutionary?

## What Economic History Can Teach Us

Pierre L. Siklos

---

## About CIGI

The Centre for International Governance Innovation (CIGI) is an independent, non-partisan think tank whose peer-reviewed research and trusted analysis influence policy makers to innovate. Our global network of multidisciplinary researchers and strategic partnerships provide policy solutions for the digital era with one goal: to improve people's lives everywhere. Headquartered in Waterloo, Canada, CIGI has received support from the Government of Canada, the Government of Ontario and founder Jim Balsillie.

---

## À propos du CIGI

Le Centre pour l'innovation dans la gouvernance internationale (CIGI) est un groupe de réflexion indépendant et non partisan dont les recherches évaluées par des pairs et les analyses fiables incitent les décideurs à innover. Grâce à son réseau mondial de chercheurs pluridisciplinaires et de partenariats stratégiques, le CIGI offre des solutions politiques adaptées à l'ère numérique dans le seul but d'améliorer la vie des gens du monde entier. Le CIGI, dont le siège se trouve à Waterloo, au Canada, bénéficie du soutien du gouvernement du Canada, du gouvernement de l'Ontario et de son fondateur, Jim Balsillie.

---

## Credits

Managing Director of Digital Economy **Robert Fay**  
Director, Program Management **Dianna English**  
Program Manager **Jenny Thiel**  
Publications Editor **Susan Bubak**  
Senior Publications Editor **Jennifer Goyder**  
Graphic Designer **Abhilasha Dewan**

Copyright © 2023 by the Centre for International Governance Innovation

The opinions expressed in this publication are those of the author and do not necessarily reflect the views of the Centre for International Governance Innovation or its Board of Directors.

For publications enquiries, please contact [publications@cigionline.org](mailto:publications@cigionline.org).



This work is licensed under a Creative Commons Attribution — Non-commercial — No Derivatives License. To view this license, visit ([www.creativecommons.org/licenses/by-nc-nd/3.0/](http://www.creativecommons.org/licenses/by-nc-nd/3.0/)). For re-use or distribution, please include this copyright notice.

Centre for International Governance Innovation and CIGI are registered trademarks.

67 Erb Street West  
Waterloo, ON, Canada N2L 6C2  
[www.cigionline.org](http://www.cigionline.org)

---

# Table of Contents

vi	About the Author
1	Executive Summary
1	Introduction
4	The Evolution of Money: Six Examples from History
14	Conclusion and Lessons for the CBDC Era
16	Works Cited

---

## About the Author

**Pierre L. Siklos** is a CIGI senior fellow who specializes in macroeconomics, with an emphasis on the study of inflation, central banks and financial markets. He also conducts research in applied time series analysis. His research has been published in a number of international journals, and he has been a consultant to a variety of institutions and central banks. His work has been widely cited in several macroeconomics and econometrics textbooks. Pierre has also been a visiting lecturer at several universities in Europe and North America as well as in Australia and New Zealand. His research has been funded by domestic and international agencies.

In 1999, he was an Erskine Fellow at the University of Canterbury in New Zealand, and in 2009, he was a William Evans Fellow at the University of Otago in New Zealand. Pierre was Wilfrid Laurier University's (WLU's) University Research Professor for the academic year 2000–2001, the director of the Viessmann European Research Centre at WLU from 2005 to 2014, and a member of the Czech National Bank's Research Advisory Committee between 2012 and 2018. In 2008, Pierre was chair of the Bundesbank Foundation of International Monetary Economics at the Freie Universität Berlin in Germany.

He is a guest professor at the Westfälische Wilhelms-Universität Münster in Germany, a research fellow of the South African Reserve Bank and Stellenbosch University in South Africa, and was appointed Fondation France-Japon/Banque de France Fellow for 2021–2022.

---

## Executive Summary

The emergence of a retail central bank digital currency (CBDC) will involve a public-private partnership where software lies at the core of the operation and distribution of digital money. Whether this development is revolutionary is debatable since the capacity of the authorities to ensure the safe and widespread use of currency was originally facilitated by private sector innovations in the production of notes and coins and the ability to thwart the counterfeiting of notes.

This paper considers the historical significance of CBDC. Selected historical illustrations are used to investigate the relationship between technology and monetary arrangements. The illustrations highlight the role of the private sector in the development of money, how and why governments took on a central role to uphold the key functions of money, and the extent to which economic crises may have played a role. The bottom line is that CBDC represents an evolution of the monetary system and should not be interpreted as a revolutionary development. If CBDC replicates the core functions of paper money, there is no reason it cannot coexist with traditional notes and coins.

Six historical examples are considered in support of the evolutionary view of the role of CBDC.

Among the lessons of history is that the nation-state will seek to protect its currency issue in support of its sovereignty. Central banks and governments will face the difficult task of ensuring that digital forms of their currencies are not subject to disruptions due to technical malfunctions or attempts to counterfeit digital currencies or interrupt payment systems. Here, too, history offers some lessons. It is the adoption of technology that helped states introduce and ensure that currency is widely accepted as a means of payment. Moreover, just as attempts by governments to exploit the printing press led some countries to abandon issuing their own currency and adopt an existing currency from abroad, so will the temptation to misuse the digital form of currency lead the public to seek out more stable forms of payment. This risks a further blurring of fiscal and monetary policies that will not disappear with the introduction of CBDC. Finally, just as the spread of small denomination notes and coins

served as a device to enhance financial inclusion, CBDC promises to hopefully do the same.

However, CBDC may portend a significant change in existing monetary systems. First, the loss of some privacy in day-to-day financial transactions could result in reduced illicit transactions and in tax avoidance. How societies will grapple with this trade-off is a work in progress. Second, CBDC offers the opportunity to reduce transaction costs in sending and receiving currency across borders and allows a much wider segment of the population to hold different currencies. Since this also potentially threatens economic sovereignty, there are likely to be many obstacles in permitting the free flow of CBDC across borders. The current geopolitical environment and the challenges in facilitating cross-border payments are likely to be very difficult to overcome.

---

## Introduction

*My fellow economists have a remarkable propensity for forgetting or ignoring the past.*

—Alan Blinder (2022, 1)

The last few years have witnessed a veritable surge in research and commentary about the significance of the digitalization of money.<sup>1</sup> While some have pointed to greater momentum toward the adoption of digital currencies worldwide (for example, Kosse and Mattei 2022), generally referred to as CBDCs, others are more skeptical. In as much as technical hurdles for the launch of safe and widely usable CBDCs can be overcome, a mix of improvements in payment systems and seeming disinterest in digital cash have reduced the urgency to introduce CBDCs (for example, Prasad 2023; Glowka, Kosse and Szemere 2023). Indeed, banknotes have experienced a revival of sorts, partly as a legacy of the pandemic as well as from the comfort derived

---

<sup>1</sup> The present study is concerned exclusively with the retail form of CBDCs (crudely put, the digital alternative to cash) and not with wholesale forms. For more about the distinction between the two, see, for example, Siklos (2022b). Wholesale digital money is seen as the natural evolution of the need for safer and more reliable movement of funds in large amounts (for example, \$100,000 or more) in a world that demands that financial transactions be conducted in real time. Developments have been ongoing for decades, and discussions today centre on issues of interoperability and ensuring final settlement is instantaneous.

from physically holding currency. Moreover, the Group of Seven (2021a; 2021b) has outlined a long list of principles that should be followed in issuing CBDC that amounts to a steep hill to climb.

The emerging policy battleground in the digital money world is over the role, functions and scope of CBDC. The impression given by some observers<sup>2</sup> (for example, see Doyle 2021) is that the imminent spread of digital forms of cash represents a revolutionary change — or shock — to the existing fiat monetary standard in place for centuries. Unfortunately, this interpretation conflates how technological change impacts economies and monetary systems with how the public chooses to accept or adapt to new forms of means of payment over time. In economic terms, the issues involve the demand for money, the role of institutional factors in influencing how much cash is held (for example, see Laidler 1993; Bordo and Jonung 1987), and now whether the digitalization of money represents a sea change in existing monetary systems or just the latest in the evolution of monetary standards. Both forces, of course, impact transaction costs and the speed with which goods and services exchanges are carried out and final settlement is reached.

When it comes to what is considered money, the public also insists that the means of payment should be widely accepted and maintain its purchasing power over time. This is nothing more than a repetition of textbook descriptions of money as a device that not only overcomes the problem of the double coincidence of wants but also the medium of exchange and store-of-value functions of money. Ultimately, there is a premium on trust in the currency of issue. The public also values familiarity with any technology. Finally, there is considerable debate over the appropriate limits to privacy in financial dealings. Not surprisingly, most proposals for CBDC stress preserving anonymity, seen as a critical function, while a public policy that also seeks to minimize corruption and maximize transparency sees advantages in CBDC as a device that can overcome the “curse of money.”<sup>3</sup>

For centuries, governments have issued currency with varying degrees of success over time. The private sector is no longer trusted as the guarantor of the principal functions of money, even if it is often the private sector that is the

source of financial innovations later adopted or incorporated by central banks into their operations. Recent incidents with so-called stablecoins and cryptocurrencies are cases in point. Of course, there have been objections to this view of the role of the state. After all, governments eventually introduced legal tender as a mechanism to overcome a form of market failure, that is, as a mechanism to build trust and economize the costs of ensuring widespread payments acceptability and settlement. Indeed, there is broad consensus that private issuers of currency implicitly, if not explicitly, require the backing of governments. The author returns to this issue below.

While the task of producing and distributing money in circulation was eventually monopolized by governments, a public-private partnership did exist in the form of fractional banking as the source of credit for the economy. The emergence of CBDC creates the prospect of a new public-private partnership of a different nature as software lies at the core of the operation and distribution of digital money. Whether this development is revolutionary is debatable since the capacity of the authorities to ensure the safe and widespread use of currency was itself facilitated by private sector innovations in the production of coins and the ability to thwart the counterfeiting of notes (for example, as in the creation of polymer notes; see Menzies 2004). Arguably, one reason for the decline in enthusiasm over the arrival of CBDC is that it potentially creates a conflict of interest since central banks typically are also responsible for payment system oversight. Another is the potential impact on commercial banking.<sup>4</sup>

Some observers also herald the arrival of CBDC as an opportunity for monetary policy to introduce a new tool in the event interest rates return to the zero lower bound, and more interest rate stimulus is required, or to protect against losses in purchasing power from inflation, for example, via the ability of the central bank to pay interest on CBDC. Yet societies found alternatives to accomplish the same objectives (for example, rapid cash transfers to individuals from the

<sup>2</sup> See <https://gpilondon.com/the-cbdc-revolution>.

