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Digital currencies:

New technology and old monetary ideas

Ousmène Jacques Mandeng,

Visiting Fellow, Institute of Global Affairs,
London School of Economics and Political Science

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Ousmène Jacques Mandeng
Visiting Fellow,
Institute of Global Affairs,
London School of Economics and Political Science

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Abstract

The success of digital currencies will likely depend on whether they can offer something existing currencies cannot. While the notion of digital currencies seems relatively novel, many have expanded on old monetary ideas for a winning formula. Economic history suggests that new currencies emerged largely in response to expanding settlement media and offering complementary usability. The paper reviews parallels between past monetary innovations and digital currencies including flexibility for paper currencies afforded by the gold standard and its international aspiration, the relevance of early international currencies like the eighteenth century Maria Theresa thaler, regional parallel currencies like the nineteenth century Vereinsmünzen and the SDR as an international asset. The paper aims to illustrate that looking at monetary history, the new currencies may be less controversial and the case for such currencies stronger than generally perceived.

JEL Classification: G18, G28

Keywords: Digital currencies, bitcoin, gold standard, international currencies, SDR

Contents

Introduction

Digital currencies matter if they offer some functions conventional currencies do not. Historically, several currencies were launched to expand prevailing settlement media and facilitate international commercial exchange. The biggest impact of digital currencies may be their ability to overcome limitations of and act as complements to conventional currencies. The recent announcement of JP Morgan, one of the largest U.S. banks, to issue a digital coin, the next stage for a utility settlement coin of a consortium of leading banks and rumours that Facebook may follow suit are indicative that there is demand for new types of settlement media.[1] This paper aims to shed light on the parallels between past monetary innovations and digital currencies to illustrate that the objectives of some of the new currencies simply follow old monetary ideas and may be less controversial and the case for such currencies stronger than generally perceived.[2]

Digital currencies have aimed at broadening the functions and utility of conventional currencies amid persistent gaps in currency roles. The obvious limitation of conventional currencies are at least twofold. They are national in scope and tied to national policy objectives typically price stability. Robert Roosa famously wrote in 1965 that "there will be recurrent collisions between the role of […] money as a medium of exchange and […] as standard of value. As a medium of exchange, money must be expansible to serve the needs of growing trade […]. As a standard of value […] money must be limited in quantity in order to preserve its purchasing power […]."3 Bitcoin and other digital currencies have recognised those limitations but only partially address them.

Economic history offers various currency examples launched to overcome existing conventional currency limitations and confined herein to currencies that are complementary to national currencies albeit no attempt is made to provide a comprehensive and representative list.4 The nineteenth century gold standard was successful in expanding the availability of settlement media and as an international standard that even explored the idea of a world currency (Bordo, 1984; Eichengreen, 1995; Flandreau, 1996; Helfferich, 1903).5 The eighteen century Austrian Maria Theresa thaler was one of the first international currencies (Kuroda, 2007). The nineteenth century Austro-German Vereinsmünzen was a parallel regional currency in Austria and Germany to overcome a fragmented coinage landscape (Zich, 2009). The IMF's Special Drawing Right (SDR) was the most ambitious modern attempt in scope to overcome existing limitations of national currencies (Boughton, 2001).

The relationship between digital currencies and historical monetary standards has been established mostly with regard to the gold standard. The parallel in particular between bitcoin and the gold standard rests mostly on the fixity of the supply of gold and the role of gold as external anchor (ECB, 2012; Dyhrberg, 2016; Selgin, 2015; Weber, 2016). However, the role of bank notes as gold tokens and the importance of active monetary policy under the gold standard have been mostly discarded. The relationship between digital currencies and other historical monetary ideas have not been explored.

The issuance of digital currencies could be undertaken by central banks and private entities. While the former dominate currency issuance, the latter in theory though not to date in practice is equally feasible. Private currencies may be perceived as unorthodox only in a contemporary context. During the nineteenth century, currencies, notably bank notes, have often been issued by private banks. Most monies are issued by private commercial banks except where state-owned banks dominate. While bitcoin and other private currencies are considered unduly volatile, most national currencies have equally exhibited prolonged periods of volatility and depreciation. The adoption of digital currencies will depend on their ability to meet though not necessarily all fundamental functions of money.

The paper focuses narrowly on currency used as settlement medium and abstracts from near-currencies or

[1] See J.P. Morgan (2019), for Facebook New York Times (2019) and for USC Financial Times (2019).
[2] See e.g. BIS (2018).
[3] Roosa (1965, p. 10).
[4] The ECU as predecessor to the euro is not covered here amid its well know origins.
[5] Eichengreen (1995) saw in the international dimension of the gold standard a critical factor that transmitted deflationary shocks across countries.

other close currency substitutes. It describes briefly in the second part, the main features of digital currencies. The third section reviews the gold standard and the fourth section the aspiration of the gold standard as an international standard. The fifth section outlines the role of the Maria Theresa Taler as an international currency. The sixth offers an overview of the Vereinsmünzen as a parallel currency and the seventh discusses the SDR. The last part offers some conclusions.

Digital currencies

The emergence of digital currencies, crypto-currencies and planned central bank issued digital currencies, is indicative of increasing digitalisation in payments and perceived lack of needed functionality of conventional currencies. Bitcoin and other crypto-currencies, are privately issued digital currencies (PDC) that normally exhibit limited acceptance. Central bank issued digital currencies (CBDC) remain today mostly at project stage only, are digital representations of national currencies constituting central bank liabilities similar to bank notes, coins and reserves and would normally offer universal acceptance in a given currency area.

