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The ECB and € E-Banknotes

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THE ECB AND € E-BANKNOTES

[Draft of 31 July 2020]

**Could the ECB issue an electronic equivalent of paper-based euro banknotes?
Under which conditions might such 'electronic banknotes' have legal tender status?**

ECB Legal Research Programme 2020 (topic 2)

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1 Introduction

The modern monetary system is controlled by the state and yet linked to private deposit banking. Monetary value held in deposits with commercial banks is known as ‘commercial bank money’ (CoBM). Monetary value held in deposits with the central bank – as well as banknotes issued by the central bank – is called ‘central bank money’ (CeBM). Under this scheme, central banks thus issue two forms of central bank money: cash for the retail sector and balances in traditional reserve accounts for wholesale purposes (reserves).¹ However, for several years now, and most recently in particular against the background of private actors commencing to issue private digital currencies, a growing number of central banks have also been investigating the possibility and implications of issuing a digital form CeBM for the general public: central bank digital currency (CBDC), also known as retail CBDC (rCBDC).²

The literature on the subject has grown accordingly. A significant proportion comes from central banks themselves³ or their staff,⁴ the Bank for International Settlement

¹ See e.g. BIS CPMI, *Central bank digital currencies*, March 2018 ([link](#)) pp. 3 et seq.

² See the most recent overviews at: Auer Raphael/Cornelli Giulio/Frost Jon, *Taking Stock: Ongoing retail CBDC projects*, BIS Quarterly Review, March 2020, 97-98 ([link](#)); Barontini Christian/Holden Henry, *Proceeding with caution: a survey on central bank digital currency*, BIS Papers, no 101, January 2019 ([link](#)); Boar Codruta/Holden Henry/Wadsworth Amber, *Impeding arrival – A sequel to the survey on central bank digital currency*, BIS Paper No. 107, January 2020 ([link](#)); Calle George/Eidan Daniel, *Central Bank Digital Currency: an innovation in payments*, r3 White paper April 2020 ([link](#)); CEMLA Center for Latin American Monetary Studies, *Key Aspects around Central Bank Digital Currencies*, Policy report, Central Bank Digital Currencies Working Group, May 2019 ([link](#)); Duong Johannes, *Overview of Central Bank Digital Currency – State of Play*,» SURF Policy Note, Issue No 158, April 2020 ([link](#)).

³ Banque de France, *Central Bank Digital Currency*, 8 January 2020 ([link](#)); Bank of Canada, *Contingency Planning for a Central Bank Digital Currency*, 25 February 25 2020 ([link](#)); Bank of England, *Central Bank Digital Currency: Opportunities, challenges and design*, Discussion Paper March 2020 ([link](#)); Bank of Israel, *Report of the team to examine the issue of Central Bank Digital Currencies*, November 2018 ([link](#)); Central Bank of the Bahamas, *Project Sand Dollar: A Bahamas Payments System Modernisation Initiative*, 24 December 2019 ([link](#)); Danmarks Nationalbank, *Central bank digital currency in Denmark? Analysis*, December 2017, No. 28 ([link](#)); CEMLA (2019); ECB, *Innovation and its impact on the European retail payment landscape*, December 2019 ([link](#)); EUROchain, *Exploring anonymity in central bank digital currencies*, IN FOCUS no. 4, December 2019 ([link](#)); ECB/Bank of Japan: *Project Stella - Balancing confidentiality and auditability in a distributed ledger environment*, February 2020 ([link](#)); Norges Bank, *Central bank digital currencies*, Norges Bank Papers 1/2018, 18 May

(BIS) and their respective internal working groups⁵ as well as their staff⁶ or that of the International Monetary Fund (IMF).⁷ Other official bodies have so far made

2018 ([link](#)); Norges Bank, *Central bank digital currencies* Second Report of the Working Group, Norges Bank Papers 2/2019 ([link](#)); Sveriges Riksbank, *The Riksbank's e-krona project Report 1*, September 2017 ([link](#)); Sveriges Riksbank, *The Riksbank's e-krona project Report 2*, October 2018 ([link](#)).

See also: Helen Partz, *Central Bank of Russia Reviews Potential Benefits and Drawbacks of CBDCs*, Cointelegraph, 19 April 2019 ([link](#)) and ([link](#)).

- ⁴ Bindseil Ulrich (2020), *Tiered CBDC and the financial system*, ECB Working Paper Series No 2351, January 2020 ([link](#)); Davoodalhosseini S. Mohammad R., *Central Bank Digital Currency and Monetary Policy*, Bank of Canada Staff Working Paper 2018-36 ([link](#)); Duong (2020); Engert Walter/Fung Ben S.C., *Central Bank Digital Currency: Motivations and Implications*, Bank of Canada Staff Discussion Paper 2017-16 ([link](#)); Fung Ben S.C./Halaburda Hanna, *Central Bank Digital Currencies: A Framework for Assessing Why and How*, Bank of Canada Staff Discussion Paper 2016-22 ([link](#)); Garrat Rodney/von Oordt Maarten R. C., *Privacy as a public good – a case for electronic cash*, Bank of Canada Staff Working Paper 24, July 2019 ([link](#)); Grym Aleksii/Heikkinen Päivi/Kauko Karlo/Takala Kari, *Central bank digital currency*, Bank of Finland BoF Economics Review 5/2017 ([link](#)); Pfister Christian, *Central Bank Digital Currency: One, Two or None?* Banque de France Working Paper Series no. 732, October 2019 ([link](#)); Pfister Christian, *Central Bank Digital Currency*, SUERF Policy Note No 143, March 2020 ([link](#)); Wierds Peter/Boven Harro, *Central Bank Digital Currency: objectives, preconditions and design choices*, De Nederlandsche Bank Occasional Studies Volume 20-01 Draft April 2020 ([link](#)); Sveriges Riksbank, *Special issue on the e-krona*, Economic Review 2018:3 ([link](#)); Sveriges Riksbank, *Second special issue on the e-krona*, Economic Review 2020:2 ([link](#)).
- ⁵ BIS Committee on Payments and Market Infrastructures and Markets Committee: *Central bank digital currencies*, *Central bank digital currencies*, CPMI Papers, no 174, March 2018 ([link](#)).
- ⁶ Auer Raphael/Bohme Rainer, *The Technology of retail central bank digital currency*, BIS Quarterly Review, March 2020, 85-96 ([link](#)); Auer Raphael/Cornelli Giulio/Frost Jon, *Covid-19, cash, and the future of payments*, BIS Bulletin No. 3, 3 April 2020 ([link](#)); Auer Raphael/Cornelli Giulio/Frost Jon, *The rise of central bank digital currencies: drivers, approaches and technologies*, forthcoming, 2020; Bech Morten Linnemann/Garrat Rodney, *Central Bank Cryptocurrencies*, BIS Quarterly Review September 2017 ([link](#)).
- ⁷ Agur Itai/Ari Anil/Dell'Ariccia Giovanni, *Designing Central Bank Digital Currencies*, IMF Working Paper, 8 November 2019, Washington DC ([link](#)); Adrian Tobias/Mancini-Griffoli Tommaso, *The Rise of Digital Money*, IMF FinTech notes No. 19/001 July 2019 ([link](#)); Kiff John/Alwazir Jihad/Davidovic Sonja/Farias Aquiles/Khan Ashraf/Khiaonrong Tanai/Malaika Majid/Monroe Hunter K/Sugimoto Nobu/Tourpe Hervé/Zhou Peter, *A Survey of Research on Retail Central Bank Digital Currency*, IMF Working Papers WP/20/104, 26 June 2020 ([link](#)); Mancini-Griffoli Tommaso/Martinez Peria Maria

rather sporadic statements.⁸ Finally, the scientific community also addressed the issue from legal, policy, economic and technical perspectives.⁹

Soledad/Agur Itai/Ari Anil/Kiff John/Popescu Adina/Rochon Celine, *Casting Light on Central Bank Digital Currency*, IMF Staff Discussion Note 18/08, November 2018 ([link](#)).

⁸ G7 Working Group on Stablecoins, *Investigating the impact of global stablecoins*, October 2019 ([link](#)); Swiss Federal Council, *Central bank digital currency report*, December 2019 ([link](#)). For media coverage of the recent spate of activity in the USA see e.g.: Nikhilesh De & Zack Seward, *US Senate Floats 'Digital Dollar' Bill After House Scrubs Term From Coronavirus Relief Plan*, 24/26 March 2020 ([link](#)); Daniel Kuhn, *The Overton Window Opens for a Digital Dollar*, 25/27 March 2020 ([link](#)); Paddy Baker, *Chris Giancarlo's Digital Dollar Project Names Ex-Treasury, CFTC Officials to New Board*, 26 March 2020 ([link](#)); Nikhilesh De, *Digital Dollar Project Calls for 2-Tiered Distribution System in First White Paper for US CBDC*, 29 May 2020 ([link](#)); Jason Brett, *After Congress Debuts Digital Dollars Amid Covid-19, New Think Tank Broadens Vision Of U.S. Money*, 30 May 2020 ([link](#)); Jason Brett, *Congress To Hold Hearing On 'Digital Dollar' Options For Possible Future Stimulus Payments*, 8 Jun 2020 ([link](#)) and particularly: *The Digital Dollar Project* ([link](#)).

⁹ For legal contributions see: Athanassiou Phoebus L., *Digital Innovation in Financial Services – Legal challenges and Regulatory Policy Issues*, Kluwer, Alphen aan den Rijn, 2018; Atner Douglas W./Buckley Ross/Zetsche Dirk A./Didenko Anton N., *After Libra, Digital Yuan, and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems*, EBI Working Paper Series 2020 - no. 65, 11/06/2020 ([link](#)); Dell'Erba Marco, *Stablecoins in Cryptoeconomics – From Initial Coin Offerings (ICOs) to Central Bank Digital Currencies (CBDCs)*, NYU Journal of Legislation & Public Policy, forthcoming ([link](#)); Geva Benjamin, *Cryptocurrencies and the Evolution of Banking, Money and Payments*, in: Chris Brummer (ed.), *Cryptoassets Legal, Regulatory and Monetary Perspectives*, Oxford University Press 2019, 11-38; Goldsmith Jacob, *The IMF must develop best practices before government-backed cryptocurrencies destabilize the international monetary system*, Emory International Law Review, 2020, Vol. 34, 595-638 ([link](#)); Hofmann Christian, *The Changing Concept of Money: A Threat to the Monetary System or an Opportunity for the Financial Sector?* European Business Organization Law Review (2020) 21:37–68 ([link](#)); Huber Joseph, *Dominant Money*, January 2020 ([link](#)); Nabilou Hossein, *Central Bank Digital Currencies: Preliminary Legal Observations*, Working Paper 2019 ([link](#)); Nabilou Hossein/Prüm André, *Central Banks and Regulation of Cryptocurrencies*, Review of Banking & Financial Law, forthcoming ([link](#)); Ricks Morgan/Crawford John/Menand Lev, *FedAccounts: Digital Dollars*, Vanderbilt Law Research Paper 18-33, UC Hastings Research Paper No. 287, George Washington Law Review, forthcoming ([link](#)); Crawford John, *Making Money Safe*, 95 Notre Dame L. Rev. Reflection 1, 2019 ([link](#)); Zellweger-Gutknecht Corinne (2016), *Digitale Landeswährung – Ein Überblick*, Jusletter 31. Oktober 2016 ([link](#)).

Economic contributions include: Andolfatto David, *Assessing the Impact of Central Bank Digital Currency on Private Banks*, Federal Reserve Board of St. Louis Working Paper No. 2018-26D, 2018 ([link](#)); Barrdear John/Kumhof Michael, *The Macroeconomics of Central*

This research paper examines whether the European Central Bank (ECB) is entitled *de lege lata* to issue an electronic equivalent of paper-based euro banknotes (hereinafter e-banknotes) and, if so, under what conditions such e-banknotes might have legal tender status. The paper is structured as follows: Part 2 sets the stage by discussing the reasons that might motivate or even compel the ECB to issue an e-banknote (2.1) and by analysing whether an e-banknote is a banknote by reference to general principles of law and financial practices (2.2). Part 3 examines which monetary policy objectives and tasks could be better fulfilled if an e-euro were issued or, conversely, whether non-issuance could in the future impair the fulfilment of the ECB's mandate. Subsequently, Part 4 analyses the constitutional framework that empowers the ECB, within certain clear limits, to pursue the objectives set. This includes particularly the interpretation of the term 'banknotes' in Article 128 TFEU¹⁰ as well as the content and scope of selected basic tasks set out in Article 127 TFEU and mirrored in the Statute of the European System of Central Banks (ESCB) and of the ECB (hereinafter: Statute).¹¹ The results are then weighed against the potential interests of third parties that could be affected by an e-euro. Part 5 proceeds by discussing the design features that a functional equivalent of a paper banknote can and must exhibit in order to meet the previously defined objectives and constitutional limits. Part 6 explores the issue of architecture, i.e. the possible models of issuance. The conclusion in Part 7 includes a summary and policy recommendations.

Bank Issued Digital Currencies, Bank of England Staff Working Paper Nr. 605, 18. Juli 2016 ([link](#)); Berentsen Aleksander/Schär Fabian, *The case for central bank electronic money and the non-case for central bank cryptocurrencies*, Fed Reserve Bank St. Louis Review 100(2):97-106, ([link](#)); Bordo Michael D/Levin Andrew, *Digital Cash: Principles and Practical Steps*, National Bureau of Economic Research Working Paper No. 25455, 2019 ([link](#)); Bordo Michael D/Levin Andrew T, *Central Bank Digital Currency and the Future of Monetary Policy*, WP 23711 NBER Working Paper Series, August 2017 ([link](#)); Brunnermeier Markus K./James Harold/Landau Jean-Pierre, *The Digitalization of Money*, NBER Working Paper No. 26300, September 2019 ([link](#)); Brunnermeier Markus K./Niepelt Dirk, *On the Equivalence of Private and Public Money*, Journal of Monetary Economics, 106 (2019) 27–41; Kumhof Michael/Noone Clare, *Central Bank Digital Currencies – Design Principles and Balance Sheet Implications*, Bank of England Staff Working Paper No. 725 ([link](#)); Niepelt Dirk, *Reserves For All? Central Bank Digital Currency, Deposits, and their (Non)-Equivalence*, International Journal of Central Banking, forthcoming 2020 ([link](#)).

¹⁰ Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C326/47.

¹¹ Protocol (No 4) on the Statute of the European System of Central Banks and of the European Central Bank.

2 Setting the stage

2.1 Dwindling use of cash

In our research paper, we assume that central banks will be induced to complement and ultimately even supplement their cash issuance with digital equivalents in the near future. The most pressing motive for this is likely to be the accelerating decline in the demand for cash.¹² The (existing and possible future) reasons for this development are briefly considered below.

The share of cash in M1 has been declining steadily for years. In the economies examined, it ranges from 20% down to less than 5%.¹³ The US, with its 40% ratio, is only apparently an exception, as most dollar notes are used abroad as a parallel currency and store of value.¹⁴ So far, three factors are mainly responsible for this development (Subsections 2.1.1-2.1.3); a fourth factor is likely to be added in the near future (Subsection 2.1.4).

2.1.1 Public law measures

A growing number of public law measures restrict or even exclude the use of cash (although being legal tender)¹⁵ and facilitate or require payments with CoBM.¹⁶ For

¹² The use of cash and cards differs according to country, place of purchase, transaction value and consumers' demographic characteristics; for details see Esselink Henk/Hernández Lola, *The use of cash by households in the euro area*, ECB Occasional Paper Series No 201, November 2017 ([link](#)).

¹³ See e.g. Wierds/Boven (2020) p. 12: in the Netherlands cash accounted for 80% in 1900 while it stood at 16% in 2019; Huber (2020), p. 3 and 9. In the UK, in March 2020 cash in M1 was at 3.64% with amounts outstanding of monetary financial institutions' sterling and all foreign currency (UK estimate of EMU aggregate) liabilities to private and public sectors not seasonally adjusted were at GBP 1'948.612 billion ([link](#)). Sweden 2%, CH 8%, For absolute amounts per OECD-countries see [link](#).

¹⁴ Federal Reserve, Money Stock Measures – Billions of dollars, March 2020 ([link](#)), tables 1 and 3; Huber, (2020) p. 9 with further reference: The share has risen from 20% (sic) in the 1950/60s in parallel with the USD as the dominant world currency.

¹⁵ See e.g. the pending request for a preliminary ruling in the cases C-422/19 and C-423/19; Herrmann (2020) p. 42 and footnote 20; Sáinz de Vicuña (2010) para 25.15 therefore even called the concept of legal tender obsolete.

¹⁶ Recital 19 of the Regulation on the introduction of the euro, (EC) No 974/98 of 3 May 1998, states that it should not be incompatible with the status of legal tender of euro banknotes and coins if Member States introduce limits on payments in banknotes and coins for reasons of public policy. Siekmann Helmut, *Restricting the Use of Cash in the*

instance, taxes and the like are more and more to be paid in cashless form.¹⁷ Also, cash ceilings have been introduced under the heading of combating tax offences, money laundering and the financing of terrorism (particularly in countries with tight financial budgets).¹⁸ Above certain levels, the acceptance of cash payments requires due diligence measures – ever more outside the financial sector.¹⁹ Cross-border cash transfers must be declared above a certain threshold.²⁰

Other measures are rooted in the monetary law environment itself. For instance, if cash changeovers follow each other too often and with very short exchange periods, people may prefer converting cash into deposits, thus avoiding further expected

European Monetary Union, in: IMFS Working Paper Series No. 108 (2016) p. 15 et seq., has strongly questioned the authority of this provision. But the ECB acknowledges commercial bank money as «other lawful means for the settlement of monetary debts», see e.g. CON/2017/8 (Denmark), CON/2014/37 (Romania), CON/2014/4 (Lithuania), CON/2013/43 und CON/2013/18 (Belgium), CON/2013/11 (Finland), CON/2013/9 (Denmark), CON/2012/83 (Slovakia), CON/2012/27 (Denmark), CON/2012/36 (Lithuania), CON/2012/33 (Spain), CON/2011/43 (Malta), CON/2010/79 (Bulgaria), CON/2011/36 (Greece).

¹⁷ See e.g. § 211 Austrian BAO; § 224 Abs. 2 German AO; Article 1680 French Code général des impôts; §35a para 2 German Income Tax Act; Article 16 Finnish Employment Contracts Act 55/2001 as modified by Act 398/2013; § 25 Abs, 1 Ziff. 1 Bst. a Austrian Income Tax Act.

¹⁸ Article 1(898) Italian Act (28/12/2015), n. 208; Portuguese Act 20/2012 (14/05/2012) modifying Act 64-B/2011 (30/12/2011); Article 69(2) Greek Act 4446/2016 (12/12/2016); Articles L112-6 para I and D112-3 para I French monetary and financial code as modified by Article 61 Act 2016-1691 (09/12/2016) and Article 1 Decree 2016-1985 (30/12/2016); Article 7 Spanish Act 7/2012 (29/10/2012); Slovenian Act on Changes and Amendments to the Act on the Prevention of Money Laundering and Terrorist Financing (17/03/2014); Slovak Act No. 394/2012 on Restriction of Cash Payments (29/11/2012); Latvian Act on Taxes and Duties that the government (20/09/2016) modified in 2019; Articles 20-21 Belgian Act (11/01/1993) as modified by Article 170 Act (29/03/2012); Danish Money Laundering Act consolidated by Act no. 1022 (13/08/2013); Articles 129(2) and 136(2) Swiss Act on debt settlement and insolvency.

¹⁹ See e.g. Article 1 of Directive (EU) 2018/843 of 30 May 2018 (so called 5th anti-money laundering Directive) and Articles 2 and 11 of Directive (EU) 2015/849 of 20 May 2015 (so called 4th anti-money laundering Directive).

²⁰ See e.g. Articles 3 and 14 Regulation (EU) 2018/1672 of 23 October 2018.

changes.²¹ The fade out of high value banknotes (for reasons of «concerns that this denomination could facilitate illegal activities»)²² does maybe not dampen demand for cash in the short-run.²³ Nevertheless, such actions increasingly place its use under a sense of general suspicion. It also seems to weaken the use of cash if the state downgrades the cash supply from a legal guarantee to a political objective²⁴ and largely delegates cash supply to the banking sector, whose business model does not rely on promoting the cash turnover.²⁵

2.1.2 The rise of commercial bank money

For over a century, the decline in the demand for cash has gone hand in hand with a corresponding rise of private money in the form of sight deposits at commercial banks^{26,27} Apart from the public law 'sponsorship' just mentioned, the reasons for this are multi-layered, but some advantages over cash stand out. First of all, book money is convenient; it eliminates physical transport and storage, including the associated costs and risks, and payees do not have to fear counterfeiting. Thanks to

²¹ Koning John Paul, *Swedish betrayal*, Blog Moneyiness, 27 December 2018; see e.g. the tight schedule of the Swedish changeovers from 2009 to 2017: Sveriges Riksbank, *Banknote and coin changeover in Sweden – Summary and evaluation*, March 2018, p. 20 (table 5).

²² ECB, Press release, 4 May 2016; see also Weidmann Jens, *Eröffnungsrede*, in: Deutsche Bundesbank Eurosystem (ed.), 3. Bargeldsymposium der Deutschen Bundesbank 2016, Frankfurt Juli 2016, 9, 13; Scholten (2017) passim.

²³ See ECB, Banknotes statistics ([link](#)): Since the EUR 500 was discontinued in 2019 their decline was at least compensated by the increased demand for EUR 200 notes.

²⁴ In Sweden, the former legal guarantee of access to cash services, which was enshrined in SFS 2001:1276, was abandoned in favour of a purely political objective (prop. 2006/07:55): Länsstyrelserna, *Bevakning av grundläggande betaltjänster*, 2015, p. 22.

²⁵ Boel Paola, *Thinking about the future of money and potential implications for central banks*, in: Sveriges Riksbank Economic Review 2016:1, 147, p. 149; Segendorf Björn/Wretman Anna-Lena, *The Swedish payment market in transformation*, in: Sveriges Riksbank Economic Review 2015:3, 48, pp. 56 and 61; Sveriges Riksbank, *Report on Cash Handling 2011*, December 2011, p. 7; Sveriges Riksbank, *Review of the Retail Payment Market in Sweden*, Riksbank Studies, Juni 2013, 104, p. 104. Between 2011 and 2015, banks reduced the number of bank counters from 1415 to 328 and lowered the number of ATMs, so that by 2015 the average distance to the nearest ATM grew to 12 km. In addition, in 2008, the Riksbank closed its branches and the Post Office's subsidiary, Svensk Kassaservice, discontinued its counter services.

²⁶ Regarding the evolution of banking and the present monetary system – with the distinctions between commercial and central bank money, as well as between physical cash and scriptural money – see Geva (2019) p. 11-37 and 341-366.

²⁷ See supra Section 2.1.

innovations in telecommunications and data processing, deposits are now booked entirely electronically, enabling ever faster processing also over long distances. Today, a wide range of infrastructures, interfaces and end devices as well as a variety of complementary services have been added.²⁸ Most recently, fears of a transmission of Covid-19 through the handling of cash have intensified tendencies to switch to non-cash payment in some countries.²⁹ There is an expectation «that the trends observed will result in a structural rather than temporary increase in cashless payments».³⁰

Most importantly, however, commercial banks traditionally enjoy great freedom to create new deposits by granting loans;³¹ accordingly, the amount of deposits is extremely elastic. While central banks traditionally were quite limited in their money creation,³² commercial banks could react more flexibly to changing circumstances such as population growth, innovation, etc. Restrictions in the form of deposit insurance, regulation and prudential supervision (including the corresponding costs) were only imposed on them with the rampant bank failures in the 1930s and, since then, increasingly in every new crisis of the financial sector.

²⁸ For example, near field communication (NFC) and instant settlement systems such as TARGET Instant Payment Settlement (TIPS; see footnote 256) now allow practically unrestricted and immediate payments with CoBM. In Sweden, Swish payments now are settled instantly 24/7 and with central bank reserves. BIS Committee on Payments and Market Infrastructures CPMI, *Fast payments – Enhancing the speed and availability of retail payments*, November 2016, Annex 2 ([link](#)) p. 74.

²⁹ Although demand for cash has risen due to the uncertainty related to Covid-19; it was hardly ever used for payment afterwards for reasons of hygiene and thus has been mostly hoarded up to now. Auer Raphael/Cornelli Giulio/Frost Jon, *Covid-19, cash, and the future of payments*, BIS Bulletin No. 3, 3 April 2020 ([link](#)).

³⁰ ECB Euro Retail Payments Board (ERPB) Secretariat and ECB Directorate Banknotes, *ERPB_response_to_the_current_Covid19_pandemic*, ERPB/2020/009, June 2020 ([link](#)).

³¹ On the money creation by commercial banks see: McLeay Michael/Radia Amar/Thomas Ryland, *Money creation in the modern economy*, Bank of England Quarterly Bulletin 1/2014, pp. 1–14; Jakab Zoltan/Kumhof Michael, *Banks are not intermediaries of loanable funds – and why this matters*, Bank of England Working Paper No. 529, 2015; German Bundesbank, *Die Rolle von Banken, Nichtbanken und Zentralbank im Geldschöpfungsprozess*, Monatsbericht April 2017, 15, 20.

³² The limitation was due to the gold and gold-foreign exchange standard, respectively; see Huber (2020) p. 13 with further reference. It has even remained in emerging market economies due to the US Treasury bill standard: Tokunaga Junji, *The Revised U.S. Treasury Securities Standard System*, University of Massachusetts Amherst Political Economy Research Institute Working Paper Series No 494, 3 September 2019 ([link](#)).

Growth of deposits is further driven by the cost calculation of banks: while they can hardly charge fees for cash transactions that would cover the comparatively high costs involved,³³ they benefit from economies of scale in the giro services – related costs incur anyway but are likely to fall further in relation to the book money units created. Besides, assets obtained in the process of deposit creation ideally generate additional net profit and payment transactions provide essential information about existing and potential clients, which (ideally) helps to optimise further lending.

2.1.3 Saving and hoarding (cash kept out of circulation)

Especially in situations of uncertainty, the public may even increase its demand for cash. However, the latter does not (at least in the short to medium term) come into circulation, but is rather used as a *store of value*, i.e. is saved or hoarded.³⁴ Although from the individual's perspective, both saving and hoarding may mean not spending the money immediately, the two cases must be distinguished.

In macroeconomic terms, *hoarding* prevents an optimal supply of liquidity to the economy, so that production lags behind its potential. In such circumstances, it may be appropriate for a monetary authority, based on its mandate and using its policy instruments, to reduce the savings ratio, notably by lowering interest rates.

Saving also keeps money out of the economic cycle in the short to medium term. However, this happens under circumstances in which additional liquidity would not promote value creation because the actual liquidity is allocated sub-optimally due to structural inefficiencies. This is the case, for example, when a government tries to keep alive over-indebted companies with unprofitable business models, thus preventing the emergence of innovative companies. In such a case, it would not be appropriate for a monetary authority to fight hoarding by means of financial repression (such as negative interest rates intended to «encourage» spending).

³³ Segendorf/Wretman (2015) p. 61.

³⁴ For instance, since the outbreak of the financial crisis in 2008, there has been a substantial increase in the ratio of cash to nominal GDP; Berentsen/Schär (2018) p. 101. The most recent example being the first phase of the SARS-Cov-2 pandemic: The euro zone recorded a seasonally exceptional increase in currency in circulation of EUR 36 billion from February to March 2020 compared to the EUR 27 billion increase before Christmas 2019 ([link](#)).

2.1.4 Future displacement of cash

Similar to the phenomenon of unofficial dollarization, the public of the euro area could start using extensively digital money denominated in a non-domestic currency unit as a complement to or instead of domestic cash and deposits.³⁵ Besides, the public could switch to euro-denominated private money without hardly ever making use of the redemption option again.³⁶

The competing monies could for instance be *state issued*.³⁷ Alternatively, private digital money could be *backed by cash*³⁸ or, in the future, by reserves³⁹ – provided that central banks will grant direct access to their balance sheet for such purposes.⁴⁰ China has opted for the latter in 2018 already with regard to non-crypto (mobile) e-money: It obliged all non-bank payment groups such as AliPay (Alibaba) and WeChat Pay (Tencent) to remove their customers' funds from their own balance sheets (thereby denying fiduciary ownership of customer funds) and had them transfer the funds until then held with commercial banks to NetsUnion and China UnionPay. Both represent the reserve-based state clearing network and have since

³⁵ Brunnermeier Markus K./James Harold/Landau Jean-Pierre, *The Digitalization of Money*, NBER Working Paper No. 26300, September 2019 ([link](#)), p. 32.

³⁶ See e.g. Hofmann (2019) p. 55 referring to the « potential eternal life of Libra coins» and p. 56: «The Libra scheme (...) can directly address millions of users (...) [if it] grows into a (...) system (...) of wide global acceptance, Libra coins may be passed on unlimitedly, and the system's redemption feature might ultimately become meaningless».

³⁷ See e.g. Norges Bank (2018) p. 7; Huber (2020) p. 21. In December 2018, Member of the Dutch Parliament Mahir Alkaya submitted an initiative note proposing a public deposit bank (depositobank) to this end. The House of Representatives rejected the proposal on 24 June 2020 ([link](#)).

³⁸ One example (albeit far from any market relevance) is the «Swiss Crypto Token» (XCHF) is structured as a bond backed with 100% cash (or exceptionally with CHF denominated high quality liquid assets); see <https://www.swisscryptotokens.ch/how-it-works>.

³⁹ Sveriges Riksbank, *Payments in Sweden 2019*, 7 November 2019, 18 et seq. ([link](#)); see also the hypothetical example of an e-Ruble at Goldsmith (2020), p. 595.

⁴⁰ In the Netherlands, the Foundation of (stichting) Ons Geld so far was denied access with the Nederlandsche Bank, among others with the somewhat counterintuitive explanation that it did not qualify as a bank and therefore did not participate in the deposit guarantee scheme. One could wonder if such participation would be necessary under a 100% reserve scheme at all (dissenting already Tobin James, *The Case for Preserving Regulatory Distinctions*, in : Federal Reserve Bank of Kansas City (ed.), *Restructuring the Financial System*, Kansas 1987, pp. 167, 172). See Wortmann Edgar, *A proposal for radical monetary reform*, 18 September 2016 ([link](#)); Wortmann Edgar, *A safe-haven for book-entry money*, 22 June 2019 ([link](#)).

acted as custodians for customer funds which are now covered by central bank reserves accordingly.⁴¹

Either way, however, a significant outflow from euro denominated money to foreign state (backed) digital money requires the latter to provide significant additional benefits to users. This would be the case, for example, for a currency used as a safe haven, but likewise for globally accepted currencies such as the US Dollar that could be used in cross-border transactions. Finally, the prospect of easier market access might also encourage exporters to accept such money, e.g. the Chinese Digital Currency/Electronic Payment (DC/EP),⁴² for their goods and services.

A second option would be *privately issued digital money of an own denomination and backed* with assets of high quality (while Bitcoin and the like are unlikely to spur widespread demand for lack of redeemability, cover and supply management⁴³). The appeal of this option could particularly lie in its usability for cross-border transfers⁴⁴ as well as value preservation in emerging market and developing economies.⁴⁵ To the extent that such privately issued and backed digital money of an own denomination offers users a comprehensive ecosystem, it is likely to end up in a third category sooner or later.

This third category includes private money denominated and redeemable in domestic or foreign currency (or other assets of high quality),⁴⁶ which succeed in establishing a widespread own ecosystem. Thanks to a wide range of opportunities to spend and receive such money, it circulates virtually endlessly within this ecosystem, thus eliminating the need for users to ever cash out again.

⁴¹ See Huber (2020) p. 24; Financial Times, *Tencent and Alipay set to lose \$1bn in revenue from payment rules*, 18 July 2018 ([link](#)).

⁴² One of the so far most comprehensive overviews gives: <https://boxmining.com/dcep/>.

⁴³ Accordingly, they serve primarily speculative purposes, capital flight and other illegal activities or are acquired for rather ideological reasons: Sveriges Riksbank, *Payments in Sweden 2019*, 7 November 2019, pp. 18 et seq. ([link](#)).

⁴⁴ Hermann (2020) p. 62 on the fact, that whoever offers a convincing solution for the issues stemming from cross-border payments might attract demand that cannot be countered by domestic (non global) central bank money – be it digital or not.

⁴⁵ Kiff et al (2020) p. 14 with further references.

⁴⁶ This third scenario described here applies equally to monies irrespective of their unit of account and potential redeemability, if they only benefit from a widespread autonomous ecosystem. For the example of Libra see Hofmann (2019) pp. 54-55.

An example for such a *closed loop use* is the Swiss Economic Circle (Wirtschaftsring-Genossenschaft; WIR), which established an independent complementary currency system in Switzerland in the 1930s. While WIR received banking status, with a share of M1 of around 1%, it never seriously threatened the Swiss franc (CHF). However, WIR Bank granted loans, mainly for private construction projects and to SMEs of the construction industry in its own currency, the WIR franc (CHW).⁴⁷ Users were contractually prohibited from exchanging CHW for CHF and CHW were only – but still – redeemable in CHF if a user terminated the business relationship with WIR Bank. Meanwhile, the redeemability at the end of the relationship has been abandoned.⁴⁸ As a result, CHW circulated mostly among debtors who accepted CHW payments to service their loans. Little CHW went to other banks, which would have required exchange and settlement in CHF reserves, and therefore, WIR Bank could largely avoid refinancing itself in CHF at the high interest rates of the 1980s. Thus, WIR loans were significantly cheaper and enjoyed annual two-digit growth rates. After the bursting of the real estate bubble (inflated by WIR and the other banks) in the early 1990s, the business model could not be resumed or extended to other sectors and WIR never regained its old appeal.⁴⁹

It could have a technically comparable, but economically far greater impact if digital coins (on DLT or others) would be issued by private entities such as Big Techs and Fin Techs.⁵⁰ In the example of Libra,⁵¹ only those who are among the industry leaders in their sector could become funding members of the responsible association.⁵² The authorisation required for such networks will presumably impose the highest demands on the coverage of the reserves⁵³ and thus bring the coins close to credit-

⁴⁷ See ISO 4217.

⁴⁸ See the General Terms and Conditions ([link](#)) Articles C.2(3) and C.11.

⁴⁹ Schneider Christian, Barter-Clubs – Chancen und Probleme: eine theoretische und empirische Analyse, Duncker & Humblot, Berlin 1995 ([link](#)) pp. 77 et seq. and 235 (growth rates) and pp. 83-84 (refinancing). For turnover rates between 1935 and 2018 see [link](#). It grew from 500 million in 1984 to 2.5 billion in 1993.