<sup>3</sup> That is, as a policy to reduce corruption in financial dealings.

<sup>4</sup> Pierre L. Siklos (2022b), and references therein, discusses the issues in greater detail. First, not all central banks are responsible for payment systems. Second, the definition and scope of these systems has to be adapted via new legislation as when shadow-type systems develop. Third, payment systems are also global in nature. Individual central banks have no control over the relevant institutions.



fiscal authorities).<sup>5</sup> The principal differences are the transaction costs of resorting to this kind of instrument relative to alternatives. Beyond this, there is the suggestion that the payment of interest on currency conflates the respective tasks of monetary and fiscal policies. Despite the massive economic shocks over the past two decades, it has become taboo to suggest that central banks should no longer be autonomous from the fiscal authorities. Here, too, history can offer some help in understanding the forces at play.

Finally, CBDC is seen as the device that will loosen the logjam created by impediments to cross-border transactions. However, the existing constraints have less to do with technology than with the regulatory environment in which currencies circulate across borders.<sup>6</sup> The internet, no longer a new technology, solved a technological problem in this regard. However, emerging “fintechs”<sup>7</sup> have been hobbled by regulatory restrictions requiring either the involvement of a correspondent bank, thereby limiting the oft-hoped-for reduction in transaction costs, or other regulatory restrictions on the pricing of cross-border services at the retail level. Recent geopolitical developments are raising questions about the future of globalization, and this may well have implications for the pressure that policy makers face in reducing barriers to the flow of small amounts of currencies across borders (for example, see Chen and Siklos 2023).

History has also taught us that money is a device that states use to impose their sovereignty. This feature of monetary systems is clear not only from the emergence of coin- and note-based monetary systems but also in an increasingly digitized financial sector. For example, the ongoing war in Ukraine has created the incentive for some

countries (namely, China and Russia) to create alternative payment settlement systems to perform an end-run around the US dollar-based standard.

There is possibly one area where CBDC may be revolutionary, namely, the potential for programmability. The tokenization of money offers the possibility that money can be directed to tailored objectives. Even here, there is more evolution than revolution since programmability simply creates a new instrument to accomplish societal objectives that governments have been engaged in for decades with varying degrees of speed, effectiveness and cost. Moreover, programmability need not be solely restricted to money. Other payment instruments (for example, debit and credit cards) are also capable of adding this kind of feature.

What is likely different is the potential blurring of fiscal and monetary policies. While the pandemic demonstrated governments’ capacity to transfer funds quickly via digital means, CBDCs create the space for central banks to do the same in the name of loosening (or tightening) monetary policy. After a few decades, the mantra that central banks deliver the best economic outcomes when they are autonomous from government — even the appearance of a reversal of this doctrine — will require debate and an update of the contract between governments and central banks.

The creation of CBDC also raises important governance questions. These have been known to observers but have been placed on the backburner amid the hype about CBDCs, stablecoins and cryptocurrencies. Equally important, the very core functions of money (namely, security and widespread acceptability) are threatened by the same technologies that will make CBDC possible. For example, quantum computing<sup>8</sup> risks countering the ability of the authorities to de-encrypt digital money transactions, thereby questioning the anonymity of transactions so prized, at least in principle, by society.<sup>9</sup> Next, to give another example, there is the question of whether digital currencies represent legal tender, with existing central bank legislation

---

5 Rapid is, to some extent, in the eye of the beholder. Large numbers of cheques were still mailed out in the United States, especially in response to the COVID-19 pandemic, while Chinese authorities relied more heavily on providing digital wallets to their citizens. Differences partly reflect familiarity with how governments communicate with citizenry, the level of digitalization attained in a country and access to the banking system (i.e., the degree of financial inclusion). On the flip side, the recent failure of Silicon Valley Bank highlighted the speed with which deposits could be withdrawn digitally and the failure of central banks’ stress tests to adequately consider this possibility in an era of rapidly rising interest rates. See, for example, Barr (2023).

6 Interestingly, the Bank of Canada’s (BoC’s) survey, launched in spring 2023, suggests that CBDC issued by foreign countries could negatively impact the dollar’s role in Canada.

7 This term (short for “financial technology”) refers to institutions that harness technology (mobile, internet) as a vehicle to provide financial services.

---

8 This refers to devices that rely on quantum mechanics, which can increase computation speed considerably beyond existing standards.

9 A counter-argument is that society (for example, through social media, the usage of credit and debit cards) may place less importance on this principle than policy makers think.

in most countries having yet to provide a clear answer (for example, see Siklos 2022a).

This paper focuses on the historical significance of CBDC from an economic perspective. The author uses selected historical illustrations to investigate the relationship between technology and monetary arrangements. The chosen illustrations are intended to highlight the role of the private sector in the development of money; how and why governments took on a central role to uphold the key functions of money; and the extent to which crises, not exclusively of the financial variety, may have played a role in the observed outcomes. The economics of money demand, transaction costs, and the role played by credibility in government and central bank institutions drive the analysis of the historical episodes considered. The principal argument of the paper is that CBDC represents the evolution of money and should not be seen as a revolutionary development. Of course, the success of CBDC will depend not only on public policy, that is, how it is introduced, its scope and how easily it can be used in transactions, but also on technological developments. Ultimately, if CBDC replicates the core functions of money, there will be scope for digital money to play a role in existing monetary systems (also see Eichengreen 2019).

Six illustrations are considered in support of the evolutionary view of the role of CBDC. They are: the Industrial Revolution in the United Kingdom; the greenbacks episode in the United States; the disappearance of private monies in Canada beginning in the late nineteenth century; the free banking experiment in Scotland; the Swiss referendum that questioned the private sector's role in money creation; and efforts and arguments in Sweden to introduce electronic money (e-krona).

One theme that ties together the foregoing historical examples is the widely held view that the imminent introduction of CBDC rests on a syllogism: first, that digital money must lead to significant disintermediation, which might raise retail banking costs; and, second, that CBDC rests on the triumph of lower transaction costs. The historical backdrop suggests that the first conclusion need not happen. The second conclusion ignores that monetary systems contain an important public good element. Hence, society will not necessarily always gravitate to

the lowest-cost solution. The paper concludes with a summary and lessons for the CBDC era.<sup>10</sup>

---

## The Evolution of Money: Six Examples from History

The potential arrival of CBDC represents the latest threat to the usage of central bank-created money. Since the early 1990s, the spread of credit and debit cards<sup>9</sup> has also contributed to a decline in cash holdings, especially for smaller transactions (for example, see Chen and Siklos 2022 and references therein). Hence, CBDC can be seen as the central bank entering the digital age in the provision of a medium of exchange. The success of credit and debit cards cannot be understood without considering the role of government regulation and central bank oversight. Indeed, it is useful to think of the spread of these alternatives to cash as requiring a form of public-private cooperation. The historical illustrations below are also meant to remind readers that other events in history are useful in highlighting the forces that drive the evolution of monetary systems over time.

Space limitations prevent a full account of the events surrounding the six episodes considered. Instead, the aim is to highlight critical features from each historical episode that provide a window in support of the view that CBDC can be seen in evolutionary terms. Indeed, it is precisely for this reason that, at least for the foreseeable future, CBDC will serve as an alternative to cash alone. Unlike some who have argued that CBDC could be a useful device to reduce corruption (Rogoff 2016), or potentially be used as an additional instrument of monetary policy (Bordo and Levin 2017), the immediate prospects for CBDC will conceivably be considerably narrower. This may partially explain, for example, why the BoC (2023) has publicly stated, “Cash isn’t going anywhere.”

---

<sup>10</sup> See [www.ifrs.org/projects/work-plan/general-sustainability-related-disclosures/exposure-draft-and-comment-letters/](https://www.ifrs.org/projects/work-plan/general-sustainability-related-disclosures/exposure-draft-and-comment-letters/).

## The Industrial Revolution in the United Kingdom and the Spread of National Currencies

Monetary systems are sometimes driven by broader societal changes. One such example considered below stems from the era referred to as the Industrial Revolution that began in the United Kingdom in the late eighteenth century and eventually spread elsewhere around the globe.

There are few symbols more potent and important than a national currency. Indeed, the spread of national currencies parallels the development of nation-states. As Eric Helleiner (2003) pointed out, it is the growing influence of government and its ability to impose various legal provisions, including legal tender, that facilitated the introduction and standardization of currencies. The spread of central banks to manage national currencies soon followed. However, one has to wait until well into the twentieth century for the number of central banks to begin matching the number of national currencies (for example, see Bordo and Siklos 2018). Of course, other factors are at play in the spread of national currencies, including the use of these currencies to cement a form of economic sovereignty, that is, independence in economic policy making, and as a device to increase trade through the development of internal markets defined by national borders. Indeed, national currencies not only serve to reduce domestic transaction costs, but also, in modern parlance, to improve financial inclusion since the circulation of national coins and notes, available in small enough denominations, made it possible for all citizens to use them as a means of payment.

While domestic transaction costs decreased, transacting internationally became costlier as national currencies created friction between countries that traded with each other even if, when the gold standard operated, the exchange rate between currencies was fixed. But this is nothing more than another illustration of currency as a device to strengthen sovereignty in the economic sphere. Arguably more important were technological improvements that made it much more difficult to counterfeit national currencies as well as standardize them within borders. In this connection, the United Kingdom, during its Industrial Revolution beginning in the late eighteenth century, is seen as being in the forefront of ensuring the widespread usage of Bank of

England notes and coins even before legal tender became the method to provide legal protection in trades (see Helleiner 2003). In this connection, the prospect of CBDC should also be seen as just another example of how technology can serve monetary needs just as automated teller machines (ATMs), credit cards, and other forms of electronic payment and transfers have changed the monetary landscape in recent decades even before there was a serious discussion about the possibility of CBDC complementing, or even replacing, physical notes and coins. Hence, rather than revolutionary, the prospect of CBDC is simply an evolution in the means of payment or as a medium of exchange as has happened previously over time.

Even if legal restrictions of the kind noted above were not in place, legislation existed shortly after the creation of the Bank of England that supported the critical, if not central, role played by Bank of England notes. For example, an act of Parliament in 1696 made counterfeiting punishable by death. Moreover, the Bank of England Act of 1708 effectively prevented notes from being issued by entities other than the Bank of England. These provisions guaranteed the preferential relationship between the bank and the state (for example, see Murphy 2023, 73).