The innovation with new digital currencies like bitcoin rest in their token-based properties. It forms part of a broader emerging development of tokenisation of assets, financial and non-financial, and currencies issued on a distributed ledger or blockchain to allow native fractional ownership and instantaneous delivery versus payment. Digital currencies represent the cash-leg in token-based transactions and serve to allow end-to-end settlement in token-based financial ecosystems that include but are not limited to digital financial market infrastructures, trade finance and value chain management. The issuance of tokens rests on a consensus mechanism based on a distributed ledger or blockchain to enable peer-to-peer transactions without recourse to a centralised ledger. Digital currencies are akin to notes and coins in functionality.

Digital currencies are a subset of money. Currencies form part of the monetary base, represent the most liquid form of money, are negotiable and allow immediate settlement of debt. PDCs serve as private media of exchange. CBDCs would serve as official media of exchange and would normally allow settlement finality.

Bitcoin and other PDCs are typically issued by relatively small non-financial institutions. Total market capitalisation of crypto-assets, including bitcoin and other PDCs but also non-currency-like assets, remains small and was US$245 billion in June 2019.[6] Bitcoin, Litecoin, Digicash are for example floating rate media of exchange. Issuance is often fixed. Exchange rates with national currencies can exhibit significant volatility. There is a high correlation in value between bitcoin and other PDCs. The exchange rate of bitcoin to the dollar was US$920 in January 2017, peaked at around US$19,500 in December 2017 and was US$7,688 in June 2019. The exchange rate movements are indicative of significant uncertainty and possibly heightened speculation about the underlying value of bitcoin.

The emergence of stable coins, digital currencies backed by reserves in the form of national currencies or other or whereby token supply is adjusted to maintain a stable nominal value relative to a given national currency, is indicative of the desire for stable digital currency valuations in national currency terms. The market capitalisation of tether, the largest stable coin, increased from less than US$14.5 million or 0.1 percent of total crypto-assets in January 2017 to US$3,250 million or 1.3 percent in June 2019.[7]

The issuance of PDCs by established financial institutions remains rare. The announcement by U.S. bank JP Morgan to issue a digital coin may signal a broader trend of proliferation of PDCs among large financial institutions; non-financial large commercial institutions like Amazon or Alibaba are also expected to issue digital coins to service their ecosystems; Facebook appears to be in advanced stages of introducing a Facebook coin.[8]

The introduction of CBDCs has been exploratory. A large number of central banks are analysing CBDC amid different use cases in retail, to replace notes and coins and in wholesale to replace reserves (BIS, 2019). The use of CBDC in cross-border transactions and to be used in regional payment integration is also being

[6] Prices from www.coinmarketcap.com as of 9 June 2019.
[7] Idem.
[8] See footnote 1.

contemplated by several central banks (Bank of Canada et al., 2018). The strongest use cases for CBDC is naturally where central bank money is needed as settlement medium in large-value payments systems to offer end-to-end digital settlement and in retail to offer a choice to the non-bank public to use central bank money in digital transactions.

The issuance of PDCs by commercial banks will likely be determined and controlled solely by the issuer. Similarly, CBDC is expected to be issued in a permissioned network only where the central bank retains issuance control and will define access, circulation and usage. Issuance and any possible expansion of the banks', non-bank commercial entities' or central banks' balance sheets will therefore rest on the decision of the issuer.

The quality and reputational attributes of the issuer will naturally determine in large part the relative acceptance of a digital currency. While CBDCs are most likely to be adopted where issued by a reputable central bank, there is a priori no reason why PDCs could not also serve as reliable media of exchange.

Gold standard

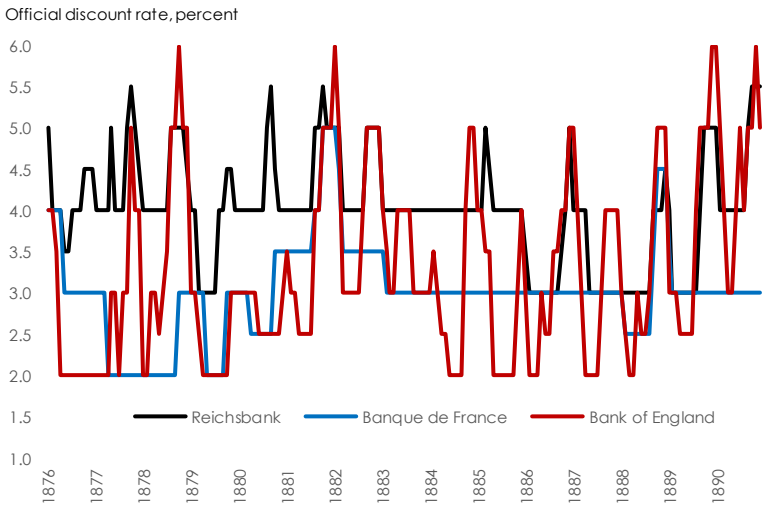
The gold standard was about the measured dissemination of paper currencies to accommodate a rising need for alternative settlement media. The gold standard emerged during the last quarter of the nineteenth century as the dominant monetary standard. It can be attributed to the qualities of gold and near universal acceptance as medium of exchange. The essence of the gold standard was the use of paper money, that is, the idea that one can use bank notes and other paper monies in lieu of gold. Different gold standards existed. The period of the classical gold standard where gold coins circulated is normally set from 1821 to 1914. [9]