⁵⁰ See on corresponding scenarios already Adrian/Mancini-Griffoli (2019) pp. 9 et seq.

⁵¹ See G7 (2019) passim.

⁵² See the business evaluation criteria (of which at least two were to be met): «Market value/customer balances: (...) More than \$1 billion USD in market value or greater than \$500 million USD customer balances. Scale: (...) Reach greater than 20 million people a year, multinationally. Brand sustainability: (...) Recognised as a top-100 industry leader by a third-party sector-specific association or media company.» Cit. Libra, How to become a funding member, 2019 ([link](#)), p. 3 (or via <http://web.archive.org>).

⁵³ Libra, White paper 2.0, April 2020 ([link](#)), p. 13 regarding custody (or via <http://web.archive.org>).

risk free cash, which at the same time will probably at least reach the convenience of deposits. Libra coins are not designed for end-users to be redeemable. But also designated dealers who exceptionally can convert the coins⁵⁴ will not have to make use of this option as long as «the more coin holders rely on the usage of digital coins for payment purposes ... the more these coins lead a life of their own and independent of currency, and the more disruptive for the established payment and monetary systems they become».⁵⁵

2.2 The e-Banknote: can a 'digital coin' be a 'banknote'?

2.2.1 What is a banknote?

There is no statutory definition for 'banknote'. Historically, it emerged as an unconditional promise in writing signed by a banker, engaging to pay on demand a sum certain in money to the bearer. It is transferrable from one person to another by delivery, free of claims and defences. As such it is a negotiable instrument.⁵⁶ The promise to pay may, however, be implicit by the mere specification of the sum 'payable' on the banknote.⁵⁷ At present, banknotes are typically issued by central banks on either paper or plastic and are legal tender. Each is counterfeit-resistant and bears a serial number that distinguishes it from any other even of the same value. The promise to pay is a mere formality⁵⁸ as convertibility is banned so that the instrument is «perpetually renewable».⁵⁹ Historically, as it evolved from a genuine promise of a commercial banker to pay money, to a legal tender inconvertible and

⁵⁴ See Libra, White paper 2.0, April 2020 ([link](#)), p. 13 (or via <http://web.archive.org>) describing this sterilisation process as «burning Libra Coins for end users and liquidating assets comprising the Reserve to make payment as appropriate».

⁵⁵ Cit. Hofmann (2020) p. 47 describing the phenomenon from a generic point of view and p. 54 specifically regarding Libra.

⁵⁶ See e.g. DAL Smout, *Chalmers on Bills of Exchange* 13th ed. (London: Stevens & Sons, 1964) at 274; AW Rogers, *Falconbridge on Banking and Bills of Exchange* 7th ed. (Toronto: Canada Law Book, 1969) at 127; Charles Proctor, *Mann on the Legal Aspect of Money*, 6th ed. (Oxford: Oxford University Press, 2005) at 25. A leading case is *Banco de Portugal v. Waterlow and Sons, Ltd.* [1932] A.C. 452 (H.L.) at 483, 487 (and as to the promise see also at 478 and 480). Whether negotiable instruments legislation applies to the banknote is outside the scope of the present discussion.

⁵⁷ *Banco de Portugal* *ibid.* at 487. For the form of the notes involved in that case see e.g. at 460, 480.

⁵⁸ For viewing the promissory language as «merely ornamental» see RG Hawtrey «The Portuguese Banknote Case» (1932), 42 *Economic Journal* 392, 395.

⁵⁹ *Banco de Portugal* (n ???) at 508.

hence a 'sterile' obligation of a central bank,⁶⁰ the banknote continuously adapted to changing economic, technological and institutional conditions.

In continental Europe, as of the end of the 16th century, moneychangers in Amsterdam 'transformed' to 'cashiers' (or *kassiers* in Dutch). Receipts they issued to their depositors, «could take the form of promises to (re)pay the sum deposited». These instruments «became negotiable by endorsement.» Gradually they became payable to bearer, and “effectively raised the money supply.»⁶¹ Having heralded the appearance of the banknote, this development was arrested with the establishment of the Bank of Amsterdam (the *Wisselbank*) in 1609, whose operations superseded to a large extent those of the moneychangers.⁶²

Europe's first freely circulating banknotes are said⁶³ to be issued by the Bank of Sweden, founded in the middle of the 17th century.⁶⁴ Its «notes were partly certified cheques» drawn on it, «partly a sort of certificates of deposits.» However, the note-issue was «against the wishes of [its] leaders (...), and had never acquired any importance.»⁶⁵

⁶⁰ The historical discussion draws on Benjamin Geva, *The Payment Order of Antiquity and the Middle Ages: A Legal History* (Hart: Oxford and Portland Oregon, 2011) Chapters 8, 10 and 11. See also Helmut Siekmann, *Deposit Banking and the Use of Monetary Instruments* in David Fox and Wolfgang Ernst (eds), *Money in the Western Legal Tradition* (Oxford: OUP 2016) at 489.

⁶¹ All quotes in this paragraph are from P. Dehing & M. 'T Hart, "Linking the Fortunes: Currency and Banking, 1550-1800" in M. 'T Hart, J. Jonker & JL Van Zanden, eds., *A Financial History of the Netherlands* (Cambridge: Cambridge University Press, 1997) at 37, 43. See also P. Spufford, "Access to Credit and Capital in the Commercial Centres of Europe", in K. Davids & J. Lucassen, eds., *A Miracle Mirrored: The Dutch Republic in European Perspective* (Cambridge: Cambridge University Press, 1995) at 303, 306.

⁶² P. Dehing & M. 'T Hart, *ibid.* at 43-44, note that with the establishment of the Bank of Amsterdam in 1609 «the municipal authorities of Amsterdam temporarily prohibited all money changers and cashiers and their paper money (...).» The ban was lifted in 1621 «and the remaining money changers and cashiers became licensed officials.» However, in this new capacity, cashiers were required to hold accounts with the Bank of Amsterdam and were prohibited from keeping money in specie for longer than 24 hours.

⁶³ See C. Eagleton & J. Williams, *Money: A History* 2nd ed. (London: British Museum Press, 2007) at 179.

⁶⁴ See EF Heckscher, "The Bank of Sweden", in JG Van Dillen, ed., *History of the Principal Public Banks* (London: Frank Cass, 1964, being 2nd impression of the 1934 1st edition, The Hague: Martinus Nijhoff, 1934) at 161, particularly at 171-77.

⁶⁵ *Ibid.* at 178.

Having evolved against this background, paper money in the form of banknotes is rooted in post-medieval England. In the course of the 17th century, goldsmiths issued receipts with respect to moneys deposited with them.⁶⁶ Some receipts were payable to the order of a payee and others to the bearer. They contained the goldsmiths' undertaking to pay on demand when presented with the receipt. Each came to be known as a goldsmiths' or bankers' note and evolved into an early form of the promissory note.⁶⁷ Originally the instrument was a certificate of deposit or a 'warehouse receipt' for deposited coins; gradually it evolved to become a mere obligation issued against a fractional reserve.⁶⁸ Already towards the end of the 17th century, it was judicially acknowledged that «[t]he notes of goldsmiths (whether they be payable to order or to bearer) are always accounted among merchants as ready cash.»⁶⁹

Even in the absence of an explicit note issuing power,⁷⁰ the Bank of England modelled its banking operations on those of the goldsmiths.⁷¹ Shortly after its

⁶⁶ RD Richards, *The Early History of Banking in England* (New York: A.M. Kelley, 1965, reprint of 1929 edition) at 40-43.

⁶⁷ JM Holden, *The History of Negotiable Instruments in English Law* (London: University of London: The Athlone Press, 1955, rep. 1993, WM. W. Gaunt & Sons) at 70-73. For the evolution of the form of the goldsmiths' note, see also A. Feavearyear, *The Pound Sterling – A History of English Money*, 2nd ed. by EV Morgan (Oxford: Clarendon Press, 1963) at 107-08.

⁶⁸ Notes were issued by banks either against deposit of specie, that is, precious metal or coins, or against the negotiation, and hence in discount, of bills of exchange, as well as of promissory notes; Adam Smith, *The Wealth of Nations* (Chicago: University of Chicago Press, 1976; being the 1776 original text, edited by E. Cannan and prefaced by GJ Stigler, 'Two Volumes in One') vol 1 at 504; George Tucker, *The Theory of Money & Banks Investigated* (New York: AM Kelly, 1964, reprint of 1839 original) at 161, 164.

⁶⁹ *Tassell and Lee v. Lewis* (1695), 1 Ld. Raym. 743 at 744, 91 E.R. 1397 at 1398 (K.B.).

⁷⁰ *The Ways and Means Act, 1694* (U.K.), 5 & 6 Will. & Mar., c. 20, s. XIX provided in s. XXIX for the Bank's power to issue formal notes under seal. «These notes were used for making payments to the Exchequer from the Bank. The Exchequer then paid them out to the government's creditors, but they never seem to have become a popular form of currency.» Holden, *ibid.* at 89. See also Christine Desan, *Making Money: Coin, Money and the Coming of Capitalism* (Oxford: OUP, 2014) at 308-11. The silence of the statute as to the bank's power to issue circulating notes is explained by Feavearyear by the strong opposition to that power, and the promoters' scheme to defuse this opposition by avoiding attention to their intention as to make the Bank a bank of circulation and issue, and not merely a bank of deposit. Feavearyear, *The Pound Sterling* (n. ???) at 126.

⁷¹ W. Holdsworth, *A History of English Law* vol. VIII, 2nd ed. (London: Methuen, Sweet & Maxwell, 1937, rep. 1966) at 188.

establishment, it began to issue to depositors, «probably to a very considerable extent»,⁷² notes payable to the bearer, similar to those of the goldsmith.⁷³

The transferability by delivery of an instrument payable to the bearer was confirmed in 1764.⁷⁴ The property right of a bona fide taker for value from a finder of a 'bank bill'⁷⁵ payable to a payee or bearer goes back to *Anon.* (1699).⁷⁶ In *Miller v. Race* (1758), in effectively applying the same rule to a bona fide taker for value of a stolen banknote payable to bearer issued by the Bank of England, Lord Mansfield characterised such instruments «as much money, as guineas themselves are; or any other current coin, that is used in common payments, as money or cash».⁷⁷

Bank of England notes competed successfully with goldsmith notes and finally superseded them as paper money.⁷⁸ After some judicial hesitation,⁷⁹ notes of the Bank of England were made legal tender by statute, the relevant provision being s. 6

⁷² *Bank of England v. Anderson* (1837), 3 Bing. (N.C.) 589 at 654, 132 E.R. 538 at 562, per Tindal C.J. (C.P.).

⁷³ Holden, *History* (n. ???) at 89-90. Originally, such notes were of two types. Notes of the first type contained a promise to pay the whole of a deposit, or some irregular sum. Notes of the second type contained a promise to pay a round sum. «The note for a round sum soon became popular and gradually ousted that for an irregular amount.» *Ibid.* at 89. See in general RD Richards, *The Early History of Banking in England* (New York: A.M. Kelley, 1965, reprint of 1929 edition) at 153.

⁷⁴ *Grant v Vaughan* (1764), 3 Burr. 1516, 97 E.R. 957

⁷⁵ According to David Fox, «Bona Fide Purchase and the Currency of Money» (1996), 55 Cambridge L.J. 547 at 560, this was a «sealed Bank of England bill». However, Holden, *History* (n. ???) at 91 describes the instrument as «a Bank of England note»

⁷⁶ 3 Salk. 71, 91 E.R. 698.

⁷⁷ (1758), 1 Burr. 452 at 457, 97 E.R. 398 at 401 (K.B.).

⁷⁸ Holden, *History* (n. ???) at 92.

⁷⁹ In *Wright v. Reed* (1790), 3 T.R. 554, 100 E.R. 729 (K.B.), Ashurt J. thought that notes issued by the Bank of England «are money to *all* intents» [emphasis added]. But Lord Kenyon Ch.J. understood *Miller v. Race*, above note 128 (and see quote which follows) to hold that these notes «are considered as money to many purposes.» Buller J. inclined to support Ashurt J., but ultimately sided with the Chief Justice. Acknowledging that «banknotes pass in the world as cash», he nonetheless stressed that «[t]his Court has never yet determined that a tender of banknotes is at all events a good tender.» In *Ex parte Imeson* (1815), 2 Rose's Bkcy Cas. 225, instruments payable in «Bank of England Notes» were held not to be payable in «money» within the meaning of a statute governing promissory notes.

of the *Bank of England Act, 1833*.⁸⁰ Their convertibility ultimately ceased to exist altogether in the course of the 20th century.⁸¹ Similarly, banknotes presently issued by the Federal Reserve in the USA are in effect non-redeemable,⁸² as they are stated to be redeemable in a mysterious, and thus in fact non-existing, 'lawful money'.⁸³ For the euro, which was conceived from the outset as a pure fiat currency, the question of redeemability never arose anyway.⁸⁴

2.2.2 What is a 'digital coin'?

In his seminal paper on Bitcoin, its mythological founder Satoshi Nakamoto defined an electronic coin to be «a chain of digital signatures» in a setting in which «[e]ach owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of the next owner by adding these to the end of the coin.»⁸⁵ This explains the mechanism under which control of the coin is transferred from one person to another. The procedure described is, however, not universal, and moreover, it does not define *what* is transferred, namely what the coin is. This is not to say that Satoshi Nakamoto's definition is useless; at least it points to the coin as being a distinct item or entity, rather than a generic value, or a sum of monetary value.

Other definitions focus on «digital representations of value»⁸⁶ and are thus unsatisfactory. They include account-based products in which the balance is

⁸⁰ (U.K.), 3 & 4 Will. IV, c. 98. More accurately, the statute made the Bank's notes legal tender in England and Wales for all payments (except for by the Bank itself) over five pounds. See Holden, *History* (n. ???) at 196.

⁸¹ Convertibility was abolished for good in the UK under the *Gold Standard (Amendment) Act, 1931*, 21 & 22 Geo. V, c. 46.

⁸² For a thorough analysis see e.g. Ali Khan, «The Evolution of Money: A Story of Constitutional Nullification» (1998-99), 67 U. Cin. L. Rev. 393, particularly at 439-443.

⁸³ Federal Reserve Act Section 16, 12 USC 411. As amended by act of Jan. 30, 1934 (48 Stat. 337).

⁸⁴ See also Scheller Hanspeter K., *The Euroean Central Bank: History, Role and Functions*, Frankfurt, ECB, 2004, para 3.4, pp. 103-108.

⁸⁵ Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System, 1. November 2008 ([link](#)) p. 2.

⁸⁶ Dong He, Karl Habermeier, Ross Leckow, et al, *Virtual Currencies and Beyond: Initial Considerations* (IMF Staff Discussion Note SDN/16/03, January 2016) at 8 ([link](#)); Kiff et al (2020) p. 5. See also ECB/Eurosystem, *Virtual currency schemes – a further analysis* (February 2015) p. 25 ([link](#)). These are definitions for 'virtual currencies' – a term used (in a sense other than game-currency) to denote what we consider 'digital currencies'. See also in the United States: Uniform Regulation of Virtual-Currency Business Act,

expressed digitally⁸⁷ and are thus too broad. Such definitions cover monetary value credited to an account; in the digital age, unless qualified,⁸⁸ they encompass credit posted to commercial bank accounts accessible from a digital device. Rather, as a token representing an asset,⁸⁹ an electronic or digital⁹⁰ coin is a distinct entity consisting of data in the form of a unique string of bits expressing a specified number of units of value.⁹¹ Like physical coins and banknotes, digital coins are not paid out of bank accounts⁹² so that their payment does not appear to require intermediation by banks. And yet, exactly as electronic funds transfers, they are paid over the cyber space. Digital currency is an assortment of digital coins or, more specifically, a system under which digital coins are issued, transferred and redeemed. A privately issued digital currency may have its own unit of account, fluctuating by reference to the value of an official unit of account, in which case it is self-anchored. Alternatively, it may be a 'claim check' or stablecoin, either in a unit of account of an official currency or in the value of a specific commodity, whether or not it is fully (or even partially) backed by a reserve of such currency or commodity.⁹³ Each digital coin may be in the form of a total unspent amount in a

drafted by the National Conference of Commissioners on Uniform State Laws and approved and recommended for enactment in all the States at its Annual Conference Meeting in its One-Hundred-And-Twenty-Sixth Year, San Diego, California July 14 - July 20, 2017, section 102(23).

⁸⁷ Indeed, the IMF Taxonomy Figure, *ibid.* specifically cover Pay-pal and e-money balances.

⁸⁸ In fact, among the three sources cited in n. ???, at least the first two, qualify it in a way that specifically excludes CoBM but not other account-based systems.

⁸⁹ Practically «with properties that suffice to attest to and transfer ownership» Digital Dollar Foundation & Accenture, *The Digital Dollar Project: Exploring a US CBDC*, May 2020 ([link](#)) at 10 (where the quoted language is part of the definition itself).

⁹⁰ We do not argue that 'electronic' and 'digital' are identical terms and yet in the present context they are used interchangeably with the use of 'digital' being substantially more prominent.

⁹¹ According to Gideon Samid, *Tethered Money: Managing Digital Currency Transactions* (Elsevier Academic Press, 2015) at 105-106, the unique string of bits should better express both identity and value.

⁹² Certainly, they may be *withdrawn* from an account like cash.

⁹³ Samid (n. ???) at 108. See also Anastasia Melachrinou & Christian Pfister, *Stablecoins: A Brave New World?* Banque de France Working Paper Series no. 757, 3 June 2020 ([link](#)), particularly addressing risks created by global privately issued stablecoins.

wallet⁹⁴ or, as will be seen below, to one degree or another, a digital representation of what otherwise would be a distinct physical banknote.

Unlike payment in account balance, payment in digital currency need not be recorded on a centralised ledger. However, in a given scheme, coins may be issued, transferred and redeemed under centralised protocol in which case the scheme is said to be centralised. Conversely, a scheme under which a digital currency is issued, transferred and redeemed over a distributed ledger is decentralised. Finally, a digital currency transferable under a decentralised protocol – such as over a distributed ledger and yet issued by a centralised operator – is hybrid.⁹⁵

Centralised protocol does not require the intermediation of bank accounts and is thus entirely different from a centralised architecture in account-balance payment systems. Furthermore, payment in digital currency, made from one digital device to another, does not necessarily require the intermediation of a dedicated electronic network. Depending on its design, connectivity may be over the Internet or a telecommunication carrier. A centralised protocol may further require the intermediation of either an operator of a central switch or a custodian acting as a virtual store or warehouse person for the coins.

The distributed ledger underlying decentralisation is an asset database that can be shared across a network of multiple sites, geographies or institutions. Blockchain is an underlying technology, requiring the Internet to support and maintain its peer-to-peer network that enables digital implementation of a distributed ledger. Being a computerised ledger on a distributed network, it generates a single version of the record on each computer. In essence it is:⁹⁶

«a type of a database that takes a number of records and puts them in a block ... Each block is then 'chained' to the next block, using a cryptographic

⁹⁴ Such a coin exists only as «an identifiable address with a balance.» See Zellweger-Gutknecht Corinne, *Developing the Right Regulatory Regime for Cryptocurrencies and other Value Data*, in Fox David/Green Sarah (eds.), *Cryptocurrencies in Public and Private Law* (Oxford: OUP 2019) 57 at 86 n 160.

⁹⁵ For this tripartite classification, see IMF Staff Discussion, *Virtual Currencies and Beyond: Initial Considerations*, January 2016 ([link](#)); where a third criterion – on the top of issuance and transfer – is added *viz.*, «mechanisms to implement and enforce internal rules on the use and circulation of the currency».

⁹⁶ UK Government Office for Science, *Distributed Ledger Technology: beyond block chain*, 2016 ([link](#)) at 17.

signature. This allows block chains to be used like a ledger, which can be shared and corroborated by anyone with the appropriate permissions.»

Accuracy of the ledger is corroborated under a method determined under rules adhered to by participants. Record security and visibility to authorised users is ensured by cryptography.

A ‘*cryptocurrency*’ denotes a digital currency in which encryption techniques are used to regulate the generation of units of currency⁹⁷ and verify the execution of payment transactions on a decentralised network.⁹⁸ Cryptography is thus used in cryptocurrencies to express and protect the value of the coins (the sequence of the bits), to prevent counterfeiting and fraudulent transactions as well as to perform validation, execution and recording. These functions are carried out on a distributed ledger, such as a blockchain. Thereon, each block contains a cryptographic hash or algorithm that links it to the previous block along with a timestamp for the transactions from that block. The network allows online payments to be sent directly from one party to another without going through a bank or any other account-holding centralised counterparty.⁹⁹

It is argued that developers of cryptocurrencies «simply migrated the cryptographic tools used to safeguard communication and applied them to safeguard digital currency» and thus subjected them to vulnerability to erosive cryptographic intractability.¹⁰⁰ In the ongoing fight against counterfeiters and fraudulent copiers, centralised schemes are better positioned to apply superior defence measures in

⁹⁷ This distinctive feature is unfortunately missing in The LawTech Delivery Panel (LTDP), *Legal statement on cryptoassets and smart contracts*, UK Jurisdiction Taskforce, November 2019 ([link](#)) paras 24-34, where the focus (particularly in para 28) appears to be on the control on the asset (rather than on its generation) by cryptographic means.

⁹⁸ This definition slightly modifies the one from <https://medium.com/@Wolfcrypto/basic-cryptocurrency-starter-guide-8f2071ea85de>; particularly, we replaced ‘transfer of funds’ by the ‘execution of payment transactions’ to point at payment by the transmission of ‘coins’ rather than ‘generic value’ in the forms of funds. See also ‘Cryptoassets’ (Wikipedia, 2019) <https://en.wikipedia.org/wiki/Cryptocurrency> accessed 29 October 2019: «A cryptocurrency (or crypto currency) is a digital asset designed to work as a medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets.» (emphasis added).

⁹⁹ Note however that not every decentralised system is that of a cryptocurrency. For a visual demonstration of the point see Dong He *Virtual Currencies and Beyond* (n ???), Figure 1 at 8. We do not adopt the taxonomy proposed by that figure.

¹⁰⁰ Samid (n. ???) at 26.

protecting the integrity of the data base as well as enhanced security procedures in both coin and identity verification upon redemption and in trade.¹⁰¹

Bit-minted money is proposed as the answer to these drawbacks. Unlike a cryptocurrency, bit-minted money is not hinged on a mathematical riddle that even as it cannot be solved at present, may be solved in the future. Rather, bit-minted money, while utilised in schemes using crypto tools for messaging and storage, is fitted on a completely different foundation, thriving to randomness, also known as quantum or pure randomness, premised on unpredictability.¹⁰² Bit-minted money is minted either by BitMint or its methodology and is further discussed below in Subsection 5.4.3.

2.2.3 Does a digital coin fall into the definition of a 'banknote'?

As it evolved from a genuine promise to pay, first of a commercial then a central bank, became legal tender and turned to be inconvertible, that is, containing an abstract 'sterile' obligation, the written banknote has been transformed in substance.

The transformation has occurred in response to ongoing advancing technological conditions, changing market demand and evolving institutional frameworks. For its part, also the form, or more specifically the media of the banknote, has crystallised in response to changing conditions. Indeed, according to Toynbee, the feasibility of paper money is «associated with the two Sinic inventions of paper and printing» that culminated in its issue by the Sung Government in 970 CE.¹⁰³ In turn, an ongoing process of improving printing, enhancing security features and replacing

¹⁰¹ See e.g. Samid (n. ???) at 92-94 and *cf.* *ibid.* at 125-27 as well as at 25, 98-100 albeit focusing on the advantage of paying with digital coins over that of paying in scriptural money which may expose account data to hackers.

¹⁰² See e.g. «Prime Numbers and National Digital Money — *The Subtle Risk Central Banks Ignore*» (August 20, 2019), online: <https://medium.com/@bitmintnews/prime-numbers-and-national-digital-money-the-subtle-risk-central-banks-ignore-f2ccd3052726>; and «Bitcoin-Chernobyl: Risk Similarities Between Nuclear Reactors and Crypto Currencies,» (July 30, 2019) online: <https://medium.com/@bitmintnews/bitcoin-chernobyl-risk-similarities-between-nuclear-reactors-and-crypto-currencies-99dd34b864be>. For the superior protection of randomness premised on «a cipher which use[s] no mathematical complexity but instead call[s] for large amounts of randomness» see e.g. Carsten Stöcker and Gideon Samid, *Randomness: The Fix for Today's Broken Security* ([link](#)).

¹⁰³ AJ Toynbee, *A Study of History: Abridgement of Volumes VII-X* by DC Somervell (London: Oxford University Press, 1957) at 62.

paper by plastic, facilitated by technological advances, has been precipitated by a search for more savings and convenience as well as confidence, safety and security.¹⁰⁴

Throughout its evolution, the banknote has remained 'written', even as the meaning of 'written' has expanded to cover printed, stamped, embossed and in theory also engraved.¹⁰⁵ At the same time, we argue, the 'writing' requirement has been functional. In the case of the banknote it is premised on the need to have a record, both as a matter of evidence to secure attribution, permanence, integrity and authenticity as well as to facilitate simple transferability. Once technology could allow these functions to be performed through a novel medium, as is the case with the digital coin, there has been no reason to insist on the written format more than on the existence of a genuine obligation to pay metallic money. The accommodation to a changed environment ought not to be limited to the nature of the obligation and bypass the media.

It is noteworthy that in the universally accepted definition of a banknote,¹⁰⁶ there is no mention of an independent requirement of being a tangible object.¹⁰⁷ Rather, the

¹⁰⁴ See in general Don Cleveland IBNS LM-136A, *History of Printed Money*, online: https://www.theibns.org/joomla/index.php?option=com_content&view=article&id=251&Itemid=127; and more specifically on existing security features: Jeff Desjardin, Central Banks: 10 Banknotes From Around the World, and Their Security Features, June 18, 2018, online: <https://www.visualcapitalist.com/10-banknotes-around-world-security-features/>; as well as *Security features for staying one step ahead of the counterfeiters*; online: <http://banknoteinfo.net/security-features/>.

¹⁰⁵ For example, under Schedule 1 to the UK *Interpretation Act* 1978 c 30: 'Writing' includes «typing, printing, lithography, photography and other modes of representing or reproducing words in a visible form (...)». A creative interpretation may treat words in a permanent record 'visible' on a computer screen as satisfying the writing requirements: Leif Gamertsfelder, «Electronic Bills of Exchange: Will the Current Law Recognise Them?» (1998) 21:2 UNSWLJ 566.

¹⁰⁶ c/r.

¹⁰⁷ Under UCC 1-201(43) 'Writing' is defined to include «printing, typewriting, or any other intentional reduction to tangible form.» This is in contrast to UCC 1-201 (31), under which 'Record' is defined to mean «information that is inscribed on a tangible medium or that is stored in an electronic or other medium and is retrievable in perceivable form.» It is recommended to revise UCC Article 4A by expanding 'writing' to include 'medium stored in an electronic or other medium and is retrievable in perceivable form'. Such distinction is for the purposes of the interpretation of the Uniform Commercial Code. Regardless it is not flawless, as for example it is hard to understand as to why an inscription is on a record and not in writing.

tangibility feature derives from the 'writing' requirement as envisioned prior to the electronic age. At that time, there was no way of 'writing' on an intangible media; writing in the air was (and is) meaningless. However, with new technologies, it has become possible to write on something intangible. We write an email exactly as much as we write a postcard or a letter. What paper or any other tangible media gives to writing is permanence – which technologically can now be accorded to an intangible record in the cyberspace. Accordingly, we argue, notwithstanding the fact that it is a uniquely generated item of information and as such an intangible, the digital coin may nevertheless be seen as 'written', or at least, functional equivalent to 'written'.

As indicated, liability on a banknote requires signature.¹⁰⁸ Generally speaking, 'signature' may be written, lithographed, facsimiled or stamped on a document (or anything else tangible) with the intent of authenticating liability on a contract.¹⁰⁹ The key is however a permanent record for the authentication of liability. Accordingly, the electronic authentication of an electronic record that substitutes writing will satisfy the signature requirement.

Observations to such ends were already made in the common law.¹¹⁰ In one case, the court did not doubt that «if a party creates and sends an electronically created document then he will be treated as having signed it to the same extent that he would in law be treated as having signed a hard copy of the same document.»¹¹¹ In another case the court looked upon an email as written.¹¹²

Accordingly, where it is a 'signed', 'written' debt obligation on which its issuer is a bank unconditionally liable to pay on demand a sum certain in money to the bearer, a claim check digital currency, even a cryptocurrency, complies with the definition of a banknote. Whether it also fulfils the function of a 'banknote' is addressed in the immediately following Section.

¹⁰⁸ c/r.

¹⁰⁹ See e.g. A.W. Rogers, *Falconbridge on Banking and Bills of Exchange*, 7th ed. (1969), pp. 440-441, 443 and 444.

¹¹⁰ Simon Gleeson, *The Legal Concept of Money* (Oxford: OUP, 2018) 176 para 9.47.

¹¹¹ *J Pereira Fernandes v. Mehta* [2006] 1 All ER (Comm_ 885 para 28.

¹¹² *Golden Ocean Group v. Salgocar Mining Industries* [2012] EWCA Civ. 265.

2.2.4 Does the digital coin fulfil the function of a 'banknote'?

As a negotiable instrument, the paper banknote is both a chattel and obligation, or else, it is both a chose in possession and a chose in action.¹¹³ Furthermore, it is a «document in which a right is incorporated in such a way that it cannot be claimed nor transferred to others (...) without the document.»¹¹⁴ As such it is a specie of the Germanic *Wertpapier*¹¹⁵ as defined in Article 965 of the *Swiss Code of Obligations*. Stated otherwise, the obligation on a banknote (sterile as it is nowadays) is embodied in the chattel, so as to inure to the benefit of the possessor of the chattel. Indeed, the transfer of possession as a requirement to the transfer of title to, hence payment in, money.¹¹⁶ Accordingly, for the digital coin to function as a written banknote, not only that the obligation thereon must be 'signed', 'written' and embodied in something permanent as a chattel; rather, that 'something' ought first to be the object of property, just as the piece of paper on which a banknote is written. Second, it must be capable of being moved from the exclusive control of one person to that of another, as paper can be moved from the possession of one person to that of another.

As for the first characteristic, that of an object of property, common law recognises proprietary features of an intangible right even where it is not a chose in action, as

¹¹³ Relating both to «a chattel, a tangible scrap of paper» and «a bundle of contracts», a claim to a negotiable instrument thus involves not only «the right to possess a thing but [also] the right to sue several persons [liable to it]». Zechariah Chaffee Jr., 'Rights in Overdue paper' (1918) 31 Harv L Rev 1104, 1109.

¹¹⁴ Swiss Code of Obligations: English Translation of the Official Text (Swiss-American Chamber of Commerce 2003). On the German *Wertpapier* see in general: L. Dabin, *Fondements du droit cambiaire Allemand* (Faculté de droit de Université de Liège 1959). For a comprehensive discussion on the German conceptual framework, and as to whether it sheds additional light on the nature of a negotiable instrument, see Denis V Cowen and Leonard Gering, *Cowen The Law of Negotiable Instruments in South Africa Vol. One: General Principles* (5th edn, Juta 1985) 79-98 (where a slightly different translation, albeit to the same effect, of the Swiss provision is reproduced at 82). Their negative conclusion as to whether the *Wertpapier* sheds additional light on the nature of a negotiable instrument at 110, is criticised by JT Pretorius' book review in (1986), 103 SALJ 151 at 154-56. On the negotiable instrument as *Wertpapier* see also: FR Malan, JT Pretorius & SF Du Toit, *Malan on Bills of Exchange, Cheques and Promissory Notes in South African Law* (5th edn, LexisNexis 2009) 4, 7.

¹¹⁵ According to Cowen & Gering, *Negotiable Instruments ibid.* at 94, the word 'Wertpapier' cannot be well translated to English, so that words such as 'security' or 'commercial paper' do not convey its accurate meaning.

¹¹⁶ David Fox, *Property Rights in Money* (Oxford: OUP, 2008) paras 3.32-3.42

long as the right is «definable, identifiable by third parties[,] capable in its nature of assumption by third parties and have some degree of permanence or stability.»¹¹⁷ It was accordingly held that cryptocurrencies are to be treated as property.¹¹⁸ Civilians may have been more dogmatic.¹¹⁹ Nevertheless, drawing on Gaius' distinction between *res corporales* and *res incorporales*, Nicholas maintains the existence of «abstract things, such as a debt or a *right of way*» that cannot be possessed and yet can be owned.¹²⁰ He concludes that the «the law of things includes all those rights which are capable of being evaluated in money terms.»¹²¹

The fulfilment of the second characteristic, that of transferability from hand to hand, requires first to explore the mechanics of payment in digital currency and second an assessment of the legal treatment of the mechanism. For its part, the mechanics of payment in a digital coin depends on the specific design of the coin and its underlying scheme. A common denominator for all mechanisms is the use of a telecommunication network, and the availability of a validating intermediary, designed to prevent double payment, something that cannot exist in the case of

¹¹⁷ *Natinal Provincial Bank v Ainsworth* [1965] AC 1175, 1247-48; [1965] 2 All ER 472, 494 (HL, per Lord Wilberforce).

¹¹⁸ First in *B2C2 Limited v Quoine PTC Limited*, [2019] SGHC (I) 03 (Singapore International Commercial Court) para 142; followed in *AA v Persons* [2019] EWHC 3556 (Comm) para 61. In reaching its conclusion *AA v Persons* also treated the Legal statement of the LawTech Delivery Panel as persuasive and yet not being an authoritative statement of the law. *Ibid.* at para 57. The LawTech Delivery Panel, Legal Statement of the UK Jurisdiction Task Force, Crypto Assets and Smart Contracts, 11 November 2019 ([link](#)), para 15. For a full discussion see *ibid.* at paras 35–85 (and to a less extent also paras 86–99). For mostly earlier scholarly discussion see David Fox, «Cryptocurrencies in the Common Law of Property» in Fox & Green (eds. (n. ???) 139, at 152-54; paras 6.38-6.41. See also Christopher Hare, «Cryptocurrencies and Banking Law: Are There Lessons to Learn», Fox and Green, *Cryptocurrencies* (n. ???) 229, at 237 n. 53; Gleeson (n ???) 166 para 9.10. Another discussion is by G A Walker, «Financial Technology Law- A New Beginning and a New Future» (20??), ??? *The International Lawyer* ??? . For another perspective see Sarah Jane Hughes, → «Property, Agency, and the Blockchain: New Technology and Longstanding Legal Paradigms,» 65 *Wayne L. Rev.* 57 (2019).