Nevertheless, it must be acknowledged that, if the concept of one country and one money is generally supported by the historical evidence, this is an incomplete story. After all, over and above the spread of national currencies, some have been used not only internationally but, in a few instances, have displaced national currencies or prevented them from having been created in the first place. Elsewhere, as in Europe, political imperatives moved countries that would eventually create the euro, to agree to abandon their own notes and coins (for example, see Issing 2008).<sup>11</sup> The British pound, for example, had a global standing as a reserve currency because of the size and span of the British Empire, even if it did not completely displace some home-grown currencies. By the early twentieth century, the US dollar would replace the pound as the reserve currency of choice and, indeed, would serve as the national

---

11 The usual argument is that the desire to avoid future wars propelled European politicians to eventually create a common currency. However, in another sign that the change was an evolutionary one, common institutions needed to be created as well as a common understanding of how a European-wide market would function. These developments would take decades and remain incomplete.

currency in several small countries that could not create their own, partly if not largely, because of poor macroeconomic management (for example, Ecuador, El Salvador, Panama, Zimbabwe).

Other authors have suggested that globalization, among other economic and political factors, implies that the world should expect fewer currencies in the future since a national currency as a device to support economic sovereignty loses much of its significance when so much trade in finance, goods and services, is global (for example, see Drucker 1997; Cohen 1998). Indeed, the concept that it is suboptimal to associate currencies with an area defined by the borders of a state is one that gave rise to the theory of optimum currency areas for which economist Robert Mundell is celebrated. Subsequent work (for example, Frankel and Rose 1998) pointed out that if the will exists to create a currency that is widely accepted outside existing state borders, then the currency area can adapt in such a manner as to give the appearance of being an optimal currency area (OCA). Mundell (2012) took this idea, together with antipathy toward fixed exchange rate systems, to suggest how the world could evolve first to using a currency basket consisting of the US dollar, the euro and the Japanese yen, to a world with a single currency called “INTOR.” Mundell had not considered an explicit role for China, nor could he explain how the International Monetary Fund (IMF), or some other international body, would enforce or decide on the weights of each currency or how this might change over time. Indeed, few believed that the euro area represented, or represents still, a geographical area that is consistent with the OCA principles (for example, see Jonung and Drea 2009). Yet it exists and has survived at least three major economic crises.<sup>12</sup> The euro continues to persist because politics, at least to date, can occasionally trump economics.

Returning to the potential introduction of CBDC, even if technology has allowed the possibility to introduce it as a new type of medium of exchange, history also suggests that trust and standardization (also devices that can lower transaction costs) will be critical elements that will facilitate its acceptance as previous evolutions in monetary systems have clearly demonstrated. As for the threat of sovereignty, it too has not disappeared.

---

<sup>12</sup> Namely, the global financial crisis (GFC), the European sovereign debt crisis and the COVID-19 pandemic.

From those who advocated using cryptocurrencies such as Bitcoin as representative of demonstrating a lack of trust in national currencies, to the now withdrawn attempt to create a pseudo-global currency, “diem,”<sup>13</sup> nation-states will continue to push back against any attempt to encroach on their perceived economic sovereignty, even if it is limited by the globalization of trade and finance. Moreover, so long as nation-states are responsible for setting the rules of the game, in the form of domestic and international regulations, private sector upstarts in the currency game will not be able to displace domestic currencies. The last few decades have repeatedly demonstrated that the ultimate protection from the state can be essential.<sup>14</sup> The moral hazard problem, most clearly seen in state support of banking systems, incentivizes governments to insist that they will not support stablecoins or cryptocurrencies. Instead, the world waits to find out whether the current dominance of the US dollar will continue or whether there will be some fragmentation in the system of global reserve currencies. That said, the private sector will be the source of innovations that will assist digital equivalents of national currencies to survive both domestically and internationally. Good practices in the conduct of monetary (and fiscal) policy will continue, as it has in the past, to dictate the usage and survival of national currencies whether they are in digital form or not.

## The Greenbacks Era in the United States

In common with most wars (for example, see Daly and Chankova 2021), the civil war in the United States during the mid-nineteenth century generated very high inflation rates, especially in the Confederacy of the South. Between 1862 and 1879, the need to finance the war led the US government to introduce paper money, called greenbacks, that were not convertible into gold (for example, see Hall et al. 2022). The name was derived from the colour of the printing on

---

<sup>13</sup> The “money” first proposed by Facebook (now called Meta), but killed by regulation and international reaction. (It was not really a new currency because it was based on the US dollar.)

<sup>14</sup> Indeed, there is a case to be made that the Bank of England, as an institution, survived not only because of its ability to thwart threats from competing institutions but also because it was favoured by successive governments. To a certain degree, “luck” also played a role when the South Sea Company, arguably one of its main competitors early in the Bank of England’s history (the bank was created in 1694), failed spectacularly when the South Sea bubble burst in 1720. See, for example, Murphy (2023) and Kynaston (2017).

the backs of bills.<sup>15</sup> Hence, greenbacks were fiat money not guaranteed in a fixed price to gold. However, greenbacks did have the protection of legal tender (for example, see Calomiris 1993). While there was a promise to someday return to convertibility into gold, a date was not, for several years, specified. Eventually, convertibility was re-established in 1879. Paper certificates, backed by gold, still existed and so, in principle, gold certificates and greenbacks circulated in parallel (for example, see Craig 1996). Indeed, the exchange rate between gold and greenbacks floated and there was no intervention to control its course.

Economic historians have been keenly interested and continue to debate the implications of the greenback era. Two issues in particular have generated a considerable amount of academic research. First, was the greenback era an illustration of the prediction of Gresham's law, whereby "bad" money drives out "good" money? In other words, was this an example of bad practice in the conduct of monetary policy? Second, did the promise of the return to convertibility play a role in the success of the greenbacks? This points to the importance of credibility in the conduct of monetary policy. As we shall see, these two issues have some resonance for the imminent introduction of CBDC.

The record of inflation led to rising pressure on politicians to ensure that inflation would remain under control. Indeed, the legacy of inflation gave impetus to a political group, called populists, that were hostile to the gold standard (for example, see Unger 1967; Frieden 1997). "Bad" money is the name given, for example, to coins whose gold (or silver) content is lower than another coin in the same denomination. In contrast, "good" money's value is set in terms of the precious metal it is based on, the denomination at which it is issued. Since greenbacks were not backed by gold, Gresham's law suggests that greenbacks would drive gold out of circulation. However, greenbacks had the property of legal tender, and this implies that all claims had to be accepted in the fiat currency. It must also be recognized that the post-civil war period in the United States was also one of persistent deflation, a fallout from the impact of the war on inflation. Not surprisingly, the greenback era is seen as representative of the operation of Gresham's law. While Arthur J. Rolnick and Warren E. Weber (1986)

originally claimed otherwise, Robert L. Greenfield and Hugh Rockoff (1995) present evidence that greenbacks did push gold out of circulation. Ben R. Craig (1996), focusing on gold certificates (proof of gold ownership), argues that they were widely used alongside greenbacks. The legal tender provision, an example that highlights the importance of legal restrictions, a theme explored in greater detail in the next two sections, is one of the factors that made a difference in the widespread acceptance of greenbacks as a means of payment.

Because of the fear of inflation and the importance the public and many politicians placed on the kind of sound monetary system delivered by the gold standard, the return to convertibility represented an important promise even if the US government did not, at first, provide precise timing for its resumption.<sup>16</sup> The promise, however, and the desire for some form of price stability, did generate an expectation that convertibility would return someday. Looking back, it appears that the promise was credible since convertibility was eventually resumed and there was no inflation problem during the greenback era, a sign that there is no evidence of excessive note issuing by the US government (for example, see Calomiris 1993).

How is the greenback era relevant for the imminent arrival of CBDC? Unless alternatives to CBDC, which presumably will carry legal tender protection and the backing of the central banks, are able to provide similar features, they will not drive out the digital equivalent to currency. Indeed, stablecoins derive a considerable amount of their value by being pegged to a reference or a basket of reference financial assets. However, so long as the temptation exists to weaken the peg, there is always a risk of failure.<sup>17</sup> Indeed, several stablecoins have already failed.<sup>18</sup> More generally, if cryptocurrencies cannot replicate the legal and

---

<sup>15</sup> There was no central bank in the United States. The US Federal Reserve would eventually be created in 1913.

---

<sup>16</sup> US monetary history is also complicated by the so-called crime of 1873 (Friedman 1992). Political pressure to replace the gold standard with a silver standard that would benefit, among others, rural populations, ultimately failed. Perhaps a third lesson that the author will not explore here further is the role of politics in influencing how means of payment evolve over time.

<sup>17</sup> This conclusion applies to private as well as publicly backed financial assets. While there is a presumption, largely backed by several historical episodes, of the public printing press generating rising inflation, there are also cases where constraints on government behaviour can ensure sound policy even in the absence of a central bank. The greenback era represents just such a case.

<sup>18</sup> Many for the reasons that explain the failure of Terra and other such stablecoins (for example, see Wong 2022).

economic backing that both conventional notes and coins (or their digital equivalents) can, they will not be able to displace central bank-issued money. In effect, this can be seen as the reverse of Gresham's law, assuming that cryptocurrencies are seen as a form of money.<sup>19</sup> Central banks have publicly indicated that cryptocurrencies will not receive any legal or economic protection.

However, there is another lesson from the greenback era for CBDC. The success of greenbacks owes much to the expectation of the resumption of convertibility to gold. The fact that the promise of the US government was eventually kept is a device that builds credibility. As Stephen D. King (2023, 96) points out: "Credibly establishing the rules of the game, it turns out, is of the utmost importance." However, credibility can take time to build. After all, greenbacks were in place for almost two decades until convertibility returned.