The gold standard consisted of the maintenance of a fixed price of a bank note denominated in a national currency in terms of a pre-announced weight of gold. Bank notes were typically reserved by a minimum amount of gold to ensure unconditional convertibility into gold and limit bank note issuance. The convertibility into gold was normally ensured by law; e.g. the 1875 bank act in Germany, stipulated that all banks notes had to be exchanged on demand for gold at a rate of 1392 mark per pound (500 grams) of gold fine.[10] Central banks would adjust monetary policy to ensure that sufficient gold would flow to accommodate domestic demand for bank notes as issuance was dependent on adequate gold reserves. During the nineteenth century, bank notes became one of the principal medium of exchange in particular in large value transactions, but were mere surrogates or tokens for gold and often not legal tender.[11]

The relative fixity of the supply of gold, as determined by gold finds and cost and technology of extraction assured the maintenance of a stable gold price. In an international context, the gold standard linked the price levels between countries and maintained stable exchange rates. The price-specie flow mechanism and law of one price ensured through arbitrage and gold movements net of transportation costs that gold flows and changes in price levels were aligned.

[9] See e.g. Bordo (1984).
[10] The gold content was fixed with the 1871 coinage act. The act stipulates that 139 ½ 1 mark coins are to be minted of 500 grams of fine gold minus 3 Mark minting fee.
[11] In Germany notes issued by the German Imperial Bank from inception in 1876 were not legal tender and became legal tender only in 1901. In Switzerland, notes issued by the Swiss National Bank became legal tender only in 1954.

Figure 1. Monetary policy under the gold standard



Source: Reichsbank (1900), Reichsbank (1925)..

Central banks under the gold standard maintained active monetary policies. Monetary policy under the gold standard was not only based on maintaining a minimum ratio of gold to bank notes but to ensure a given reserve requirement was met while other monetary policy objectives could be achieved. The German Imperial Bank (Reichsbank) and Bank of England pursued very active interest rate adjustments through their discount or policy rates to influence gold flows and attain wanted policy outcomes. This allowed central bank to maintain some discretion in the conduct of monetary policy (Figure 1).

World gold coin

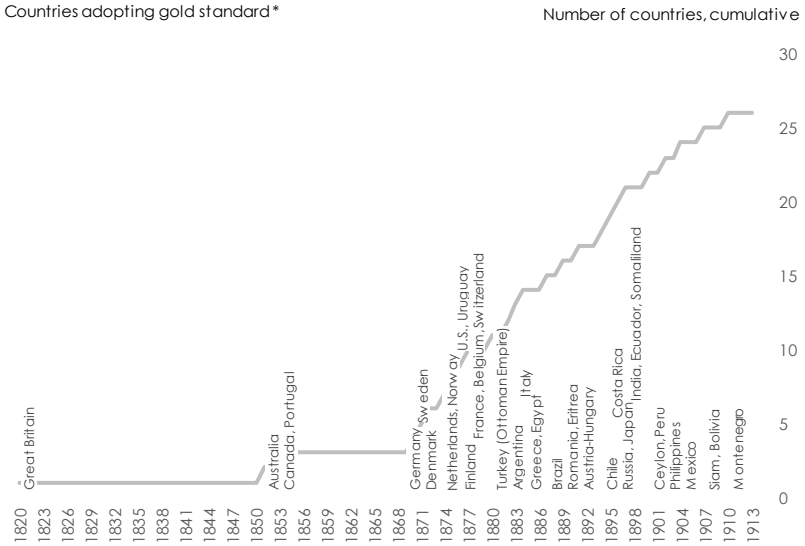
The propagation of the gold standard had been motivated in large part by international trade and financial interests and concerns of undue isolation of the countries on a silver standard.[12] The aim to use a common standard to facilitate international trade had been contemplated with the universal adoption of the gold standard during the nineteenth century.

Great Britain adopted the gold standard in the 1820s, attracted other countries notably Germany, that switched from silver, and France, that switch from a bi-metallic gold and silver standard, in the 1870s followed by other countries through the last quarter of the nineteenth century and World War I (Figure 2). The U.S. adopted gold gradually starting in the 1830s, switching from silver, and formalised adoption in the 1870s.

The adoption of a common standard was attempted with the formation of the Latin Monetary Union of 1865, with the participation of Belgium, France, Italy, and Switzerland. It was based on a bi-metallic standard with a fixed exchange ratio between gold and silver of 1:15.5 and was open to universal membership and followed informally by several countries.

[12] The reasons for adopting the gold standard remain contested, see e.g. Flandreau (1996).

Figure 2. Gold standard adopters



Source: Officer, EH.net. * Year of first-time adoption. Does not indicate continous adherence to gold standard or exclusive use of gold.

The 1867 Paris Monetary Conference, held during the World Exposition (Exposition Universelle), explored the possibility of adopting a world gold coin. The conference, with the participation of 20 countries including the United States, adopted an informal resolution by which countries that had not adopted the franc system to include a coin with a simple conversion into the 5-franc gold coin as a common denominator in their national coin offerings.[13] The conference achieved consensus except for the Netherlands, that a future international monetary standard should be based solely on gold attesting that the gold standard was seen as the monetary standard of the future.

U.S. President Andrew Johnson was favourable to the proposal of a universal coinage as presented at the Paris Conference:[14] "[…] the inconveniences of commerce and social intercourse resulting from the diverse standards of money value were very fully discussed, and plans were developed for establishing by universal consent a common principle for the coinage of gold. […] A report of these interesting proceedings will be submitted to Congress, which will, no doubt, justly appreciate the great object and be ready to adopt any measure which may tend to facilitate its ultimate accomplishment." England, the German States and the Netherlands refused to make needed adjustments and the plan was never adopted.