¹¹⁹ See in detail e.g. Daniel Carr, «Cryptocurrencies as Property in Civilian and Mixed Legal Systems» in Fox and Green, *Cryptocurrencies* (n. ???) 177.

¹²⁰ Barry Nicholas, *An Introduction to Roman Law*, (Oxford at Clarendon Press, 1962) at 106. Indeed, «incorporeal things» are recognised by the Institutes. *The Institutes*, Book II Title II, translation reproduced in RW Lee, *The Elements of Roman Law*, 4th edn (London Sweet & Maxwell, 1956) at 114 and discussion at 110.

¹²¹ Nicholas, *ibid.* at 98 (emphasis added).

payment by means of a paper banknote. To both such ends several scenarios are available:

1. Being in control of a digital coin 'affixed' to a single Internet domain, for which it attorns to the payer, a 'baliee'¹²² complies with the payer's instructions and executes them by attorning to the payee, thereby causing 'possession' in the coin to be transferred from the payer to the payee. Alternatively, such a system may be viewed as run by a central switch operator, which at the instruction of the payer transfers the control of the coin from the payer to that of the payee;
2. A 'coin' in the form of an unspent transaction output (UTXO)¹²³ in the payer's wallet, reflecting earlier transactions, is transformed into a new UTXO in the payee's wallet. Where the payer does not use up the entire UTXO, payment is carried out by splitting the payer's UTXO into two UTXO's: one in the sum of payment going to the payee's wallet, and the second, in the amount of the balance of the UTXO, remaining in the payer's wallet.
3. The payer sends from his or her digital device to the payee's device a 'coin' or any split of it. The payee may (but is not required to) validate the coin authenticity with the 'mint'.

Respectively, these are the methods of payment in WingCash, Bitcoin¹²⁴ and BitMint. Among these three, only Bitcoin requires a blockchain and is a cryptocurrency.

¹²² We agree with the LTDP (n. ??) paras 87-88 that strictly speaking no 'bailment' can exist with respect to a 'digital banknote', except that we address below the option of 'control' as a functional equivalent to 'possession'.

¹²³ The term is explained e.g. in <https://komodoplatfrom.com/whats-utxo>, visited on January 16, 2020.

¹²⁴ Satoshi Nakamoto, «Bitcoin: A Peer-to-Peer Electronic Cash System» (2008) at 2, online: <https://bitcoin.org/bitcoin.pdf>, accessed 28 December 2017 and see e.g. Stuart Hoegner, «What is Bitcoin?» in Stuart Hoegner, ed, *The Law of Bitcoin* (Bloomington IN: iUniverse, 2015) at 1; Neil Guthrie, «The End of Cash? Bitcoin, the Regulators and the Courts» (2014) 29 BFLR 355. For its mechanics, see Jonathan Levin, «Bitcoin: New Plumbing for Financial Services», *coindesk* (29 November 2014), online: <http://www.coindesk.com/bitcoin-new-plumbing-financial-services/>, accessed 28 December 2017. See also Nicholas Wenker, «Online Currencies, Real-World Chaos: The Struggle to Regulate the Rise of Bitcoin» (2015) 19 Tex Rev L & Pol 145; and Jacob Hamburger, «Bitcoins vs. State Money Transmission Laws: Protecting Consumers or Hindering Innovation?» (2015) 11 J L Econ & Pol'y 229. See also

Neither WingCash nor BitMint are cryptocurrencies. No blockchain is required in BitMint or even exists in WingCash. Both WingCash and BitMint are discussed in Part 5.

In a cryptocurrency, the coin consists of the total available in the wallet. Stated otherwise, a coin is not handled as a unique and separate entity from the beginning of a payment transaction to its end. Furthermore, in a cryptocurrency, the sequence of the bits represents the value of the coin. Being unique to each coin, it is that sequence which gives the coin its identity. Accordingly, insofar as each coin in WingCash and BitMint has both an identity and a specific value, as separate functions and from the beginning of the transaction to its end, among the three designs addressed in Part 5 they both stand closer to the paper banknote. Between them, WingCash coin, being a digital representation of the fiat currency banknote, is thus closer to the paper banknote. This, however, may not compensate for some unique features of BitMint, such as continuous payment, coin splitting and tethering. Furthermore, the BitMint payment transaction better assimilates payment in cash as it does not require any intermediation. Finally, among the three, only BitMint facilitates transactions between simple mobile phones and with no resort to the Internet and thereby enhances inclusion. True, smartphones and Internet will enhance the functionality of BitMint and yet, unlike in the other designs, they are not indispensable. We believe that broader-based accessibility is a key factor in according a legal tender status to a monetary object.

Payment under each scheme is premised on the transfer of control of the digital coin. Functional equivalence with transfer of possession of a paper banknote is quite obvious. For example, in a case of digital coins accessed by keys, Fox speaks of a presumption in favour of control by the public key holder as the «intangible analogue of the familiar (...) presumption that possession is evidence of title».¹²⁵ Undoubtedly, this principle guided the drafters of the UNCITRAL Model Law on Electronic Transferable Records (2017)¹²⁶ (MLETR).

<https://en.wikipedia.org/wiki/Bitcoin>, accessed 28 December 2017; <http://www.coindesk.com/information/what-is-bitcoin>, accessed 28 December 2017; http://www.wired.com/2011/11/mf_bitcoin, accessed 28 December 2017; and «The Great Chain of Being Sure About Things», *The Economist* (31 October 2015). See also https://en.bitcoin.it/wiki/How_bitcoin_works, accessed 28 December 2017.

¹²⁵ Fox, «Cryptocurrencies in the Common Law of Property» (n. ???) at 157, para 6.50.

¹²⁶ Model Law on Electronic Transferable Records, A 72/17, UNCITRAL, 2017 ([link](#)), accessed 27 April 2020 (hereafter: MLETR).

Thus, Article 11 MLETR focuses on the concept of «exclusive control of [an] electronic transferable record» as a functional equivalent of «the possession of a transferable document or instrument.» ‘Transferable document or instrument’ is defined in Article 2 MLETR to mean:

«a document or instrument issued on paper that entitles the holder to claim the performance of the obligation indicated in the document or instrument and to transfer the right to performance of the obligation indicated in the document or instrument through the transfer of that document or instrument.»

In turn, Article 2 MLETR defines ‘electronic record’ to mean «information generated, communicated, received or stored by electronic means». Under Article 10(1) MLETR, an electronic record becomes an ‘electronic transferable record’, where:

- «(a) [It] contains the information that would be required to be contained in a transferable document or instrument; and
- (b) A reliable method¹²⁷ is used:
 - (i) To identify that electronic record as the electronic transferable record;
 - (ii) To render that electronic record capable of being subject to control from its creation until it ceases to have any effect or validity; and
 - (iii) To retain the integrity of that electronic record.»¹²⁸

Article 8 MLETR renders information that is «accessible so as to be usable for subsequent reference» the functional equivalent of ‘writing’. Similarly, MLETRs Article 9 provides that where «a reliable method is used to identify [a] person and to indicate that person's intention in respect of the information contained in [an]

¹²⁷ The general reliability standard is provided for in Article 12 MLETR. It addresses operational rules, the assurance of data integrity, the ability to prevent unauthorised access and use, the security of hardware and software, the regularity and extent of independent audit, a declaration by a supervisory or accreditation body, and any applicable industry standard.

¹²⁸ Under Article 10(2) MLETR:
«The criterion for assessing integrity shall be whether information contained in the electronic transferable record, including any authorised change that arises from its creation until it ceases to have any effect or validity, has remained complete and unaltered apart from any change which arises in the normal course of communication, storage and display.»

electronic transferable record», a legal signature requirement by that person is satisfied.

Article 11(1) MLETR goes on to provide that the «exclusive control of [an] electronic transferable record» established by «a reliable method», which also identifies the person in control meets a legal requirement for «the possession of a transferable document or instrument». As well, under Article 11(2) MLETR, «the transfer of control over [an] electronic transferable record» is the equivalent for the «transfer of possession of a transferable document or instrument».¹²⁹

A footnote to Article 1(3) MLETR leaves open the possibility of excluding negotiable instruments from what otherwise seems to be a proper framework for the creation and transfer of an electronic instrument. Taking into account the fact that the banknote is a negotiable instrument, this is unfortunate. At the same time, standing on its own, MLETR statutory language is quite proper and fit to cover negotiable instruments in general and for our purposes, the banknote in particular. Indeed, the banknote is a signed transferable document or instrument, entitling its holder to claim from the signer the performance of an obligation indicated therein. For its part, in a digitised form, the banknote is an electronic transferable record, authenticated by an identified person, which is under the exclusive control of the one entitled to enforce the obligation it contains. Transferability in the former format is by the physical delivery of the paper banknote, while the transferability in the latter format is by the transfer of control over the electronic record of the banknote.

Functional equivalence with a paper banknote further requires transferability to a bona fide transferee for value free of any claim or defence. This is, however, neither a physical nor a technological feature of money. Rather, it is a quality accorded to money by law. Way back in *Miller v Race* (1758),¹³⁰ Lord Mansfield rejected the lack of an 'earmark' to a monetary object as the rationale for the passage in circulation free of defences and claims. Rather, he explained this quality on the basis of the 'currency' of money – which is an attribution by law. Certainly, a paper banknote

¹²⁹ In this context, Article 15 MLETR provides that:

«Where the law requires or permits the endorsement in any form of a transferable document or instrument, that requirement is met with respect to an electronic transferable record if the information required for the endorsement is included in the electronic transferable record and that information is compliant with the requirements set forth in articles 8 and 9.»

This, however, is irrelevant for the banknote, which is payable to the bearer and thus transferable by the mere delivery.

¹³⁰ 1 Burr 452, 97 Eng Rep. 398, 401.

bears a unique serial number – and in today’s technology may be made to bear a small chip – all of which facilitate tracing; and yet, for the policy reason pointed by Lord Mansfield, even a stolen banknote cannot be traced into the hands of a bona fide taker for value. Accordingly, irrespective of tracing technological capabilities, we do not see any obstacle for the law to accord the currency quality to digital coins functioning as money.¹³¹

Relating to the quality of passage in currency is that of anonymity. Certainly, in comparison to payment by transferring funds, payment in digital currency works like payment in cash: «[t]he value of the transaction is verified regardless of the identity of the payer» even without exposing the payer’s hackable account.¹³²

In conclusion, a digital coin falling into the definition of a ‘banknote’ is capable of fulfilling the function of a paper banknote.

2.2.5 The digital coin as an e-banknote: Monetary law and the history of the banknote

Falling into the definition and fulfilling the function of a ‘banknote’, a digital coin issued by a bank is a ‘banknote’, or more specifically an electronic banknote (e-banknote). This conclusion is supported once the role of monetary law in general and particularly as applied to the history of the banknote is appreciated. Having evolved from a genuine promise to pay, first of a commercial then a central bank, having become legal tender, and having turned to be inconvertible, that is, containing an abstract ‘sterile’ obligation, the written banknote transformed in substance in response to ongoing advancing technological conditions, changing market demand and evolving institutional frameworks. With technology facilitating the change in the media, from written to digital, the move to digital is just another step in the same process.

History demonstrates that technology, market demand and institutional framework shaped the emergence and evolution of the banknote. The role of statutory law was not to lead, but rather to facilitate developments for societal benefit. Hence, statutes and constitutional powers in relation to money ought to be interpreted in the spirit of accommodating new developments, harnessing them for the protection of the public, but not hindering them.

¹³¹ For the same conclusion with regard to cryptocurrencies see e.g. Sarah Green, *It’s Virtually Money*, in Fox David/Green Sarah (eds.), *Cryptocurrencies in Public and Private Law*, Oxford, OUP 2019, para 2.46.

¹³² Samid (n.) at 50.

While in England the law followed the creation of the banknote, the issuance of the written banknote in the USA, first by practice then by statute, bypassed a rigid interpretation of a federal constitutional power under Article 1 Section 8 «to coin money»,¹³³ which has been taken to give the power to issue only full-bodied metallic money.¹³⁴ Market (and government) demands were met by the issuance of banknotes, originally by state chartered banks with no statutory basis, subsequently by national banks, and finally by the Federal Reserve, first by its regional Reserve Banks, and subsequently by the Board of Governors of the Federal Reserve System.¹³⁵ All such banknotes have served as money even as only the latter are accorded legal tender status. All were held not to be in violation of the US Constitution.

Reflecting on this history, Khan observed that:

«Money is a living creature of the market and its form changes to facilitate commercial transactions in an ever more efficient, convenient safe manner. As such most innovations in monetary practices are attributable to the decisions of the market (...).»¹³⁶

He then speaks of the (written) banknote, constituting bank money, as «the creation of the law merchant and the needs of the market», of which «entrenchment in the

¹³³ For constitutional aspects of money issuance in the US see e.g. Thomas Wilson, *The Power 'to Coin' Money: The Exercise of Monetary Powers by the Congress* (Armonk New York and London, England: ME Sharp, 1992); and Khan, «The Evolution of Money» (n. ???). The full text of the US Constitution is available e.g. at <https://constitutionus.com/> (Visited May 6, 2020).

¹³⁴ Khan *ibid.* at 393.

¹³⁵ For a succinct summary see e.g. Warren E. Weber (formerly of the Federal Reserve Bank of Minneapolis), *Government and Private E-Money Like Systems: Federal Reserve Notes and National Bank Notes*, Working Paper, 18 June 2015 ([link](#)) at 3, (visited May 06, 2020):

«Throughout most of U.S. history, bank notes have been issued either solely by private banks or solely by the government through the Federal Reserve System, the central bank. From 1786 to 1914, bank notes were issued solely by private banks. State banks were the issuers from 1786 to 1863; both state and national banks from 1864 to 1866; and only national banks from 1866 to 1914. After 1935, bank notes were solely issued by the government in the form of Federal Reserve notes. The period from 1914 to 1935 is unique in that it was the only time that both privately-issued and governmentally-issued bank notes were simultaneously in circulation. (...).»

¹³⁶ Khan (n ???) at 396, citing (quoting???) Cyril James, «International cooperation in the Field of Money: A Strand of Economic History», in *Money and the Law* 1, 1-2 (1945).

legal system was the affirmation of a simple monetary tradition: the market creates, modifies, and recreates the concept of money. The law simply recognises and changes, often *ex post facto*.»¹³⁷ His overall thesis is «that no legal text, not even the most authoritative, such as the United States Constitution can fully predict how the future will discard some of the most obvious paradigms.»¹³⁸

A common feature of the routes under which the paper banknote was recognised in both England and the USA is the slow pace of the process. There is, however, no need to adhere to this pace in connection with the euro e-banknote where the statutory basis is available and individual initiatives by private players cannot be stopped and can hardly be harnessed.

Indeed, Khan's observations are confirmed by the shifting nature of the banknote, first in substance and ultimately, we say, in form. Indeed, the role of the interpretation of monetary law is to accommodate market developments and harness them to the advantage of society, rather than to endeavour to lead and create models, or even worse, to set in stone and freeze paradigms existing at a given time that have been overtaken by technological, institutional and market developments. In the final analysis, giving a broad meaning to a term, in this case 'banknote', is a legitimate tool to ensure that the law remains in tandem with market and technological developments, particularly where, for political reasons, the legislative route is not a promising option. This background only reinforces to read 'banknote' in Article 128(1) TFEU as including the e-banknote.

¹³⁷ Khan, (n. ???) 414.

¹³⁸ Khan, *ibid.* 397.

3 A goal based perspective

3.1 Preliminary considerations

While Article 130 TFEU provides the ECB with a high degree of independence,¹³⁹ the latter extends only to the powers conferred upon the ECB by the Treaty and the Statute.¹⁴⁰ In fact, the ECB is constrained by its statutory objectives (the primary one being price stability¹⁴¹) and tasks as well as «by the demands of democratic legitimacy and accountability».¹⁴² Against this backdrop and since the question is to be answered under existing law, the ECB's mandate is taken as a starting point for the remainder of our research paper.

The relevant provisions are first and foremost Articles 127 et seq. TFEU.¹⁴³ Article 127(2) lays down four basic tasks of the ESCB (or rather the Eurosystem),¹⁴⁴ (reproduced in Article 3.1 of the Statute), of which only two need to be considered in more detail for our purposes: the definition and implementation of the monetary policy (1st indent) and the promotion of the smooth functioning of payment systems (4th indent). Both of them will be addressed shortly, together with further possible objectives. In the first place, however, the focus shall be on Article 128 TFEU.

¹³⁹ The provision reads as follows: «When exercising the powers and carrying out the tasks and duties conferred upon them by the Treaties and the Statute of the ESCB and of the ECB, neither the European Central Bank, nor a national central bank, nor any member of their decision-making bodies shall seek or take instructions from Union institutions, bodies, offices or agencies, from any government of a Member State or from any other body. The Union institutions, bodies, offices or agencies and the governments of the Member States undertake to respect this principle and not to seek to influence the members of the decision-making bodies of the European Central Bank or of the national central banks in the performance of their tasks.»

¹⁴⁰ This also includes the duty to act in accordance with the principles of an open market economy with free competition and favouring an efficient allocation of resources as set out in Article 119 TFEU.

¹⁴¹ Article 127(1) 1st sentence TFEU. At the same time, it is also a guiding principle for the Union: Article 119(2) and (3).

¹⁴² Lastra Rosa Maria, *International Financial and Monetary Law*, 2nd ed., Oxford University Press, 2015, para 7.86.

¹⁴³ Article 139(2) exempts the application of some provisions – among them in (c) and (d) the objectives and tasks of the ESCB as set out in the Articles 127(1) to (3) and (5) and 128 – for Member States whose currency is not the euro.

¹⁴⁴ The Eurosystem comprises the European Central Bank and the national central banks of the Member States whose currency is the euro; see Article 282 and Article 139(2)(c) and (d) TFEU.

3.2 Note-issue

3.2.1 A basic task of the ESCB

Article 128(1) TFEU gives the ECB the exclusive competence to authorise the issue of euro banknotes within the Union and empowers the ECB and the National Central Banks (NCBs) to issue such banknotes.¹⁴⁵ Article 128(2) provides that the volume of the issue of coins by Member States is also subject to approval by the ECB. As a result, the ECB was given control over the entire volume of cash supply – or rather: the supply of all forms of cash existing when the Treaty was drafted, signed and amended.¹⁴⁶

The privilege of note-issue is often referred to as the core task of central banks.¹⁴⁷ The Treaty drafters also originally listed it under the basic tasks, in Article 105(2) 4th indent of the EC Treaty, the predecessor of Article 127(2) TFEU.¹⁴⁸ However, in the course of the negotiations, it was cut off and dealt with separately in Article 105(4), which later became 128(1) TFEU.¹⁴⁹

One may wonder what the reason for this separation was. The explanation is provided by the materials on Article 3.1 of the Statute: The draft version of 3 July 1990 still listed the issuing of notes (now: banknotes) as a basic task. However, this caused uncertainty regarding the extent to which the NCBs would keep the possibility to issue domestic banknotes before a single currency would be available and even for a limited time at the beginning of Stage Three. Besides, the UK wished to permanently retain the right for some commercial banks in the UK to issue banknotes and – seemingly even more importantly – to keep the Queen's head on

¹⁴⁵ Regarding the constitutional dimension of this provision see *infra* Part 4.

¹⁴⁶ Unlike coins, only the issue of notes as such is subject to authorisation, not the volume of issuance. However, here too, the ECB must be able to influence the quantity since the volume is based on demand and limited where further issuance would endanger price stability: van den Berg Chapter 7 main texts after footnotes 178 and 198.

¹⁴⁷ See e.g. Lastra (2015) para 7.33 asking why it was not included in the enumeration of basic tasks.

¹⁴⁸ See Van Den Berg Carel C. A., *Making of the Statute of the European System of Central Bank: An Application of Checks and Balances*, Dutch University Press, 2005 and Purdue University Press, Amsterdam ([link](#)), Chapter 7 main text before footnote 193.

¹⁴⁹ See UEM/82/91; van den Berg (2005) Chapter 7 main text before footnote 199.

one side of euro banknotes issued by the Bank of England.¹⁵⁰ For these reasons, Article 16.2 was added to the Statute.¹⁵¹

In contrast to the other basic tasks, therefore, the provision on the issuance of notes contains a multi-level hierarchy of competence: At the apex, the ECB is *solely* competent to authorise the issue as such, as stated in the first sentence of Article 128(1) TFEU and Article 16.1 of the Statute, respectively. This includes the competence to allocate issuance quotas to the NCBs and the ECB itself. By contrast, the NCBs' competence to issue, as referred to in the second sentence of each of the two provisions, is only of a *derived* quality, since it depends on the ECB's authorisation of the quantity and the allocation of the quota. Finally, the concession¹⁵² granted in Article 16.2, according to which the ECB, when exercising its competence, must «respect as far as possible existing practices regarding the issue and design» of banknotes, does *not* reach the quality of a competence at all.¹⁵³ Lastly, coin issuance, subject to the ECB's authorisation of the quantity, remained a competence of the Member States. From this point of view, it was consistent to legislate on the issue of cash separately in Article 128 TFEU.

The concession made in Article 16.2 of the Statute remained quite marginal: The provision makes clear that just *existing* practices could be retained, and even these only *as far as possible*, i.e. to the extent that neither the singleness of monetary policy nor the objective of price stability would be compromised.¹⁵⁴ For these reasons, the issue of banknotes is to be understood as a basic task of the Eurosystem, with the ECB enjoying the sole competence to determine the quantum of issuance and the design.

3.2.2 The case for an e-banknote

However, the marginalisation of cash as described in Part 2 means that the public increasingly misses out on a range of benefits that public money provides: inclusion (in terms of access and pricing); privacy; credit-risk free value (including the

¹⁵⁰ See van den Berg (2005) Chapter 7 main text before and after footnote 178.

¹⁵¹ See van den Berg (2005) Chapter 7 main text before footnotes 178 (regarding Article 16.2), 155 and 205 (regarding Queen's portrait).

¹⁵² The materials speak of a «concession» that was to be more than a mere «(non-binding) Declaration»: van den Berg (2005) Chapter 7 main text between footnotes 202 and 205.

¹⁵³ Rather, it is a mere right to request with the responsibility of the ECB to follow the request if it is compatible with its policy. Insofar, it is more than a right to petition (which does not even require the addressee to listen or respond).

¹⁵⁴ See van den Berg (2005) Chapter 7 main text before footnotes 178.

possibility to opt out of the commercial banking system entirely); instant discharge of monetary debts; resilience (insensitivity to outages); and – above all – an issuer that is acting in the general interest.

This last point particularly needs further elaboration. If only private providers were left to supply the public with monetary objects in the future, the competition in which they have been involved up to now with central banks would be eliminated. By their very nature, private actors are generally stakeholder oriented, self-serving and profit-making institutions. This is not wrong by itself, but, as will be explained below, in the monetary area it has undesirable consequences due to a combination of circumstances:

First, in the absence of a public competitor (acting in the public interest), private actors will probably internalise the social costs of possible systemic disruptions even less than before.¹⁵⁵ A public actor, in contrast, is by virtue of its mandate inclined to subsidise the distributional network if necessary in order to *onboard* the public at large.¹⁵⁶ A public actor refrains from commercialising user *data* for data protection reasons alone, but also as its «business model» does not derive profit from marketable data¹⁵⁷ (let alone is predominantly based on it).¹⁵⁸ Moreover, ideally, a public actor preserves the *value* of its monetary objects by subjecting their issuance to a price stability goal¹⁵⁹ and investing in security in advance to prevent operational failure. It can do so easily because it is self-financing from seignorage and the

¹⁵⁵ See Mancini-Griffoli et al (2020) pp. 11-12.

¹⁵⁶ The mere fact that banks had to be forced by law to open payment accounts with basic features (via Directive 2014/92/EU, not applying to SMEs, though) shows that if free to decide, they only take on «profitable» customers.

¹⁵⁷ See Garrat/von Oordt (2019) *passim*.

¹⁵⁸ Armelius Hanna/Boel Paola/Clausen Carl Andreas/Nessén Marianne, *The e-krona and the macroeconomy*, in: Special issue on the e-krona, Sveriges Riksbank Economic Review 2018:3 ([link](#)) 43-65, p. 14; Mancini-Griffoli et al (2020) p. 11; BIS, *Special feature on payments*, BIS Quarterly Review 2020, p. 95; Wierds/Boven (2020) p. 11; see also *infra* Section 4.5. On the other hand, private business models' key motive may well be to obtain payment data from users, whether or not to combine those with earlier collected data: Wierds/Boven (2020) p. 11; see also Hofmann (2020) pp. 48, 50, 56 referring to big tech and data giants.

¹⁵⁹ Hofmann (2020) p. 53 and footnote 66. See in contrast the tendency towards over-issue under the profit-maximising goal of the commercial banks in case without convertibility: Lastra (2015) para 2.20; Herrmann (2010) pp. 324 et seq. with further references; Klein Benjamin, *The competitive Supply of Money*, in: *Journal of Money, Credit and Banking*, 1974, 423, pp. 424 and 426 ff.

proceeds of its foreign and monetary reserves and enjoys budgetary autonomy, meaning that, although the law may require an efficient allocation of resources,¹⁶⁰ it is not obliged to maximise profits for delivery to the government (financial dimension of central bank independence).¹⁶¹ It can be expected that a public actor will design digital equivalents of its cash in such a way that debts can be discharged with it *instantly*¹⁶² and with *finality* – as is the case with physical cash.

Second, competition between several private providers will not suffice to keep the quality of the monetary objects at high levels. This is due to the fact that payment systems «tend to become natural monopolies, reflecting strong network externalities (the value of using a given payment network is greater the larger the user community, including savings from netting transactions), economies of scale (decreasing average costs, including high fixed development and maintenance costs), and economies of scope, (gains from aggregating data to provide additional services)». ¹⁶³ The resulting market concentration will bar new firms from entering the market, stifle incentives for further innovation, make it obsolete for the dominators to internalise social costs and entice them to charge unjustifiably high fees for their services. ¹⁶⁴

Third, the market is characterised by genuine agility. The mechanisms described can therefore not be dealt with by regulation alone. Regulatory procedures are too slow and complex and their outcome is too rigid to fully cover future development. Often, regulation has unforeseen adverse side-effects and ties up forces for monitoring and enforcement that could otherwise be deployed in a productive manner.¹⁶⁵ Likewise, the introduction of fast payment systems will not suffice,¹⁶⁶ as this only improves the

¹⁶⁰ See Article 127(1) TFEU.

¹⁶¹ For the Eurosystem see Chapter 6 of the Statute and Article 282(3) TFEU; Lastra (2015) paras 2.131, 7.82-83.

¹⁶² Conversely, the experience of cross-border payments serves as an example for what happens, if the banking industry benefits from a monopoly in an area: payments take days and are most expensive, especially for the weakest players: Hofmann (2020) p. 40. See also Mancini-Griffoli et al (2020) p. 11 with reference to monopolistic private issuers.

¹⁶³ Mancini-Griffoli et al (2020) p. 11 with further references.

¹⁶⁴ Armelius/Guibourg/Levin/Söderberg (2020) p. 13. See also their definition of network effect and externalities on pp. 11 and 13.

¹⁶⁵ Armelius/Guibourg/Levin/Söderberg (2020) p. 15. In support of antitrust regulations and data protection legislation: Mancini-Griffoli et al (2018) p. 20. For another dissenting opinion see *supra* footnote 221.

¹⁶⁶ In this sense Mancini-Griffoli et al (2018) p. 12.

payment landscape, but does not cover the public's need for and right to a risk-free store of value.

The above leads to the conclusion that cash issuance is not merely a right granted to the public authorities. It is also accompanied by a duty to make use of it which cannot be fully waved or delegated. The issuance of cash is the provision of a public task in the general interest. However, if Article 128(1) TFEU were to be interpreted narrowly, the fulfilment of this task will soon become impossible. The ever-increasing digitalisation of our society inevitably means that physical cash will no longer be able to fulfil its intended functions in the future. Article 128(1) TFEU should therefore be interpreted in such a way that the competences in terms of note-issue also include a digital functional equivalent of the paper banknote.

Finally, the fact that the use of cash is dwindling must not be taken as evidence that the public does not actually need or value the benefits mentioned above (any longer). It is rather due to the digitalisation of ever more aspects of life (as well as cash-restricting regulations) that the use of cash is becoming increasingly inconvenient and even cumbersome. For a growing group of actors the disadvantages of physical cash start outweighing the advantages, even though the latter are valued and worth protecting. This group then only make an exception in extreme cases (as highlighted by the flight to cash during the financial crisis and recently upon the outbreak of the Covid-19 pandemic again). But this cannot be a justification for a fade out of cash without equivalent replacement. Rather, it is the ECB's duty to use its (implied) powers¹⁶⁷ and continue to make the advantages of state-issued cash available to the public in the future – in a digital form, adapted to the technical realities of our society.

3.3 Monetary policy

3.3.1 Preconditions

3.3.1.1 Monetary value and its expression

In the following, we argue that the fulfilment of the tasks listed in Article 127(2) TFEU, and in particular the conduct of monetary policy, requires as an essential

¹⁶⁷ See *infra* Part 4.

precondition the issue of cash as provided for in Article 128 TFEU – or more generally, the issue of base money for the public with selected functions.¹⁶⁸

Today, price stability is recognised as a public good that contributes to broad-based prosperity, including a high level of employment and efficiency in a market economy.¹⁶⁹ Accordingly, the Treaty assigns overriding importance to this objective.¹⁷⁰ In practice, the prices that consumers pay for (a representative basket of) goods and services should remain reasonably stable over time. But what is the subject-matter of the price anyway? Ultimately, it expresses the monetary value of all kinds of economic objects. However, this expression involves several elements, among them most notably: a currency unit; monetary objects; technical nominalism; and uniformity of money.

To begin with, a working unit of account is needed with which monetary value can be measured and expressed.¹⁷¹ It is this unit or denominational standard that is called the *currency unit*. Within the Eurosystem, it is the euro, divided into 100 cents.¹⁷²

It must be distinguished from so called *monetary objects*. The latter comprise all objects, including tangible and intangible symbols and records that represent the currency unit as well as its quantity. Such representation is needed to make the abstract monetary value perceptible – in an attributable, permanent, authentic and integer way.¹⁷³ The most important monetary objects today are coins, banknotes and book money.¹⁷⁴ Today, the main two types of the latter are reserves held with central banks and deposits held with commercial banks.

¹⁶⁸ As such stand out: public access, privacy granting, credit-risk free, instantly discharging (free of claims and defences), underlying of all secondary money denominated in the single currency unit, resilience, public-interest oriented issuer.

¹⁶⁹ Armelius/Guibourg/Levin/Söderberg (2020) p. 8.

¹⁷⁰ Lastra (2015) para 7.28.

¹⁷¹ Armelius/Guibourg/Levin/Söderberg (2020) p. 9.

¹⁷² Article 2, Regulation 974-98 of 3 May 1998.

¹⁷³ Attributability means that a statement (regarding unit and quantum) can be related to a legal subject (here the issuer), permanence makes the attributable statement reproducible independent of place and time, authenticity means that the statement is made by the authorised legal subject (excluding counterfeiting and unlawful usurpation of issuance) and integrity is given if no unauthorised change can be made (excluding falsification of counterfeiting).

¹⁷⁴ Book money is not to be confused with the many different ‘access objects’, such as debit and credit cards, which provide only power of control and disposal over monetary

Furthermore, *nominalism* must be ensured: market participants should be able to rely on a monetary object being accepted at its face value.¹⁷⁵ For this purpose, it must ideally be completely risk-free. Otherwise, risk results in a premium, thus reducing the real value of the monetary object. Thereby, commercial transactions would become considerably less efficient, since risks and the real value of a monetary object would have to be determined before any business could be conducted. If a monetary object nevertheless contains a risk, it has to be neutralised as far as possible by taking countermeasures (to be discussed shortly). This applies all the more so if several monetary objects of the same currency unit co-exist in an economy, since no uniformity of money could be achieved otherwise.

It is precisely the *uniformity of money* that is a further, indispensable prerequisite:¹⁷⁶ All monetary objects of the same currency must circulate at their nominal value, i.e. at par.¹⁷⁷ This is not self-evident if the monetary objects have different issuers. If uniformity of money could be reached, this would again lead to undesirable friction for the economy, as market participants would first have to compare the 'intracurrency' exchange rates. Furthermore, following Gresham's law, they would rather hoard lower-risk money objects and spend higher-risk ones as quickly as possible, or, even worse, not accept them at all, thereby impairing liquidity in the market.

objects without being such objects themselves. Over time, however, some access objects have merged into monetary objects, including banknotes (which originally simply provided access to coins).

¹⁷⁵ Vischer Frank, *Geld- und Währungsrecht im nationalen und internationalen Kontext*, Helbing Lichtenhahn Verlag, 2010 Basel, p. 49.

¹⁷⁶ Armelius/Guibourg/Levin/Söderberg (2020) p. 1 with further references in footnote 2 and pp. 10-12.

¹⁷⁷ See e.g. ECB, *The Payment System: Payments, Securities and Derivatives, and the Role of the Eurosystem*, Frankfurt a.M., 2010 ([link](#)), p. 45; Söderberg Gabriel, *Why did the Riksbank get a monopoly on banknotes?* In: Special issue on the e-krona, Sveriges Riksbank Economic Review 2018:3, 6-16, p. 8 et seq. on the triggering factors for introducing state-backed banknotes; Gorton Gary, *Misunderstanding Financial Crises: Why We Don't See Them Coming*, Oxford University Press, Oxford 2012, p. 19; Armelius Hanna/Clausen Carl Andreas/Hendry Scott, *Is central bank currency fundamental to the monetary system?* in: Second special issue on the e-krona, Sveriges Riksbank Economic Review 2020:2 ([link](#)) 19-32, pp. 26 et seq.

3.3.1.2 Exogenous levelling factors

As mentioned, for a monetary object to circulate at nominal value, it must in principle be completely risk-free. Yet, the monetary objects commonly used today involve different risks, among them credit risks and liquidity risks. The reason for this lies in the composition of the monetary aggregate M1. It consists of those monetary objects that can instantly be used as means of payment and influence prices accordingly. Banknotes and coins form only a small part of M1,¹⁷⁸ with deposits held with commercial banks (hereinafter deposits) representing the bulk.¹⁷⁹ Since banknotes are no longer redeemable, they have lost their claim-check nature and with it the inherent risk of default.¹⁸⁰ Similarly, the central bank can theoretically issue additional banknotes at any time – thus, in principle, they do not give rise to any liquidity risk. Not surprisingly, banknotes circulate today at their face value.¹⁸¹

In contrast, deposits consist of debts of individual entities whose balance sheets back these debts not only with CeBM (as it would with 100% reserve banking of narrow banks) and other standardised and immediately monetisable assets. Rather, the asset side of the balance sheet also consists of a considerable quota of individual credit claims with incongruent maturities. Nevertheless, deposits are perceived and accepted by the public as a means of payment and store of value of uniform quality – both in comparison with each other and with credit risk-free public money.