In the nineteenth century, the gold standard provided credibility in the belief that prices would be stable. Today, under our fiat money standard, price stability is supposedly ensured by the promise to keep inflation low and stable, often in a regime where inflation is targeted. Unfortunately, that promise risks being broken, given the inflation surge that began in 2021, and shows signs of remaining persistent for some time. Moreover, central bank communication that initially interpreted the inflation spike as transitory turned out to be incorrect. Both events have seriously dented the credibility of the current monetary regime. In the case of CBDC, the threat, in addition to loss of purchasing power, resides with uncertainty about the reliability and resilience of CBDC security features. And, while central banks have stressed that CBDC will not carry interest because of the implications for commercial banks, the ability of the technology to deliver interest combined with persistent inflation will put pressure on central banks to explain why CBDC will be advantageous over conventional notes and coins. Perhaps more importantly, other means of payment (for example, smartcards, payment apps and so forth), while not carrying the legal tender protection, offer benefits that may well outweigh the costs of using CBDC instead. Indeed, the promise of CBDC as a technologically

driven device that will make cross-border transactions easier and cheaper, may be undone if international agreement over the acceptability of CBDC across borders is not achieved.

Central banks warn of the potential negative implications of paying interest on CBDC, as opposed to the zero interest on conventional currency, as well as the risks that the central bank will unfairly compete with the financial sector. However, the loss of trust and credibility in central banks will complicate attempts to persuade the public to use CBDC.<sup>20</sup>

## The End of Private Money in Canada and Dominion Bank Notes

Prior to Canada's Confederation in 1867, it was believed that a private note issue would be the best way to satisfy the need for money. There was no central government that could set a common standard in the then provinces of Upper and Lower Canada. Much of the inspiration came, of course, from the United Kingdom (see Neufeld 1964, part 1, section 2.4). It was also the practice that bank notes would be convertible into gold. Hence, trust in the system and, therefore, the degree to which notes were accepted as a means of payment, were critical.

It was under these circumstances that commercial banks came into existence. Banks understood, of course, that it could be quite profitable to issue notes that effectively pay zero interest while the resulting deposits created by the note issued could be loaned out at a positive interest rate. Convertible notes and certificates then represent "token money" since they have no intrinsic value. It was worthwhile accepting zero interest on the notes because a reliable means of payment represents a considerable benefit. That said, it is the notion of legal restrictions (Wallace 1983), that is, rules set by the state defining what is used as a means of final payment, that explains why financial assets that provide different returns can coexist. Legal restrictions in the financial system, of course, abound. For example, governments impose limits on the ability of commercial banks to issue loans without the necessary backing in

19 El Salvador has done just that, declaring bitcoin as legal tender. Unsurprisingly, international institutions have criticized the decision, and after some initial excitement, the experiment appears to be turning sour. See, for example, Alfaro, Laranjeira and Costas (2022); Taylor (2022).

20 Not to mention the difficulty of explaining to the public the differences between CBDCs and cryptocurrencies. The fact that many central banks have devoted some effort to inform the public that CBDCs are unlike cryptocurrencies suggests that they are aware of the dangers of conflating the two types of financial assets.

the form of reserves or other means to ensure that some liquidity is available on demand.

As governments grew in importance, the seigniorage (namely, the profit from the issue of notes) was revenue that could instead have benefited the fiscal authorities. By 1866, provincial notes were introduced to take advantage of the seigniorage opportunity.<sup>21</sup> Equally important, however, are the denominations used for transaction purposes. Day-to-day spending necessitated small denominations, and these were most likely to circulate and relatively more costly to produce. Governments early on monopolized the issue of small denomination notes while the private banks circulated larger denomination notes.

Following Confederation, dominion notes replaced provincial notes and the first Bank Act was introduced. While the central government was given exclusive authority over all currency-related matters, it took several decades until the issue of all notes and coins was monopolized by government. In Canada, at least, this did not require the creation of a central bank — this would come almost 70 years after Confederation.

What does the Canadian experience with the introduction of notes portend for the prospect of a CBDC?<sup>22</sup> First, the needs of trade demand a form of money that is divisible and, therefore, can simultaneously be used for small and large transactions. In the case of CBDC, denominations can, in principle, become irrelevant since there is no physical requirement to produce notes and coins with pre-specified denominations. Second, widespread acceptance of notes as a means of payment requires some uniformity or at least

a common understanding of what constitutes widely recognized and easily identifiable currency, whether in physical or digital forms. Finally, and arguably most demanding of all, the public needs to have trust that currency serves as a means of payment.<sup>23</sup> Trust can be obtained and lost by both the private and public sectors. In the case of the private sector, repeated bank failures and financial crises led to more regulation and supervision while inflation, of course, has often been blamed on excessive money growth by governments.<sup>24</sup>

Canada's history suggests that currency reforms were a gradual process that often required what today would be called a public-private partnership where governments provided the means to ensure that a widely accepted means of payment is available and trusted while the private sector allocates credit. Equally important, the process is an evolutionary one not necessarily spurred by some technical change but in response to what is eventually seen as a threat to economic prosperity.<sup>25</sup> Indeed, interest in CBDC is perhaps keenest in the case of remittances since digital currencies are seen as a means of dramatically reducing transaction costs. However, just as legal restrictions are deemed essential to understand why the public holds similar financial assets that generate different yields, so do these restrictions, on a global scale, pose an impediment to the spread of CBDC (for example, see Chen and Siklos 2023).

## The Free Banking Era in Scotland

We are used to thinking that social welfare demands that the banking industry be regulated to some extent.<sup>26</sup> However, during the first half of the nineteenth century, the so-called free

---

21 In countries where the government has difficulty raising revenue in the form of taxes, seigniorage is relatively more important. Seigniorage likely played a more important role in Canada's early history but has generally been a minor source of revenue over time. There exists a link between seigniorage and inflation and political instability since the former's ability to generate revenue is tied to how much money is in circulation (see Cukierman, Edwards and Tabellini 1992).

22 Ben Fung, Scott Hendry and Warren E. Weber (2017) claim to draw lessons from the same era in Canadian history for CBDC, but the authors do not mention the role of regulation, nor do they highlight the evolutionary element in currency reforms. The authors place a great deal of emphasis on the role of counterfeiting, which remains a perennial problem, and one that is far from unique to the Canadian experience and would likely remain so when CBDCs are created. They are correct, however, in arguing that the introduction of a CBDC need not be inflationary even though the introduction of Dominion notes, as they were known, did lead to an inflationary surge in Canada. In contrast, George Selgin (2017) sees Canada's experiment with private note issue as a success.

---

23 The legal tender provision is important. However, successful currency arrangements can exist without this legal restriction. For example, the Bank of England came into being in 1694, but the pound only became legal tender following the coming into force of the Bank of England Act of 1833 (Bank of England 1969). As mentioned above, not all central banks have clear legal tender provisions in legislation. It is, however, interesting that the question is being revisited (see Sweden's example below) because of the challenges surrounding the potential introduction of CBDC. James Powell's (2005) history of the Canadian dollar also highlights the loss of confidence in the private bank note issue as one that policy makers believed held back economic growth.

24 A very concise and readable recent history of inflation is King (2023).

25 Stated differently, technical change may be necessary but is not sufficient to explain the evolution of currency arrangements.

26 One reason is fear that the failure of one bank will become contagious, leading to additional failures.

banking experiment in Scotland<sup>27</sup> attracted a great deal of interest among economists — both those who supported and those who opposed government intrusion in financial markets. Interest in this experiment waxes and wanes but has not disappeared.

However, even among die-hard supporters of free banking experiments (for example, see Dowd 1992), there is acceptance that free banking does not imply a financial system that is wholly unregulated where prospective banking firms can enter (or exit) easily without, for example, obtaining a charter or meeting certain capital requirements. Support for the free banking concept stems from the philosophical position that economic activity ought to be relatively unfettered by regulation and supervision because individuals will organize institutional arrangements that minimize the costs of doing business and maximize social welfare. Supporters argue that competition does not produce financial instability, for example, from banks' reckless behaviour in an attempt to obtain — and hold on to — customers. Instead, competitive pressures foster stability. A lender of last resort, such as a central bank, is therefore unnecessary. Competition leads to an economy with many banks, none of which monopolize the financial system.

Scotland's free banking experiment is considered the archetypical case study for arrangements of this kind introduced in 19 banks by 1844 (after which free entry was no longer allowed). The four largest supplied almost half the notes in circulation. Other than for one crisis (for example, see Kroszner 1995), the system appears to have performed well. Several other countries, including Canada and the United States, also experimented with versions of the Scottish model (for example, see White 2015). "The [Scottish] banking system made rapid strides in both stability and efficiency. Freedom to issue notes ensured healthy competition and adequate banking services wherever they were in demand. The regular notes exchanges made the banks watchdog of one another and prevented any bank from getting seriously out of line with the general development of the economy....Scotland did not altogether avoid bank failures, but its record with respect to

stability was much better than most countries in similar stages of development" (Cameron 1967, 70).

Few historical examples have created as much disagreement as the Scottish free banking experience. Nevertheless, there is little disagreement about some of the essential facts. For example, as in the Canadian experience discussed in the previous section, the government imposed legal restrictions on the issue of notes in small denominations. Moreover, other rules did create some impediments for entry into banking. Finally, even if the Bank of England was not legally bound to assist banks in Scotland facing liquidity problems, it is likely that, in the event of a major crisis, the central bank would have intervened. Of course, we will never really know (for example, see Cowen and Kroszner 1989; Briones and Rockoff 2005). Perhaps a useful way to think about free banks in Scotland is that they can be likened to modern-day shadow banks. In other words, the free banks that, in principle, were self-regulated entities, operated in parallel with other banks that could count on the support of a lender of last resort. The small geographical size of Scotland may also have played a role in the success of free banking.

How, then, does this historical episode resonate with the imminent era of CBDC? First, the Scottish experience is a reminder that politics, here in the form of legal restrictions, does play a role. For example, central banks have already made clear that they will not permit pseudo-money types of means of payment, such as cryptocurrencies or stablecoins, to be on the same level playing field as a CBDC. Hence, legal tender, and other forms of protection for those holding CBDC, will not be extended to other digital alternatives. A second way in which the Scottish experience has modern-day echoes is captured by the challenges of a shadow banking system that sits outside the existing regulated and supervised financial system. As noted above, while the shadow banks share a considerable portion of the blame for the GFC of 2008–2009, the newer threat comes from so-called fintechs that can provide a wide array of financial services currently provided by commercial banks at a lower cost.<sup>28</sup> Indeed, in a sign that government regulations lag financial innovation, the manner in which the Canadian government plans to

---

27 Also in Canada and the United States. Free banking was not much of a success in Canada. Only five new banks were founded under the Free Banking Act; two failed and the others converted to legislative charters. Also, mortgages and personal loans were prohibited so that banks were limited to commercial lending.