Maria Theresa thaler

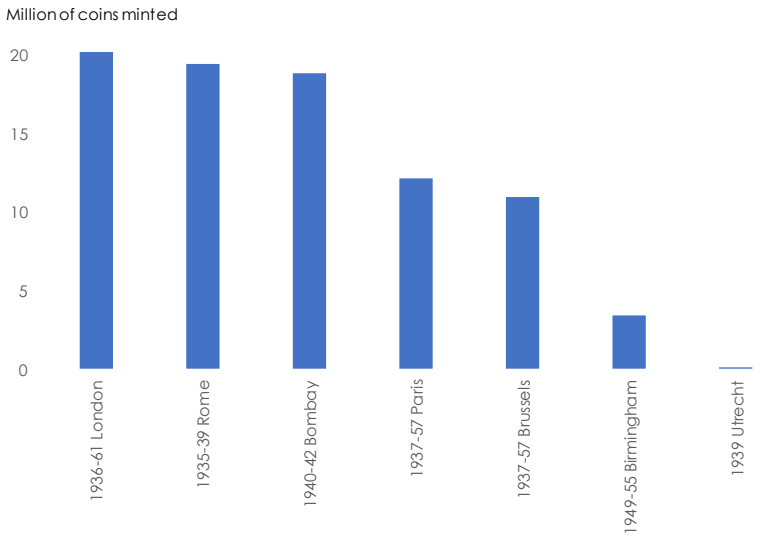
The Maria Theresa thaler is one of the first international currencies.[15] It served as medium of exchange mainly in the Middle East and Africa through the twentieth century gaining prominence well outside of Austria's former sphere of influence. It became a private, deterritorialised currency with decentralised issuance. The thaler achieved adoption not by political power, as in the case of colonial currencies or by treaty; the coin became a pure trading currency in particular during the twentieth century with issuance and circulation beyond any sovereign interference.

The Maria-Theresa thaler was one of the main silver coins in Austria during the eighteenth and nineteenth century. The coin was minted upon the coronation of the Habsburg Empress Maria Theresa in 1741 and wore her effigy. It remained in circulation after her death in 1780, lost its legal tender status in 1852 and was

[13] See e.g. Helfferich (1903, pp. 141-147). On the description of the monetary plan, see e.g. Department of State (1867).
[14] Johnson (1867).
[15] The only other coin that was arguably more important for international trade was the Mexican silver dollar or Spanish pieces of eight. Spanish pieces of eight were minted in Sevilla, Mexico and Potosi.

withdrawn from circulation in Austria in 1892.

Figure 3. Maria Theresa thaler coinage



Source: Tschoegl (2001) Table 2. Total minted of non-Austrian 85 million and total of Habsburg and Austrian 305 million.

The thaler became a prominent vehicle currency for the main commodities in the Red Sea region already from the 1760s. [16] It circulated widely from inner Africa in Sudan and Ethiopia, the northwest cost of Africa to Madagascar and from Turkey to Oman and as far as China and served as legal tender in Saudi Arabia, Ethiopia, Nigeria, Yemen and Oman.[17] The coin was used extensively to acquire commodities but also in exchange for other currencies like the Indian rupee and sterling. With Austria ceding the right to mint the coin to Italy in 1935, several mints issued the coin including in Paris, Brussels, Rome, London, Bombay (Figure 3). Attempts to replace the thaler with their own silver coins by the colonial governments of Great Britain and Italy in the territories under their control had only partial success attributed in part to the inter-territorial advantages the thaler possessed. Its circulation became somewhat impaired with its demonetisation by the Ottoman Empire and the replacement in the British colonies for British silver coins from 1900.

The Maria Theresa thaler value usually exceeded its intrinsic value in terms of the current silver price.[18] The coin was popular amid its high familiarity, stable fineness, its beautiful and ornate design that made counterfeiting difficult though the reason for the attraction of the thaler remain contested. It was not the only currency in circulation and its value may have rested in its complementarity with other currencies.[19]

Vereinsmünzen

The German customs union coins (Vereinsmünzen) were important parallel currencies that served as medium of exchange to facilitate regional payments integration. The coins were minted to meet current demand as substitute for national coins though circulated in parallel to existing coins whereby issuance was an outcome of the perceived relative utility of the custom union to national coins.

[16] See Kuroda (2007) with reference to Danish geographers in the Arab peninsula.
[17] See e.g. Tschoegl (2001). In Ethiopia, civil servants were paid in the Maria Theresa thaler (Kuroda, 2007). Other foreign silver coins also played important international roles like the Mexican silver dollar and Japanese silver dollar in China.
[18] Keynes (1930, p. 14) with reference to the Maria Theresa thaler wrote that "[…] a coin might have a value somewhat superior to that of its metal content because of the convenience and prestige of the coin, or because the stamp was a guarantee of fineness and acceptability, or merely because of its aesthetic qualities […]."
[19] See Kuroda (2007, p. 91) for an explanation based on currency complementarity: "The [Maria Theresa thaler] alone could not mediate between buyers and sellers: it could work well only in association with other monies. The key to solve the mystery is the nature of the complementary relationship among monies in circulation side by side."

The custom union coins were silver and gold coins issued in Germany and Austria in the territory of the German customs union (Zollverein) and Austria in 1838-71. The coins aimed to establish some greater monetary harmonisation in the German states amid a multitude of existing monetary standards and align German with Austrian coinage. They became very popular and dominated silver minting through 1871 when Germany without Austria adopted monetary union with the mark.