There are various levelling factors that can help to achieve such fungibility of deposits, but experience shows that their combination is most effective. The set of factors discussed here are of an exogenous nature in that they all lie outside the monetary objects themselves. The first is to put strong measures in place that enforce contracts. This compels each bank to keep its deposit promises, but also strengthens

¹⁷⁸ See supra footnotes 13 et seq.

¹⁷⁹ Others being comparably liquid assets such as transaction accounts or travellers' cheques.

¹⁸⁰ See Zellweger-Gutknecht Corinne, *Developing The Right Regulatory Regime for Cryptocurrencies and other Value Data*, in Fox David/Green Sarah (eds.), *Cryptocurrencies in Public and Private Law*, Oxford, OUP 2019, paras 4.06 et seq. and especially 4.44: «banknotes nowadays can only be exchanged for other banknotes of the same total face value. [This] never leads to any form of repayment». What has remained though (and is actually addressed with the price stability mandate embedded in a protecting institutional framework) are inflation and exchange rate risk.

¹⁸¹ Originally, banknotes were issued in the form of promissory notes by commercial banks and thus covered by the issuing bank's balance sheet. Due to the associated individual credit risk, they circulated at different values; see e.g. Gorton (2012) p. 17.

the asset side of its balance sheet by urging its own debtors to meet their obligations. Here, trust and the deriving levelling effect rest on the *rule of law*.¹⁸²

Second, various *forms of assistance* are conceivable when financial problems arise: illiquidity can be bridged by a lender of last resort (LoLR) facility, while in the event of insolvency, guarantee schemes take effect. However, often it is not possible in practice to decide in due time whether a bank is illiquid or already insolvent. This implies some moral hazard, since a bank could hope to be kept on a lifeline even though its economic conduct would require resolution or liquidation. Deposit protection schemes are not without their problems either: they extend to a maximum limit for each individual depositor and are not designed to remedy systemic crises. In most countries, pre-financing by the banking sector is (still) insufficient. In the case of a state guarantee, depositors ultimately cover their lost deposits with their own tax money, which seems as unsatisfactory as an open bail-out by the government: both burden the public with the risks banks are exposed to, while leaving potential profits with the bank. In the past, states have repeatedly rushed to help failing systemically relevant banks,¹⁸³ and proof that legal prohibitions adopted in response to the bail-outs in the recent financial crisis will be observed in the future has yet to be provided.

Third, in order to avoid bank failures and bail-outs, deposits are safeguarded by means of *regulation, authorisation and supervision*.¹⁸⁴ Regulatory frameworks typically prescribe minimum liquidity coverage ratios (LCR), minimum capital levels, minimum reserves, maximum leverage ratio, accounting standards, disclosure standards etc. They also address settlement finality, recovery, resolution, supervisory mechanisms and authorisation requirements for credit and e-money

¹⁸² Bank of Canada (2020) p. 4; Armelius/Clausen/Hendry (2020) p. 23. The latter attribute in theory the same effect to performance histories (since debtors would then try not to default in order to avoid negative track records that would impair future business opportunities). But in practice, they concede that information deficiencies will remain due to time lags and limited access to such histories.

¹⁸³ In England, the practice was for quite some time until the 1990s even not to let fail any financial institution: Capie Forrest/Wood Geoffrey, *The development of the Bank of England's objectives: evolution, instruction or reaction?* In: Conti-Brown Peter/Lastra Rosa María (eds.), *Research Handbook on Central Banking*, Edward Elgar Publishing, Cheltenham/Northampton 2018, 34-52, p. 46.

¹⁸⁴ For the concepts and objectives of bank regulation see Goodhart Charles, *Financial regulation*, in: Eijffinger Sylvester/Masciandaro Donato (eds.), *Handbook of central banking: financial regulation and supervision after the financial crisis*, Edward Elgar Publishers, Northampton 2011, pp. 328-336.

institutions.¹⁸⁵ Moreover, instant payment methods and the public's increased education regarding the entire safety net may further enhance trust in the banking system and its deposits.¹⁸⁶

3.3.1.3 Endogenous levelling factor (and the case for an e-banknote)

However, ultimately, the most decisive factor securing parity between deposits and CeBM is of an endogenous quality: it is the claim-check nature of deposits and, as a consequence, their convertibility on demand into CeBM (or rather the notional possibility to convert).¹⁸⁷ The uniformity of money is assured, on the one hand, because all deposits are convertible into *cash* at par value – thereby, in the perception of the public, one commercial bank's deposits become convertible into another commercial bank's deposits independent of the issuer.¹⁸⁸ It is the «demandability clause»¹⁸⁹ and with it people's confidence «that they can convert it on demand to the liability of another commercial bank or the central bank»¹⁹⁰ which levels these monetary objects, thus making them fungible.

On the other hand, commercial banks usually settle their mutual claims with *reserves*, thereby abolishing the credit risk and removing the liquidity risk.¹⁹¹ Thus, in the event of an electronic customer payment, once the payer's bank has transferred reserves in the amount concerned to the payee's bank, the latter can credit its customer's account.¹⁹² If, instead, the payee's bank were to grant an interbank loan to the payer's bank, the former would have to assess (and price) the individual

¹⁸⁵ LCR: Delegated Regulation (EU) 2015/61 supplementing Regulation (EU) No 575/2013; capital: Regulation (EU) No. 575/2013; reserves: Article 19 of the Statute; Regulation (EC) No 2531/98 of 23 November 1998 and Regulation (EC) No 1745/2003.

¹⁸⁶ Armelius/Clausen/Hendry (2020) p. 28.

¹⁸⁷ Fox (2016) p. 134.

¹⁸⁸ Armelius/Clausen/Hendry (2020) p. 26 with further reference; Brunnermeier/James/Landau (2019): safety of private money convertible into central bank money is independent of the issuer.

¹⁸⁹ Andolfatto David, *What is Money? How is it Created and Destroyed?* Simon Fraser University, January 2009, p. 14.

¹⁹⁰ Brainard Lael, *Digital Currencies, Stablecoins, and the Evolving Payments Landscape*, Speech 16 October 2016, The Future of Money in the Digital Age, Conference, Washington D.C. ([link](#)), p. 3.

¹⁹¹ See CPMI/IOSCO, *Principles of Financial Market Infrastructures*, report, September 2012, p. 7 footnote 6; Armelius/ Guibourg/Levin/Söderberg (2020) p. 9.

¹⁹² See the example in Armelius/Clausen/Hendry (2020) p. 27.

creditworthiness of the latter. This could lead to a risk premium¹⁹³ on the customer's credit balance, thereby destroying the uniformity of money.

However, settlement with reserves minimises only the risks among banks. Customer deposits, in contrast, remain exposed to the individual credit and liquidity risk of their bank. Only banknotes offer a certain degree of protection against these risks – but they are now in danger of disappearing. This must not be accepted by the monetary authorities. Even if the exogenous factors described above are in place, it is at least an open question whether they are sufficient to prevent future banking crises. Historical experience speaks against it. Recent regulatory adjustments do not necessarily change this assessment, as market players have always found ways to circumvent regulation.¹⁹⁴ Even worse, with the use of cash, an important factor with a moderating effect on the banking sector is in danger of disappearing in the future.

For this reason, the ECB should fill the gap that threatens to arise from the marginalisation of banknotes by the issuance of an electronic cash-equivalent. Only a credit risk-free monetary object such as cash, whether physical or digital, issued by the public sector and serving as underlying redeemable for deposits can have a levelling effect on deposits in two further ways – from the perspective of both depositors and banks:

Depositors get a *sense of control* when, thanks to cash, they are able to withdraw their money from a bank whose solvency they doubt.¹⁹⁵ But the sense of control extends even further, since, unlike when deposits are withdrawn by transfer, cash-out allows customers to leave the banking system as a whole if they are in doubt about systemic stability. Depositors do indeed make use of this option, as is shown by the fact that after the collapse of Lehman, the Bundesbank alone issued as many EUR 500 banknotes in one month as in the entire year before.¹⁹⁶ Without cash, the public would have no alternative course of action, as even a shift into AAA government bonds of their own currency would not be equivalent. Only cash is of such a nature that it can be used at any time both to retain value without credit risk and to make payments. As behavioural studies show, the willingness of people to (continue to)

¹⁹³ This was precisely the case with banknotes issued by private banks during periods of free banking and one of the reasons for the termination of the latter.

¹⁹⁴ Riksbank (2018) p. 12; Armelius/Guibourg/Levin/Söderberg (2020) p. 15 enlisting a number of potential disadvantages that would come with further regulation.

¹⁹⁵ See Wierst/Boven (2020) p. 14: «a euro (...) exchangeable 1:1 for private money (...) bolsters confidence in the monetary system».

¹⁹⁶ Weidmann Jens, *Eröffnungsrede*, in: Deutsche Bundesbank Eurosystem (ed.), 3. Bargeldsymposium der Deutschen Bundesbank 2016, Frankfurt Juli 2016, 9, p. 13.

expose themselves to risk increases the more they have (or believe to have) control over an event.¹⁹⁷

At the same time, cash also has a *disciplining* effect on banks, because with unsustainable management, they must expect depositors to withdraw their deposits.¹⁹⁸ If depositors for lack of cash could only make transfers, this preventive effect would be far weaker. As has been shown, depositors then have no real alternative. Deposits without a redemption obligation would become fiat money of their own kind for the public – although the issuers of this fiat money do not primarily pursue public welfare but their own interests.¹⁹⁹ This might result in a tendency for the entire banking sector to gradually over-extend the creation of credit (not in the sense that there would be inflation, but that also credit demand of poor debtors would be covered and asset bubbles financed, thus over time destabilising the financial system dearly needed for the conduct of monetary policy).²⁰⁰

To sum up, cash, as the primary form of money and the underlying asset with which deposits can be redeemed, plays a paramount role as a trust-building anchor and disciplining instrument.²⁰¹ When it disappears in its physical form, the resulting gap should not remain open, but the function should be taken over by an e-banknote. Even if the latter (like cash) is associated with the risk of bank runs,²⁰² chances are good that there will never be such run because of the preventive effect, or because at least recovery measures can be taken before the situation becomes dire because depositors have kept their deposits with the bank(s) concerned thanks to a sufficient sense of control.

¹⁹⁷ See Armelius et al (2020) pp. 29 et seq.

¹⁹⁸ See for the last financial crisis e.g. Wierts/Boven (2020) pp. 13-14.

¹⁹⁹ See also Wierts/Boven (2020) p. 13: «the dependency of citizens and businesses on the banking sector would increase. ... If there were no public alternative for the private euro, the value of private money would not be linked to the public euro one-to-one.»

²⁰⁰ Insofar we deviate from Armelius et al (2020) p. 24 who only address (and rightly deny) the inflationary risk.

²⁰¹ See e.g. Norges (2018) p. 17; also Söderberg (2018) p. 11 regarding the redeemability of private banknotes for Riksbank banknotes in the 19th century.

²⁰² See *infra* Subsection 4.4.6.

3.3.2 Transmission

3.3.2.1 Mechanism

Cash thus not only preserves the uniformity of money in terms of deposits, but also contributes to the qualitative level of the deposit-issuing banks. The latter is equally important since commercial banks play a cardinal role in the transmission of monetary policy,²⁰³ which is now briefly described.

In order for the ECB to fulfil this core mandate, i.e. to use monetary policy to guarantee stable prices in the real economy, a so-called transmission mechanism is required, which deploys over several stages: at the beginning, a monetary policy decision is taken (e.g., to help closing a production gap in the real economy). Next, the *setting* of an appropriate monetary policy instrument is *changed* accordingly (e.g., the repo rate is reduced). In other words, the ECB alters the conditions of its monetary policy operations,²⁰⁴ which it conducts with its counterparties. According to Article 19.1 of the Statute, the eligible counterparties basically consist of credit institutions.²⁰⁵ Therefore, at this stage, financially sound banks are indispensable, at least under the current concept.

The adjustment in monetary policy operations ultimately increases or decreases the counterparties' reserves and influences the conditions under which they lend and borrow money in financial markets.²⁰⁶ This passes through to changes in the interest rates and prices of financial market assets. Finally, via a range of transmission channels (e.g., the – both key – bank deposit and lending rate, but also real interest rate, expectations etc.), the financial market movements are passed through to the real economy (spurring demand for financing for additional production in order to meet the demand which, in our simplified example, would otherwise have led to an undesired price increase).²⁰⁷

²⁰³ Hofmann (2020) p. 52.

²⁰⁴ By providing standing facilities and entering into open market operations; Nessén et al (2018) pp. 32-34.

²⁰⁵ ECB, *The Implementation of Monetary Policy in the Euro Area*, September 2006 ([link](#)), p. 11.

²⁰⁶ Wierds/Boven (2020) p. 20.

²⁰⁷ See e.g. Armelius Hanna/Boel Paola/Clausen Carl Andreas/Nessén Marianne, *The e-krona and the macroeconomy*, Sveriges Riksbank Economic Review 2018:3, p. 52; Meaning/Dyson/Barler/Clayton (2018) p. 15.

3.3.2.2 The case for an e-banknote

In this context, an e-banknote could assume different functions. To begin with, depending on its design, the e-banknote could serve as a *source of information* by maintaining or even enhancing the ECB's ability to collect financial data in real time.²⁰⁸ However, since this can at most be an auxiliary reason for the introduction of an e-banknote, as the possible advantages are outbalanced by quite considerable risks,²⁰⁹ it will not be dealt with in more detail.

In the most extensive scenario, an e-banknote could be used as an *instrument* that generates itself monetary policy impulses. To this end, it would be designed to be interest-bearing and/or have other variable features. The ECB would then be in a position to manage its demand via the interest rate charged or paid. This will be further discussed (and rejected) in Subsection 3.3.3.

Finally, e-banknotes could be designed in a cash-like way with no variable elements. If so, they would qualify as a so called *autonomous factor*, since the amount issued is not controlled by the ECB but based on public demand.²¹⁰ Such a step may be necessary, in particular, to prevent or reduce the switch of the public to funds not denominated in euro.²¹¹ The latter could impair the transmission mechanism just described, prompting the ECB and other central banks to loosen monetary policy control.²¹² Hence, the e-banknote would not be a monetary policy instrument itself, but – once more – an essential prerequisite for the effective use of such instruments.²¹³ This needs to be further elaborated.

²⁰⁸ Bergara Mario/Ponce Jorge, *Central Bank Digital Currency: The Uruguayan E-Peso Case*, in: Gnan Ernest/Masciandro Donato (eds.), *Do we Need Central Bank Currency? Economics, Technology and Institutions*, Société Universitaire Européenne de Recherches Financières, 2018, 82-90, p. 90: «with e-Peso monetary policy analysis will dispose of granular information in real time, which is not available with physical cash. This should improve the efficiency of day-to-day monetary operation»; Kiff et al (2020) p. 11 with further reference: «CBDC could (...) tap more granular payment flow data to enhance macroeconomic projections».

²⁰⁹ Kiff et al (2020) pp. 13-14.

²¹⁰ Nessén Marianne/Sellin Peter/Asberg Sommar Per, *The Implications...*, Sveriges Riksbank Economic Review 2018:3, 29, pp. 32-34.

²¹¹ See supra Subsection 2.1.4.

²¹² Adrian/Mancini-Griffoli (2019) p. 9.

²¹³ See also Keller Christoph, *comments vor Article 17-24*, in: Siekmann Helmut (ed.), *EWU Kommentar zur Europäischen Währungsunion*, Mohr Siebeck, Tübingen 2013, para 16 (translated): the banknote monopoly [is] one of the main pillars of the demand for central bank money and thus for the operational business of central banks («*das*

As explained, it is questionable whether parity between deposits and CeBM can be maintained without any cash at all and only with clearing and settlement in reserves.²¹⁴ But even if this view were to prevail,²¹⁵ it would be too short-sighted. As has been shown, several reasons could lead to a situation where the public will make fewer and fewer payments denominated in euro.²¹⁶

Under these circumstances, not only the demand for bank loans will decline, but all interbank customer payments – thus reducing the banks' need for clearing and settlement in CeBM. Neither will prudential liquidity requirements have a stabilising effect on the quantum of reserves required, as they are based on the expected future outflow of deposits. As a result, the banks will be demanding fewer and fewer reserves.

Admittedly, banks cannot reduce the total amount of reserves available in the system on their own. This is because liquidity needs of the banking system as a whole are governed by open market operations initiated by the central bank.²¹⁷ Yet, if reserve turnover collapses, this massively impairs the central bank's ability to act. After all, «reserves are also a monetary policy tool».²¹⁸ This is so because, as seen, the central bank steers the condition of its provision and sterilisation by transacting with its counterparties, the commercial banks.²¹⁹ This, however, amounts to a pushing the rope, if the latter neither demand new nor use their existing reserves.

Banknotenmonopol [ist] einer der Stützpfeiler für die Nachfrage nach Zentralbankgeld und damit für das operative Geschäft der Zentralbanken»).

²¹⁴ See supra Paragraph 3.3.1.3.

²¹⁵ See e.g. Wierts/Boven (2020) p. 13: «This channel [i.e. the exchange of commercial banks' claims on other banks for balances in the reserve accounts with the central bank] does not depend on the use of cash by the general public and continues to exist even if general purpose CBDC is not introduced.»

²¹⁶ See supra Section 2.1: because the public only (1) saves or hoards them; (2) prefers monetary objects in a non-domestic denomination or (3) uses monetary objects denominated in euro, whose acceptance, though, no longer depends on redeemability.

²¹⁷ As opposed to standing facilities, which regulate the liquidity needs of individual banks at their initiative. See e.g. BIS CPMI/MC (2018) p. 11: «The central bank may ... manage the total amount of central bank money outstanding through liquidity-providing and liquidity-absorbing open market operations; Nessén et al (2018) pp. 30-31.

²¹⁸ Armelius/Guibourg/Levin/Söderberg (2020) p. 9.

²¹⁹ See in detail ECB (2006) pp. 14-33.

Finally, monetary policy would also be impaired if the growing use of monetary objects in foreign or own denominations led to prices and wages being quoted in this way. The latter would remain unaffected, if the Eurosystem were then to try to influence the exchange rate to accommodate monetary conditions in times of negative macroeconomic shocks.²²⁰

Such a scenario must be avoided. To this end, the public in the euro area should be provided with digital monetary objects denominated in euro that are sufficiently attractive to prevent the migration out of the currency as outlined above. As can be seen below, however, the traditional privately issued deposits will most probably not suffice for this purpose. Rather, the introduction of a state-issued e-banknote will be required.²²¹

However, the above should not make us forget that cash and especially banknotes must not be reduced to their indirect functions just described. The Treaty drafters clearly wanted cash first and foremost to be used for its very characteristic primary purposes: a means of payment and store of value. This is shown unmistakably by the fact that cash issued by the state or one of its agencies and denominated in euro has been given legal tender status.²²²

3.3.3 Instrument

3.3.3.1 Pass-through of policy rate

Some economists would welcome a digital form of public money for the general public being designed in such a way that it could itself be used as an instrument of monetary policy.²²³ The most important variable design feature for this purpose would be the possibility to pay or collect interest. The introduction of limits would be another obvious possibility (be it limits per person, per transaction or overall and

²²⁰ Armelius/Guibourg/Levin/Söderberg (2020) p. 13 give a corresponding example for Sweden.

²²¹ Dissenting Hofmann (2020) pp. 58 et seq., who considers regulatory promotion of the convenience of deposits to be sufficient.

²²² See Article 128(1) third sentence TFEU (euro banknotes issued by central banks) and xxx [regulation re coins].

²²³ See e.g. Agarwal Ruchir/Kimball Miles, *Breaking through the Zero Lower Bound*, IMF Working Paper WP/15/224, 2015; xx.

as an alternative or in combination with interest). Both would allow the central bank to govern the public's demand.²²⁴

The policy options which this opens up for the central bank can be divided into several groups. First, there is the expectation that an interest-bearing rCBDC might make monetary policy more effective through improved pass through of policy rate changes.²²⁵ This would be because, if the central bank raises both its policy rate and interest rates on rCBDCs and the public has a choice between the latter and deposits, banks would be forced to raise interest rates by a comparable amount,²²⁶ if they wanted to avoid an outflow of deposits to rCBDC.²²⁷

However, as especially the BIS rightly pointed out, it is «not clear that the pass-through of the policy rate needs strengthening».²²⁸ Besides, it is not compatible with a free market economy for the central bank to impose interest rates as a sovereign act – and it would be equally undesirable to try to come close to this effect through indirect means.

3.3.3.2 Alleviate the effective lower bound constraint

Second, it is presumed that issuing interest-bearing rCBDC might help to alleviate the effective lower bound constraint – although only if cash were abolished or made costly simultaneously.²²⁹ The effective lower bound (ELB) describes the floor for

²²⁴ Cit. Nessén Marianne/Sellin Peter/Asberg Sommar Per, *The implications of an e-krona for the Riksbank's operational framework for implementing monetary policy*, Sveriges Riksbank Economic Review, 2018:3, 29-42, p. 34.

²²⁵ See e.g. Armelius/Boel/Clausen/Nessén (2020) p. 52; Meaning et al (2018) p. xx.

²²⁶ Better service could outweigh a (small) part of the interest.

²²⁷ Nessén et al (2018) p. 35.

²²⁸ BIS CPMI/MC (2018) p. 10.

²²⁹ Kiff et al (2020) p. 13; Rogoff Kenneth, *Costs and Benefits to Phasing Out Paper Currency*, NBER Working Paper 20126, National Bureau of Economic Research, Cambridge MA 2014 ([link](#)), passim; Bordo Michael D./Levin Andrew, *Digital Cash: Principles and Practical Steps*, National Bureau of Economic Research Working Paper No. 25455, 2019 ([link](#)). See also Ben S. Bernanke, *How big a problem is the zero lower bound on interest rate?* Hutchins Center on Fiscal & Monetary Policy at Brookings, 12 April 2017 (explaining that «the scope for rate cuts is limited by the fact that interest rates cannot fall (much) below zero, as people always have the option of holding cash, which pays zero interest, rather than negative-yielding assets.» and positing, «Although the Fed was able to further ease monetary policy after 2008 through unconventional methods, the ZLB constraint greatly complicated the Fed's task.»). But see Tyler Cowen, *Did the zero lower bound matter?* Marginal Revolution, 14 May 2019 ([link](#)) with further reference.

nominal interest rates. It lies a few decimal points below zero as it corresponds to the costs incurred by holding non-interest-bearing cash (instead of reserves), including expenses for storage, insurance, transport, etc.²³⁰ Holding an interest-free rCBDC would probably be costless. It is therefore feared that the ELB would raise to close to zero in the future, since monetary policy counterparties may opt to hold rCBDCs rather than reserves, thereby circumventing the central bank's monetary policy interest rates²³¹ and preventing the central bank from using negative interest rates on its monetary policy instruments.²³²

Since 2011, several central banks have introduced negative interest rate policies.²³³ The motives vary. Mostly, they aim to encourage banks to increase their lending to the real economy. Partially, they also seek to protect safe haven currencies, such as the Swiss franc and Danish krone, from unwanted further inflows.²³⁴ Almost ten years after their introduction, the low interest rates have spread to more and more parts of the economy and the associated side effects are becoming more tangible: The interest margins of banks are eroding, as are those of institutions forced by law to make low-risk investments, such as pension funds. Other actors are urged to make ever riskier investments in companies and states, some of which are already deeply indebted. As a result, debtors that are structurally unable to survive continue to be financed. Since there are also governments among the debtors, the conflict of interests of the central banks that control the interest rates is as obvious as it is inevitable.

At the same time, robust evidence of the positive effects of low interest rates has been rare to date. Besides, although the lower rates measures were expressly

²³⁰ Nessén et al (2018) p. 36; Nabilou (2019) p. 11.

²³¹ Nessén et al (2018) p. 35.

²³² Nessén et al (2018) pp. 36-37.

²³³ The rate on the deposit facility, which banks may use to make overnight deposits with the Eurosystem has been first been set below zero in June 2014 ([link](#)). The Swiss National Bank applied negative repo rates on from August 2011 to May 2012 (SNB Annual Report 2011, pp. 48-49 and 2012 pp. 43 and 45); since January 2015, the interest rate on reserves has been negative ([link](#)). For further references see Viñals Jose/Gray Simon/Eckhold Kelly, *The Broader View: The Positive Effects of Negative Nominal Interest Rates*, IMF Direct, 10 April 2016 ([link](#)).

²³⁴ See also Zellweger-Gutknecht, *Negativzins: Vergütung für die Übernahme des Geldwertrisikos durch den Kapitalnehmer*, Zeitschrift für die gesamte Privatrechtswissenschaft, 2015, 350-376, pp. 362 et seq.

described as temporary measures,²³⁵ their end, almost a decade after their introduction, is not foreseeable. Instead, open consideration is being given to designing rCBDC in a preventive manner so that the policy could be continued. Moreover, it is questionable whether the envisaged objective – that monetary policy counterparties cannot circumvent the central bank's interest rate policy – could not also be achieved by milder means, namely by prohibiting counterparties from holding rCBDC (whether as legal or beneficial owners). Since all of them are regulated institutions, this measure should be enforceable.

Furthermore, negative interest rates are tantamount to taxation, at least in economic terms.²³⁶ The strict principle that any tax must have a firm basis in law could be avoided up to now, as negative rates were only directly applied to monetary policy counterparties based on contractual agreements on the open market or within the framework of facilities which the banks use on their own initiative. However, such 'validation' is unlikely to be available when issuing rCBDCs in the performance of a public task. Also, negative interest rates would have to be weighed against the property guarantee. In addition, it could counteract the purpose of price stability, since, with stable prices, the basket of goods that can be purchased with a sum of money would – after deduction of interest – decrease.

Apart from this, imposing negative interest rates would be psychologically difficult for the depositors to bear and «could give rise to public resentment and would make its introduction politically inexpedient».²³⁷ However, this must not be avoided by the preventive building in of an interest feature. Since experience shows that what can be used will be used (preferably at first in exceptional circumstances), not only the use but already the technical preparation of such use requires a sufficient legal basis. This is precisely what is missing *de lege lata* for the issue of an e-banknote, since there is no doubt that physical cash has always been interest-free.

²³⁵ See e.g. Mersch Yves, *The causes of monetary policy measures and their impact – a review*, Speech at the Euro Finance Week, FAROS Institutional Investors Forum, Frankfurt, 17 November 2016 ([link](#)).

²³⁶ The idea of «taxing currency» (Rogoff [2014] p. 1) this way is attributed to Gesell Silvio, *Die Natuerliche Wirtschaftsordnung*, Rudolf Zitzmann Verlag, 1916 (available in English as *The Natural Economic Order*, Peter Owen Ltd., London, 1958); see also Buiter Willem H., *Negative Nominal Interest Rates: Three Ways to Overcome the Zero Lower Bound*, NBER Working Paper 15118, June 2009.

²³⁷ Nabilou (2019) p. 12 with further reference.

3.4 Payment system

An objective relating to the provision of payment infrastructure for the financial system is found frequently in central bank laws.²³⁸ This is not surprising, as the issuance of CeBM by itself would be futile. Only if the management of circulation is likewise ensured, can the money issued fulfil its intended functions, i.e. serve the public as a means of payment and store of value and, in dealings between the central bank and the monetary policy counterparties, ensure smooth settlement of payments in private money and effective transmission of monetary policy decisions into the real economy.²³⁹

In line with this, the fourth indent of Article 127(2) TFEU, as mirrored in Article 3.1 of the Statute, requires the ESCB to «promote the smooth operation of payment systems» in order to enable the circulation just mentioned. Besides, Article 22 of the Statute provides that «[t]he ECB and national central banks may provide facilities, and the ESCB may make regulations, to ensure efficient and sound clearing and payment systems within the Union and with other countries.» Since Article 34.1 of the Statute empowers the ESCB to make regulations,²⁴⁰ take decisions, make recommendations and deliver opinions, the ESCB enjoys a wide and forceful range of instruments to foster its payment system related objective.²⁴¹

This objective needs clarification in several respects. First, by interpreting the term ‘clearing and payment systems’, the Court of Justice of the European Union (CJEU) has referred inter alia to the Payment Services Directive (PSD), which defines a ‘payment system’ as «a funds transfer system with formal and standardised arrangements and common rules for the processing, clearing and/or settlement of payment transactions»^{242, 243} The CJEU further interpreted the term ‘clearing’ in the

²³⁸ BIS, *Issues in the Governance of Central Banks*, A report from the Central Bank Governance Group, 18 May 2009 ([link](#)), p. 41; Riksbank (2020) p. 9.

²³⁹ ECB, *The role of the Eurosystem in payment and clearing systems*, Monthly Bulletin April 2002, 47-60 ([link](#)), pp. 47 and 49; Athanassiou Phoebus L, *Payment Systems*, in: Amtenbrink Fabian/Herrmann Christoph (eds.), *EU Law of Economic and Monetary Union*, Oxford University Press, Oxford 2020, 711-735, para 24.14.

²⁴⁰ Legal acts of general application, binding in their entirety and directly applicable in all Member States (participating in the euro area); see ECB, *The role of the Eurosystem in payment and clearing systems*, Monthly Bulletin April 2002, 47-60 ([link](#)), p. 50.

²⁴¹ See ECB, *The Payment System: Payments, Securities and Derivatives, and the Role of the Eurosystem*, Frankfurt a.M., 2010 ([link](#)), pp. 309-327.

²⁴² See today Article 4(7) PSD2, i.e. Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market,

light of the task conferred on the Eurosystem by the fourth indent of Article 127(2) TFEU, which mentions only payment systems, and therefore regarded it as being limited to payment clearing systems alone, providing e.g. net settlement payment.²⁴⁴ Second, 'smooth' is used here as an overarching term, which expresses that systems should be efficient but at the same time secure, which requires a constant balancing between these conflicting characteristics.²⁴⁵ Third, the ESCB is not obliged to operate such systems itself. Rather, it is sufficient if it 'promotes' them.²⁴⁶ Fourth, although this duty is listed among the basic tasks in Article 127 TFEU, it is not an end in itself, unlike note-issue and monetary policy. It actually enables and fosters the fulfilment of the latter two and is therefore rather of a *supporting* nature.²⁴⁷ Fifth and finally, the Eurosystem considers itself to assume complementary roles in order to fulfil its task: an operative role as owner and operator of or participant in a system,²⁴⁸ a monitoring role as overseer of systems²⁴⁹ and an enabling role as facilitator and catalyst.²⁵⁰ To this must be added the shaping role of the regulator, which permeates and strengthens the three roles mentioned above.²⁵¹

amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC.

²⁴³ CJEU, *United Kingdom of Great Britain and Northern Ireland v ECB* T-496/11 [2015] ECLI:EU:T:2015:133 (so-called CCP location policy case), para 94. See also Athanassiou (2020) para 24.7. See also paras 24.13-16 regarding the pivotal role of payment systems.

²⁴⁴ CJEU, *United Kingdom of Great Britain and Northern Ireland v ECB* T-496/11 [2015] ECLI:EU:T:2015:133, paras 89-101.

²⁴⁵ ECB (2002) p. 48 i.f.

²⁴⁶ Waldhoff Christian, *comments on Article 127*, in: Siekmann Helmut (ed.), *EWU Kommentar zur Europäischen Währungsunion*, Mohr Siebeck, Tübingen 2013, para 57.

²⁴⁷ *Ibid* sees evidence for the supportive role of what is termed to be a side task (*Nebenauftrag*) in the fact that the ESCB has the right to leave the role of an operator to others.

²⁴⁸ Athanassiou (2020) paras 24.26-35; ECB (2010) pp. 243-270.

²⁴⁹ Athanassiou (2020) paras 24.36-41; ECB (2010) pp. 271-290; ECB, *Revised Oversight Framework for Retail Payment Systems*, Frankfurt a.M., 2016 ([link](#)).

²⁵⁰ Athanassiou (2020) para 24.32-45; ECB (2010) pp. 291-308; ECB (2002) pp. 53-58; CJEU, *United Kingdom of Great Britain and Northern Ireland v ECB* T-496/11 [2015] ECLI:EU:T:2015:133 para 4.

²⁵¹ *Ibid* para 84, where such regulation was deemed to go «beyond mere oversight». See e.g. the (binding) TARGET2 Guideline, which the Governing Council adopted on 26 April 2007, in order to harmonise the individual rules governing the contractual relationship between participants and NCBs (i.e. the terms and conditions subject to which TARGET2 offers its services). For details see Athanassiou (2020) para 24.31.

Currently, the Eurosystem operates in the field of payment systems as the issuer of euro banknotes and as the bank of banks, essentially providing the latter with liquidity in the form of reserves. Both types of CeBM require their own kind of payment system. In fact, historically, central banks' payment systems function was rooted in the need to strengthen the banknote as a means of payment.²⁵² Even though the supply, circulation and storage of cash cannot do completely without electronics,²⁵³ it requires nonetheless a payment system, which, however, is not to be understood primarily as a technical but rather as an organisational infrastructure. In this regard, the Eurosystem issues banknotes as described earlier.²⁵⁴ Moreover, the ECB oversees the activities of the NCBs and initiates further harmonisation of cash services within the euro area, while the NCBs put cash into circulation in particular via the banking system and ensure the proper functioning of their national cash distribution systems. Therein, the users themselves are responsible for transfer and storage, supported by various services performed by their banks and other authorised cash handlers who recirculate banknotes based on standards set by the Eurosystem.²⁵⁵

In contrast to face-to-face cash payments, the transfer of digital funds regularly requires a settlement process and the corresponding technical infrastructure and agents. In this regard, the Eurosystem predominantly implements its operational competencies in connection with TARGET2, the backbone of the infrastructure facilitating wholesale payments in euro, and, since November 2018, TARGET instant payment settlement service (TIPS),²⁵⁶ on both of which it has also issued guidelines.²⁵⁷ The Eurosystem conducts its oversight in accordance with Article 12.1 of the Statute, largely following a soft law approach with regard to financial market

²⁵² See ECB (2010) p. 151.

²⁵³ Wierst/Boven (2020) p. xx.

²⁵⁴ See supra Section 3.2.

²⁵⁵ See e.g. Decision ECB/2010/14 of 16 September 2010 on the authenticity and fitness checking and recirculation of euro banknotes.