---

28 For example, an app is used to share financial information between, say, a chartered financial institution and a firm offering fintech services. The growth in fintech is also being spurred by developments in artificial intelligence.



legislate open banking is still under review.<sup>29</sup> Other countries, such as Australia and the United Kingdom, already permit some forms of open banking. One of many issues is whether these fintechs will have access to the resources of the BoC in the event of a financial crisis. Then there are a host of issues around consumer protection in the case of fraud and other forms of illicit behaviour when the source of the problem resides outside Canada, where the government has no jurisdiction.

Just as digitalization led, over time, to a more rapid settlements system (for example, the ubiquity of electronic transfers), there remains scope for achieving settlement in real time. Although there has been a lot of progress at the wholesale level, the scope for real-time and low-cost digital transfer at the retail level lags far behind. The best example is the case of remittances whose costs remain high, despite the widespread use of the internet due to legal restrictions at both the domestic and international levels (for example, see Beck, Janfils and Kpodar 2022). These all represent illustrations of how legal impediments can hamper innovation as was apparently the case in Scotland in the nineteenth century (for example, see Cowen and Kroszner 1989). Finally, just as academics have been debating the merits of free banking as a device to ensure financial stability, so is the digitalization of finance creating challenges for the introduction of CBDC without threatening financial stability. After all, as has been noted by many (for example, see Kiff et al. 2020), CBDC represents another tool of monetary policy depending on how and in what form it is introduced. And, so long as the possibility exists for such a tool to be abused, there is potentially a new threat to financial instability (for example, see Bank for International Settlements 2021).

## Switzerland's Sovereign Money Referendum

Fiat monetary standards are beset by frequent bouts of excessive inflation while the growth of credit, which tends to be pro-cyclical, gives rise to frequent financial crises. The history of inflation stems from money mischief (Friedman 1992; King 2023; Granville 2013), whereas poor regulation, supervision and management have

often led to excessive credit growth and financial crises (Reinhart and Rogoff 2009; Borio 2012).

For decades, many observers and academics have placed the blame on the fractional reserves banking system. Under this system, banks can create new deposits and, consequently, expand the money supply by several multiples, creating loans based on the idea that, at any given moment, only a fraction of depositors will demand funds from their accounts.<sup>30</sup> Assuming that inflation is eventually driven by increases in the money supply, as in Milton Friedman's (1970, 24) famous dictum wherein "inflation is always and everywhere a monetary phenomenon," it would seem clear that an effective way to prevent inflation and the credit booms and busts that ensue would be to limit money growth. As a result, well-known economists, who lived through the Great Depression of 1929-1933 in the United States, advocated for a banking system where money creation would be divorced from credit creation (Fisher 1936).

Proposals to limit money and credit creation have frequently been advanced. One specific example, known as the Chicago Plan of the 1930s, proposed by prominent University of Chicago academics (see Douglas et al. 1939), has from time to time resurfaced in various incarnations. The core idea was to end fractional reserve banking by requiring commercial banks to hold 100 percent in reserves against demand deposits.<sup>31</sup>

The idea was revived most famously in Switzerland in the wake of the GFC of 2008-2009. In Switzerland, a citizens' initiative would have constitutionally required the Swiss National Bank (SNB) to become the sole issuer of Swiss francs. The vote, via referendum, asked citizens to change the monetary system and replace it with one that declared, "for crisis-resistant money:

<sup>29</sup> See, for example, [www.canada.ca/en/financial-consumer-agency/services/banking/open-banking.html](http://www.canada.ca/en/financial-consumer-agency/services/banking/open-banking.html).

<sup>30</sup> This gives rise to so-called money multipliers, which, for a time, were the subject of considerable research to estimate them and their role in the money and credit creation processes (see, for example, Humphrey 1987).

<sup>31</sup> They are deposits that can be withdrawn on demand (sometimes referred to as sight deposits). Whether a practical version of such a plan would be feasible is a question beyond the scope of the present study. Using a highly stylized model, Jaromir Benes and Michael Kumhof (2012) suggest that the Chicago Plan would generate more economic growth and keep inflation very low and stable. However, models of this kind leave the definition of money unclear and cannot explain how monetary and fiscal policy can remain separate from each other. Indeed, some of the worst historical abuses of monetary regimes took place when the central bank's printing press was entirely subservient to the fiscal authorities' demand to finance ever larger deficits.

end fractional-reserve banking.<sup>32</sup> The ban on fractional reserve banking also means, in the context of CBDC, that commercial banks would no longer be necessary for the issue, holding and deposits of digital money. In part, for this reason, worries are being raised in many quarters about the threat that CBDC will severely harm the commercial banking sector (for example, see Cecchetti and Schoenholtz 2021; Niepelt 2021). The potential for disintermediation resulting from a form of public money also played an important role in the debate in the Swiss referendum.

The episode highlights many issues that have plagued the success or failure of monetary regimes throughout history, notably, the importance of trust and fears that the public sector must back the monetary standard in place because abuse and, hence, inflation and financial crises, originate from the private sector. Normally, these arguments are stated in reverse. The fact that the public and private sectors must work in tandem, supported by adequate regulation and support, is critical. This is relevant for one of the most critical elements in the CBDC debate, namely, whether the digitalization of money ought to allow citizens to hold accounts at the central bank. Since the monetary authority is the ultimate backer of currency in circulation, the argument is that accounts at the central bank would provide the public with the safest form of guarantee against the costs of commercial bank failure. Indeed, the prospect of accounts at the SNB, Switzerland's central bank, came up during the referendum campaign (for example, Jordan 2018).

While space does not permit a complete discussion here (for example, see Siklos 2022a; 2022b), the failed Swiss initiative did generate some prominent and, arguably, misplaced support (for example, Wolf 2018), perhaps more out of frustration at the sheer number of banking crises that have plagued fiat money systems (see Laeven and Valencia 2012) than as a serious alternative. For example, one of the most important functions of a central bank is to act as a lender of last resort. The resulting moral hazard created by a system where the authority that oversees commercial banks is also the one that must bail them out occasionally — at public expense — has not gone unnoticed. For this reason, it is strong safeguards (prudent and

effective regulation) that set a high bar that has limited, albeit imperfectly, the moral hazard risks.

The prospect of the public having direct access to the resources of a central bank also raises questions about the role of financial intermediation. The connection between finance and economic growth has been well documented (for example, Levine 2005; Ang 2008). Moreover, even in the absence of bank accounts at a central bank, 100 percent reserve requirements against some deposits would not prevent the growth of credit stemming from other types of deposits.<sup>33</sup> And, if the 100 percent reserve requirement were extended to all forms of deposits, and the central bank were ultimately responsible for deciding how much money to create, this would represent a shift away from the market deciding what to finance toward a *dirigiste* system wherein credit would effectively be dictated and allocated by the state. Not only would the autonomy of central banks be put into question but, as the aftermath of the 2008–2009 financial crisis demonstrated, it would revive concerns about the role of central banks and, by implication, governments, in the credit allocation process. Arguably more important is that even if the 100 percent reserve requirement were applied to all types of deposits, this would not have prevented the emergence of the shadow banking sector, which likely was the principal instigator of the financial crisis that enveloped the world in 2008–2009 (for example, see Pozsar et al. 2013).

The Swiss experience illustrates that revolutionary ideas are difficult to introduce or are revived at times of crisis when the existing regime falls short of expectations. However, monetary regimes have evolved relatively more slowly over time and not always in the aftermath of a financial crisis. Despite the occasional step back, this kind of evolution has been able to generate long periods of stable prices (for example, as with inflation targeting) with few, if any, financial crises (namely, the so-called Great Moderation; see Federal Reserve Board 2004). Moreover, technical changes can be rapid, but institutions and practices can evolve slowly. Finally, an evolutionary approach to thinking about the potential role of CBDC recognizes that revolutionary changes may create new threats to stable monetary systems while less radical

32 Known as the Vollgeld Initiative (see [www.snb.ch/en/ifor/media/dossiers/id/media\\_dossiers\\_vollgeld](http://www.snb.ch/en/ifor/media/dossiers/id/media_dossiers_vollgeld)). The initiative was soundly defeated (76 percent voted against).

33 The Chicago Plan, in one of its most common versions, would require commercial banks to maintain a 100 percent reserve requirement against demand deposits only.

solutions (i.e., CBDC as a complement to notes and coins in circulation) can be more practical and potentially elicit more public support.

## Sweden's E-krona Hits a Wall?

Sweden stands out among advanced economies in the reduction of notes and coins in circulation. The share of currency to GDP hovers just above one percent but has fallen very gradually over time (for example, see Ingves 2020, diagram 1) despite technological factors that have dramatically changed the payments landscape since the early 1950s. Moreover, notes in circulation did not experience much of a surge during the pandemic, unlike a few other countries, and holdings of notes and coins appear to have reached a floor (for example, see Ingves 2020; Siklos 2022b). This development, among others, reflects the rapid progress toward digitalization in several facets of Sweden's society, notably in finance (IMF 2023a). Nevertheless, the seemingly small step toward replacing physical notes and coins generated sufficient controversy and debate to trigger a review by the Swedish central bank (Riksbank) beginning in 2020.<sup>34</sup> As noted in the introduction, the potential conflict of interest stemming from the role of government in the payment system, as well as legal questions surrounding the concept of legal tender for both cash and digital currencies, prompted the decision to conduct a review.<sup>35</sup> The review was completed in early 2023. While stressing that international developments imply some urgency in introducing a CBDC, dubbed the e-krona, the Riksbank continues to stress that cash as legal tender must continue to be accepted. In a sign that the e-krona's entry is not imminent, the central bank acknowledged that more work is needed on "specific parts of the technical solution" in the words of the IMF's latest article IV report on Sweden (IMF 2023b, 11).

The debate in Sweden highlights the role of transaction costs in payment systems and the impact of existing means of payment. In

addition, the IMF, for example, has proposed 10 recommendations that go beyond mere transaction costs, illustrating how even countries at the vanguard of CBDC development are confronting major challenges with technological factors that impact a form of money that is only intended to complement existing notes and coins that are already little used in Sweden. Most importantly, Sweden's example highlights the need to consider both the social and the private costs not only of digitalization but also in driving changes in payment habits. The Riksbank defines social costs as consisting primarily of time spent in completing transactions using alternative forms of payment. Additionally, there are the private costs largely explained by fees and related transaction costs. The opportunity cost (i.e., "value of the time spent on payments is the alternative cost for the individual") is estimated to be 75 percent of mean after-tax wages (see Sveriges Riksbank 2023, 24).