Nineteenth century Germany was a coinage and banking muddle.[20] The multitude of monetary standards in nineteenth century Germany rests in its political divisions. Germany at the end of the Napoleonic Wars was a patchwork of hundreds of independent states. The political and economic integration of Germany occurred only gradually during the nineteenth century.[21] The Congress of Vienna preserved sovereignty for coinage with the 39 federal states.[22] In the early 1870s in Germany, there were 7 coinage systems and 53 paper currencies in circulation, comprising bank and state treasury notes (see Appendix Table).[23] Throughout the nineteenth century there were numerous attempts to harmonise coinage and bank note issuance.[24]

Germany maintained two main coinage systems after the Congress of Vienna with the thaler system (14-Thalerfuß) in the Northern German states and the gulden system (24 ½-Guldenfuß) in the Southern German states.[25] Austria maintained its own system based on the gulden (20-Guldenfuß or Konventionsfuß). The systems were mostly based on a silver standard with the exception of the German state of Bremen that maintained a gold standard.[26] Other German states adhered to derivatives of either system, had their own systems, i.e. a thaler of one state was not equal to a thaler of another, and in addition foreign coins circulated freely.[27] In 1837, the Munich Coinage Treaty (Münchner Münzkonvention) among the Southern German States set a standard for minting gulden coins on the basis of common specifications. In 1838, the Dresden Coinage Convention (Dresdner Konvention), comprising all member countries of the Zollverein, established further coinage harmonisation by obligating member countries to opt for either thaler or gulden, introduction of fixed parities between standards and adoption of a common coin, the union coin (Vereinsthaler or Doppelthaler) to circulate in parallel in the Zollverein.[28] The union coins saw only limited issuance.

The Vienna coinage convention (Wiener Münzvertrag) of 1857 established a common coinage between the Zollverein and Austria and set fixed parities between the standards of the Zollverein and Austria with Austria adopting a new gulden. [29] The crown (Krone) was introduced as a common gold coin but saw only limited

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[20] Schultz (1976, p. 11) quotes Alexander Lips, professor at the University of Marburg lamenting in 1822 about the multitude of coinage, units and weights in Germany: "*In keiner Hinsicht sieht Deutschland verworrener und zerrissener aus und einem Volke weniger gleich als durch die so ganz grund- und inhaltsleere Verschiedenheit seines Geldes […].*"

[21] See e.g. Bergman et al. (1989), Gunlicks (2003), and Tipton (2003). The formation of the German Confederation (Deutscher Bund) with the Congress of Vienna of 1815 brought important consolidation of Germany's political entities amid the establishment of 39 independent and sovereign federal states and free cities. The 1834 Customs Union (Zollverein) advanced economic integration with the suspension of internal tariffs among the signatory countries including most German states but excluding Austria and its possessions. The 1864 Prussian-Danish and the 1866 Prussian-Austrian wars (Einigungskriege) resulted in further territorial consolidation and increasing dominance of Preußen. The adoption of the 1867 Constitution of the North German Federation (Norddeutscher Bund) laid the foundation for political unification under a federal structure and leadership of Preußen. Political union with the integration of the Southern German states was achieved with the 1871 formation of the German Empire (Deutsches Reich) after the 1870-71 Prussian-French war. The German Empire was constituted of 26 federal states (Bundesländer) and free cities.

[22] See e.g. Hellferich (1898, p. 4): "*Das innerste Wesen eines Staatengebildes kommt in wenigen seiner Institutionen so deutlich zum Ausdruck, wie in seiner Münzverfassung. Strenge Centralisation und einheitliches Regiment, Ohnmacht der Centralgewalt und kleinstaatliche Zersplitterung spiegeln sich hier deutlich wieder.*"

[23] Kaiserliches Statistisches Amt (1880).

[24] Helfferich (1898) highlights that coinage and paper currency reforms were pursued independently whereby the paper currency reform was seen as part of the banking reforms.

25 For a detailed survey of German coinage, see e.g. Rittmann (1975).

26 Preußen introduced in 1750 a gold coin the Friedrichsdor but it remained marginal. Gold played generally in Germany only a small role.

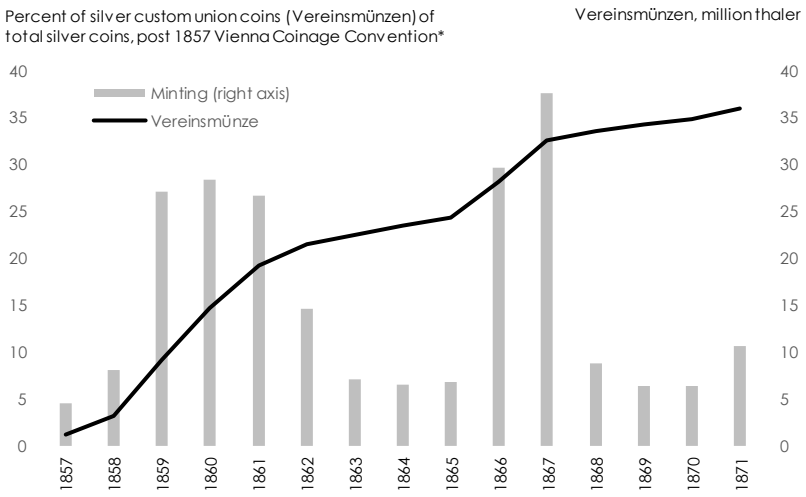
27 The free cities of Bremen (Pistolen), Lübeck and Hamburg (Lübische Kurantwährung) and the federal state (Reichsland) of Elsaß-Lothringen (Franc) had their own coinage systems.