²⁵⁶ For historical details on the Trans-European Automated Real-time Gross Settlement Express Transfer system, TARGET, its successor, TARGET2, and the TARGET instant payment settlement service, TIPS, see Athanassiou (2020) para 24.27-35. For other operational roles, e.g. in connection with automated clearing houses (ACHs), the Continuous Linked Settlement System (CLS) and the Correspondent central banking model (CCBM) see ECB (2002) pp. 55-56.

²⁵⁷ See Guideline ECB/2007/2 of 26 April 2007 on a Trans-European Automated Real-time Gross settlement Express Transfer system (TARGET2) and its Annexes; Guideline ECB/2015/15 of 2 April 2015 amending the TARGET2-Guideline.

infrastructures (FMIs).²⁵⁸ In addition, the ECB and the NCBs have developed standards and recommendations aimed at harmonising and systematising supervision and facilitating the comparison of assessments of different systems.²⁵⁹ Finally, as a catalyst, the Eurosystem encourages change that helps to overcome remaining fragmentation in the payment sector and mitigates risks due to the complexity of the market. The most outstanding result to date in this respect is clearly the implementation of the Single Euro Payments Area (SEPA) project.²⁶⁰

In light of the above, it could be argued that the Eurosystem's task to provide facilities under Article 22 of the Statute may include the establishment of an *infrastructure* for the processing and settlement of rCBDC. As mentioned, this should, however, not be an end in itself. Rather, the supportive nature of the task in question must be respected. Therefore, the infrastructure in question would have to become indispensable either because otherwise the Eurosystem could no longer fulfil its task under Article 128(1) TFEU (to issue banknotes) or under Article 127(1) TFEU (to implement the single monetary policy). That there is such need has already been explained.²⁶¹

It was also shown that there is a need for rCBDC in the sense of the digital monetary object itself.²⁶² Accordingly, the mere provision of the core infrastructure by the Eurosystem would suffice. At the same time, however, it would still be indispensable: Given the strong network externalities associated with payment systems,²⁶³ the Eurosystem should provide a core infrastructure on which private operators could build additional services. This would make it possible to reconcile competing policy objectives: On the one hand, it would help to mitigate the market dominance of private payment systems and reduce the concentration risk in such payment systems, while, on the other hand, creating a level playing field under which the private sector could further innovate its services to the public.²⁶⁴

Given the strong network externalities that come with payment systems, the Eurosystem should provide a core infrastructure on which private providers could

²⁵⁸ See however Regulation ECB/2014/28 of 3 July 2014 on oversight requirements for systemically important payment systems.

²⁵⁹ For further details, also regarding the assignment of the leading role in oversight: Athanassiou (2020) paras 24.40-41.

²⁶⁰ See Athanassiou (2020) para 24.43.

²⁶¹ See *supra* Paragraph 3.3.2.2.

²⁶² *Ibid.*

²⁶³ IMF (2020) p. 11.

²⁶⁴ BIS Annual Economic Report 2020 (part III) pp. 67, 73, 75.

build additional offers. This would allow to reconcile competing policy objectives: on the one hand, it would help to mitigate the market dominance of private payment systems or reduce concentration risk in such payment systems, while, on the other hand, a competitive level playing field were created wherein the private sector could further innovate its service to the public.

To return to the *monetary object itself*: while Article 128(1) TFEU imposes limits on the Eurosystem in the design of a relevant rCBDC, such limits are not immediately apparent with regard to the implementation of the Eurosystem's monetary policy and the functioning of the euro area money market. In other words, this would mean that based on Article 127(1) and (4) TFEU, a design would also be conceivable which would give the rCBDC functionalities that an e-banknote *de lege lata* could not have under Art. 128(1) TFEU, namely the possibility of making it interest-bearing. As has been shown, such a feature would have far-reaching effects. In particular, it could affect its users in their fundamental right to property as enshrined in Article 17(1) of the Charter of Fundamental Rights of the European Union.²⁶⁵ The Eurosystem is bound by the principle of proportionality in the exercise of its competences. Since, in our opinion, the desired objectives can also be sufficiently achieved with the help of an e-banknote (or evidence to the contrary would have to be brought forward first), a more far-reaching design would not be permissible.

3.5 Financial stability

Financial stability can be a goal pursued with the issuance of rCBDC, but it may as well restrict the design of such digital currency. Retail CBDC may serve as a back-up for electronic saving and paying in CoBM, particularly in times of financial crisis, thus enhancing the resilience of the financial system. Similar to proposals on 'narrow banking' and 'full-reserve money', rCBDC may render the overall financial system safer by unbundling, at least in part, the dual function of deposits as a means of payment for depositors and of refinancing for the bank. On the other hand, it is feared that rCBDC could lead to a disruption of commercial banks' business models, enhanced risk of large-scale bank runs ('digital runs') and, more fundamentally, too large of a 'footprint' of central banks in the financial system, thereby increasing financial stability risk. How the issuance of a rCBDC will impact financial stability in the short and longer term is difficult to anticipate, as economic studies yield ambiguous results.²⁶⁶ A careful balancing of interests is of the essence.²⁶⁷

²⁶⁵ [2012] OJ C326/391 (hereafter: Charter).

²⁶⁶ Financial stability objectives are difficult to spell out and pursue due to their multidimensionality (see David J. Archer, *A coming crisis of legitimacy?*, Sveriges

While the exact scope of its financial stability mandate remains opaque,²⁶⁸ the ECB must take the potential implications on financial stability – both positive and negative – into account when deciding whether to issue an e-euro and how to design such e-euro. It is not unlikely that the ECB, in its multiple capacities as monetary authority and prudential supervisor, will encounter conflicting financial stability objectives with a view to the issuance of an e-euro, which need to be carefully managed at an institutional level. As a monetary policy-maker, the ECB depends on a stable and functioning banking system to transmit monetary impulses.²⁶⁹ It may therefore, subject to a well-reasoned proportionality assessment, pursue financial stability as an intermediate objective of monetary policy, i.e. an objective that ultimately promotes its primary objective of price stability.²⁷⁰ Not unlike in the case of unconventional monetary policy measures, financial stability considerations or, more specifically, the need to ensure smooth transmission channels in the face or in anticipation of a dwindling use of cash as a public money, may therefore, in principle, inform the ECB's decision to issue an e-euro. In its capacity as the direct (micro-)prudential supervisor of the most significant banks of the euro area, the ECB bears «significant responsibility (...) to safeguard financial stability in the Union».²⁷¹

Riksbank Economic Review, Vol. 3, 2016, 86-95, 91-92, amongst others). Not only do they relate to different (and sometimes conflicting) time horizons, but they also closely interact with other policy fields, exhibiting prudential, monetary and fiscal dimensions. Attempting to locate financial stability objectives within the EU's law and policy Gianni Lo Schiavo, *The Role of Financial Stability in EU Law and Policy*, Wolters Kluwer 2017).

²⁶⁷ See *infra* Sections 4.4 and 4.5.

²⁶⁸ Fundamentally Psaroudakis Georgios, *The Scope for Financial Stability Considerations in the Fulfilment of the Mandate of the ECB/Eurosystem*, *Journal of Financial Regulation*, Vol. 4, 2018, 119-156.

²⁶⁹ Confirmed by the ECJ in Case C-62/14 *Peter Gauweiler and others v Deutscher Bundestag* EU:C:2015:400 and Case C-493/17 *Heinrich Weiss and others* EU:C:2018:1000.

²⁷⁰ See Matthias Goldman, *United in Diversity? The Relationship between Monetary Policy and Prudential Supervision in the Banking Union*, *European Constitutional Law Review*, 2018, 1-28, 16-17. Similarly Psaroudakis (n 268) 131 («due attention to financial stability is inherent in the price stability mandate» and «a financial stability mandate of the ECB [...] is implied in article 127(1) TFEU»).

²⁷¹ Recital 55 Council Regulation (EU) No 1024/2013 of 15 October 2013 conferring specific tasks on the ECB concerning policies relating to the prudential supervision of credit institutions [2013] OJ L287/63. Macroprudential policy, however, has in principle remained a national competence. The ECB's role is limited to the sponsorship of European Systemic Risk Board. See Council Regulation (EU) No 1096/2010 of 17

In that capacity, the ECB is primarily focused on the safety and soundness of the individual bank. It will therefore naturally tend give more emphasis to potential shorter-term financial stability risks associated with the introduction of an e-euro, such as potential disruptions of banks' traditional business models, rather than (less certain) long-term financial stability gains.

November 2010 conferring specific tasks upon the ECB concerning the functioning of the European Systemic Risk Board [2010] OJ L331/162.

4 A constitutional perspective

4.1 The ECB's power to authorise the issuance of e-banknotes

In the following, we argue that Article 128(1) TFEU provides for both a *source of competence* for the ECB to issue an e-euro and a *limitation* to that competence. It serves as a source of competence in that it confers upon the ECB the power to issue (or authorise the issuance of) cash as a retail public money, with the limited exception of minor cash (coins).²⁷² The issuance of a widely-used public money is a precondition for monetary policy,²⁷³ which is why the issuance power was accorded to the ECB in the first place. Article 128(1) TFEU imposes limitations on the ECB's competence to issue an e-euro by restricting its functional design. We derive these conclusions, in a first step, from a historical, teleological and systematic interpretation of Article 128(1) TFEU and Article 16 of the Statute.

4.1.1 E-banknotes as banknotes under Article 128(1) TFEU

The wording of Article 128(1) TFEU and Article 16 of the Statute does not exclude that euro banknotes be issued in a medium other than paper, nor does the drafting history of these provisions. As the Maastricht Treaty was drafted before the Internet had started impacting economic and social interactions on a massive scale and first forms of e-money had evolved, it does not come as a surprise that working groups involved with the future issuance of euro banknotes had paper-based banknotes in mind.²⁷⁴ The drafting history, however, does not reveal any evidence of a *qualified silence* of the Treaty drafters in the sense that they intended to exclude media other than paper for banknotes covered by Article 128(1) TFEU. The fact that the emergence of the Internet and of private digital currencies (such as Liberty Reserve in 2006) did not lead to an amendment of the provision in the Treaties of Amsterdam (1997), Nice (2001) and Lisbon (2007) does not indicate such qualified silence. At the time, these private digital currencies were still in their infancy, and the discussion about their effect on central banking and the prospects for the introduction of a

²⁷² On the issuance of coins as a remaining, but very limited, national competence according to Article 128(2) TFEU see *infra* Subsection 4.1.3.

²⁷³ See *supra* Subsection 3.3.1.

²⁷⁴ See e.g. ECB, Report on the legal protection of banknotes in the EU Member States, Frankfurt, 9 November 1999 ([link](#)), p. 41 («authorised *paper* money»); see also p. 5 with reference to a «Working Group on *Printing* and Issuing a European Banknote (BNWG)» (emphases added).

rCBDC started only about a decade after the signing of the Treaty of Lisbon.²⁷⁵ While technology may have allowed for the digital issuance of central bank currency already at the time of these Treaty amendments, the evidence is that the drafters simply did not have rCBDC on their radar screens.²⁷⁶ As a consequence, they neither explicitly made provision for the issuance of a rCBDC nor explicitly – even silently – excluded it from the scope of Article 128(1) TFEU.

Article 128(1) TFEU should be read in light of the intention to design a constitutional framework for Economic and Monetary Union (EMU) that is flexible enough to accommodate economic, social and technological developments.²⁷⁷ This particularly pertains to developments that, like the crowding out of cash by privately-issued digital currencies, could jeopardise the use of the euro as the single currency, which underlies EMU as its very basis. A teleological interpretation of Article 128(1) is consistent with the dynamic and evolving nature of EMU and the ECB more specifically²⁷⁸ and takes into account the evolution of the concept of banknote, of which the transition from the paper to the digital medium only constitutes the last in a row of evolutionary steps.²⁷⁹ Accordingly, we find that the paper medium is not a defining feature of the concept of a banknote. The requirement for it to be ‘written’ to give it permanence may just as well be met by a digital record. A purposive reading of Article 128(1) TFEU suggests instead that the defining feature of banknotes relates to their function: to serve as a credit-risk free means of payment and store of value accessible to the general public. The provision puts the ECB in charge of issuing or authorising the issuance of a retail public money. The medium

²⁷⁵ The Bank of England was leading in initiating this global discussion. See e.g. Victoria Cleland, *Digital Future for Sterling: Assessing the Implications*, Bank of England, 5 July 2017.

²⁷⁶ Similarly, Banque de France (2020) p. 31.

²⁷⁷ See supra Subsection 2.2.5. On intertemporal flexibility with a view to the ESCB's relation vis-à-vis the political authorities Carel C. A. van den Berg, *The Making of the Statue of the European System of Central Banks, An Application of Checks and Balances* (Dutch University Press, 2005), Chapter 2. On the need for institutions to be adaptable Douglas C. North, *Economic Performance Trough Time* (1994) 84(3) *The American Economic Review* 359.

²⁷⁸ The CJEU uses teleological interpretation frequently. In the *CILFIT* case, it affirmed that: ‘(...) every provision of [EU] law must be placed in its context and interpreted in the light of the provisions of [EU] law as a whole, regard being had to the objectives thereof and to its state of evolution at the date on which the provision in question is to be applied.’ (emphasis added). Case C-283/ 81 *CILFIT v Ministero della Sanità* EU:C:1982:335 para 20.

²⁷⁹ See supra Subsection 2.2.3.

of that issuance, however, may adapt to (unanticipated) changes in technology and user demand.

At the same time, it is this defining function of banknotes that *limits* the ECB's competence to issue e-banknotes. Their intangible nature renders e-banknotes much more versatile than paper-based banknotes and allows for their use to serve other functions – including functions we may not even anticipate yet today. In particular, e-banknotes could open up new horizons in the conduct of monetary policy, allowing for a much more direct control of (potentially ultra-negative) interest rates and effectively creating a form of tax.²⁸⁰ Article 128(1) TFEU, however, while allowing in principle for the issuance of e-banknotes by the ECB, legally restricts their use to the functions of cash. In other words, in order to be covered by Article 128(1) TFEU, e-banknotes must be designed as a functional equivalent to paper-based banknotes.²⁸¹ Accordingly, their functions would be limited to those of a means of payment and a store of value, which excludes their use as a monetary policy tool.

This reading is supported by a systematic interpretation of the provision. Both the Treaty and the Statute mention banknote issuance separately from the basic tasks of monetary policy.²⁸² The fact that the competence to issue banknotes is codified in a separate article corroborates that issuing banknotes – whether paper-based or

²⁸⁰ See supra Subsection 3.3.3.

²⁸¹ Coming to similar conclusions, reports issued by the De Nederlandsche Bank and the Banque de France base their argumentation on the second paragraph of Article 16 of the Statute stating: «The ECB shall respect as far as possible existing practices regarding the issue and design of banknotes.» However, this provision has a very specific historical background. It was added to satisfy the British, who wanted to retain the right for some commercial banks in Scotland and Northern Ireland to issue banknotes and to have the portrait of Queen Elisabeth II on a national side of euro banknotes issued by the Bank of England in case the U.K. were to enter Stage Three of EMU. With Brexit, this provision has obviously lost its original relevance. See Wierds/Boven (2020) p. 28; Banque de France (2020) p. 31.

²⁸² See Article 127(2) TFEU; Article 3.1 of the Statute. In the drafting process of the Maastricht Treaty, banknote issuance was originally also mentioned in the list of the basic tasks of the ESCB (in addition to the competence provision), but then removed prior to the adoption of the Treaty. The fact that Article 16 of the Statute is placed under Chapter III (Organisation of the ESCB) instead of Chapter IV (Monetary Functions and Operations of the ESCB), however, is the result of an oversight that was never corrected. See van den Berg (n 277), Chapter 7 para II.3.

digital – is the logical precondition for monetary policy, rather than an instrument of that policy.

4.1.2 Scope of the ECB's competence based on Article 128(1) TFEU

Based on Article 128(1) TFEU, the ECB is competent to issue e-banknotes to the extent these banknotes exhibit a cash-like functional design. The power of banknote issuance – whether paper-based or digital – is a power in its own right. In particular, the issuance of e-banknotes by the ECB would not require any prior legislative act authorising the ECB to make use of its powers. Article 133 TFEU states:

«Without prejudice to the powers of the European Central Bank, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall lay down the measures necessary for the use of the euro as the single currency. Such measures shall be adopted after consultation of the European Central Bank.» (emphasis added)

Article 133 TFEU provides for the legislative competence at EU level to issue secondary law acts to address certain issues pertaining to the *use* of the euro. Those are ancillary acts of legislation that cannot and must not interfere with the constitutional powers granted to the ECB. When the euro was adopted, it was necessary to put a detailed legal framework in place to facilitate the substitution of national currencies and to address practical matters arising from the introduction of a single currency.²⁸³ Moreover, as Member States retained the competence to issue euro coins and only the power over the volume of coin issuance was transferred to the ECB, it was for the EU legislators to regulate the denominations and technical

²⁸³ See Council Regulation (EC) No 1103/97 of 17 June 1997 on certain provisions relating to the introduction of the euro [1997] OJ L300/1 ('1st Euro-Regulation'), pertaining to the continuity of contracts and ECU-denominated obligations as well as conversion and rounding; Council Regulation (EC) No 974/98 of 3 May 1998 on the introduction of the euro [1998] OJ L139/1 ('2nd Euro-Regulation'), introducing euro banknotes and coins over a transitional period and regulating the substitution of national currencies; Council Regulation (EC) 2866/98 of 31 December 1998 on the conversion rates between the euro and the currencies of the Member States adopting the euro [1998] OJ L359/1, determining the conversion rates at which, until today, banknotes and coins denominated in national currencies can be converted into euro.

specifications of euro coins uniformly for the euro area.²⁸⁴ In contrast, all matters regarding the design of euro banknotes, including denominations, specifications and security, relate to powers *incidental* to the issuance power according to Article 128(1) TFEU and are therefore laid down in ECB decisions.²⁸⁵ Article 10 of Regulation 974/98 is of a purely declaratory nature, merely repeating the legal tender status assigned to euro banknotes by Article 128(1) TFEU and Article 16 of the Statute.

4.1.3 The ECB's exclusive competence to issue an e-euro on the basis of Article 128(1) TFEU

What remains to be clarified is whether the ECB is *exclusively* competent to issue (or authorise the issuance of) an e-euro. As Member States explicitly remained competent to issue euro coins according to paragraph 2 of Article 128, one may argue that they retain the power to issue some sort of 'digital coins' alongside the issuance of e-banknotes by the ECB.²⁸⁶ However, this view overlooks the fact that the distinction between banknotes and coins with their respective denominations is not practicable for an e-euro. Just like book money, an e-euro will be stored, transferred and accounted in lump sums. And just like in a bank account, the electronic wallet will show no separable '20-cent' or 'five-euro piece' of the digital coin.

Accordingly, the delineation of competences assigned to the European level for (physical) banknotes on the one hand and to the national level for (physical) coins on the other is not pertinent in the digital world. The result cannot be that the ECB/NCBs and the Member States possess *parallel* competences to issue an e-euro. Allowing Member States to issue a limited volume of 'their own e-euro' would almost certainly create confusion among users and threaten the singleness of the euro. On a fundamental level, national competence cannot provide for a single e-euro. This is why Member States effectively transferred monetary sovereignty to the EU level and put the independent ECB in charge of the issuance of the single currency, with the limited exception of (physical) coins, and of conducting a single

²⁸⁴ See Council Regulation (EU) No 729/2014 of 24 June 2014 on denominations and technical specifications of euro coins intended for circulation (Recast) [2014] OJ L194/1. This legislative competence derives from Article 128(2) TFEU.

²⁸⁵ Decisions ECB/2013/10 and ECB/2019/9 regarding denominations, specifications, reproduction, exchange and withdrawal; Decisions ECB/2008/3, ECB/2010/14 and ECB/2012/19 regarding security. See, however, Council Regulation (EC) 1338/2001 of 28 June 2001 laying down measures necessary for the protection of the euro against counterfeiting [2001] OJ L181/6, which applies to both banknotes and coins.

²⁸⁶ This appears to be the stance in: Banque de France (2020) p. 31.

monetary policy for the euro area.²⁸⁷ From the perspective of practicability, it would make little sense and be very costly to divide the digitisation of payments between the ECB and the Member States. Several issuers would be issuing the essentially same thing: What would distinguish the e-euro issued by Member State X from the e-euro issued by Member State Y and the e-euro issued by the ECB/NCBs?

In practice, the issue may cause little concern since the volume of coin issuance by Member States is subject to ECB authorisation and the ECB could therefore control the volume of 'digital coins' authorised for issuance under Article 128(2) TFEU. However, there are more fundamental reasons to assume that the European competence to issue an e-euro must prevail. We have argued that rCBDC is much closer to the concept of banknote as set out in Article 128(1) TFEU than to the concept of coin according to Article 128(2) TFEU as history attests to the unimportance of coins as payment objects.²⁸⁸ Representing a subsidiary form of cash,²⁸⁹ the issuance of coins has traditionally been left to the Treasury or a body closely linked to it (e.g., the Mint).

Article 128(2) TFEU was never meant to control Article 128(1) TFEU, but on the contrary, to leave in the hands of Member States only powers as to subsidiary objects of payment – which in the case of the e-banknote are not needed. Accordingly, the ECB is competent to issue any form of cash, except physical coins.²⁹⁰ This understanding is supported by the reasons for which Member States retained coin issuance as a remaining piece of national monetary sovereignty. Originally set to become a supranational competence as well, the issuance of coins was 'returned' to Member States in the course of the Maastricht negotiations in order not to break with the tradition of coin issuance being a power governments are typically vested with. A majority in the Intergovernmental Conference (IGC) agreed that coins were of «minor monetary importance» and that it would suffice for the ECB to control the volume of coin issuance to ensure conformity with its primary objective of price stability.²⁹¹ Member States' interests in keeping coin issuance a national competence

²⁸⁷ On monetary sovereignty and the euro Charles Proctor, *Mann on the Legal Aspects of Money* (7th edn, OUP 2012), Chapter 31; for a conceptualisation of monetary sovereignty Claus D. Zimmermann, *The Concept of Monetary Sovereignty Revisited*, 24(3) *European Journal of International Law* 797 and Claus D. Zimmermann, *A Contemporary Concept of Monetary Sovereignty* (OUP 2013).

²⁸⁸ See supra Subsection 2.2.3.

²⁸⁹ The fact that a limit of acceptance (50 pieces) exists only for coins attests to their minor importance (see Article 11 Regulation 874/98).

²⁹⁰ See on this point also infra Section 4.2.

²⁹¹ Van den Berg (2005) xx.

were primarily of a sentimental and fiscal nature. Since an e-euro by definition would lack a 'national side' like physical coins to exhibit kings and queens, national heroes and historical monuments, sentimental interests can largely be neglected. Fiscal interests of Member States, in contrast, will be affected by a loss of seignorage, achieved today by net emission of EUR 900 million p.a. less costs,²⁹² to the extent an e-euro substitutes physical coins. However, the ECB/NCBs could compensate Member States for their lost seignorage. Each NCB could credit the relevant Member State's account with e-euro up to the value of coins no longer authorised for issue by the ECB every year. The amount would have to be set for the future based on the (overall quite linear) development to date.

4.2 Issuance of an e-euro as an implied power of the ECB

We have put forward that e-banknotes are the logical continuation of paper-based banknotes and covered by Article 128(1) TFEU to the extent their usage is restricted to the functions of cash. This is our primary line of argumentation. In the following, we will bring forward the accessory argument that the ECB possesses the competence to issue an e-euro even if this e-euro were not to qualify as banknotes according to Article 128(1) TFEU but represented a new type of monetary object different from 'banknotes' or 'coins'.²⁹³

This accessory argument relies on implied powers that are indispensable for the ECB to fulfil its monetary mandate according to Article 127(1) and (2) TFEU.²⁹⁴ In fact, the ECB, like other central banks, was given the power over the issuance of banknotes because the use of the latter by the public is an indispensable precondition for the conduct of monetary policy.²⁹⁵ The indispensability for the conduct of monetary policy, however, does not necessarily relate to the concept of 'banknote' according to Article 128(1) TFEU. In principle, any type of outside money accessible to the general

²⁹² ECB Statistical Data Warehouse ([link](#)).

²⁹³ Such '*sui generis* e-euro' would still be a euro. It would simply supplement physical euro cash by digital euro cash, i.e. a new monetary object representing that same monetary value.

²⁹⁴ The CJEU acknowledges implied powers to the extent that these powers are indispensable for an EU institution to carry out a task conferred on it by the Treaties. See e.g. joined cases C-281, 283-285 and 287/85 *Germany and others v Commission* EU:C:1983:351 para 28: «(...) it must be emphasised that where an article of the [Treaties] (...) confers a specific task on the Commission it must be accepted, if that provision is not to be rendered wholly ineffective, that it confers on the Commission necessarily and per se the powers which are indispensable in order to carry out that tasks.»

²⁹⁵ See supra Sections 3.2 and 3.3.

public, i.e. money coming from outside the private sector, because it is issued or fully backed by a public institution such as a central bank, could serve as a precondition of monetary policy. This includes an e-euro issued by the ECB/NCBs or authorised for issuance by the ECB, whether or not it qualifies as 'banknotes' in the strict sense of the term.

Article 128(1) TFEU nevertheless has a confining effect. The term 'banknote' limits the implied powers of the ECB in that it excludes the issuance of types of outside money that do not share the distinctive features of banknotes. In particular, the issuance and transfer of banknotes are independent from the identity of users. It is due to the *token-based nature* of banknotes that the issuer's balance sheet only shows a bulk position 'banknotes' and no individual accounts as it is the case for reserves. This feature of banknotes is vital for the privacy of users and excludes from the ECB's implied powers the issuance of an account-based e-euro. Moreover, as has been stated before, banknotes are not a tool of monetary policy and were never (intended to be) used as such. As in the primary argumentation above, the accessory argumentation therefore excludes the possibility that digital cash could serve such a function.

Implied powers are powers that are indispensable for an authority in order to carry out a task it is assigned with.²⁹⁶ If the use of physical cash were to diminish to an extent that it would no longer exhibit its stabilising effects, confidence in the monetary system may erode and the conduct of monetary policy be impeded. The issuance of an e-euro will then become necessary for the ECB to fulfil its basic task of defining and implementing the monetary policy of the euro area, for which it is given far-reaching independence.²⁹⁷ In the exercise of its monetary powers – explicit and implied – the ECB is independent and barred from taking or seeking any outside instructions. It would be a violation of this independence if the co-legislators could interfere via secondary legislation. While the significant and persistent dwindling of cash may appear to be a development of a distant future, the ECB has a duty to act in anticipation of that point. There is no doubt that private initiatives will continue to seek to fill the void by issuing digital currencies. Network effects, i.e. the fact that a growing number of users of a digital currency increases the utility of that digital currency for each new and existing user, require central banks to be among the first movers.

²⁹⁶ See n 294.

²⁹⁷ Articles 130 and 282(3) TFEU; Article 7 of the Statute.

Being based on implied powers of the ECB necessary to pursue its monetary mandate, the issuance by the ECB of a token-based outside money would neither require a Treaty amendment nor a legislative act of authorisation by the Council and EU Parliament. An account-based form of outside money, in contrast, would have to be authorised by an act of secondary legislation. It would also require a careful design in light of the impact of its use (and ultimately its replacement of cash) on fundamental rights of end-users, in particular users' right to privacy as enshrined in Article 8(1) of the Charter and Article 16(1) TFEU.

4.3 Legal tender status of an e-euro

4.3.1 When does an e-euro possess legal tender status?

Whether or not e-banknotes have legal tender status depends on who is their legal issuer²⁹⁸ and is therefore a consequence of their exact architecture and the issuance model chosen.²⁹⁹ Article 128(1), third sentence, TFEU³⁰⁰ states:

«The banknotes issued by the European Central Bank and the national central banks shall be the only such notes to have the status of legal tender within the Union.»

Accordingly, e-banknotes issued by the ECB/NCBs *by definition* have legal tender status based on primary law, i.e. without the need for further legislation. Article 128(1) TFEU allows for the ECB to authorise the issuance of e-banknotes by non-ESCB entities, for example commercial banks. It excludes, however, explicitly legal tender status for such banknotes. Article 128(1) TFEU was phrased to accommodate the British practice, according to which some commercial banks in Scotland and Northern Ireland issue their own banknotes fully backed by pound sterling. These banknotes are not legal tender in Scotland or Northern Ireland, but nevertheless enjoy a legal status comparable to that of banknotes issued by the Bank of England.³⁰¹

The wording of Article 128(1) TFEU further suggests that legal tender status could be assigned to an e-euro that does *not* qualify as banknotes, but represents a new

²⁹⁸ 'Issuance' essentially refers to the appearance as a liability on the central bank's or commercial bank's balance sheet.

²⁹⁹ See *infra* Part 6.

³⁰⁰ See also Article 10, second sentence, Regulation 974/98 (with a purely declaratory character).

³⁰¹ Van den Berg (n 277), xxx.

type of monetary object (according to our scenario above under Section 4.2).³⁰² In fact, it was chosen to ensure that Member States could (continue to) grant legal tender status to current accounts with commercial banks ('book money') denominated in euro. In its version of 25 October 1990, Article 16.1 of the draft Statute had read as follows:

«The Council shall have the exclusive right to authorise the issue of notes within the Community. The notes issued by the ECB and the national central banks *shall be the only legal tender for any amount.*» (emphasis added).

In the negotiations during the Governors' meeting on 13 November 1990, the Dutch delegates cautioned against the loss of the legal tender status they thought CoBM enjoyed in the Netherlands once the euro was adopted.³⁰³ It was agreed to change the second sentence of Article 16.1 of the draft Statute as follows:

«The notes issued by the ECB and the national central banks *shall be the only notes to have legal tender status.*» (emphasis added).

The Dutch IGC presidency included the same wording also in Article 105(4) fourth indent of the draft Treaty of 25 September 1991 (now: Article 128(1) TFEU).³⁰⁴ The intention was to allow Member States to maintain practices that treat account-based private money in a manner equivalent to legal tender, as is the case with Article 6:114 of the Dutch Civil Code, without subjecting such money to authorisation by the ECB. However, nothing in the wording or history of Article 128(1) TFEU suggests that legal tender status (or a treatment equivalent to such status) is excluded for a token-based monetary object issued by the ECB/NCBs.

³⁰² The same is true for Article 16, third sentence, of the Statute («The banknotes issued by the ECB and the national central banks shall be the only such notes to have the status of legal tender within the Union.»; emphasis added) and Article 10, second sentence, Regulation 974/98 («[...], these banknotes denominated in euro shall be the only banknotes which have the status of legal tender in all [participating] Member States.»; emphasis added). See also Article 11, second sentence, Regulation 974/98 regarding coins.

³⁰³ Article 6:114 of the Dutch Civil Code codifies the acceptance of bank transfers as a valid payment method for private law purposes. It does not, however, formally assign legal tender status to CoBM in public-law terms.

³⁰⁴ Van den Berg (n 277), xxx.

The main purpose of the reference to legal tender in Article 128(1) TFEU was simply to ascribe to the euro the status of *exclusive* legal tender once it substituted the national currencies of euro area Member States. There was to be a *single* euro, and clearly, Member States are forbidden from creating parallel currencies by granting legal tender status to banknotes, coins or any other monetary object *not* denominated in euro.³⁰⁵ Even if an e-euro were to qualify as a monetary object different from banknotes or coins according to Article 128(1) and (2) TFEU, it would be euro-denominated.³⁰⁶ Primary law does therefore not exclude that legal tender be granted to such e-euro by an act of secondary law to the extent it is issued by the ECB and/or NCBs. The issuance of a legal tender e-euro qualifies as an act of public authority and is therefore, according to general principles, not delegable to private actors.³⁰⁷ The ECB may authorise the issuance of a *sui generis* e-euro by commercial banks, but such e-euro could not be given the status of legal tender.

Monetary object	Issuer	Legal tender status
Banknote (Article 128(1) TFEU)	ECB/NCBs	By definition (based on Article 128(1) TFEU)
	Commercial banks (subject to ECB authorisation)	Excluded (based on Article 128(1) TFEU)
Coin (Article 128(2) TFEU)	Member States	Yes (based on Article 11 Regulation 974/98)
Other	ECB/NCBs	Possible (based on secondary law)
	Commercial banks (subject to ECB authorisation)	Excluded (principle of non-delegability of acts of public authority)

4.3.2 What does legal tender mean in the EU?

The meaning of legal tender and its implications in EU and national private and public law are characterised by a remarkable lack of legal certainty. Prior to the adoption of the euro, every euro area Member State had its own distinct

³⁰⁵ This possibility was briefly discussed at the outset of the Greek sovereign debt crisis ('Eurolino'), but then dropped due to its obvious interference with primary law.

³⁰⁶ A '*sui generis* e-euro' would also have to be convertible to ensure that it circulates at par with physical cash euro and to avoid the assumption of the public that banknotes and the e-euro were two kinds of euro.

³⁰⁷ See also the assessment made by the European Legal Tender Expert Group (ELTEG): European Legal Tender Expert Group, *Report on the definition, scope and effects of legal tender of euro banknotes and coins*, Brussels, 21 January 2009 ([link](#)), p. 5.

understanding of the meaning of legal tender with a view to its national currency.³⁰⁸ This understanding was often based on historical tradition, doctrine and/or case law rather than statutory provisions. Article 128(1) TFEU refers to the term 'legal tender' without defining it. It continues to be an open question whether Article 128(1) TFEU has fully harmonised the meaning of the term at EU level or whether pre-existing national understandings of its meaning have remained largely unaffected.

The EU has not (yet) made use of its exclusive competence in matters of monetary policy to clarify the issue.³⁰⁹ Secondary law referring to the status of the euro as legal tender is scarce and generally limited to assigning legal tender status to certain (physical) expressions of the euro, without clarifying any further the fundamental consequences of that status.³¹⁰ Instead, the Commission adopted in 2010 a non-binding Recommendation on the scope and effects of legal tender of euro banknotes and coins, addressed to euro area Member States and the ECB, amongst others.³¹¹ This Recommendation was informed by the findings of the European Legal Tender Expert Group (ELTEG), an inter-institutional working group composed of national and EU experts.³¹²

The ELTEG had reached consensus on only three core implications of the concept of legal tender, later adopted in Article 1 of the Commission Recommendation: (1) responsibility to accept (unless explicitly agreed otherwise); (2) acceptance at full face value; and (3) legally recognised means to discharge from payment obligations. These three core features can be seen as a common denominator of the different national understandings of the concept of legal tender within the euro area.

³⁰⁸ See ELTEG (n 307), Annex (pp. 23-73).