While digital money has potential advantages (for example, speed of payment and settlement) as well as some convenience benefits such as the reduction, if not elimination, of "shoe-leather costs," substantial costs are often glossed over. This is an illustration of how the private sector, left to its own devices (profit maximization, cost minimization) need not be socially "optimal." The Riksbank estimates that cash payments are the most socially costly (Sveriges Riksbank 2023). However, differences in social costs are most notable for households and least for businesses (ibid., figure 2). Moreover, the relatively high social costs attributed to cash transactions by households may largely be explained by the inclusion of the time spent settling a transaction (i.e., handing over cash and counting it). For households and businesses, this is estimated to represent approximately 40 percent of total costs<sup>36</sup> and almost 50 percent for payment service providers and the central banks that process and oversee payments. The remaining costs are private. Of course, assigning an opportunity cost to completing a cash transaction, the precise value of which is debatable, remains unclear. Indeed, the report concludes that such payments "provide important benefits to society, for instance by making the payment market inclusive and resilient" (ibid., 22). It is notable that these benefits are not quantified. Hence, the conclusions are not based

34 For example, users would be required, under the currently planned arrangement, to have an account with the Riksbank settlement system, called RIX. For details about how e-krona might be distributed, see [www.riksbank.se/globalassets/media/rapporter/e-krona/2021/e-krona-pilot-phase-1.pdf](http://www.riksbank.se/globalassets/media/rapporter/e-krona/2021/e-krona-pilot-phase-1.pdf).

35 According to the Riksbank, in December 2022, payment in cash is enshrined in a new Sveriges Riksbank Act that came into effect in 2023 (chapter 4, section 12). See [www.riksbank.se/en-gb/payments-cash/payments-in-sweden/payments-report-2022/the-riksbanks-work-and-policy/the-riksbank-gets-clearer-responsibility-for-cash/](http://www.riksbank.se/en-gb/payments-cash/payments-in-sweden/payments-report-2022/the-riksbanks-work-and-policy/the-riksbank-gets-clearer-responsibility-for-cash/).

36 Author's calculations based on Figure 12 data in Sveriges Riksbank (2023). Costs including delivery of goods and services, time spent scanning and the amount to be paid are excluded.

on a proper cost-benefit analysis. In addition, the costs are based on a snapshot taken in 2021. Costs do change over time, and the bundling of banking services, for example, renders cost-benefit calculations even more complex. Finally, there are other costs whose implications are difficult to quantify. For example, an empirical investigation covering 129 countries (Armeliu, Claussen and Reslow 2022) reports that Sweden and, to a lesser extent, Norway, stand out in part because of a drive to reduce tax evasion (namely, the curse of money phenomenon mentioned in the introduction) but also because of attempts to change over currency notes and coins that began in 2012.

Government attempts to replace notes and coins, not an unusual phenomenon, are likely to have an impact on the demand for holding currency.<sup>37</sup> Although this is likely to be less costly in the case of changes made in digital currencies, the incentive to do so is thereby greater. Hence, to the extent the public is aware and has memory of such episodes, it is likely to impact the demand for CBDC.

Norway's central bank, the Norges Bank, has conducted similar calculations (also survey-based, completed in 2020) and reached comparable conclusions (Norges Bank 2022). Both central banks' attempt at pinning down transaction costs of different payment forms are comprehensive, whereas others are either out of date or leave out certain groups such as households (for example, Kosse et al. 2017 for Canada; Schmiedel 2012 for the European Union).

Money has a clear public element that goes beyond the usual functions of money (unit of account, store of value, medium of exchange) that can generate some "inefficiencies" to prevent cashless bank branches, changes in the number of ATMs and restrictions in the use of cash in day-to-day transactions, all for society's benefit.

The evolution toward digital money must also confront other questions that require a critical role for governments and not only the central bank and the public sector. Examples include the operation of a digital money system when there are interruptions in electricity or some

crisis that impacts the payment network(s). There are also gaps in data and knowledge about the public's thirst for digital-only money, which also points to an evolution in the adoption of CBDC rather than an outright revolution.

---

## Conclusion and Lessons for the CBDC Era

This paper has used six illustrations from history to argue that the anticipated introduction of a retail CBDC reflects the evolution of monetary systems that has gone on for several centuries. It is not even clear how novel currency in digital form really is given that digital forms of payment (for example, debit and credit cards) are ubiquitous. Perhaps the legal tender provision associated with existing notes and coins may matter when these are complemented with currency in digital form. However, as we have seen, currency in circulation can and has thrived even before the legal tender concept was enforced. The backing of the state behind its currency likely does play an important role in the acceptability of a means of payment but, once again, as society has become used to transacting in digital forms, the anticipated arrival of a retail CBDC cannot be thought of as a revolutionary advance in payment mechanisms.

What is clearer from the lessons of history is that the nation-state will seek to protect the currency issue as a means of supporting its sovereignty and seigniorage flows. It is also abundantly clear that central banks and governments will face the difficult task of ensuring that digital forms of their currencies are not subject to disruptions due to technical malfunctions or attempts to counterfeit digital currencies or interrupt payment systems. Here, too, history offers some lessons. It is the adoption of technology that helped states introduce — and ensure — that currency is widely accepted as a means of payment. Moreover, just as attempts by governments to exploit the printing press led some countries to abandon issuing their own currency and adopt an existing currency from abroad, so will the temptation to misuse the digital form of currency lead the public to seek out more stable forms of payment. In other words, the risks of a further blurring of fiscal and

---

37 Arguably the most famous recent example, albeit with a different aim, is India's currency demonetization of 2016. Other examples include the Bank of England's change from paper to polymer notes in 2022. Searching "banknotes of the [name of the currency]" will yield a Wikipedia page with information about when notes were withdrawn in different countries.

monetary policies will not disappear with the introduction of CBDC and may yet be enhanced. Finally, just as the spread of small denomination notes and coins served as a device to enhance financial inclusion, CBDC promises to perhaps do the same in an increasingly digital world.

There are, however, three important areas where a CBDC potentially represents a significant change in existing monetary systems. First, the greater loss of privacy in day-to-day financial transactions means that, despite promises by central banks to preserve the anonymity of transactions when individuals use CBDC, skepticism is likely to remain. The potential trade-off is the reduction in the number of illicit transactions and in tax avoidance. How societies will grapple with this issue remains very much a work in progress. Second, depending on how nation-states regulate cross-border digital transactions, CBDCs offer the opportunity to reduce transaction costs in sending and receiving currency and allow a much wider segment of the population to hold different currencies. And, third, the potential blurring of fiscal and monetary policies makes it easier for both authorities to inject cash, in a digital fashion, into an economy. This can give the appearance of the ending of the separation of fiscal and monetary policies thought to be an important source of low and stable inflation, at least until the inflation surge that began in 2022. Poor monetary and fiscal policies also potentially threaten economic sovereignty. Hence, there are likely to be many obstacles in permitting the free flow of CBDC across borders. And in the current geopolitical environment, the challenges faced by central banks to convince political authorities of the net benefits of cross-border digital currency holdings with minimal regulatory impediments are likely to be very difficult to overcome.

Undoubtedly, as with any new technology, there are benefits and costs that are not yet visible. However, central banks should be encouraged to reassure the public that the introduction of a CBDC represents an evolution of the monetary system for the digital era while acknowledging that some of its purported benefits will require buy-in by the political authorities who should, with the advice of the monetary authorities, set out to develop the necessary regulatory framework. This means that central banks, as has been noted above, should continue to be adamant that paper money and coins are not about to disappear. Next, these same central banks should clearly communicate the

potential economic benefits (i.e., lower transaction costs, elimination of settlement risk, less costly cross-border transactions, reduction of tax avoidance, greater financial inclusion) from digital forms of cash. If they can do so credibly, then CBDC, as currently envisaged, will assuredly be seen as the next evolution of the monetary system but not a revolutionary change in the existing regime.

## Acknowledgement

The author is grateful to two anonymous peer reviewers for their comments that helped improve the paper.