28 The set parity was 1 Vereinzmünze = 2 thaler = 3 ½ gulden, see Rittmann, 2003.

29 The set parity was 2 thaler = 3 ½ gulden (Southern Germany) = 3 gulden (Austria), see Rittmann (2003). Several German

coinage.[30] The 2 and 1 Thaler silver coins were the dominant coins. The custom union coins were elevated to be accepted as legal tender in all local currency payments and common minting standards were enforced.[31] In 1867, following the Prussia-Austrian war, Austria left the coinage convention but the union coins remained legal tender in Germany and Austria through 1871. The proliferation with the Vienna coinage convention of the union coins throughout the Zollverein laid the foundation for a common currency in Germany.[32]

Figure 4. Vereinsmünzen coinage



Source: Deutscher Reichstag (1873). * Only large denomination thaler and gulden coins (Kurantmünzen) in circulation in German states excluding Austria and German free cities (Hansestädte).

The minting of the custom union coins was the outcome of a decision by market participants to convert a given unit of silver into either a national or custom union coin. The popularity of the coins was indicative of mounting economic integration among the German states and Austria. The mechanism of flexible minting allocations ensured that the circulation of the coins corresponded to actual demand for regional media of exchange. The custom union coins made up more than 90 percent of all minted silver coins from 1857 through 1871 and of the total stock of silver coins outstanding in 1871 represented 36 percent from only 1 percent in 1857 (Figure 4).

Special Drawing Rights

The SDR is issued by the IMF and can be used only for transactions with the IMF or among IMF member countries' central banks. It is a novel form of an international asset that is neither a currency nor a security.[33] The SDR emerged during the 1960s amid long held concerns about the adequate supply of gold and foreign exchange reserves under the Bretton Woods system of fixed exchange rates. The first SDR allocation was made in 1969. The SDR ambitiously was meant to become the main international reserve asset but only had very limit success.

The purpose and origin of the SDR can be traced to the origins of the IMF itself. John Maynard Keynes stated

states were not members of the Zollverein including Bremen, Hamburg, Lübeck, Mecklenburg.

30 Germany was still on a silver standard. The union gold coin represented only 4.4 percent of the silver coins minted in 1857-71.

31 The Doppelthaler, the Einthalerstück and Thalerstück (14-Thalerfuß) were legal tender in all Zollverein member states. The Einthalerstück allowed the thaler system to proliferate in the Southern German states, see Hellferich (1898)

32 Hellferich (1898) indicates in 1857-1871, the union coins (Vereinsthaler) were minted in the amount of 229 million thaler compared with a total of state thaler and state gulden of 6 ⅛ million thaler.

33 The European Currency Unit (ECU) could serve as another relevant historical example for a currency basket.

as part of the objectives of his 1942 proposal of an international clearing union:[34] "We need a *quantum* of international currency, which is neither determined in an unpredictable and irrelevant manner as, for example, by the technical progress of the gold industry, nor subject to large variations depending on the gold reserve policies of individual countries […]."

The IMF issues SDRS through allocations to IMF member countries. Countries receive an asset (SDR holdings) and a liability (SDR allocation) in SDRs at the same time in proportion to their IMF quotas.[35] SDRs represent a claim on the foreign exchange holdings of other IMF member countries that have the obligations to accept SDRs in exchange of foreign exchange.[36] The SDR mechanism is self-financing and levies charges on allocations which are used to pay interest on SDR holdings. If a country does not use any of its allocated SDR holdings, the charges are equal to the interest received. If a country's SDR holdings rise above its allocation, it effectively earns interest on the excess. If it holds fewer SDRs than allocated, it pays interest on the shortfall. SDRs are held predominately by central banks in their accounts at the IMF and used almost exclusively in transactions within the IMF. The SDR is also a unit of account and all transactions of the IMF are accounted for in SDRs.

The SDR was originally valued as an equivalent weight in gold consistent with the par-values under the Bretton Woods System of fixed exchange rates. In 1969, its valuation was set equal to 0.8887 grams of fine gold equivalent to the value of 1 dollar, being the par value of the dollar, so that 1 SDR equalled 1 dollar. The collapse of the Bretton Woods System and devaluations of the dollar led to the adoption of generalised floating.

The valuation of the SDR under generalised floating since July 1974 has been based on the market value of a basket of currencies.[37] The objective was for the basket to be relatively stable in purchasing power terms and that no single currency should have an undue influence on the value of the basket.[38] The decision to base the SDR on a basket of currencies was taken at a meeting of the Committee of Twenty in January 1974.[39]

[34] IMF (1969). Italics as per original.
[35] Quotas represent the subscription to the IMF. Each IMF member country is assigned a quota based broadly on its relative position in the world economy. The quota determines the maximum financial commitment of a country to the IMF, its voting power and guides its access to IMF financing.
[36] The SDR designation mechanism provides that in the event there is insufficient capacity under the voluntary trading arrangement, the IMF can ask member countries with sufficiently strong external positions to buy SDRs with freely usable currencies up to a certain amounts from member countries with weak external positions.
[37] See IMF (1979a). The idea of valuing the SDR in terms of a currency basket can be attributed to the IMF Executive Director for Cyprus, Israel, Netherlands, Romania and Yugoslavia (IMF, 1971).
[38] IMF (1974).
[39] IMF (1979b).