³⁰⁹ See Article 3(1)(c) TFEU. A minority within the European Legal Tender Expert Group (ELTEG), however, was of the opinion that the EU had already made use of its (limited) competence to define what legal tender is and that all further implications of the legal tender status were governed by national law: ELTEG (n 307), p. 2.

³¹⁰ An exception is Article 11 Regulation 974/98, giving creditors the right to refuse acceptance of more than fifty euro-denominated coins, although the implications of that provision remain opaque. See Robert Freitag, *Euro as legal tender (and banknotes)*, in Hermann Christoph/Amttenbrink Fabian (eds), *EU Law of Economic and Monetary Union* (OUP 2020) 595, para 21.26.

³¹¹ Commission Recommendation 2010/191/EU of 22 March 2010 on the scope and effects of legal tender of euro banknotes and coins [2010] OJ L83/70.

³¹² ELTEG (n 307).

Which other elements can be deduced from the legal tender status remains an open question.³¹³ The question is not without practical relevance, and the CJEU will soon have to decide on the matter in a pending request for a preliminary ruling.³¹⁴ Article 128(1) TFEU, being a provision of primary EU law, must be interpreted in an autonomous manner. Autonomous interpretation, however, does not necessarily imply a distinct European concept of legal tender. In light of the absence of a clear definition of legal tender in EU law, the CJEU may well find that the term lacks common understanding at EU level – at least beyond the core features identified in the Commission Recommendation – and that Article 128(1) TFEU refers to the understandings according to the law and practice in each euro area Member State predating the adoption of the euro.³¹⁵ Such interpretation would confirm the prevalent understanding of legal tender as a largely ‘open concept’.³¹⁶

4.3.3 Why assign legal tender status to an e-euro?

The existence of legal tender is often explained by its stability and trust-building effects and the fact that it facilitates the exercise of fundamental freedoms.³¹⁷ Cash as legal tender serves a number of public interests. The ECB, in charge of authorising the issuance of euro banknotes, therefore, sees itself «responsible for protecting the status of euro cash as the sole legal tender», including by «guaranteeing the existence of euro cash and its usability as legal tender».³¹⁸

But is it really mandatory for a means of payment and store of value to have legal tender status in order to serve its key functions in the public interest? In other words, would there be any major drawbacks if no legal tender in a strict sense were available to the general public, for example, in case physical cash would naturally be replaced at some point in time by an e-euro lacking formal legal tender status?³¹⁹

³¹³ Elements discussed by the ELTEG included: refusal of high denomination banknotes; validity of cash surcharges; and refusal of cash in Business to Customer (B2C) relationships. ELTEG (n 308), pp. 5-7, 9-10.

³¹⁴ Joined cases C-422/19 and C-423/19 *Johannes Dietrich v Hessischer Rundfunk*.

³¹⁵ Suggested by Freitag (n 310) para 21.59.

³¹⁶ See also Yves Mersch, *The role of euro banknotes as legal tender*, 4th Bargeldsymposium of the Deutsche Bundesbank, Frankfurt, 14 February 2018 ([link](#)).

³¹⁷ See Mersch (n 316).

³¹⁸ Mersch (n 316).

³¹⁹ History shows that the need for a legal tender in the strict sense may be bypassed. Kosovo's currency regulation under the UN Administration, for example, established the following: (1) freedom to choose currency; (2) presumption of use of currency widely used; and (3) power of the government which currency is widely used.

There is a policy and a legal aspect to that question. As far as policy is concerned, history shows a remarkable desire of policy-makers to maintain a formal legal tender at all times. In the transitional period lasting from 1 January 1999 until 31 December 2001, during which no euro-denominated legal tender existed yet, pre-existing national currencies were declared to be sub-divisions of the euro to avoid a period without legal tender.³²⁰ The banknotes and coins denominated in a national currency kept their status as legal tender within their territorial limits until 31 December 2001³²¹ and even beyond.³²²

The concept of legal tender has its origins in the Mint Lords who forced their people to accept the money they issued in order to earn seignorage. While the fiscal interest in maintaining the legal tender concept may have become outdated, legal tender is still important in order to spur demand in a currency (network effect). It regularly implies that (1) the government has to accept its own currency; and (2) private parties will accept it if nothing else has been agreed upon (default result). For these reasons, it would be recommendable for an e-euro – whether or not it qualifies as banknotes according to Article 128(1) TFEU – to possess formal legal tender status, i.e. to be issued by the ECB/NCBs.

Legally speaking, however, a formal legal tender status is not mandatory. We have argued that there must be a form of retail public money to serve the key functions of providing a credit-risk free means of payment and store of value for the general public and that the ECB must guarantee a form of such retail public money.³²³ But it must not necessarily be physical cash, nor must it be formally assigned legal tender status. The legal position of a non-legal tender e-euro could and would have to be clarified in alternative ways. For example: To ensure that payment in e-euro discharges a citizen of public debts (such as taxes or television fees), the ECB could allow direct payment in e-euro by adopting an according legal act. In the unlikely event that a government would refuse to be paid in e-euro, the respective NCB could

Although the regulation avoided the use of ‘legal tender’, the media took it to mean that the Deutsche Mark replaced the Yugoslav dinar as official legal tender in Kosovo. See e.g. ‘Kosovo adopts Deutschmark’, BBC News, 3 September 1999 ([link](#)).

³²⁰ Article 6 Regulation 974/98. More specifically, ‘money of payment’ was distinct from ‘money of account’.

³²¹ Article 9 Regulation 974/98.

³²² According to Article 15 Regulation 974/98, banknotes and coins denominated in national currency kept their former status as legal tender for a maximum of six months after the end of the transition period.

³²³ See supra Section 3.2.

credit the government's reserve account instead. As long as physical cash continues to exist, a non-legal tender e-euro could be 'attached' to the legal tender status of banknotes and coins by the ECB guaranteeing to convert e-euro to physical cash promptly and at all times.³²⁴

4.4 Balancing of interests regarding the fundamental right to conduct a business

A potential limitation to the ECB's power to issue a rCBDC could be seen in the fundamental right to conduct a business as enshrined in Article 16 of the Charter. Arguably, this is because with the issuance of rCBDC, the central bank as a public authority may enter into a domain that has previously been perceived as a 'private business' conducted by commercial banks in particular. From a fundamental rights perspective, this is a grey area given that commercial banks' intermediary role is not only a business case but also aimed at supporting the central bank in fulfilling tasks of public authority. However, the fact is that depending on the exact features attached to it, rCBDC has the potential to change – to varying degrees – the conditions under which commercial banks have conducted their business to date.

The ECB, like any other institution of the EU, is bound to observe fundamental rights when interpreting the Treaty and executing its tasks. In particular, it must ensure that any measure it implements is justified in light of the legitimate goals pursued by it and proportionate to potentially affected rights of third parties. The economics literature offers insights into the potential impacts of rCBDC issuance on commercial banks (and other financial institutions) and is discussed in more detail below. We argue in the following that the risk of disintermediation is less of an issue than often assumed. In light of alternative strategies for banks to cope with changed underlying conditions for their business, disintermediation may even offer a chance for a change to the better in the longer term. Digital runs, on the other hand, pose a real risk that needs to be managed appropriately.

4.4.1 Risk of disintermediation

Very early on, the discussion about the potential introduction of rCBDC also included the potentially associated negative effects on financial institutions³²⁵ and especially commercial banks.³²⁶ Depending on the technical design of an e-banknote

³²⁴ Banque de France (n 276) 32.

³²⁵ E.g. payment services providers, money-transmission businesses and other entities operating in the markets for stored-value products.

³²⁶ Broadbent Ben, *Central banks and digital currencies*, Speech given by the Bank of England Deputy Governor for Monetary Policy, London, 2 March 2016 ([link](#)), p. 3; Smets Jan,

and the financial conditions attached to it, households could consider it an alternative to deposits rather than to cash.³²⁷ For the issuance³²⁸ of digital money, central banks would thus enter into direct competition with commercial banks or, at least, open up the market to further competition to the extent that central banks would make their reserves available to other intermediaries issuing fully-backed private e-banknotes.³²⁹

The public demand for e-banknotes will be based on a variety of *motives*.³³⁰ In any case, the starting point is convenience, or rather the need for digital money that is suited to the needs of modern life. However, the unique selling point compared to private fractional-reserve money will always be the desire to hold money that is not subject to the insolvency risk of the issuer – and in times of crisis it may even become the sole motive. In normal times, however, cost considerations are likely to spur additional demand if central banks (that are neither geared to maximising profits nor enticed to exploit its market power) can operate with lower fees than private competitors. Furthermore, the need for privacy will also play a role, since central banks do not commercialise data.³³¹

Absent any mitigating measures (discussed later³³²), the banks would be *affected* in several ways. First, to the extent to which deposits would no longer be used for payments (by funds transfer, card transactions, etc.), the associated income streams

Fintech and Central Banks – Fintech and the Future of Retail Banking, Speech given by the National Bank of Belgium Governor, Brussels, 9 December 2016 ([link](#)), p. 9; see also the study provided by MIT for the Bank of England in 2016: Moreno Arturo/Navarro Adriano/Quayyum Arif/Saravia Sergio/Siddiqui Emaad/Vasileva Detelina, *15.998 Independent Study in Blockchain – Project 3: Issuing a Central Bank Digital Currency*, p. 10; Broadbent (2016), Mancini-Griffoli et al (2018), Andolfatto (2018), Kumhof and Noone (2018), Meaning et al (2018), and Chiu et al (2019), among others.

³²⁷ See e.g. Bindseil (2020) pp. 9-14; BIS CPMI/MC (2018) pp. 11 et seq.; Wierds/Boven (2020) p. 19.

³²⁸ The same could apply to storage and transfer; however, these are delegable tasks, thus bearing a lower disintermediation risk.

³²⁹ See e.g. Adrian/Mancini-Griffoli (2019) p. 13 regarding potential motives (sponsoring of domestic issuers operating under direct supervision instead of leaving the market to natural monopolies of international big firms; retention of seignorage revenue).

³³⁰ See e.g. Juks (2019) p. 88.

³³¹ On the potential welfare impact of reductions in privacy in payments: Garrat/von Oordt (2019) *passim*.

³³² See *infra* Paragraph 4.4.7.2.

would erode.³³³ Second and equally correlated with the volume of payments no longer processed via their balance sheets, banks would be stripped of transaction data needed to provide information-intensive non-traded loans in a risk-adequate manner.³³⁴ Third and most importantly, the shift from deposits to e-banknotes would result in banks losing funding. The adverse effects would be all the more distressing the more households made a switch, as their deposits are traditionally used by banks as an important, stable, comparatively inexpensive and uncollateralised source of refinancing.³³⁵ Fourth, operational discipline of banks might decline or improve depending on the type of deposits to be redeemed in e-banknotes: those of cautious and well-informed wholesale depositors or of insured and passive retail depositors.³³⁶ Fifth and finally, services that are currently cross-subsidised (by both payment fees and economies of scale in funding) would need to become viable on a stand-alone basis.³³⁷

4.4.2 Freedom to conduct a business

In short, the introduction of an e-banknote could force banks (at least de facto) to accept a decrease in market power or else take measures that could entail costs and loss of income for them. This, in turn, could impair the *freedom to conduct a business*, which economic agents such as banks enjoy under Article 16 of the Charter. Freedom to conduct a business, which coincides with freedom to pursue an occupation, is one of the general principles of EU law.³³⁸ It is derived from the case law of the CJEU³³⁹ and aims to safeguard the right of each person, individual and

³³³ BIS (2018) p. 15.

³³⁴ Goodfriend Marvin, *Money, Credit, Banking, and Payments System Policy*, in: The U.S. Payments System: Efficiency, Risk and the Role of the Federal Reserve, Humphrey David B. (ed.), Kluwer Academic Publishers, 1990, 248, 253 et seq. (reprint: [link](#)); Fama Eugene, *What's Different About Banks?* Journal of Monetary Economics, Volume 15, Issue 1, January 1985, 29-39. See also Geva (2019) pp. 14, 20, 22.

³³⁵ See infra Subsection 4.4.4.

³³⁶ Mancini-Griffoli et al (2018) p. 16.

³³⁷ BIS (2018) p. 15.

³³⁸ See CJEU C-143/88, C-92/89 *Zuckerfabrik Süderdithmarschen and Zuckerfabrik Soest* [1991] ECR I-415, paras 72-77. The same is true of freedom to pursue an occupation: C-177/90 *Kühn* [1992] ECR I-35, para 16; C-280/93 *Germany v Council* [1994] ECR I-4973, para 78; C-248/95 *SAM Schiffahrt and Stapf* [1997] ECR I-04475, para 72.

³³⁹ The CJEU's case law in turn was inspired by national laws of EU Member States. Bernsorff Norbert, *Commentary [in German] on Article 16*, in: Meyer/Hölscheidt (eds.), *Charta der Grundrechte der Europäischen Union*, 5th ed. 2019, para 1; CJEU, C-4/73 *Nold* [1974] ECR 491; C-230/78 *Eridania* [1979] ECR 2749; C-151/78 *Sukkerfabriken* [1979] ECR 1; C-240/97 *Spain v Commission* [1999] ECR I-6571.

company, in the EU to pursue a business, i.e. to conduct a profit-seeking activity,³⁴⁰ without being subject to discrimination or disproportionate restrictions imposed by EU institutions (or Member States acting within the scope of EU law).

However, Article 16 of the Charter does *not* grant an *absolute* right. Rather, the provision itself makes clear that the freedom to conduct a business is to be exercised without prejudice to EU law and to national laws and practice. In addition, the freedom can be subjected to legitimate restrictions as set out in Article 52 of the Charter, if they are provided for by law and do not impair the very substance of the freedom guaranteed.³⁴¹ Further, limitations must correspond to objectives of general interest pursued by the Union or protect the rights and freedoms of others and, in line with the principle of proportionality, must not constitute a disproportionate interference in relation to the aim pursued.³⁴² In particular, a measure concerned should not exceed the limits of what is appropriate and necessary in order to attain the objectives pursued by the legislation in question. Where there is a choice between several appropriate measures, recourse must be had to the least onerous.³⁴³

With regard to e-banknotes, this means that their introduction needs a legal basis, which, as shown, can be seen in Article 128(1) TFEU as well as Article 128(1) in conjunction with 127(1) and/or 127(4) TFEU.³⁴⁴ Furthermore, e-banknotes will, as shown, contribute to realising the ECB's mandate in the digital age. In particular, they will help to preserve and foster two core objectives of general interest pursued by the Union in the field of monetary policy: first, to provide credit-risk free money in euro to the public, thus preventing households and corporates from leaving the euro for other digital private or public currencies;³⁴⁵ and second, to maintain price stability, since such switch away from the euro would both weaken the banking sector and complicate the transmission of monetary policy.³⁴⁶

Finally, as already explained, the same retention effect could not be achieved as efficiently and by less interference with the fundamental freedoms of banks through

³⁴⁰ CJEU, C-314/12 *UPC Telekabel* [2014] ECR I-192 paras 47 et seq.

³⁴¹ CJEU, C-200/96 *Metronome Musik* [1998] ECR I-1953, para 21.

³⁴² CJEU, C-184/02 *Kingdom of Spain* and C-223/02 *Republic of Finland v European Parliament and Council of the EU* [2004] ECR I-7829, paras 52–55.

³⁴³ See CJEU, C-184/02 *Kingdom of Spain* and C-223/02 *Republic of Finland v European Parliament and Council of the EU* [2004] ECR I-7829, para 57 with further references.

³⁴⁴ See *supra* Sections 3.1-3.4 and 4.1-4.3.

³⁴⁵ See *supra* Section 3.2.

³⁴⁶ See *supra* Section 3.3.

stricter supervision and regulation (of the financial market) and competition alone.³⁴⁷ In this regard, the principle of proportionality would be respected. However, the concrete effects on the banks must now be explained and weighted, taking into account external circumstances and conflicting public interests. The following subsections are devoted to this balancing of interests.

The introduction of an e-banknote will affect banks' business models in various ways. The following is an overview of banks' possible reactions, which, however, in practice will probably occur in combination. The order chosen is based on the assumption that without pressure, banks will change the status quo as little as possible. They will therefore try to maintain profitability to keep their costs low and their lending volume high.

4.4.3 Internalisation

If a banking system is well capitalised and resilient, it is likely to be able to absorb a mild outflow from deposits to e-banknotes.³⁴⁸ This applies all the more if the transition phase is accompanied by mitigating measures.³⁴⁹ At best, the resulting lower profits could be offset by the elimination of existing costs. The latter currently include the expenses related to cash turnover and negative interest on excess reserves.

At the end of 2019, total excess liquidity with central banks in the euro area amounted to 1.8 trillion (with negative interest rates at 0.5%).³⁵⁰ Overnight deposits with commercial banks stood at 4.47 trillion (for households) and 2.17 trillion (for corporates), respectively.³⁵¹ Besides, a total of 1.29 trillion euro banknotes were in circulation.³⁵² Insofar as *physical banknotes will be exchanged* for e-banknotes, new savings and income opportunities could arise for banks: costs of cash handling will be reduced and, provided banks were included in the payment processing, new fees could be raised or at least additional transaction data obtained.

At the same time, however, it should be noted that participation in a fundamentally new payment system for e-banknotes will require complex technical solutions. Thus,

³⁴⁷ See supra Subsections 3.2.2. and 3.3.1.

³⁴⁸ Confident in this regard: Bank of Canada (2020) section 4.

³⁴⁹ See infra Subsection 4.4.7.

³⁵⁰ http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=117.BSI.M.U2.N.R.LRE.X.1.A1.300.0.Z01.E.

³⁵¹ <https://www.euro-area-statistics.org/banks-balance-sheet-deposits?cr=eur&lg=en>.

³⁵² https://www.ecb.europa.eu/ecb/legal/pdf/ecb_2019_31_f_sign.pdf.

banks will incur probably major *initial investment costs*, at least for interface solutions, and, later, (lower) maintenance costs. Banks will have to internalise these cost factors in each of the approaches discussed below.

Banks that hold a *surplus of (negative yielding) reserves* with the central bank will likely accept a balance sheet reduction³⁵³. The extent of the latter can only be estimated. For Sweden, an estimate assumes that total demand (including all kinds of reasons to hold e-krona) will reach less than 3% of the gross domestic product (GDP) in normal times.³⁵⁴ Another study expects demand for an e-krona to meet the domestic transactional needs to be around 1-2% of GDP.³⁵⁵ Applied to the euro area with its GDP at EUR 11.9 trillion in 2019,³⁵⁶ these estimates would imply that transactional demand for e-banknotes would amount to a maximum of EUR 0.23 trillion. Given the figures above, and assuming that not only deposits but also cash will be exchanged, this seems to be tenable from a macroeconomic perspective – even though transaction demand is volatile within a month³⁵⁷ and further demand will stem from households and corporates that want to have savings in e-banknotes. For Sweden, in normal times, the latter demand is expected to reach 0.35% of GDP³⁵⁸, which would correspond to EUR 0.04 trillion in the euro area.

However, some reservations should be made: At the micro level, the situation at an *individual bank* can look quite different (if it has e.g. no excess liquidity while being faced with considerable deposit outflows). Also, in *times of stress*, the shift in deposits for ‘saving’ purposes in the literal sense could be massive, sudden and irresistible. This scenario will be examined in detail separately at the end.³⁵⁹ Besides, even banks with excess reserves might prefer to contain the outflow of deposits. This is because otherwise the *liquidity and funding* positions could be impaired due to the outflow of both (highly liquid) reserves and (relatively stable) deposits.³⁶⁰

³⁵³ Juks Reimo, *When a central bank digital currency meets private money: effects of an e-krona on banks*, Sveriges Riksbank Economic Review, Special issue on the e-krona, 2018:3, 79-99, p. 81.

³⁵⁴ Juks (2018) p. 88.

³⁵⁵ Under the assumption of a significant share of the payment market of 30%: Segendorf Björn, *How many e-krona are needed for payments?* Sveriges Riksbank Economic Review – Special issue on the e-krona, 2018:3, 66-78.

³⁵⁶ https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&lang=en.

³⁵⁷ Segendorf (2018) p. 73.

³⁵⁸ Segendorf (2018) p. 75.

³⁵⁹ See infra Subsection 4.4.6.

³⁶⁰ Juks (2018) pp. 83-87.

4.4.4 Funding

4.4.4.1 Retention by offering better value propositions

In order to *retain* the existing quantum and structure of refinancing, banks could be compelled to *offer a better value proposition* by improving services or setting higher interest rates on retail deposits or both.³⁶¹ The reason for the retention effort is primarily that deposits from retail customers are particularly stable and inexpensive sources of funding.³⁶² Moreover, since retail depositors do not require collateral, the bank is relatively free in how it structures the asset side of its balance sheet.³⁶³

This is due to the market power of the banks,³⁶⁴ which in turn has several sources. First, it is based on the sluggishness of retail depositors:³⁶⁵ Even though their deposits may be formally demandable, withdrawals remain partial and quite rare since they «are motivated mostly by individual depositors illiquidity needs and thus are predictable based on the law of large numbers».³⁶⁶ Besides, retail depositors are insensitive to risks and price differences since they often lack the necessary financial sophistication and, because of deposit insurance, have little incentive for the adequate attentiveness. Instead, they stay with the bank once selected, above all, because it offers them a range of services,³⁶⁷ but also in order to avoid high switching

³⁶¹ Bank of Canada 2020 sect. 4; Adrian/Mancini-Griffoli (2019), p. 10; Hofmann (2020) p. 61; Berentsen Aleksander/Schär Fabian, *The case for central bank electronic money and the non-case for central bank cryptocurrencies*, Fed Reserve Bank St. Louis Review 100(2):97-106, ([link](#)) pp. 101-102; Juks (2018) pp. 90-91 (however with the assumption of an interest bearing e-krona).

³⁶² See e.g. Bank of Canada (2020) section 4.

³⁶³ Mancini-Griffoli et al (2018) p. 16; Huang Rocco/Ratnovski Lev, *The Dark Side of Bank Wholesale Funding*, *Journal of Financial Intermediation*, 2011, 20 (2): 248–63 ([link](#)), sections 1 and 2.2. See however Smets (2016) p. 10 and footnote 13 with reference to opposing views.

³⁶⁴ Drechsler Itamar/Alexi Savov/Philipp Schnabl, *Banking on Deposits: Maturity Transformation without Interest Rate Risk*, NBER Working Papers 24582, National Bureau of Economic Research, Inc. 2018 ([link](#)), pp. 34 et seq.

³⁶⁵ Song Fenghua/Thakor Anjan V., *Relationship Banking, Fragility, and the Asset-Liability Matching Problem*, *The Review of Financial Studies*, Volume 20, Issue 6, November 2007, 2129–2177 ([link](#)) and SSRN ([link](#)).

³⁶⁶ Huang/Ratnovski (2011) 248–63 and ECB Working Paper Series No 1223 ([link](#)), section 1.

³⁶⁷ For instance transactional services like check-writing and overdraft privileges, as well as more relationship-oriented services like access to live bank tellers, cash management advice, etc.: Song/Thakor (2007) section 1.1.2.

costs.³⁶⁸ Another source of bank's market power is the level of concentration of local deposit markets.³⁶⁹ Given the importance of network effects and the sunk costs required for entry, the banking sector tends to monopolies, which allows imposing the terms and conditions in the retail sector.

In view of the above, it is unlikely that the principle of an open market economy as set out in Article 119 TFEU would be violated at all if banks were induced to offer depositors a better value proposition in order to retain deposits. Rather, there appear to be deficiencies in competition in the retail sector, from which the banks have so far benefited: Quite contrary to the principle of free competition, implicit government guarantees have subsidised bank funding in an estimated range of 60 to 80 basis points in recent decades.³⁷⁰ In addition, because the public had no (more³⁷¹) access to convenient digital *and* risk-free money, banks have been able to pay interest on retail deposits below the risk-adjusted rate. In any case, the low level cannot only be explained by the fact that banks must cover distinct costs such as deposit insurance fees, regulatory costs, as well as branch networks, salaries or marketing.³⁷² Most of these costs serve to maintain market power and the associated deficiencies. If an e-banknote were to break this power, they could disappear or be diverted to improve operational efficiency and customer services.

What is more, these costs are also incurred, at least in part, in the wholesale sector today.³⁷³ Nevertheless, wholesale funds earn higher interest rates – even though they are much more volatile and regularly only available against collateral;³⁷⁴ yet another indication that an e-banknote will not lead to distortions of competition, but will rather mitigate existing ones.

³⁶⁸ Huang/Ratnovski (2011) section 1 with further references.

³⁶⁹ Drechsler/Savov/Schnabl (2018) pp. 35, 61. The less small(er) firms account for a large percentage of the total market, the less concentrated it is.

³⁷⁰ The Netherlands Scientific Council for Government Policy (WRR), *Money and debt - the public role of banks*, Summary of WRR report 100, The Hague 2019, p. 8 ([link](#)); Mancini-Griffoli et al (2018) p. 23 and footnote 31 with further references to economic literature.

³⁷¹ See *infra* Paragraph 4.4.6.2.

³⁷² Adrian/Mancini-Griffoli (2018) p. 10.

³⁷³ However, there is also a great need for secure storage of value in the wholesale market, as the near-money premium shows: BIS CPMI/MC (2018) p. 17. If the wholesale sector could also replace part of its reverse repos with e-banknotes, the current scarcity of highly liquid and safe instruments would be alleviated.

³⁷⁴ Nabilou (2019) p. 18 with further references to economic literature in footnote 94.

Finally, whether or not an e-banknote will be issued, other developments in the financial markets will likely increase competition for deposit funding and payment services. Banks will therefore have to prepare for more competition anyway.³⁷⁵

4.4.4.2 Alternative funding in the market

Banks will only raise deposit rates until the resulting costs correspond to the costs of *alternative funding in the market*.³⁷⁶ At the latest when this point is reached, they will start adjusting the liability side of their balance sheet, in order to compensate for the loss in liquidity and funding stability just described.³⁷⁷ To this end, they will in particular roll-over maturing deposits from *asset managers* (such as pension and mutual funds) and other short-term liabilities by issuing new long-term market funding.³⁷⁸ Such restructuring will be easier for a banking sector that can already draw on an existing market for short- and long-term funding (and actually does make use of it to partially fund its operations). If banks instead have to turn to foreign markets for wholesale funding, investors will have little need for local currency. Because banks then will have to refinance in foreign currency, at least a functioning foreign currency swap market is required to enable banks to hedge their currency risk (with e.g. export or import firms exposed to foreign assets and thus willing to take the other side of the trade).³⁷⁹ No financial market is needed insofar as banks find *real sector depositors* willing to convert their demand deposits into stable funding instruments issued by banks, in particular term deposits.³⁸⁰

From the banks' standpoint, any alternative funding seems less attractive than retail deposits: The conversion will entail costs, even if only the real sector were involved.³⁸¹ But most importantly, wholesale customers (e.g., money market funds)

³⁷⁵ Bank of Canada (2020) section 4; Riksbank (2018) p. 30; Juks (2018) p. 90 with reference to competition due to Fintech.

³⁷⁶ The total cost of bank funding will fall as the repo rate increases: Juks (2018) p. 87.

³⁷⁷ For the adverse effects for banks confronted with an outflow of deposits to (foreign) e-money providers that in turn recycle client funds back to the banks and reactions of the latter: Adrian/Mancini-Griffoli (2019) p. 10.

³⁷⁸ Adrian/Mancini-Griffoli (2019) p. 10; Juks (2018) pp. 88 et seq.; Smets (2016) p. 10.

³⁷⁹ Juks (2018) p. 86 and footnote 12 with further reference.

³⁸⁰ Juks (2020) pp. 69-71.

³⁸¹ Juks (2020) p. 73: the cost of conversion will be lower if the real sector holds deposits for saving purposes and higher if it holds them for transaction purposes. In contrast, the funding restructuring via financial markets will in any case entail costs since wholesale investors will only exchange their liquid assets against less liquid assets if they are appropriately compensated for it.

are well-informed players requiring risk-adjusted interest rates, margins and information-insensitive collateral, thus restricting the banks' possibilities to grant information-intensive non-traded loans. All in all, historical data suggest that such a roll-over will increase the bank's funding costs. For Sweden, the effect has been quantified at up to 25 basis points.³⁸² Moreover, institutional investors dispose of larger lot sizes and, compared to the retail sector, usually increase their safety margins or even withdraw their assets faster and more rigorously in times of stress.³⁸³

But even if in the recent past mainly wholesale investors were at the forefront of bank runs, restructuring flows of funding in their direction need not necessarily destabilise the banking system in the future. Depositors and payment transactions will become less dependent on banks, in line with the switch to e-banknotes. Hence, the systemic relevance of banks and the associated moral hazard should decrease, while the risk of additional retail outflows and the monitoring of wholesale investors should further discipline the banks – thereby contributing to the overall stability of the financial system.

4.4.4.3 Alternative funding via central banks

Regularly, reference is also made to the central bank as a further funding alternative:³⁸⁴ If banks needed liquidity – triggered by the public's switch away from deposits – and could not obtain it elsewhere, the central bank would be referred to in its role as liquidity provider in ordinary and extraordinary times.³⁸⁵ While this is admissible in principle, its implementation will pose major *challenges*. These are twofold: first, it could further increase the central banks' balance sheet size and, with regard to the asset side, their footprint in the (financial) economy. Second, there is a risk of a structural change on the asset side of central banks' balance sheet if the criteria for eligible collaterals were softened (or even uncollateralised loans granted to liquidity seeking banks). The same would be the case if the range of assets eligible for outright purchase were expanded or the criteria of central bank's currency

³⁸² In case of uncovered funding: Juks (2018) pp. 90 et seq. and 98.

³⁸³ Gorton Gary B., *Slapped in the Face by the Invisible Hand: The Panic of 2007*, Oxford University Press, 2010 ([link](#)), pp. 15, 43 et seq.

³⁸⁴ Wiertz/Boven (2020) p. 19-21; Juks (2018) 82; Bank of Canada (2020) section 4.

³⁸⁵ Brunnermeier Markus K./Niepelt Dirk, *On the Equivalence of Private and Public Money*, *Journal of Monetary Economics*, 106 (2019) 27–41, p. xx.

reserves portfolio relaxed.³⁸⁶ Both challenges are to be taken seriously, but at the same time must be put into perspective.

To start with the *footprint*, i.e. the central bank's investments in financial (collateral) markets and beyond, it should be remembered that this exposure was originally much higher. This is because also the share of cash in M1 was much higher than today.³⁸⁷ Then as now, the central bank covered its issued (cash) money with assets. The latter consisted not just of precious metals. Rather, a number of tradable assets were also eligible for cover from an early stage, among them bills of exchange, cheque and government debt securities.³⁸⁸

Thus, depending on the share of cash in M1, the central banks' footprint in the past was at times significantly larger than it was before the quantitative easing programmes were launched from 2007/2008. Nevertheless, the *size* of the footprint at that time does not appear to have distorted the markets (for eligible assets) in any significant way. The problem is therefore apparently less the quantity of central bank investments than their quality, i.e. the composition of the portfolio on their assets side. Why is this so?

A fundamental difference between commercial banks and central banks is that the latter (ideally) only monetise³⁸⁹ *standardised and marketable* assets. In contrast, banks create money also by granting unsecured loans, where they must decide individually whether they want to accept the risk of the counterparty. Not so the central banks: (again: ideally) they leave the assessment of the quality of the monetised assets to the market and thus do neither have to examine the individual

³⁸⁶ For instance, if the Swiss National Bank (SNB) purchases euros from banks, it then invests these currency reserves on the financial markets according to the Investment Policy Guidelines issued by the Governing Board of the SNB (which in turn are based on the permitted investment operations and responsibilities set down in the Articles 5, 9, 42 and 46 of the National Bank Act; see [link](#)).

³⁸⁷ See supra Section 2.1.

³⁸⁸ For instance, in Switzerland this comprised bills of exchange, cheque and liquid debt securities of foreign countries (all maturing within three months), treasury bills and bonds issued by government and state (owned) agencies and mortgage bonds issued by the Swiss Mortgage Bond Institutes (all maturing within two years) as well as sight deposits abroad. See Art. 19 of the Swiss National Bank Act of 1953 ([link](#)). A comparable provision existed in § 19 of the German Bundesbank Act of 1957 ([link](#)).

³⁸⁹ I.e. they create reserves by accepting these assets as collateral in temporary transactions or buying them outright.

risk profile of assets nor, in the case of debts, the credit risk in particular.³⁹⁰ This reflects the idea of efficient markets, which determine the quality and price of assets more adequately than the state ever could.

This must of course be relativised in several ways. First, the financial crisis has painfully shown that the market can overvalue assets in irrational exuberance (temporarily). Second, demand and supply of an asset (and with it its market valuation) are distorted once the asset becomes eligible for central bank operations.³⁹¹ Third, and most importantly, central banks have inflated the reserves of their monetary policy counterparties from the onset of the financial crisis in 2007, in order to provide the market, which had dried up, with the necessary liquidity. To do this, however, they often had to significantly expand their baskets of eligible assets,³⁹² because otherwise there would not have been enough collateral on the banks' balance sheets.³⁹³ Some central banks went so far as to include even the pure opposite of standardised and marketable assets, namely non-securitised loans, in their basket of eligible assets.³⁹⁴

In contrast to the past, this not only increased the size of central banks' asset portfolio (aka footprint) but also considerably expanded its qualitative composition. However, all of that occurred in extraordinary times, out of urgent necessity and has yet to prove its worth in the long run, as it remains to be seen whether the effects achieved can justify the associated risks of market distortions and moral hazard. The distortion risk is due to the fact that resources would be less effectively allocated

³⁹⁰ Wierds/Boven (2020) p. 21 footnote 24.

³⁹¹ BIS CGFS (2015) p. 24: «There is also evidence that eligibility-induced issuance incentives can be an important source of structural effects, as banks look to issue more of certain types of central bank-eligible assets.»

³⁹² BIS Global Financial System Markets Committee, *Central bank operating frameworks and collateral markets*, Report, CGFS Papers No 53, March 2015 ([link](#)), pp. 4 et seq.

³⁹³ The monetary policy and intraday credit operations of the Eurosystem are to be collateralised, «to mitigate the risk of financial loss to the liquidity-providing central bank in the event of counterparty default»: Athanassiou (2020) para 713 and footnote 12, referring to the second indent of Article 18.1 of the Statute.