---

## Works Cited

- Alfaro, Laura, Carla Larangeira and Ruth Costas. 2022. "El Salvador: Launching Bitcoin as Legal Tender." Harvard Business School Case Collection. June. [www.hbs.edu/faculty/Pages/item.aspx?num=62068#](http://www.hbs.edu/faculty/Pages/item.aspx?num=62068#).
- Ang, James B. 2008. "A Survey of Recent Developments in the Literature of Finance and Growth." *Journal of Economic Surveys* 22 (3): 536–76. <https://doi.org/10.1111/j.1467-6419.2007.00542.x>.
- Armelius, Hanna, Carl Andreas Claussen and André Reslow. 2022. "Withering Cash: Is Sweden Ahead of the Curve or Just Special?" *International Journal of Central Banking* 18 (4): 91–123. [www.ijcb.org/journal/ijcb22q4a3.htm](http://www.ijcb.org/journal/ijcb22q4a3.htm).
- Bank for International Settlements. 2021. *Central bank digital currencies: financial stability implications*. Report No. 4. [www.bis.org/publ/othp42\\_fin\\_stab.pdf](http://www.bis.org/publ/othp42_fin_stab.pdf).
- . 2022. *Annual Economic Report 2022*. June 21. [www.bis.org/publ/arpdf/ar2022e.htm](http://www.bis.org/publ/arpdf/ar2022e.htm).
- Bank of England. 1969. "The Bank of England note: a short history." *Quarterly Bulletin* (June): 211–22. [www.bankofengland.co.uk/quarterly-bulletin/1969/q2/the-bank-of-england-note---a-short-history](http://www.bankofengland.co.uk/quarterly-bulletin/1969/q2/the-bank-of-england-note---a-short-history).
- BoC. 2023. "Bank of Canada launches public consultations on a digital dollar." Press release, May 8. [www.bankofcanada.ca/2023/05/bank-canada-launches-public-consultations-digital-dollar/](http://www.bankofcanada.ca/2023/05/bank-canada-launches-public-consultations-digital-dollar/).
- Barr, Michael S. 2023. "Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank." Board of Governors of the Federal Reserve System. April 28.
- Beck, Thorsten, Mathilde Janfils and Kangni R. Kpodar. 2022. "What Explains Remittance Fees? Panel Evidence." IMF Working Paper 22/63. April. [www.imf.org/en/Publications/WP/Issues/2022/04/01/What-Explains-Remittance-Fees-Panel-Evidence-515957](http://www.imf.org/en/Publications/WP/Issues/2022/04/01/What-Explains-Remittance-Fees-Panel-Evidence-515957).
- Benes, Jaromir and Michael Kumhof. 2012. "The Chicago Plan Revisited." IMF Working Paper 12/202. August. [www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Chicago-Plan-Revisited-26178](http://www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Chicago-Plan-Revisited-26178).
- Blinder, Alan S. 2022. *A Monetary and Fiscal History of the United States, 1961–2021*. Princeton, NJ: Princeton University Press.
- Bordo, Michael D. and Lars Jonung. 1987. *The Long-Run Behavior of the Velocity of Circulation: The International Evidence*. Cambridge, UK: Cambridge University Press.
- Bordo, Michael D. and Andrew T. Levin. 2017. "Central Bank Digital Currency and the Future of Monetary Policy." NBER Working Paper 23711. August. [www.nber.org/papers/w23711](http://www.nber.org/papers/w23711).
- Bordo, Michael D. and Pierre L. Siklos. 2018. "Central Banks: Evolution and Innovation in Historical Perspective." In *Sveriges Riksbank and the History of Central Banking*, edited by Rodney Edvinsson, Tor Jacobson and Daniel Waldenström, 26–89. Cambridge, MA: Cambridge University Press.
- Borio, Claudio. 2012. "The financial cycle and macroeconomics: What have we learnt?" BIS Working Papers No. 395. December. [www.bis.org/publ/work395.pdf](http://www.bis.org/publ/work395.pdf).
- Briones, Ignacio and Hugh Rockoff. 2005. "Do Economists Reach a Conclusion on Free-Banking Episodes?" *Economic Journal Watch* 2 (2): 279–324. <https://econjwatch.org/articles/do-economists-reach-a-conclusion-on-free-banking-episodes>.
- Calomiris, Charles W. 1993. "Greenback Resumption and Silver Risks: The Economics and Politics of Regime Change in the United States, 1862–1900." In *Monetary Regimes in Transition*, edited by Michael D. Bordo and Forrest Capie, 86–132. Cambridge, UK: Cambridge University Press.
- Cameron, Rondo. 1967. *Banking in the Early Stages of Industrialization: A Study in Comparative Economic History*. New York, NY: Oxford University Press.
- Cecchetti, Stephen G. and Kermit L. Schoenholtz. 2021. "Central bank digital currency: Is it really worth the risk?" In *Central Bank Digital Currency: Considerations, Projects, Outlook*, edited by Dirk Niepelt, 57–63. London, UK: Centre for Economic Policy Research Press.
- Chen, Hongyi and Pierre L. Siklos. 2022. "Central bank digital currency: A review and some macro-financial implications." *Journal of Financial Stability* 60 (June): 100985. [www.sciencedirect.com/science/article/abs/pii/S1572308922000146](http://www.sciencedirect.com/science/article/abs/pii/S1572308922000146).
- . 2023. "Currency Substitution in a World of Looming Retail CBDCs: Suggestive Currency Substitution-Based Evidence." Hong Kong Institute for Monetary and Financial Research Working Paper No. 09/2023. May.
- Cohen, Benjamin J. 1998. *The Geography of Money*. Ithaca, NY: Cornell University Press.
- Cowen, Tyler and Randall Kroszner. 1989. "Scottish Banking before 1845: A Model for Laissez-Faire?" *Journal of Money, Credit and Banking* 21 (2): 221–31. [www.jstor.org/stable/1992370](http://www.jstor.org/stable/1992370).

- Craig, Ben R. 1996. "Competing Currencies: Back to the Future?" *Economic Commentary*, October 15. Cleveland, OH: Federal Reserve Bank of Cleveland. EC 10/15/1996. [www.clevelandfed.org/en/publications/economic-commentary/1996/ec-19961015-competing-currencies-back-to-the-future](http://www.clevelandfed.org/en/publications/economic-commentary/1996/ec-19961015-competing-currencies-back-to-the-future).
- Cukierman, Alex, Sebastian Edwards and Guido Tabellini. 1992. "Seigniorage and Political Instability." *American Economic Review* 82 (3): 537–55. [www.jstor.org/stable/2117320](http://www.jstor.org/stable/2117320).
- Daly, Kevin and Rositsa D. Chankova. 2021. "Inflation in the Aftermath of Wars and Pandemics." *Goldman Sachs Global Economics Analyst*, March 25. [www.gspublishing.com/content/research/en/reports/2021/03/25/dc7aa7e7-7452-4009-88c9-3af7172d194c.html](http://www.gspublishing.com/content/research/en/reports/2021/03/25/dc7aa7e7-7452-4009-88c9-3af7172d194c.html).
- Douglas, Paul H., Earl J. Hamilton, Irving Fisher, Willford I. King, Frank D. Graham and Charles R. Whittlesey. 1939. "A Program for Monetary Reform." July. [https://monetary.org/images/pdfs/a\\_program\\_for\\_monetary\\_reform.pdf](https://monetary.org/images/pdfs/a_program_for_monetary_reform.pdf).
- Dowd, Kevin, ed. 1992. *The Experience of Free Banking*. London, UK: Routledge.
- Doyle, Michael. 2021. "The future of money: The digital currency revolution is here, and may sweep away 5,000 years of monetary history." *The Globe and Mail*, June 5. [www.theglobeandmail.com/business/article-the-digital-currency-revolution-may-usurp-analog-money/](http://www.theglobeandmail.com/business/article-the-digital-currency-revolution-may-usurp-analog-money/).
- Drucker, Peter F. 1997. "The Global Economy and the Nation-State." *Foreign Affairs* 76 (5): 159–71. [www.foreignaffairs.com/articles/1997-09-01/global-economy-and-nation-state](http://www.foreignaffairs.com/articles/1997-09-01/global-economy-and-nation-state).
- Eichengreen, Barry. 2019. "From Commodity to Fiat and Now to Crypto: What Does History Tell Us?" NBER Working Paper 25426. January. <https://doi.org/10.3386/w25426>.
- Federal Reserve Board. 2004. "The Great Moderation." Remarks by Governor Ben S. Bernanke at the meetings of the Eastern Economic Association, Washington, DC, February 20. [www.federalreserve.gov/boarddocs/speeches/2004/20040220/](http://www.federalreserve.gov/boarddocs/speeches/2004/20040220/).
- Fisher, Irving. 1936. "100% Money and the Public Debt." *Economic Forum* (April–June): 406–20.
- Frankel, Jeffrey A. and Andrew K. Rose. 1998. "The Endogeneity of the Optimum Currency Area Criteria." *The Economic Journal* 108 (449): 1009–25. <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-0297.00327>.
- Frieden, Jeffrey A. 1997. "Monetary Populism in Nineteenth-Century America: An Open Economy Interpretation." *The Journal of Economic History* 57 (2): 367–95. [www.jstor.org/stable/2951042](http://www.jstor.org/stable/2951042).
- Friedman, Milton. 1970. "The Counter-Revolution in Monetary Theory." Institute of Economic Affairs Occasional Paper No. 33.
- . 1992. *Money Mischief: Episodes in Monetary History*. New York, NY: Harcourt Brace.
- Fung, Ben, Scott Hendry and Warren E. Weber. 2017. "Canadian Bank Notes and Dominion Notes: Lessons for Digital Currencies." Bank of Canada Staff Working Paper 2017-5. February. [www.bankofcanada.ca/2017/02/staff-working-paper-2017-5/](http://www.bankofcanada.ca/2017/02/staff-working-paper-2017-5/).
- Glowka, Marc, Anneke Kosse and Robert Szemere. 2023. "Digital payments make gains but cash remains." Committee on Payments and Market Infrastructures Brief No. 1. January. [www.bis.org/statistics/payment\\_stats/commentary2301.htm#](http://www.bis.org/statistics/payment_stats/commentary2301.htm#).
- Granville, Brigitte. 2013. *Remembering Inflation*. Princeton, NJ: Princeton University Press.
- Greenfield, Robert L. and Hugh Rockoff. 1995. "Gresham's Law in Nineteenth-Century America." *Journal of Money, Credit and Banking* 27 (4): 1086–98. <https://doi.org/10.2307/2077791>.
- Group of Seven. 2021 a. "G7 Finance Ministers and Central Bank Governors Communiqué." Policy Paper. June 5. [www.gov.uk/government/publications/g7-finance-ministers-meeting-june-2021-communique/g7-finance-ministers-and-central-bank-governors-communique](http://www.gov.uk/government/publications/g7-finance-ministers-meeting-june-2021-communique/g7-finance-ministers-and-central-bank-governors-communique).
- . 2021 b. "Public Policy Principles for Retail Central Bank Digital Currencies (CBDCs)." October 14. [www.gov.uk/government/publications/g7-public-policy-principles-for-retail-central-bank-digital-currencies-and-g7-finance-ministers-and-central-bank-governors-statement-on-central-bank](http://www.gov.uk/government/publications/g7-public-policy-principles-for-retail-central-bank-digital-currencies-and-g7-finance-ministers-and-central-bank-governors-statement-on-central-bank).
- Hall, George, Jonathan Payne, Thomas J. Sargent and Bálint Szöke. 2022. "Costs of Financing US Federal Debt Under a Gold Standard: 1791–1933." Working Paper. June. Princeton University Bendheim Center for Finance. <https://bcf.princeton.edu/working-papers/costs-of-financing-us-federal-debt-under-a-gold-standard-1791-1933/>.
- Helleiner, Eric. 2003. *The Making of National Money: Territorial Currencies in Historical Perspective*. Ithaca, NY: Cornell University Press.
- Humphrey, Thomas M. 1987. "The Theory of Multiple Expansion of Deposits: Why It Is and Whence It Came." *Federal Reserve Bank of Richmond Economic Review* 73 (2): 3–11. [www.richmondfed.org/publications/research/economic\\_review/1987/er730201](http://www.richmondfed.org/publications/research/economic_review/1987/er730201).