Table 1. SDR basket valuation

Initial weights

	Jul 1969-Jun 1974	Jul 1974-Jun 1978	Jul 1978-Dec 1980	1981-85	1986-98	1999-2016	from Oct 2016
Gold (grams)	0.8887						
U.S. dollars		0.330	0.330	0.420	0.420	0.419	0.417
Deutsche marks		0.125	0.125	0.190	0.190		
Pound sterling		0.090	0.075	0.130	0.120	0.113	0.081
Japanese yen		0.075	0.075	0.130	0.150	0.094	0.083
French francs		0.075	0.075	0.130	0.120		
Canadian dollars		0.060	0.050				
Italian lire		0.060	0.050				
Netherland guilders		0.045	0.050				
Belgian francs		0.035	0.040				
Swedish krona		0.025	0.020				
Australian dollars		0.015	0.015				
Danish krone		0.015					
Norwegian krone		0.015	0.015				
Spanish peseta		0.015	0.015				
Austrian shillings		0.010	0.015				
South African rand		0.010					
Saudi Arabia riyals			0.030				
Iranian rials			0.020				
Euro						0.374	0.309
Chinese renminbi							0.109

Source: Boughton (2001, Table 18.4 corrected and amended). *In January 1999, the Deutsche Mark and French franc were replaced by equivalent amounts of euro; weights with effect from January 2011.

The IMF staff advanced proposals on possible valuation methods for the SDR based on the principle that "to value the SDR for transactions purposes by equating it to a specified package of currencies, in which a number of currencies are combined with given weights; and to relate the interest rate on the SDR to a weighted average of the interest rate on the same currencies, combining them with the same weights […].There are difficult questions to be decided as to the currencies to be included in the package and the weights to be selected. Insofar as possible, a rather large number of currencies should be included so as to minimize the impact of unusual movements in the money market of an individual country. However, since one of the major purposes of the calculation would be to determine the rate of interest, one could only include currencies for which a suitable market rate of interest, in addition to a market exchange rate, could readily be determined."[40]

The SDR is not the outcome of a singular vision but rather the campaign of competing views among IMF member countries. The changes in the valuation basket offers a glimpse about countries' perspectives on the purposes of the SDR and its evolution from a basket to reflect inclusiveness and diversification reminiscent of the IMF membership to assuming properties to compete with the main reserve assets.

The IMF aimed to elevate the SDR to replace gold and the dollar in the international monetary system. Following a proposal by the U.S. in 1972 to overhaul international monetary relations and making the SDR the formal numeraire of the system, in 1978 the IMF amended its treaty provisions for the SDR to become "the

[40] IMF (1973).

principal reserve asset in the international monetary system."[41]

There are SDR204 billion of SDR outstanding (equivalent of US$291 billion). There have been only three generalised allocations and one special allocation to IMF member countries since inception. The SDR obtained renewed visibility in March 2009 with proposals by the Chinese and Russian authorities to establish greater reserve currency diversification based on the SDR.[42] This was followed by a large general allocation of SDRs in August 2009 of SDR161 billion. The inclusion of the renminbi in the SDR valuation basket in October 2016 also failed to generate renewed momentum.

The SDR has been hampered by important limitations guiding issuance and allocations. Any decision to make a new SDR allocation requires 85 percent of the voting power of the membership to agree significantly constraining any ability to offer more flexible SDR allocations. The treaty limitations are likely to make it near impossible to achieve meaningful needed changes to the SDR. The small amount outstanding reflects the interest of some dominant IMF member countries that have to date constrained the further adoption and development of the SDR. Greater and more frequent SDR allocations will remain critical for the SDR's future.

Conclusions

The issuance of digital currencies is desirable if they can exceed functionality and role of existing currencies. An essential limitation of existing national currencies is their territorial limitation and alignment with fulfilling national policy objectives. Another disadvantage is that national currencies for large value transactions can only be used in national payment systems. Historically, those restrictions have at times given rise to important currency innovations. The economic history of Germany further shows that coinage or currency harmonisation and adoption are complicated and may require some supportive regulatory or political goodwill and alignment. Past historical successes suggest that acceptance of new currencies will likely be highest where national currencies may not be congruent with international needs and developments.

The gold standard established the notion of currency tokens. Stable coins have emulated basic principles of the gold standard. Tokens may be mere claims on an underlying reserve and yet successfully fulfil most needed currency functions. CBDCs or PDCs may both pursue the idea of token-based digital currencies. The credibility of the convertibility into the underlying will determine actual adoption. The importance insight offered from the gold standard is that passive rules may not be sufficient to ensure adequate token supply.

The gold standard was particularly successful in facilitating international exchange. While no different from fixed exchange rates, the ambitions for a world coin under the gold standard are illustrative that stable exchange rates if linked by a common reference basket of values can offer stable exchange relations. PDCs may consider the possibility of identifying a common value reference to establish greater inter-currency stability to facilitate inter-currency transactions. The objective of bitcoin to serve international exchange echoes a world coin. However, it was the linkages to national currencies as a basis for adopting an international standard that guided consideration for a world coin. Bitcoin and other PDCs may need to establish stability to national currencies before being able to serve as international standard.

The Maria Theresa thaler shows that denationalised, deterritorialised and decentrally issued currencies can represent useful and relatively widely adopted media of exchange. Currencies can be issued and be stable to meet non-national policy objectives and fulfil important exchange functions irrespective of any sovereign interference. The thaler also highlights the possibility for a currency to be directed at serving a particular economic function, like international trade, suggesting that a currency must not address all currency functions or can be used only for certain specialist functions.

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[41] International Monetary Fund, Articles of Agreement, Article VIII section 7, 1 April 1978. The IMF Articles of Agreement constitute the international treaty on which the IMF was established. The Articles were adopted in 1944 and came into force in 1945. The Articles were subsequently amended in 1969, 1978, 1992, 2009 and 2011.