³⁹⁴ See e.g. BIS CGFS (2015) p. 23 regarding the policy change of the Bank of England in 2011. Juks (2020) p. 75 mentions further examples (Federal Reserve, Bank of Canada) which show that the «inclusion of raw loans to the set of eligible collateral is by no means an extraordinary step for central banks» since they «have already collateral frameworks that allow pledging of raw loans in their credit operations».

because increased financial intermediation by *central* banks would take place at the expense of the efficient use of information at a *decentralised* level.³⁹⁵

The moral hazard risk concerns in particular the banks themselves, if central banks, as it has been suggested, would provide them with un(der)collateralised funding, possibly becoming (one of) their largest depositors that refrain from running themselves in times of financial stress.³⁹⁶ If risks would actually occur, in particular if a bank would become insolvent and could not redeem its loan to the central bank or if collateral in the central bank's portfolio would default, the central bank balance sheet became negative. In extreme cases, the state would have to recapitalise it and ultimately compensate via taxes. Of course, this would not be far from what was practiced in the past via bail-outs and the like. However, the latter were to be overcome with the help of improved regulation and resolution procedures – and not to be accepted again through the back door, quasi as collateral damage in the course of issuing e-banknotes.

As a result, this means that central banks should only participate in the restructuring of funding insofar as commercial banks can offer them standardised and marketable assets either as collateral or for sale. In any case, they should not grant uncovered loans to banks and should only accept standardised and marketable assets as collateral or buy outright. The former is the only way to keep the central banks' footprint in the market within acceptable limits; the latter keeps the moral hazard risk as low as possible.

4.4.4.4 Alternative funding by cooperative means of self-help

However, this could lead the banks to grant less information-intensive loans that are not easily securitised. To avoid this undesirable consequence, new ways would have to be created to make it easier for banks to monetise such loans: banks should *restructure their funding through* new channels based on the *cooperative idea of self-help*.

The Swiss system of Mortgage Bond Institutions could serve as a model for this: For each type of loan that banks grant to the public, at least two institutions (for reasons of competition)³⁹⁷ would have to be established. Shareholders of such institutions would be banks that grant the type of loan in question (e.g., mortgages). The banks

³⁹⁵ BIS CPMI/MC (2018) p. 14; Wierds/Boven (2020) p. 21 with reference to a paper (in Dutch) of Houben Aerdts/Reijnders Dion, *De lat voor digitaal centralebankgeld ligt hoog*, Economisch Statistische Berichten, 4774, 2019, 256-258.

³⁹⁶ Brunnermeier/Niepelt (2019) pp. 38-39.

³⁹⁷ And in contrast to e.g. the Danish model of covered bonds.

would then pledge the loans they had granted to the public (here: the mortgages) to the institutions as collateral to obtain (covered) loans themselves from the institutions. The pledge is made by entering the loans to the public in question in a separate register (so-called registered pledge). For their part, the institutions would refinance the covered loans they grant to the banks by issuing covered bonds to the public. To this end, the loans to the banks would likewise be entered in a pledge register, thereby serving as collateral by registered pledge.³⁹⁸

Since, unlike with securitisation, the banks would keep their (pledged) loans granted to the public on their own balance sheets, they would remain more cautious in their lending – as would the institutions that likewise keep the (pledged) loans granted to the banks on their own balance sheets. This is all the more so as the institutions would only accept good quality loans as collateral, since otherwise the other shareholders would intervene in order to avoid that too lax of a practice of their institution would put pressure on the quality of the bonds and thus on their price in comparison with the bonds of competing institutions.

4.4.5 Lending

If banks do not succeed in internalising the outflows of their deposits (or the resulting deterioration in liquidity and refinancing) or avert them by means of a better value proposition and lack adequate refinancing alternatives at the same time, they will have to adjust their lending practice:³⁹⁹ long-term loans will tend to be either more expensive or granted less frequently.

However, cutting the lending to the real sector would only improve the bank's liquidity, but not its funding situation. This is so because a reduction in lending will also destroy retail deposits (consisting of the lent money).⁴⁰⁰ In addition deleveraging would further weaken the banks' market power since they would not only lose market share and potential revenue but also transaction data needed to provide loans in a risk-adequate manner, to the extent that payments are no longer processed via their balance sheets.⁴⁰¹

³⁹⁸ See Swiss Mortgage Bond Act of 25 June 1930 ([link](#); only in German, French and Italian).

³⁹⁹ Juks (2020) p. 68 deems the effect of a (retail) CBDC on banks supply of loans in normal times to be likely insignificant.

⁴⁰⁰ Juks (2018) p. 85.

⁴⁰¹ Goodfriend (1990) pp. 248, 253 et seq.; see also Geva (2019) pp. 14, 20, 22.

For this reason, banks will increase their lending rates where possible.⁴⁰² This, in turn, will depend on their power in loan markets⁴⁰³ and the (non-)availability of substitutes for bank lending to companies and households such as the corporate bond market as well as direct lending by institutional and retail investors.⁴⁰⁴ Provided that banks start from a position of market power, some even argue that banks would have leeway to increase rates on deposits, increasing both their amounts and lending.⁴⁰⁵

In any case, it must be ensured that the PSD2 will also cover transactions with e-banknotes, in the sense that, at the request of the person who made a transaction, the related data will be released to authorised or registered third parties.⁴⁰⁶ This would enable banks to have access to the complete financial history of a potential borrower – even if the latter did not (or no longer) have a payment account with the bank. In this way, banks could continue to operate where their core competence lies: in the provision of information-intensive non-traded loans in a risk-adequate manner.

4.4.6 Stressed times

4.4.6.1 Problem outline

A particular concern relates to the impact of an e-banknote on the banking sector in stressed times. If a confidence crisis occurs, bank creditors compare relative merits of different alternatives to their current investments. Where only a single bank is affected, runs today are already mostly digital,⁴⁰⁷ with retail clients transferring their deposits to other banks and wholesale creditors not rolling over their maturing debts

⁴⁰² See e.g. Bank of England (2020) p. 35.

⁴⁰³ Mancini-Griffoli et al (2018) pp. 15-16; Agur/Ari/Dell'Ariceia (2019) p. xx.

⁴⁰⁴ Juks (2018) p. 91.

⁴⁰⁵ Andolfatto (2018) p. xx.

⁴⁰⁶ See Article 67 PSD2 regarding rules on access to and use of payment account information in the case of account information services: «(1) Member States shall ensure that a payment service user has the right to make use of services enabling access to account information as referred to in point (8) of Annex I. (...) .» See also Article 94(2) PSD2 regarding data protection: «Payment service providers shall only access, process and retain personal data necessary for the provision of their payment services, with the explicit consent of the payment service user.» For the time being, Article 3(a) PSD2 excludes payment transactions «made exclusively in cash directly from the payer to the payee, without any intermediary intervention.»

⁴⁰⁷ Kiff et al (2020) p. 17.

claims. In both cases, the bank concerned must settle the transfer or repayment to accounts with other banks by means of reserves.⁴⁰⁸

But the greater the mistrust in the banking sector as a whole, the more retail creditors ask for cash – and wealthy as well as wholesale creditors for safe assets such as government bonds. Both escapes routes are limited, however; the former because cash handling involves inconvenience, risk and cost and the latter because the supply of safe assets is limited, so that with increasing demand their price rises and their yield falls, respectively.⁴⁰⁹ Beyond a tipping point, particularly large sophisticated creditors will therefore shift their money to offshore banks or into foreign currency assets, ultimately turning the banking crisis into a currency crisis.⁴¹⁰

If, in contrast, an e-banknote were available, even the creditors of an individual troubled bank might prefer to switch to e-banknotes. The liquidity thus withdrawn would make the banking system as a whole more fragile, which could develop into an aggregate run.⁴¹¹ The process could be remarkably fast, as psychological moments may provide an additional momentum: since all creditors are equally aware of this readily available option and anticipate the corresponding reaction of their peers, they themselves will act all the more quickly.

4.4.6.2 Historic evidence

In order to better assess the magnitude of such a run, the experiences of those countries in which a digital form of public money was available during crises in the past must be taken into account. Of course, the nature of the crisis (individual, systemic), the design of the public money (e.g., limits or potential payment options) as well as further circumstances (in particular aid for troubled banks in form of state guarantees or deposit insurance) will also need to be considered.

An instructive example is the Swiss PostFinance. When the financial crisis hit in 2007/2008, PostFinance was wholly owned by the Swiss Post, which had been an independent public-law institution of the Confederation since 1998. Due to this legal form, a subsidiary but unlimited state guarantee existed for all deposits with PostFinance. These deposits reached nearly CHF 45 billion in 2007, while deposits

⁴⁰⁸ In the event that the troubled bank could no longer cover a resulting negative balance by borrowing from other banks, the central bank would have to assess the liquidity and solvency situation before it could intervene as lender of last resort. Juks (2018) p. 93.

⁴⁰⁹ Juks (2018) pp. 91-94.

⁴¹⁰ Adrian/Mancini-Griffoli (2019) p. 12.

⁴¹¹ Bank of Canada (2020) section 4.

with Swiss banks amounted to around CHF 190 billion.⁴¹² However, the abolition of the state guarantee had been under discussion for some time. The necessary statutory amendment went to parliament in 2009, came into force in 2012 and terminated the state guarantee as of 2017.⁴¹³ Since then, the deposits are only protected by the deposit guarantee scheme, which the banks finance themselves and ex post. The limit of CHF 30,000 per depositor and bank was temporarily increased to CHF 100,000 in December 2008 as an emergency measure. The system ceiling was also raised from CHF 4 to 6 billion (around 3% of privileged deposits); since September 2011 it has been permanently anchored in ordinary law.⁴¹⁴ Since PostFinance was granted bank status in 2013, it has also been participating in the guarantee system. In Switzerland, the financial crisis primarily affected the two big banks UBS and Credit Suisse, which had been heavily active in the US subprime market. From autumn 2007, there were massive outflows of deposits to other banks, which only stopped when the federal government and the Swiss National Bank (SNB) rescued UBS in October 2008 and subprime paper prices recovered from 2009 onwards thanks to purchases by the US Fed.⁴¹⁵ Given the above, how did deposits at PostFinance develop in the period concerned? Between 2004 and 2008, inflows fluctuated at around CHF 2-3 billion per year. Then, deposits doubled from CHF 58 to 120 billion by 2016, where they still lie today.⁴¹⁶

Two things stand out. First, from 2007 to 2016, across all deposits the ratio at PostFinance increased from one to two-fifths, whereby the inflow remained strong in 2009 – even though deposit protection had been increased and UBS was rescued. Second, inflows stopped permanently only with the abolition of the state guarantee in 2017. These are indications that (at least in Switzerland) the public has a need for credit-risk-free money even outside of a crisis, and that it perceives deposit

⁴¹² See answer of the Swiss Federal Council to an interpellation (inquiry, case no. 10.3851) of 1 October 2010 ([link](#); only available in German, French and Italian).

⁴¹³ Based on three Acts, all in force since 1 October 2012: Postal Act, Postal Organisation Act Postal Ordinance.

⁴¹⁴ In September 2008, total privileged deposits amounted to CHF 193 bn, with eight banks (groups of banks) exceeding CHF 5 bn, the largest of which was CHF 36 bn: Sethe Rolf, *Einlagensicherung und Systemstabilität*, SZW 6/2012, 507-522 ([link](#)), pp. 514-515.

⁴¹⁵ For a brief overview of the measures taken see e.g.: Jordan Thomas, Introductory remarks given by the Governor of the SNB at the news conference held in Zurich on 11 December 2008 ([link](#)), pp. 4 et seq.

⁴¹⁶ According to the Postfinance annual reports ([link](#)), deposits (in CHF billion) developed as follows: 32.8 (2003); 35.7 (2004); 38.2 (2005); 40.6 (2006); 43.7 (2007); 58.0 (2008); 73.3 (2009), 84.1 (2010); 92.2 (2011); 103.0 (2012); 108.5 (2012); 113.6 (2013); 117.2 (2014); 114.9 (2015); 119.4 (2016); 119.8 (2017); 118.9 (2018); 119.1 (2019).

insurance as an imperfect substitute. However, after the crisis, outflow related to such need was so moderate that it could easily be absorbed by the rest of the banking system – not least because PostFinance is not allowed to grant loans and therefore holds its funds as deposits with the other banks unless it invests them in the financial market.⁴¹⁷

Other such examples⁴¹⁸ include the deposit accounts offered by the Swedish National Debt Office; the Dutch Postcheque- en Girodienst as well as the Rijkspostspaarbank; the US Postal Savings banks and in the British Post Office Savings Bank. Here too, the type of crisis, the design of the digital public money and further circumstances would have to be taken into account – but this would go beyond the scope of the present paper. However, the Swiss experience already leads to the conclusion that digital public money will always experience inflows in a crisis. Its magnitude, though, depends largely on how this money is designed and what complementary crisis intervention measures are taken. The last Subsection is therefore devoted to these.

4.4.7 Factors affecting the degree of potential disintermediation

4.4.7.1 External conditions

Several factors will influence the demand for e-banknotes. First, there are external circumstances that cannot (directly) be influenced, such as the general interest rate environment and the stability of the financial system. It is assumed that in the absence of a crisis and with a generally higher interest rate level, demand for an e-banknote will be modest⁴¹⁹ – at least if, as advocated here, the latter is not interest-bearing.⁴²⁰ Moreover, banks are likely to be able to more easily absorb the switch from deposits to e-banknotes if they have substantial excess reserves with the central bank.

Accordingly, the introduction of (non-interest-bearing) e-banknotes may be more appropriate at a time when the general interest rate level is close to, but not below,

⁴¹⁷ See PostFinance, Financial report 2019, pp. 29-30 ([link](#)). In 2019, amounts due from other banks reached 30% of all assets. The prohibition for PostFinance grant loans is about to be lifted.

⁴¹⁸ In addition, Bank of England (2020) pp. 36-37 suggests taking into account previous financial reforms in the UK that have had implications for bank intermediation such as Competition and Credit Control in 1971 and the financial liberalisation reforms of the 1980s. For further economic literature looking at state banks with healthy balance sheets or explicit and credible state guarantees: Mancini-Griffoli et al (2018) p. 24 footnote 36.

⁴¹⁹ Juks (xx)

⁴²⁰ See supra Subsection 3.3.3.

zero, when the financial sector is stable and the stock of excess reserves of banks with the central bank is high.⁴²¹ In the event of deviations from these supposedly favourable external conditions, the following other elements will be all the more important.

4.4.7.2 General mitigating measures

Mitigating measures refer to measures that do not directly pertain to features attached to the e-banknotes themselves. They rather aim to influence the economic environment in which banks operate through policy measures and regulation in a way that either prevents possible disintermediation or at least cushions its effects. Most notably, mitigating measures include deposit insurance and moratoria *de lege lata et ferenda* under the Bank Recovery and Resolution Directive, but also possible policy rate facilitations by the central bank.⁴²²

Tobin pointed out that if deposits in digital form and covered by the state, which he had called for as early as 1987,⁴²³ were introduced, deposit insurance could be limited to covering operational risks in the future.⁴²⁴ However, historical experience shows that the outflow from deposits is significantly lower where deposit insurance is available.⁴²⁵ State banks with healthy balance sheets or explicit and credible state guarantees have also alleviated the run risk in the past. For instance, in Sweden the banking crisis of 1990-1994 did not incite any run from bank deposits to the then still state-owned Postgirot, since the government announced to guarantee all deposits of the 114 banks.⁴²⁶

⁴²¹ As to possible consequences if reserves are low see e.g. Bank of England (2020) p. 37.

⁴²² For further adjustments of the current regulatory landscape: Juks (2018) pp. 95-96.

⁴²³ Tobin James, *The Case for Preserving Regulatory Distinctions*, in: Federal Reserve Bank of Kansas City (ed.), *Restructuring the Financial System, Kansas 1987* ([link](#)), 167-183, p. 172: «I think the government should make available to the public a medium with the convenience of deposits and the safety of currency, essentially currency on deposit, transferable in any amount by check or other order» and p. 173: «Computer capabilities should soon make it possible to ... even ... order payments to third parties by card or telephone».

⁴²⁴ *Ibid* p. 172; Ordóñez Miguel Fernández, *The future of banking: secure money and deregulation of the financial system*, Areces Foundation Seminar, 6 February 6 2018 ([link](#)), p. 4.

⁴²⁵ Mancini-Griffoli et al (2018) p. 24; Wierts/Boven (2020) p. 24.

⁴²⁶ Segendorf (2018) p. 74. Neither was there a run into National Debt Office (NDO) accounts during the Financial crisis of 2007/2008. However, in the latter the crisis of confidence remained concentrated to a limited number of banks. In addition, NDO accounts do inter alia not offer any payment functionality and inflows take up to two weeks to be credited: Juks (2018) pp. 94-95.

For this reason, and in particular to prevent run risk in crises, it would seem advisable to maintain the current deposit guarantees. In order to minimise the moral hazard risk, however, at least where insurance is still financed ex post or is even guaranteed by the state, a switch to a system financed ex ante solely by the banking sector would be necessary.

Beyond the ceiling of protected deposits, relevant authorities should be given the ability to freeze the flow of payments based on specific pre- and in-resolution moratorium powers which could be introduced through amendments to Title III (early intervention) and Chapter VI (resolution powers) in Title IV (resolution) of the Bank Recovery and Resolution Directive (BRRD).⁴²⁷

4.4.7.3 Specific features attached to e-banknotes

Finally, and most importantly, the degree of possible disintermediation of banks will largely depend on specific features attached to e-banknotes.⁴²⁸ The risk of disintermediation is all the lower, the less the convenience and functionality provided by the e-banknote comes close to that of deposits. However, it would be wrong to choose a particularly rudimentary, unattractive model for this reason. This would undermine the goal of finally providing the public with an adequate digital form of public money, which in particular prevents people from migrating from their own currency.⁴²⁹

To date, a number of economic models have been developed in which disintermediation is mitigated by several specific features or a combination thereof.

⁴²⁷ For the existing moratorium powers see Article 69 of Directive 2014/59/EU of 15 May 2014 ([link](#)). For recently proposed amendments see: Financial Markets Law Committee (FMLC), Bank Recovery and Resolution Directive: Legal Uncertainties in the Proposal to Amend Moratorium Powers, April 2018 ([link](#)).

⁴²⁸ Only focusing on the economic design: Bank of England (2020) p. 38.

⁴²⁹ See e.g. Kiss et al (2020) p. 22 and Bank of England, Central Bank Digital Currency: Opportunities, Challenges and Design, Discussion Paper, March 2020 ([link](#)), pp. 34 et seq. enlisting a number of attributes that are key to CBDC success in terms of design options: payment functionalities allowing 24/7 availability, some offline payment options, optimal balance between throughput and speed of settlement, between privacy and integrity (resistance against illegal use) as well as between efficiency and security, intuitive handling, cost-effectiveness, open architecture and interoperability.

First, there would be the possibility of introducing interest⁴³⁰ or other *financial barriers*, such as fees⁴³¹. Alternatively or in addition, it is proposed to limit access, for example to residents and non-residents with a nationality from within the euro area⁴³² or via absolute *ceilings* (e.g., per transaction).⁴³³ A third proposal focuses on convertibility, either not guaranteeing it at all⁴³⁴ or limiting it to selected non-bank assets such as government bonds or cash.⁴³⁵

However, for the reasons already explained, we reject any demand control of e-banknotes via (positive or negative) interest rates on e-banknotes.⁴³⁶ Our further

⁴³⁰ Kiff et al (2020) pp. 33 et seq.; Bank of England (2020) p. 38; Kumhof Michael/Noone Clare, Central Bank Digital Currencies – Design Principles and Balance Sheet Implications, Bank of England Staff Working Paper No. 725 ([link](#)), who use further features in addition to the interest calculation: non-convertibility between reserves and CBDC, no guaranteed on demand convertibility of deposits into CBDC, issuance of CBDC by central bank and only against eligible securities (gov. bonds); Keister/Sanches 2019: interest increases cost of funding for banks [Should Central Banks Issue Digital Currency? Federal Reserve Bank of Philadelphia Working Paper No. 19-26]; Chiu/Davoodalhosseini/Jiang/Zhu (2019) situation if banks have market power [Central Bank Digital Currency and Banking, Bank of Canada Staff Working Paper No. 2019-20]; Andolfatto (2018) [Assessing the Impact of Central Bank Digital Currency on Private Banks, Federal Reserve Board of St. Louis Working Paper No. 2018-26C]; Brunnermeier/Niepelt (2019) ceb lends back to cob [On the Equivalence of Private and Public Money, Journal of Monetary Economics 106 (October) 27-41].

⁴³¹ Kiff et al (2020) pp. 33-34 with further references.

⁴³² Wierds/Boven (2020) p. 34.

⁴³³ Gürtler/Nielsen/Rasmussen/Spange, Central bank digital currency in Denmark? Danmarks Nationalbank, 2017 ([link](#)), pp. 16-17; Kiff et al (2020) pp. 31-33; Panetta Fabio, 21st Century Cash: Central Banking, Technological Innovation and Digital Currency, Speech given by the Bank of Italy Deputy Governor, 7 June 2018, SUERF Policy Note, Issue No 40 ([link](#)), p. 6; on the technical challenges: Gürtler Kirsten Elisabeth/Rasmussen Kristine/ Nielsen Søren Truels/Spange Morten, Central bank digital currency in Denmark?, Danmarks Nationalbank Analysis No 28, 15 December 2017 ([link](#)), p. 17; waterfall account for exceeding payments suggested by Bindseil (2020) p. xx and implemented by the Central Bank of Bahamas DBDC pilot: Central Bank of the Bahamas, Project Sand Dollar: A Bahamas Payments System Modernisation Initiative, 24 December 2019 ([link](#)), p. 12.

⁴³⁴ Kumhof/Noone (2016); since then parity with reserves and cash would be lost, this proposal lacks support among central banks: Wierds/Boven (2020) p. 35.

⁴³⁵ Wierds/Boven (2020) p. 21; Bindseil (2020) p. xx; Juks (2018) p. 96; Kiff et al (2020) p. 16: issued only against existing physical cash; Kumhof/Noone (20xx) ([link](#)): issuance of CBDC by central bank and only against eligible securities (government bonds).

⁴³⁶ See supra Subsection 3.3.3.

deliberations are therefore based on the assumption of non-interest-bearing e-banknotes.⁴³⁷

Instead, for a transition period (until banks have adapted to the co-existence of e-banknotes), we prefer limits on the amount of rCBDC that could be held.⁴³⁸ For very practical reasons, the public would ultimately also be confronted with limits in the case of cash (to which costs involved in withdrawing and storing large amounts of cash would be added): Comparing the amount of demand deposits within the euro area with the amount of cash in circulation, it is clear that the supply of cash would quickly reach logistical limits. For instance, the Sand Dollar Project in the Bahamas comprises limits, the exceeding of which triggers an automatic ‘waterfall’ so that the surplus is returned to a bank deposit.⁴³⁹ For unbanked users, it would be conceivable that payments above the limit are not executed at all.

It was also proposed to choose a supply mechanism whereby e-banknotes would only be issued against specific non-bank assets, i.e. not in direct exchange for bank deposits and the like.⁴⁴⁰ This would initially have the advantage that the total amount of bank deposits would not decrease, since the assets in question would be paid with bank deposits. But if demand for e-banknotes were high, the banks would still be affected. Because if non-bank assets such as government bonds are to be a sufficient cover for e-banknotes, they must be eligible under central bank standards. If they became scarce, this would also impact bank’s possibility to further refinance with the central bank. Moreover, such a system would favour the wholesale sector, which traditionally already holds such assets, over the retail sector, for which e-banknotes are primarily intended. A tiered structure might be most beneficial: for example, the exchange of deposits could be limited to the amount of the secured deposits. At the same time, the guarantee per bank and depositor would be reduced by the withdrawals made and only increased again when a new deposit is made.

Finally, preference should be given to models in which the central bank merely provides the core infrastructure and a minimum necessary functionality for payments.⁴⁴¹ On this platform, private sector firms (so called Payment Interface Providers) – among them necessarily banks – could connect and offer customer-

⁴³⁷ Models without an interest feature can be found at: Bank of Canada, Contingency Planning for a Central Bank Digital Currency, 25 February 2020, section 4.

⁴³⁸ See also Wierds/Boven (2020) pp. 21 and 34.

⁴³⁹ See Bindseil (2020) p. xx.

⁴⁴⁰ See footnote 435.

⁴⁴¹ See e.g. Bank of England (2020) p. xx (at Figure 4.1).

facing services and build additional functionality (so called overlay services). While the central bank would ensure security, resilience and interoperability by standard setting and regulation, the private sector could further innovate its services in a competitive environment and take over functions such as compliance, from which the central bank should refrain.

4.4.8 Conclusion

The above leads to the conclusion that, while the issue of e-banknotes will affect the fundamental right of banks to conduct a business according to Article 16 of the Charter, the conditions for such an intervention, and in particular the principle of proportionality, will be respected, if appropriate features are attached to e-banknotes and further mitigating measures are taken.

This is because the objectives of general interest pursued with the introduction of an e-banknote cannot be achieved just as effectively and with less interference with banks' fundamental rights by stricter supervision and regulation alone. Besides and as shown, although banks will possibly suffer losses in their earnings, these earnings have so far been partly due to impaired competition, since the lack of digital, credit-risk-free money has enabled them to obtain (too) favourably priced refinancing.

Systemically important institutions, in addition, have benefitted from indirect subsidisation because investors and other counterparties of the banks have factored in the (expected) state aid in times of crisis. E-banknotes with the right features, in contrast, will create improved conditions of competition, which should eliminate these distortions. With estimated subsidies of 60 to 80 basis points, the expected overall increase in banks' financing costs of up to 25 basis points takes on a different dimension. Besides, whether or not an e-banknote will be issued, disintermediation of the banking sector is already happening as a result of developments in payments. Banks will therefore have to prepare for more competition anyway.⁴⁴²

This is all the more so since the monetary system cannot be compared to any ordinary market from which the state has to withdraw according to the principle of a free market economy. Even if money as such is not a public good, confidence in its stability and the instrumental provision of core infrastructure that ensures the safety, efficiency and finality of payments in all segments are certainly public goods in

⁴⁴² See also Bank of England (2020) p. 37.

whose provision the central bank plays a pivotal role.⁴⁴³ In other words, only the – well measured – intervention of the government or, in its place, of the central bank, which is especially qualified for this purpose, allows the market to develop efficiently in the monetary area.

Finally, the core content of Article 16 of the Charter would only be violated if e-banknotes literally drove banks out of their market. As has been shown, this is not to be expected in normal times and in particular not in an environment with higher interest rates. Besides, the introduction of an e-banknote can be cushioned by mitigating measures that prevent or alleviate bank runs in times of crisis.

4.5 Balancing of interests regarding the fundamental rights to privacy

As outlined earlier, we argue that only an e-banknote that mimics the properties of the physical banknote as closely as possible can be subsumed under Article 128(1) TFEU. One of the proverbial characteristics is the anonymity that cash conveys to its holder: although every banknote carries a serial number, this number is not used (except in isolated cases, such as ransom money) to track the payment method. Coins lack a corresponding earmark from the outset.

However, the use of cash has been increasingly restricted by regulations in recent decades precisely because of this characteristic.⁴⁴⁴ This creates a peculiar situation for banknotes. Purely de facto, they still provide their holder with full privacy. But in legal terms, privacy has been weakened by derogatory regulations. The latter oblige merchants and financial intermediaries in particular to clarify and, if necessary, report the economic background of a transaction⁴⁴⁵ while holders are subject to self-

⁴⁴³ See BIS Annual Economic Report 2020 (part III/CBs and payments in the digital era) pp. 67, 73 and 75.

⁴⁴⁴ See supra Section 2.1.

⁴⁴⁵ See Directive (EU) 2018/843 of 30 May 2018 (so called 5th anti-money laundering Directive) amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU; Regulation (EU) 2015/847 of 20 May 2015 on information on the payer accompanying transfers of funds; Regulation (EU) 2018/1672 of 23 October 2018 on controls on cash entering or leaving the Union and repealing Regulation (EC) No 1889/2005. Regarding cryptocurrencies and AML see Rueckert Christian, *Cryptocurrencies and fundamental rights*, Journal of Cybersecurity, 2019, 1–12 ([link](#)), p. 3 with further reference.

declaration for tax purposes.⁴⁴⁶ In addition, the law enforcement authorities have access to coercive measures – in particular search warrants – if they provide an appropriate court authorisation. The protection of the persons concerned is ensured in that they can demand to keep the seized objects under seal until the legality of the coercive measures has been definitively clarified by the court.⁴⁴⁷

The public interests behind these limitations of the privacy conveyed by cash are aimed at maintaining the integrity of the financial market, enforcing the tax system and protecting law and order including an effective administration of justice.⁴⁴⁸ However, they also have to observe the fundamental right to respect for private and family life as recognised by Article 8 of the Convention for the Protection of Human Rights and Fundamental Freedoms of the Council of Europe (ECHR), the right to respect for private and family life and the right to the protection of personal data as recognised, respectively, by Articles 7⁴⁴⁹ and 8 of the Charter as well as the application of the proportionality principle.⁴⁵⁰

Article 7 of the Charter obliges the institutions and bodies of the Union and the Member States to refrain from invading privacy and to ensure the positive protection of privacy through legislation, case law and administration. Of the four aspects mentioned in the provision, the respect for private life is of particular interest here. It encompasses all areas of life that do not affect others, including professional activities,⁴⁵¹ whereby the extent of this ‘non-public sphere’ is primarily determined by a person's legitimate expectations of privacy.⁴⁵²

⁴⁴⁶ See e.g. Regulation (EC) 1889/2005 of 26 October 2005 on controls of cash entering or leaving the Community; European Commission, Guidelines for a Model for a [non-binding] European Taxpayers' Code, Brussels 2016 ([link](#)), p. 13.

⁴⁴⁷ Art. 47(1) and (2) of the Charter. See e.g. C-310/16 *Dzivev et al* EU:C:2019:30, paras 24 et seq. and 37 et seq.

⁴⁴⁸ See e.g. recitals 1 et seq. of Regulation (EU) 2015/847 and (EU) 2018/1672.

⁴⁴⁹ Article 7 of the Charter has the same scope of application as Article 8 ECHR, even though the wording is different. See Article 52(3) of the Charter; Explanatory Note on Article 7 of the Charter; Rueckert (2019) p. 6.

⁴⁵⁰ See e.g. recital 33 of Regulation (EU) 2018/1672; recital 35 of Regulation (EU) 2015/847; recital 51 of Directive (EU) 2018/843.

⁴⁵¹ CJEU, C-92/09 and C-93/09 *Volker und Markus Schecke and Eifert* [2010] ECR I-11063, para 59.

⁴⁵² Bernsdorff Norbert, Commentary on Article 7 CFR, in: Meyer Jürgen/Hölscheidt Sven (eds.), *Charta der Grundrechte der Europäischen Union*, 5th ed. 2019 Nomos Verlag Baden-Baden, para 15.

While Article 8 of the ECHR includes the protection of personal data as part of the protection of ‘private life’, the Charter addresses data protection specifically in Article 8.⁴⁵³ The latter provision is applicable where authorities systematically collect, store, share or process data – public or private – related to a natural (or legal) person thereby affecting the person’s private life. Notwithstanding the distinction between Articles 7 and 8 of the Charter, the jurisprudence has considered privacy to be at the core of data protection.⁴⁵⁴

An interference with the rights just described requires justification in accordance with Article 52(1) of the Charter: it has to be provided for by law and if, while respecting the essence of that right and subject to the principle of proportionality, it must be necessary and genuinely meet objectives of general interest recognised by the Union.⁴⁵⁵

Anti-money laundering (AML) regulation and other crime prevention concepts of governments regularly do interfere with the rights to data protection and privacy. Although they are not disputed in principle to date, the co-legislators will have to demonstrate that the interference concerned is necessary in a democratic society and that they sought to strike a fair balance between the interests of the users of e-banknotes and the aim of AML regulations and the like (such as law enforcement, consumer protection, etc.).⁴⁵⁶ This is all the more so since the e-banknote shall serve as an equivalence with physical banknotes that inherently grant its users privacy to a very large extent.

Under these circumstances, it seems appropriate for an e-banknote not to be designed in a completely anonymous way, but to replicate the status quo of physical banknotes through its technical design:⁴⁵⁷ Transactions above a certain threshold can

⁴⁵³ In contrast, the US Constitution does not explicitly mention privacy or data protection at all: Kokott Juliane/Sobotta Christoph, The distinction between privacy and data protection in the jurisprudence of the CJEU and the ECtHR, *International Data Privacy Law*, Volume 3, Issue 4, November 2013, 222–228 ([link](#)) p. 223.

⁴⁵⁴ Rueckert (2019) p. 6.

⁴⁵⁵ See CJEU, C-310/16 *Dzivev et al* ECLI:EU:C:2019:30 para 36; C-419/14 *WebMindLicenses* [2015] EU:C:2015:832, paras 71 and 73.

⁴⁵⁶ See e.g. Hingst/Neumann in FS Schmidt (2019) p. 477; Kokott/Sobotta (2013) p. 225.

⁴⁵⁷ EUROchain (2019) *passim*; BIS 2020 Special feature on payments BIS Quarterly Review p. 95. See also Wierst/Boven (2020) p. 33; Bank of Canada (2020) section 2-4.

be tracked, while anonymity is maintained for transactions below.⁴⁵⁸ If data is nonetheless recorded, e.g. for authentication purposes, it must be technically ensured that it is either used in a confidential way or deleted immediately afterwards. In addition, it must be ensured that the mere holding of e-banknotes, regardless of thresholds, preserves the privacy of the holder – subject to coercive measures permitted by court. To this end, legislation will have to specify clearly and precisely under what circumstances access can be granted

Would it therefore be inadmissible to extend the automatic exchange of information maintained for financial accounts to e-banknote balances? The justification put forward there is likely to outweigh the interest of e-banknote holders in maintaining confidentiality, too. However, even with automatic information exchange, only balances are reported, not transaction data. The latter, in turn, would only be made available in the context of coercive measures obtained by court order (and after overcoming sealing rights).⁴⁵⁹ From a technical point of view, not only should anonymous small payments be possible, but long-term protection should also be ensured by the system deleting such transaction data by default. A ‘forgetting’ feature should be built in.

⁴⁵⁸ A proposal how to achieve this result by means of ‘anonymity vouchers’ see EUROchain (2019) p. 6. For different techniques to reach privacy see also ECB/Bank of Japan (2020) passim; Bank of England (2020) p. 44 ([link](#)).

⁴⁵⁹ For potential enabling techniques in this regard see ECB/Bank of Japan (2020) passim.