- IMF. 2023a. "Sweden: Financial Sector Assessment Program – Technical Note on Central Bank Digital Currency and Fintech." IMF Country Report No. 23/134. April 5. [www.imf.org/en/Publications/CR/Issues/2023/04/05/Sweden-Financial-Sector-Assessment-Program-Technical-Note-on-Central-Bank-Digital-Currency-531866](http://www.imf.org/en/Publications/CR/Issues/2023/04/05/Sweden-Financial-Sector-Assessment-Program-Technical-Note-on-Central-Bank-Digital-Currency-531866).
- . 2023b. "Sweden: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Sweden." IMF Country Report No. 23/111. March 16. [www.imf.org/en/Publications/CR/Issues/2023/03/16/Sweden-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-530937](http://www.imf.org/en/Publications/CR/Issues/2023/03/16/Sweden-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-530937).
- Ingves, Stefan. 2020. "Future money and payments." Economic Commentaries No. 9. Sveriges Riksbank, October 15.
- Issing, Otmar. 2008. "The Euro: A currency without a state." Center for Financial Studies Working Paper 2008/51. December.
- Jonung, Lars and Eoin Drea. 2009. "The euro: It can't happen. It's a bad idea. It won't last. US economists on the EMU, 1989–2002." Economic Papers 395. Brussels, Belgium: European Commission. December. [https://ec.europa.eu/economy\\_finance/publications/pages/publication\\_summary16343\\_en.htm](https://ec.europa.eu/economy_finance/publications/pages/publication_summary16343_en.htm).
- Jordan, Thomas J. 2018. "How money is created by the central bank and the banking system." Speech presented at the Zürcher Volkswirtschaftliche Gesellschaft, Swiss National Bank, Zurich, Switzerland, January 16.
- Kiff, John, Jihad Alwazir, Sonja Davidovic, Aquiles Farias, Ashraf Khan, Tanai Khiaonrong, Majid Malaika, Hunter K. Monroe, Nobu Sugimoto, Hervé Tourpe and Peter Zhou. 2020. "A Survey of Research on Retail Central Bank Digital Currency." IMF Working Paper No. 2020/104. June. [www.imf.org/en/Publications/WP/Issues/2020/06/26/A-Survey-of-Research-on-Retail-Central-Bank-Digital-Currency-49517](http://www.imf.org/en/Publications/WP/Issues/2020/06/26/A-Survey-of-Research-on-Retail-Central-Bank-Digital-Currency-49517).
- King, Stephen D. 2023. *We Need to Talk About Inflation: 14 Urgent Lessons from the Last 2,000 Years*. New Haven, CT: Yale University Press.
- Kosse, Anneke and Ilaria Mattei. 2022. "Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies." Bank for International Settlements Paper No. 125. May.
- Kosse, Anneke, Heng Chen, Marie-Hélène Felt, Valéry Dongmo Jiongo, Kerry Nield and Angelika Welte. 2017. "The Costs of Point-of-Sale Payments in Canada." Bank of Canada Staff Discussion Paper 2017-4. [www.bankofcanada.ca/2017/03/staff-discussion-paper-2017-4/](http://www.bankofcanada.ca/2017/03/staff-discussion-paper-2017-4/).
- Kroszner, Randall. 1995. "Free Banking: The Scottish Experience as a Model for Emerging Economies." Policy Research Working Paper Series 1536. November. <https://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-1536>.
- Kynaston, David. 2017. *Till Time's Last Sand: A History of the Bank of England 1694–2013*. London, UK: Bloomsbury.
- Laeven, Luc and Fabián Valencia. 2012. "Systemic Banking Crises: An Update." IMF Working Paper 2012/163. June. [www.imf.org/en/Publications/WP/Issues/2016/12/31/Systemic-Banking-Crises-Database-An-Update-26015](http://www.imf.org/en/Publications/WP/Issues/2016/12/31/Systemic-Banking-Crises-Database-An-Update-26015).
- Laidler, David E. W. 1993. *The Demand for Money: Theories, Evidence, and Problems*. 4th ed. New York, NY: Harper & Row.
- Lerner, Abba Ptachya. 1943. "Functional Finance and the Federal Debt." In *Selected Economic Writings of Abba P. Lerner*, edited by David C. Colander, 297–310.
- Levine, Ross. 2005. "Finance and Growth: Theory and Evidence." In *Handbook of Economic Growth*, vol. 1A., edited by Philippe Aghion and Steven N. Durlauf, 865–934. Amsterdam, NL: Elsevier.
- Menzies, Gordon. 2004. "Money to burn, or melt? A cost-benefit analysis of Australian polymer notes." *The North American Journal of Economics and Finance* 15 (3): 355–68. [www.sciencedirect.com/science/article/abs/pii/S1062940804000336](http://www.sciencedirect.com/science/article/abs/pii/S1062940804000336).
- Mundell, Robert. 2012. "The case for a world currency." *Journal of Policy Modeling* 34 (4): 568–78. [www.sciencedirect.com/science/article/abs/pii/S0161893812000634](http://www.sciencedirect.com/science/article/abs/pii/S0161893812000634).
- Murphy, Anne L. 2023. *Virtuous Bankers: A Day in the Life of the Eighteenth-Century Bank of England*. Princeton, NJ: Princeton University Press.
- Neufeld, Edward P. 1964. *Money and Banking in Canada: Historical Documents and Commentary*. Toronto, ON: McClelland and Stewart.
- Niepelt, Dirk. 2021. "'Reserves for All': Political rather than macroeconomic risks." In *Central Bank Digital Currency: Considerations, Projects, Outlook*, edited by Dirk Niepelt, 39–44. London, UK: Centre for Economic Policy Research Press. <https://cepr.org/publications/books-and-reports/central-bank-digital-currency-considerations-projects-outlook>.
- Norges Bank. 2022. "Costs in the Norwegian payment system 2020." Norges Bank Paper No. 3. Oslo, Norway: Norges Bank. [www.norges-bank.no/en/news-events/news-publications/Reports/Norges-Bank-Papers/2022/memo-32022-kostnader/](http://www.norges-bank.no/en/news-events/news-publications/Reports/Norges-Bank-Papers/2022/memo-32022-kostnader/).



- Powell, James. 2005. *A History of the Canadian Dollar*. Ottawa, ON: Bank of Canada. [www.bankofcanada.ca/2005/12/a-history-of-the-canadian-dollar-by-james-powell/](http://www.bankofcanada.ca/2005/12/a-history-of-the-canadian-dollar-by-james-powell/).
- Pozsar, Zoltan, Tobias Adrian, Adam B. Ashcraft and Hayley Boesky. 2013. "Shadow Banking." *Economic Policy Review* 19 (2): 1–16.
- Prasad, Eswar. 2023. "Central banks bow to the inevitability of digital currencies." *Financial Times*, May 3. [www.ft.com/content/fd8f979e-e4a2-4752-9400-951e4c969578](http://www.ft.com/content/fd8f979e-e4a2-4752-9400-951e4c969578).
- Reinhart, Carmen M. and Kenneth S. Rogoff. 2009. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton, NJ: Princeton University Press.
- Rogoff, Kenneth S. 2016. *The Curse of Cash: How Large-Denomination Bills Aid Crime and Tax Evasion and Constrain Monetary Policy*. Princeton, NJ: Princeton University Press.
- Rolnick, Arthur J. and Warren E. Weber. 1986. "Gresham's Law or Gresham's Fallacy?" *Journal of Political Economy* 94 (1): 185–99. <https://doi.org/10.1086/261368>.
- Schmiedel, Heiko, Gergana Kostova and Wiebe Ruttenberg. 2012. "The social and private costs of retail payment instruments: a European perspective." European Central Bank Occasional Paper Series No. 137. Frankfurt am Main, Germany: European Central Bank.
- Selgin, George. 2017. "The History and Success of Canada's Private Currency." Foundation for Economic Education, March 20. <https://fee.org/articles/the-history-and-success-of-canadas-private-currency/>.
- Siklos, Pierre L. 2022a. *Retail Central Bank Digital Currency: Has Its Time Come?* CIGI Paper No. 261. Waterloo, ON: CIGI. [www.cigionline.org/publications/retail-central-bank-digital-currency-has-its-time-come/](http://www.cigionline.org/publications/retail-central-bank-digital-currency-has-its-time-come/).
- . 2022b. *A Digital Loonie among Many Digital Currencies: Prospects and Outlook*. CIGI Paper No. 269. Waterloo, ON: CIGI. [www.cigionline.org/publications/a-digital-loonie-among-many-digital-currencies-prospects-and-outlook/](http://www.cigionline.org/publications/a-digital-loonie-among-many-digital-currencies-prospects-and-outlook/).
- Sveriges Riksbank. 2023. "Cost of payments in Sweden." Riksbank Studies NR 1. March 23. [www.riksbank.se/globalassets/media/rapporter/riksbanksstudie/engelska/2023/riksbanksstudie-cost-of-payments-in-sweden.pdf](http://www.riksbank.se/globalassets/media/rapporter/riksbanksstudie/engelska/2023/riksbanksstudie-cost-of-payments-in-sweden.pdf).
- Taylor, Luke. 2022. "El Salvador's crypto gamble goes sour." *New Scientist* 254 (3392): 16. [www.sciencedirect.com/science/article/abs/pii/S0262407922011058](http://www.sciencedirect.com/science/article/abs/pii/S0262407922011058).
- Unger, Irwin. 1964. *The Greenback Era: A Social and Political History of American Finance, 1865–1879*. Princeton, NJ: Princeton University Press.
- Wallace, Neil. 1983. "A Legal Restrictions Theory of the Demand for 'Money' and the Role of Monetary Policy." *Federal Reserve Bank of Minneapolis Quarterly Review* 7 (winter): 1–7.
- White, Lawrence H. 2015. "Free Banking in History and Theory." In *Renewing the Search for a Monetary Constitution: Reforming Government's Role in the Monetary System*, edited by Lawrence H. White, Viktor J. Vanberg and Ekkehard A. Köhler. Washington, DC: Cato Institute.
- Wolf, Martin. 2018. "Why the Swiss should vote for 'Vollgeld.'" *Financial Times*, June 5. [www.ft.com/content/d27b000e-6810-11e8-8cf3-0c230fa67aec](http://www.ft.com/content/d27b000e-6810-11e8-8cf3-0c230fa67aec).
- Wong, Russell. 2022. "Why Stablecoins Fail: An Economist's Post-Mortem on Terra." Federal Reserve Bank of Richmond Economic Brief No. 22-24. July. [www.richmondfed.org/publications/research/economic\\_brief/2022/eb\\_22-24](http://www.richmondfed.org/publications/research/economic_brief/2022/eb_22-24).

---

**Centre for International  
Governance Innovation**

67 Erb Street West  
Waterloo, ON, Canada N2L 6C2  
[www.cigionline.org](http://www.cigionline.org)

 @cigionline