[42] Xiaochuan Zhou (2009), "Reform of the international monetary system," People's Bank of China website http://www.pbc.gov.cn/english/detail.asp?col=6500&id=178, 23 March 2009; President of Russia (2009), "Russian proposals to the London Summit (April 2009)," President of Russia website http://eng.kremlin.ru/text/docs/2009/03/213995.shtml, 16 March 2009.

The Vereinsmünzen or custom union coins offer important insights into the possibility of parallel currencies. The legal tender status of coins in Germany meant that holders could decide freely between local and custom union coins whereby the coinage outcome was entirely driven by market and usage considerations, that is, the relative propensity to hold either coins was endogenous to the use case.

The SDR encapsulates a fundamental aim to seek currency stability in international transactions. The basket approach allows to internalise currency fluctuations. Considerations for the composition of the basket illustrate the likely trade-off between stability and usability. Among official currencies, the SDR has remained unique but indicating the difficulties of establishing a governance structure satisfying a large number of stakeholders. Some stable coins have adopted a reference basket idea but success appears limited. Adoption of a basket-based currency will naturally depend on whether users value the advantages of a stable currency relative to their international trading partners more than relative to their national trading partners.

Digital currencies would offer the possibility to conduct large value payments transactions outside national payment systems. The possibility to issue tokenised CBDC would allow central bank money to serve as medium of settlement in peer-to-peer transactions among residents, cross-border and off-shore. This remains the main advantage of digital currencies and constitute an essential addition to existing currency functionalities.

Digital currencies have assumed some of the properties of historical currencies and could explore further adaptations. Issuers of digital currencies could agree to a common standard for exchange arrangements on the basis of a set basket of commodities or other relevant assets.[43] The standard could serve as a common valuation reference to peg or fix the value of digital currencies to facilitate inter-digital currency exchange. The issuance of digital currencies to serve a given international commercial network could be conducted by a consortium of central banks or by a private entity with the objective to support international exchange. This could comprise a digital currency to serve only intra-regional settlement including to be used as internal currency to a regional payments system. The idea of a parallel currency could be adopted similarly by a consortium of central banks or a private entity with the aim to circulate in parallel to existing currencies and leave adoption to user preferences for conducting local versus e.g. international transactions. This would also be close in principle to the "hard ECU" approach for the E.U. that implied a supra-national money-issuing authority together with the existing national central banks.[44] The issuance of a parallel digital currency could be done only in exchange of local currencies to mitigate its monetary impact.

The adoption of digital currencies is considered here to depend on their ability to complement rather than substitute for existing currencies. In the past, a key driver of currency innovation was to expand currency availability often amid actual and perceived limitations and shortages of existing national currencies. While efficiency gains through digitalisation may be a key factor, alternative uses or uses where national currencies are too constrained, will likely dominate motivation for adoption.

[43] See e.g. Coats (2014) on the idea of a real SDR.

[44] See e.g. within the context of European monetary union, Gros and Thygesen (1992) on the parallel currency and "hard ECU" proposals that favour competition as alternatives to the institutionalist approach in the Delors report. They explain that aims by some central banks to preserve some decentralised features were rejected for the final statute of the European System of Central Banks as emphasis was on homogenous policy and "indivisibility of monetary authority." The relevant contemporary parallel to a parallel currency are countries with a high incidence of dollarization.

Appendix

Appendix table. German monetary standards

	Standard (specie)	Thaler (silver)			Curant (silver) *	Southern German (silver)	Thaler (gold)	French Franc (gold)
	Units						Louisd'or, Pistole	
		Thaler 30 12 Pfennig	Thaler 30 10 Pfennig	Thaler 48 Schilling 12 Pfennig	Mark 16 Schilling 12 Pfennig	Gulden 60 Kreuzer	5 Thaler 72 Grote 5 Schwaren	Franc 100 Centimes
States (German Empire 1871)								
Anhalt		▪						
Baden						▪		
Bayern						▪		
Braunschweig		▪						
Bremen							▪	
Elsaß-Lothringen								▪
Hamburg					▪			
Hessen-Darmstadt						▪		
Lippe		▪						
Lübeck					▪			
Mecklenburg-Schwerin				▪				
Mecklenburg-Strelitz				▪				
Oldenburg		▪						
Preußen **		▪				▪		
Reuß ältere Linie		▪						
Reuß jüngere Linie		▪						
Sachsen			▪					
Sachsen-Altenburg			▪					
Sachsen-Coburg-Gotha ***			▪			▪		
Sachsen-Meiningen						▪		
Sachsen-Weimar		▪						
Schamburg-Lippe		▪						
Schwarzburg-Rudolstadt ****		▪				▪		
Schwarzburg-Sondershausen		▪						
Waldeck		▪						
Württemberg						▪		

Source: Deutscher Reichstag (1871).
Multiple coinages per state are possible due to territorial rearrangements.
* For wholesale transactions also Hamburger Bankvaluta of silver bullion at 59 1/3 Mark.
** Gulden in Hohenzollern Hechingen, Hohenzollern Sigmaringen, Frankfurt a.M.
*** Gulden in Sachsen-Coburg and Thaler in Sachsen-Gotha.
**** Gulden Schwarzburg-Rudolstadt Oberherrschaft and Thaler in Schwarzburg-Rudolstadt Unterherrschaft.

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Institute of Global Affairs
The London School of Economics
and Political Science
Houghton Street
London WC2A 2AE

Email: iga@lse.ac.uk

lse.ac.uk/iga

Design: LSE Design Unit (lse.ac.uk/designunit)