5 A design perspective

5.1 Introduction

A digital money privately issued is often referred to as 'virtual currency'.⁴⁶⁰ This contrasts with what is known as a 'central bank digital currency' or CBDC⁴⁶¹ retail⁴⁶² scheme, where the central bank either issues directly, or fully backs the issuance of, digital currency available to the public at large. Under the first option, the central bank, as the issuer, may nevertheless delegate functions to the private sector. Particularly it may distribute the e-banknotes to the public through commercial

⁴⁶⁰ See e.g. Benjamin Geva, «Disintermediating Electronic Payments: Digital Cash and Virtual Currencies», (2016), 31: 12 *J.I.B.L.R* (Journal of International Banking Law and Regulation) (UK), 661, 664-666, albeit acknowledging that uniform terminology is not universally accepted. For the adherence of the ECB to that term in the proposed meaning, see originally European Central Bank/Eurosystem, *Virtual Currency Schemes* (October 2012) at 13, online: <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf>, accessed 7 May 2020; and as amended in European Central Bank/Eurosystem, *Virtual Currency Schemes: Further Analysis* (February 2015) at 25, online: <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemesen.pdf>, accessed 7 May 2020. Finally, according to Athanassiou Phoebus L., *Digital Innovation in Financial Services – Legal challenges and Regulatory Policy Issues*, Kluwer, Alphen aan den Rijn, 2018, p. 77 'virtual currencies' are:

«digital representations of value, which despite not being issued by a central bank or another public authority, nor 'attached' to a fiat currency (subject to notable exceptions) are voluntarily accepted by natural or legal persons, as means of exchange, and which are stored, transferred and traded electronically, without a tangible, real-world representation»

However, we do not share his view that lack of 'attachment' to a fiat currency is a normal feature as this will exclude claim-checks to fiat currencies or stablecoins. At the same time his view on the matter is not unique: denomination in its own unit of account appears to be an element in the definition of 'virtual currency' (that is, privately issued digital currency) in IMF Staff Discussion, *Virtual Currencies* (n. ?) at 7.

⁴⁶¹ Athanassiou, *ibid.* at 185, generically defines CBDCs as:

«centrally issued digital equivalents of *fiat* money ... that are not intended as parallel units of account, which fulfill some of the functions of money (namely as means of payment and stores of value), and which can facilitate proximity and long-distant payments alike.»

However, we find the qualification in the definition to be puzzling as CBDC is certainly used as a medium of exchange as well.

⁴⁶² A 'wholesale' scheme is for the settlement of interbank payment and is outside the scope of the present discussion.

banks and/or other intermediaries exactly like it distributes at present physical banknotes. Alternatively, under the second option, a central bank may authorise licensed entities, particularly commercial banks, to issue their own banknotes while fully backed by a 100% reserve of CeBM. Various options of these architecture and issuance models are discussed below in Part 6. But first, this part lays down design options.

5.2 Token-based vs. account-based schemes

Today, most payments, at least in volume, are made over the non-cash payment system premised on the use of 'scriptural money'. Its architecture is *centralised*. Thereunder, a bank maintains deposit accounts for customers (who thus keep with it CoBM). For its part, a large bank may also maintain deposit accounts (in CoBM) for correspondent banks. Finally, the central bank maintains settlement (deposit) accounts at least for large banks (which thus hold with it CeBM).⁴⁶³ As a whole, the system can be visualised as a pyramid at whose head or apex stands the central bank with which at least large banks hold accounts, and possibly with small banks holding accounts with large banks. Individual and corporate customers are at the bottom or base of the pyramid holding their accounts in banks (whether large or small).⁴⁶⁴

Given the prominence of this system, there is an inclination to address rCBDC as an 'amendment' or 'correction' to it, by way of adding to it a feature, under which, in addition (or even in lieu of) tangible banknotes, scriptural central bank money becomes available to the public at large – and not only to the large banks. It is thus not surprising that account-based schemes are being discussed as a rCBDC option.

Nonetheless, in Subsection 2.2.2, we defined a digital coin as a distinct entity consisting of data in the form of a unique string of bits expressing a specified number of units of value. Like physical coins and banknotes, digital coins are not

⁴⁶³ On moving away from this tiering structure see e.g. Evangelos Benos, Gerardo Ferrara and Pedro Gurrola-Perez, «The impact of de-tiering in the United Kingdom's large-value payment system» (2017) Bank of England, Working Paper No 676.

⁴⁶⁴ See e.g. E Gerald Corrigan, «Luncheon Address: Perspectives on Payment System Risk Reduction», in David B. Humphrey, ed, *The U.S. Payment System: Efficiency, Risk and the Role of the Federal Reserve* (Boston: Kluwer Academic Publishers, 1990) at 129-130. See also Hans J Blommestein & Bruce J Summers, «Banking and the Payment System», in Bruce J Summers, ed, *The Payment System: Design, Management and Supervision* (Washington: International Monetary Fund, 1994) at 15 and 27; and Bruce J Summers, «The Payment System in a Market Economy», in Summers, *ibid*, at 1–5.

paid out of bank accounts. This distinguishes them from an account-based product even where information relating to value stored in it is available digitally.⁴⁶⁵

Consequently, we argue that as a matter of law, only token-based schemes involve digital coins and can be treated as genuine rCBDC products. However, we recognise that this restriction is not universally held. This Section challenges both the efficacy and, as far as the ESCB is concerned, also the validity of the so-called account-based rCBDC schemes.

To begin with, such schemes fall into two broad categories:

1. 'Plain sovereign money'⁴⁶⁶ schemes under which CeBM⁴⁶⁷ becomes available to members of the public in accounts on the books of the central bank.
2. 'Electronic money' schemes under which digital devices 'loaded' with CeBM will be distributed to the public through commercial banks.⁴⁶⁸

Both proposals will impose «a large administrative burden» on the central bank that «could distract it from its other functions in [regulating] and managing monetary policy.» Furthermore, thereunder, the central bank, «a state-owned enterprise», would undertake pure market functions, in which it «would have no commercial incentive to innovate [payment] services».⁴⁶⁹ Accordingly, under a variation of the

⁴⁶⁵ See regarding account vs token-based approaches: Bank of England (2020) p. 46-47.

⁴⁶⁶ Beware of inconsistent use of terminology. Andrew Jackson, *Sovereign Money - paving the way for a sustainable recovery* (London: Positive Money, November 2013), online: <https://positivemoney.org/wp-content/uploads/2013/11/Sovereign-Money-Final-Web.pdf>, accessed 28 December 2017, uses the term to denote central bank money distributed directly to business to fund infrastructure projects.

⁴⁶⁷ However, it does not make sense to us to have a hybrid system under which scriptural money is available to the public in both CoBM and CeBM as we read Dyson & Hodgson (n. ???) at 28-30 to suggest.

⁴⁶⁸ CPSS and the Group of Computer Experts of the central banks of the Group of Ten countries *Security of electronic money* (Basle: BIS, 1996) particularly at 5; online: <https://www.bis.org/cpmi/publ/d18.pdf>. For e-money redeemed in CoBM see Tobias Adrian & Tommaso Mancini-Groffoli, *The Rise of Digital Money*, (IMF Fintech Note/19/01 July 2019) at 4.

⁴⁶⁹ Ben Dyson & Graham Hodgson, *Digital Cash: Why Central Banks Should Start Issuing Electronic Money*, London: Positive Money, 2016 ([link](#)) at 15, accessed 28 December 2017.

first proposal, customers' accounts on the books of the central bank will be operated through and managed by commercial banks.⁴⁷⁰

The 'plain sovereign money' proposal is also contrary to Article 17 of the Statute. Thereunder, «[i]n order to conduct their operations, the ECB and the national central banks may open accounts for credit institutions, public entities and other market participants.» General members of the public are not included. Taking into account the overall objectives and tasks of the ESCB, we read the list as exhaustive so as to exclude those who are not listed. Accordingly, to bypass direct operations by a central bank and comply with Article 17 of the Statute, both proposals could be adjusted by having CoBM become accessible to their customers against a full reserve of CeBM.

Small amendments to Article 17 of the Statute do not require a Treaty change.⁴⁷¹ However, both 'plain sovereign money' and 'electronic money' proposals, including their variations, involve scriptural money that, by definition, does not consist of 'banknotes' as envisaged in Article 128(1) TFEU.⁴⁷² But regardless of the interpretation of TFEU and Statute provisions, access to central bank scriptural money is not a matter of (properly defined) digital currency, as the latter, similarly to cash, is to be distinguished from central bank scriptural money.⁴⁷³

As well, access to central bank scriptural money has monetary policy implications and in a way, goes to a radically different model of monetary system as well as banking. Such a model has been envisaged a long time ago, albeit as a full-reserve banking, under which commercial banks maintain 100% reserve of CeBM and do not

⁴⁷⁰ For a precedent from Sri Lanka, albeit for investors' securities accounts operated by intermediaries on the books of the central bank, see *Payment & Settlement Systems Act*, No. 28 of 2005, Chapter II Securities Accounts (Secs 6-10), online: <http://www.cbsl.gov.lk/pics_n_docs/09_lr/_docs/acts/Paymt_&_setmt_sys_act.pdf>, accessed 28 December 2017.

⁴⁷¹ Rather, under Article 129(3) TFEU, they «may be [made] by the European Parliament and the Council, acting in accordance with the ordinary legislative procedure [which] shall act either on a recommendation from the European Central Bank and after consulting the Commission or on a proposal from the Commission and after consulting the European Central Bank.»

⁴⁷² For the view that compliance with TFEU art. 128 requires «to equate the CBDC to a digital form of banknotes» see e.g. Banque de France, *Central Bank Digital Currency*, (n. ???) at 31.

⁴⁷³ See supra Section 2.2.

create CoBM beyond such reserve.⁴⁷⁴ An alternative model, under which the public will have access to CoBM backed by fractional reserve as well as to either CeBM⁴⁷⁵ or CoBM backed by full reserve will be, to say the least, quite confusing to the public. In any event, an «account-based [system] (...) uses a reconciliation-intensive, message-based approach to adjust entries in a ledger»⁴⁷⁶ in which «the operator of the system authenticates the sender to ensure authorization to update account balances on a potentially centralised account ledger.»⁴⁷⁷ Conversely, since «[i]n a token-based system, the token contains all information necessary for the recipient to verify the legitimacy of the transaction (...) the recipient can verify [on his or her own] the object transferred (i.e., the token)»,⁴⁷⁸ which brings efficiency gains.

Finally, without an identity tied to it, a figure recorded in a bank's server, in the form of a bit string, could easily be changed by a hacker who penetrates into the bank's computer.⁴⁷⁹ «It is this very fact that allows a hacker to sneak into the [bank] computer and later the figure from \$1.00 to \$100.00 or to withdraw whatever he wishes.»⁴⁸⁰ Conversely, for its own part, inasmuch its unique bit string expresses its identity, a digital coin is less exposed to alteration and is less hackable.⁴⁸¹

For all these reasons, the discussion in this Part is confined to token-based schemes so as truly to be considered e-banknotes.

⁴⁷⁴ Patrizio Lainà, *Proposals for Full-Reserve Banking: A Historical Survey from David Ricardo to Martin Wolf*, *Economic Thought* 4:2, 2015 ([link](#)) at 12, accessed 28 December 2017.

⁴⁷⁵ For such a dual system see Dyson & Hodgson, *Digital Cash* (n. ???) at 25 – 28.

⁴⁷⁶ The Digital Dollar Project (n. ???) at 10.

⁴⁷⁷ Ibid. at 18.

⁴⁷⁸ Ibid. at 17.

⁴⁷⁹ See in general «Metadata: a hacker's best friend» (25 July 2017), online: <https://blog.sweepatic.com/metadata-hackers-best-friend/>

⁴⁸⁰ Samid (n.) at 25.

⁴⁸¹ Even as this risk exists, albeit to a less extent, in relation to cryptocurrencies. See e.g. «Once hailed as unhackable, blockchains are now getting hacked» (February 19, 2019), online: <https://www.technologyreview.com/2019/02/19/239592/once-hailed-as-unhackable-blockchains-are-now-getting-hacked/>

5.3 rCBDC-proposals

5.3.1 Forerunners

A few specific central bank cryptocurrency schemes have been floating.⁴⁸² In the US, proposals have been made for Fedcoin, being a central bank-issued centrally created cryptocurrency, to be available to the public at large.⁴⁸³ Digital coins are to be centrally issued on a blockchain-style decentralised ledger, but nevertheless with the central bank being in full control of quantity, timing and fixed value in denominations of the national fiat currency unit of account. Effectively, transactions will be validated by an independent notary nominated by the central bank. A similar proposal was made in the UK for RSCoin.⁴⁸⁴

Another proposal is for a NationCoin, being a Regulated and Sovereign Backed Cryptocurrency (RSBC). The scheme envisages cryptocurrencies, which as in Bitcoin, will be created by and transacted over a blockchain. Upon their creation, cryptocurrencies will be stored, and released to the public by a Digital Asset Reserve, as RSBC, at the fixed value of the national unit of account. Transactions are to be verified by 'miners' who will be paid freshly minted cryptocurrencies.⁴⁸⁵

For its part, *The Digital Dollar Project Whitepaper* speaks of a «new transactional infrastructure such as distributed ledger technology»,⁴⁸⁶ but does not elaborate.

⁴⁸² See: Morten Bech and Rodney Garratt, «Central bank cryptocurrencies» (2017) BIS Quarterly Review ([link](#)), at 55, accessed 12 March 2018. See also: Katrik Hegadekatti, «Towards Regional Monetary Unions through Blockchain Networks» (2017) MPRA paper No 82838 ([link](#)), accessed 12 March 2018; and Heike Mai, «Why would we use crypto euros? Central bank-issued digital cash – a user perspective» (2018) EU Monitor Global financial markets ([link](#)), accessed 12 March 2018.

⁴⁸³ See e.g. Wendy McElroy, «Fedcoin: The U.S. Will Issue E-Currency That You Will Use», *Bitcoin.com*, 12 January 2005 ([link](#)), accessed 28 December 2017.

⁴⁸⁴ See George Danezis and Sarah Meiklejohn, *Centrally Banked Cryptocurrencies* (London: University College London, 2015), online: <https://eprint.iacr.org/2015/502.pdf>, accessed 28 December 2017. In part this article is too technical to the uninitiated in computer science and related subjects (including myself). «RSCoin is the core of a system of scalable and auditable transactions, not a full product» which thus could be used as a basis for either a retail or wholesale product. Email message to the author from George Danezis dated 4 December 2017.

⁴⁸⁵ Kartik Hegadekatti and Yatish S G, *Generation, Security and Distribution of NationCoins by a Sovereign Authority*, 7 January 2017 ([link](#)), accessed 28 December 2017.

⁴⁸⁶ N. ??? at 11.

5.3.2 Libra

Proponents of cryptocurrencies are attracted by the amenability of a rCBDC regulated by blockchain to an algorithmic monetary policy.⁴⁸⁷ A prominent cryptocurrency rCBDC project is that of the most recent version of Libra, under which a single-currency stablecoin is backed by a reserve consisting of cash or cash equivalent in the given currency and in the full amount of the issue.⁴⁸⁸ To facilitate agreement among all validator nodes on the ledger transactions, the Libra Blockchain adopted the Libra Byzantine Fault Tolerance (LibraBFT) consensus protocol:

«The main guarantee provided in this approach is resilience against to Byzantine failures – preventing individual faults from contaminating the entire system. LibraBFT is designed to mask any deviation from correct behavior in a third of the participants. These cover anything from a benign bit flipping in a node's storage to fully compromising a server by stealing its secret keys»⁴⁸⁹

Thus, even if up to one third of the network validated nodes are compromised or fail, BFT consensus is designed to function correctly. This class of consensus protocols enable high transactions throughput, low latency and a more energy-efficient approach to consensus than 'proof of work' used in some other blockchains. For its part, the Libra Association pledges it will perform due diligence on prospective validators.

Previous blockchain projects view the blockchain as a collection of blocks of transactions. Conversely, the Libra Blockchain will be a single data structure that records the history of transactions. At the same time, in order to securely store transactions, data on the Libra Blockchain will be protection free by Merkle trees, a

⁴⁸⁷ See e.g. [Note «Digital Delegation Doctrine: Central Bank Digital Currencies and the Future of the Separation of Powers»](#) 12 N.Y.U. J.L. & Liberty 874-910 (2019).

⁴⁸⁸ For details see Libra White Paper v2.0, April 2020, online: <https://libra.org/en-US/white-paper/>, on which the discussion below relies.

⁴⁸⁹ The LibraBFT Team, State Machine Replication in the Libra Blockchain (modified to incorporate updates to the Libra payment system as found in the White Paper v2.0, *ibid.*) at 2. <https://developers.libra.org/docs/state-machine-replication-paper>.

data structure used by other blockchains that enables the detection of any changes to existing data.⁴⁹⁰

In the Libra payment process, transactions will be signed cryptographically so that even if all validators are compromised, no falsified transactions from addresses with secure signature keys can be accepted as committed.

5.3.3 WingCash

There are also a few specific proposals for non-cryptographic rCBDC. One is WingCash. The United States Federal Reserve established in 2015 a 331-member Faster Payments Task Force to support a broader effort to improve the speed, safety and efficiency of payments.⁴⁹¹ On March 29, 2016 McKinsey & Company was selected to support Faster Payments Task Force efforts to assess faster payments solution proposals from various providers across the United States payments industry.⁴⁹² Among the 17 faster payments solutions, WingCash came tied in the first place.⁴⁹³ Its proposal is described as:

«A software platform that would be owned and operated by the Federal Reserve and the Governing Organization.⁴⁹⁴ The Federal Reserve would issue digital currency (digital Fed notes) and is tied to the Internet domain (Fednotes.com).»

⁴⁹⁰ For 'Merkle tree' being a transaction data linked together with hash references in a turned upside down tree-like fashion see e.g. Daniel Drescher, *Blockchain Basics* (Frankfurt am Main: 2017, Apress) at 77-78.

⁴⁹¹ «Strategies for Improving U.S. Payment System» (26 January 2015) Federal Reserve System, online: <https://fedpaymentsimprovement.org/wp-content/uploads/strategies-improving-us-payment-system.pdf>, accessed 28 December 2017.

⁴⁹² «Federal Reserve engages in effort to access faster payments solutions» (29 March 2016) Federal Reserve, online: <https://www.federalreserve.gov/newsevents/press/other/20160329a.html>, accessed 28 December 2017.

⁴⁹³ See «The U.S. Path to Faster Payments FINAL REPORT PART TWO: A CALL FOR ACTION» (July 2017) Faster Payments Task Force at 13, online: <https://fasterpaymentstaskforce.org/wp-content/uploads/faster-payments-task-force-final-report-part-two.pdf>, accessed 28 December 2017.

⁴⁹⁴ Defined in the Glossary as «The executive officers, board of directors and board of advisors responsible for governing the Raster Payments Network [- FPN]».

This faster payment solution proposal «seek[s] to make it possible for any entity to transfer value electronically using methods that seek to preserve and to emulate physical currency.» Accordingly, its Faster Payments Network (FPN) will allow «persons and businesses to hold and transfer digital Fed notes for payment, with the direction of payment flow from the Payer directly to the Payee.» Thus,⁴⁹⁵

«(...) the FPN specifies a single Internet domain (...) where the Federal Reserve publishes digital bills and coins (Fed notes). Each Fed note is a unique web page with an immutably assigned URL that includes both a currency code (e.g., USD) and a unique identifier similar to a serial number (...). Combined these components form a unique immutable address for each Fed note (...).»

The Fed notes would constitute 'legal tender' so as to be the equivalent of US physical currency. «[E]ach Fed note is assigned a single, permanent, monetary unit of value» as well as «a field that stores the URL of the issuer (...) and a field that stores the URL of the current holder (...).» Each Fed note would be cryptographically 'signed' by the 'Fed' using 'asymmetric (public key) cryptography' (PKC), with the Fed also acting as the Certificate Authority (CA). Fed notes are to be transferred by means of an exchange of cryptographically 'signed' messages from the payer to the Fed, (with a copy to the payee) followed by a message from the Fed to the payee. With the completion of each payment, the FPN updates the 'possession' of attribute of the Fed note from the payer to the payee. In the process, the Fed thus acts not only as the issuer but also as a controller of the Internet domain associated with each Fed note and custodian of the transfer record.

The WingCash proposed solution envisages the use by the Fed of the WingCash platform. It is a platform that allows a safe and secure transfer of value among individuals and businesses. The Network has two distinct parts: one allowing Treasury to design and issue digital Fed notes. The second is to be operated by the Fed (either directly or through a Governing Organization), and consist of a global directory service distributing the digital notes and records their transfer. Initial distribution is to be made by the Fed to banks which will make the digital notes available for withdrawals to their customers. Both successful competition and interoperability with existing networks such as ACH and cards is anticipated.

⁴⁹⁵ WingCash (Proposer), *Faster Payments QIAT* (21 February 2017) at 11 and 14, online: https://drive.google.com/file/d/0B_CNQOWTRQwuZWhqbDUzNVJsNGc/view, accessed 28 December 2017. B. Geva, co-author of this research paper, contributed to the legal analysis.

5.3.4 BitMint

BitMint money, developed by *BitMint*, was identified as «the only candidate qualifying as a universal digital representation of worldwide currencies.»⁴⁹⁶ Its digital currency, unlike all known cryptocurrencies, does not rely on algorithms that could be cracked by quantum computers. *BitMint* looked into a different strategy to build the digital currency. They chose quantum-grade randomness as the basis for future currencies. Each coin has a unique identity; however, the identity of the bits does not determine the value of the coin. The value of the coin is determined by payload string. The identity string and the payload string are based on pure randomness and are fused together, inseparably. A coin trader can extract a substring, containing an identity string and payload string, and pass it to another, as payment.

Users get a coin to their device like a text message. They can then split the coin to make payment for any sum up of the sum of the coin. Payment is carried out by directly transmitting the bits that comprise the coin split to the payee's device under any communication method without real time intervention of any remote server. Thereby, BitMint facilitates continuous payment simultaneously made in real time during the purchase – as for example a buyer fills in his or her car tank in a gas station.

Having a unique identity, a coin can be made tethered money, so that it is possible to tie to it terms of use, expiration date, intended purpose, time of payment or designated redeemer.⁴⁹⁷ As well, the BitMint digital money framework enables uninterrupted payment online and offline, not dependent on network availability,

⁴⁹⁶ Helmut Scherzer, «Chapter 36: On the Quest to the Ultimate Digital Money» in Linnhoff-Popien, Claudia, Ralf Schneider, and Michael Zaddach. *Digital Marketplaces Unleashed*. (Springer: 2018) at 36.6. See also this quote in Helmut Scherzer, Senior Principal Technology Manager for Giesecke & Devrient at the Chip-to-Cloud Security Forum, held September 25-17, 2013, Nice, French Riviera. It is online at slide no. 16 in <http://pennwell.sds06.websds.net/2015/amsterdam/slideshows/T1S7O3-slides.pdf>, accessed 28 December 2017.

⁴⁹⁷ Gideon Samid, *Tethered Money: Managing Digital Currency Transactions* (London: Academic Press Elsevier, 2015) at 108. See also at 50 where the author discusses tethering as a means to protect the holder of BitMint coins in case the digital device on which they are held is stolen. We should however observe that whether this will protect the dispossessed owner from a bona fide purchaser for value is a question of law.

that fits centralised or decentralised regimen, and peer-to-peer payments – all of which makes it fit to become legal tender.

BitMint is centrally minted. Its rCBDC solution is a digital-fiat currency claim-check to a defined quantity of a specific commodity, including a fiat currency.⁴⁹⁸ It can be issued either directly by a central bank⁴⁹⁹ or by a private issuer such as a commercial bank,⁵⁰⁰ ideally holding 100% reserve.

BitMint digital currency may be operated either as a unified global digital money platform or decentrally, in a system in which each central bank operates its own CBDC mint. Central banks can, however, choose any distribution and/or authentication channel, whether of BitMint's delegated authentication solution or delegated to 'designated dealers', such as commercial banks, delegated Mints and/or distributed ledgers network (e.g., blockchain, Ethereum). When authenticating on a distributed ledger, only the identity of the coin is exposed; no need to expose the value, like when authenticating cryptocurrencies. When several central banks of various countries launch their own respective rCBDC, or if one large country will authorise several local Mints, there will be full interoperability through BitMint's InterMint.⁵⁰¹

BitMint's technology enables controlled privacy, from full anonymity to be fully traceable and anything in between, in compliance with regulatory requirements in each jurisdiction. The coin itself can carry its chain of custody (optional) that can be bypassed only by court order.⁵⁰² Each coin is equipped with smart contracts capabilities. Through its quantum randomness generation process and distribution management model and technical architecture, BitMint retains the basic

⁴⁹⁸ For detailed information on BitMint see e.g.: <http://www.bitmint.com/>, accessed 12 March 2017; http://finder.startupnationcentral.org/company_page/bitmint/, accessed 12 March 2017, and sites and videos accessible through it; and <https://medium.com/@bitmintnews>, accessed 12 March 2017, and associated articles.

⁴⁹⁹ For details, see Gideon Samid, «Bitcoin.BitMint: Reconciling Bitcoin with Central Banks», BitMint, LLC, online: <https://eprint.iacr.org/2014/244.pdf>, accessed 28 December 2017.

⁵⁰⁰ DigFin, Banking & Payments: Q-Pay could mark the next sea change in finance Bank of Shanghai is testing BitMint's Q-Pay, a.k.a. «pay like cash», which looks like a preamble to a new paradigm of digital money, January 8, 2019, online: <https://www.digfingroup.com/bitmint-q-pay/> accessed 08 May 2020.

⁵⁰¹ David Lee Kuo Chuen, editor, «Handbook of Digital Currency», 2015, Elsevier Academic Press, chapter 20.

⁵⁰² See e.g. «BitMint: Non-Speculative Digital Currency (The Future of Money)» (August 07, 2014) online : <https://www.youtube.com/watch?v=f5UfpW1kS4Y>.

characteristics of having quantum security, resisting counterfeiting and discouraging money laundering. This eliminates or at least substantially reduces the possibility of misuse or participating in illegal acts, while protecting individuals' privacy rights.

BitMint is inoculated against quantum attack, because it is vaccinated with quantum randomness, as the critical ingredient for construction of a comprehensive financial platform. That platform is designed to move and store money fast, efficiently, conveniently and securely. Not being a cryptocurrency, BitMint is not underlined by complex cryptographic algorithms that may crash against quantum computers.

6 Architecture and issuance models

6.1 Introduction

The ensuing discussion puts forward a few generic rCBDC architectural designs. To make the discussion relevant to the ESCB, we tailor the analysis to fit the legal framework for the issuance of euro e-banknotes.

To begin with, under Article 128(1) TFEU, either the ECB or the NCBs under the ECB's authority, but no one else, may issue e-banknotes circulating within the Union as legal tender. Anyone else, including a commercial bank, may issue only non-legal tender e-banknotes, and only as authorised by the ECB. We read the power to issue banknotes under Article 128(1) TFEU to include the power to redeem them. As well, while the TFEU does not address the point, for an e-banknotes system to operate, as in the case of written banknotes, there must be a mechanism for the distribution of the e-banknotes to the public. Finally, and this is by definition also not addressed by Article 128(1) TFEU, unlike written banknotes that pass from hand to hand by delivery, an e-banknote system requires a mechanism of transfer or payment. We take this mechanism to operate online real-time. The powers to distribute and run a transfer system may be seen as incidental to the issuance power or part of the basic task to «promote the smooth operation of payment systems» under Article 127(2) TFEU as further implemented by Article 22 of the Statute⁵⁰³ stating that:

«The ECB and [NCB]s may provide facilities, and the ECB may make regulations, to ensure efficient and sound clearing and payment systems within the Union and with other countries.»

rCBDC models are often divided into direct, indirect and hybrid. Under this classification, in the direct model, the central bank issues the currency and runs its transfer system. Under the indirect model the central bank issues the currency to intermediaries which issue to the public their own currency, fully backed by the central bank issued currency. Those intermediaries also run the inter-customer transfer system. Finally, in a hybrid system, the central bank issues its currency directly to the public, and yet the transfer system is run by intermediaries.⁵⁰⁴

While we avoid purely hypothetical options, we do not adopt this classification, together with its terminology, as in our view, it is not adequately fine-tuned to take

⁵⁰³ c/r.

⁵⁰⁴ These classifications are similar but not identical to Auer/Böhme (2020) pp. 88-93.

into account all reasonable scenarios. Particularly, this classification does not address the distribution of the banknotes to the public as well the option of commercial banks acting on behalf of the central bank. In pointing out our options, we nevertheless suppose that, other than the ECB and NCBs, the only other legitimate player in its own right in each scenario is a commercial bank. This assumption may also be supported by reading a 'banknote' in Article 128(1) TFEU to mean a note issued by a bank and no one else. We take 'bank' to cover a licensed deposit-taking commercial bank, which under EU law is a 'credit institution',⁵⁰⁵ but argue that the term could include every regulated entity carrying out a substantial aspect of the 'banking business'. For sure, each of the three players (the ECB, the NCBs and a commercial banks) may outsource functions and yet remain legally bound by the acts or omissions of their third-party contractor. While we do not divide functions between the ECB and the NCBs, we note that the authorisation power is exclusively in the ECB's hands. We assume that overall the ESCB operates in concert so that there is no competition either among NCBs or between any NCB and the ECB. At the same time, the greater is the role for commercial banks, the more space becomes available for autonomy and hence competition as well as innovation, albeit at the cost of a greater need for interoperability. For simplicity sake, we also assume that under each option, redemption is exactly the reverse operation of issuance. Finally, under all options, other than the backed one, discussed below in Subsection 6.2.5, the legal issuer is a central bank, whether the ECB or the NCBs, so that the e-banknote has legal tender status.

At the same time, we reject outright an option under which non-legal tender 'digital coins' not characterised as an e-banknote will be issued by the ECB (or the NCBs) as a claim to a 'legal tender' paper banknote. We question the power to issue such digital coins as well as whether they will not be e-banknotes in any event. As well, from the banknote history we can learn that a promise to pay legal tender by a financial institution, and certainly by a central bank, is likely to be treated as 'money' and then become, at least used as, 'legal tender'. We do not see any good reason to take this roundabout route.

The following options are thus available:

⁵⁰⁵ Under Article 4(1) of Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 [2013] OJ L176/1:

«credit institution means an undertaking the business of which is to take deposits or other repayable funds from the public and to grant credits for its own account».

6.2 Issuance (and redemption) options

Under the first three scenarios outlined here, a member of the public holding an e-banknote has a direct claim against the central bank, which depending on the scheme, is either the ECB or an NCB.

6.2.1 Full direct option

Both the distribution and transfer system are run by the ECB or the NCBs.

In this scenario, the central bank (either the ECB or the NCBs) will deal directly with e-banknote holders. Holders will purchase e-banknotes directly from the central bank typically paying out of bank accounts or, in theory, in tangible banknotes. A comprehensive network linking all e-banknote holders throughout the Union will be run by the ESCB. To clarify, as any of the other systems set out below, this option will not require the opening or use of accounts in a central bank by members of the public.

6.2.2 Limited direct option

Distribution is run by commercial banks, while the transfer system is operated by the ECB or the NCBs.

As far as distribution is concerned, this scenario mimics the current system for tangible banknotes. Commercial banks will buy e-banknotes from a central bank (either the ECB or the NCBs), paying out of their reserve accounts. Commercial bank customers will purchase e-banknotes (issued by a central bank) from their own commercial banks and will typically pay by having their respective accounts with their commercial bank debited. As in Subsection 6.2.1, a holder of an e-banknote will have a direct relationship with the issuing central bank. Moreover, as in Subsection 6.2.1, a comprehensive network linking all e-banknote holders throughout the Union will be run by the ESCB.

6.2.3 Indirect option

Both the distribution and transfer system are operated by commercial banks.

This option replicates the scenario discussed above in Subsection 6.2.2 other than that the inter-customer transfer system is also run by commercial banks (and not the ESCB). Otherwise, as in Subsection 6.2.2, commercial banks will buy e-banknotes from a central bank (either the ECB or the NCBs), paying out of their reserve accounts. Commercial bank customers will purchase e-banknotes (issued by a

central bank) from their own commercial banks and will typically pay by having their respective accounts with their commercial bank debited. As in Subsection 6.2.1, the holder of an e-banknote will have a direct relationship with the issuing central bank.

6.2.4 Hybrid option

Both the distribution and transfer system are operated by commercial banks.

Also in this scenario, a member of the public who holds an e-banknote has a direct claim against the central bank (whether the ECB or an NCB). This scenario differs from the option addressed in Subsection 6.2.3 in facilitating the issuance of e-banknotes by one or more commercial banks on behalf of the central bank. The task delegated to a commercial bank is purely ministerial and does not involve policy choices. Rather, the issuing commercial bank will act strictly as instructed by the delegating central bank.

Unlike in the scenario set out above in Subsection 6.2.3, commercial banks issue the e-banknotes as agents for a central bank (either the ECB or an NCB). Upon the issuance of an e-banknote on which the central bank (and not the commercial bank) is liable directly to the holder, the reserve account of the ('issuing') commercial bank at its NCB is debited.

6.2.5 (Likely) Backed option

Both the distribution and transfer system are operated by commercial banks.

In theory, Article 128(1) TFEU allows for the ECB to authorise commercial banks to issue non-legal tender e-banknotes without fastening any condition as to the availability of a full reserve of CeBM.⁵⁰⁶ Nevertheless, in the broad context of a rCBDC, we shall limit our discussion to the option under which one or more commercial banks are authorised to issue e-banknotes only against a full central bank money reserve. In this scenario, a holder of an e-banknote will not have a direct claim against either the ECB or an NCB. At the same time, as long as the system runs properly, the holder will have the security of full backing by either the ECB or an NCB as if the e-banknote was issued by the latter. While an e-banknote issued by a commercial bank is not legal tender, it is redeemed (i.e., payable) in legal tender,

⁵⁰⁶ See on the option to grant access to reserve accounts to this end, thus creating a synthetic CBDC Kiff et al (2020) p. 25 and Box 1 on p. 27.

namely banknotes (whether in paper or electronic format) issued by a central bank (whether the ECB or an NCB).

In this scenario, authorised commercial banks issue e-banknotes in their own names so that each will have under each e-banknote a direct relationship with the respective holder. The latter will not be in privity with a central bank (whether the ECB or an NCB). Under Article 128(1) TFEU, such e-banknotes do not have legal tender status. However, if the e-banknotes are fully backed by CeBM, the chance is that they will circulate as monetary objects in discharge of payment obligations. What is thus envisaged is not a system of the private issuance of fiduciary digital currencies.⁵⁰⁷ Hence, issues identified in the old system under which written banknotes were issued by commercial banks – as a form of CoBM⁵⁰⁸ – are not anticipated to arise. Rather, under this scenario, the system will mimic the issuance of written banknotes in the UK by a few designated banks in Scotland and Northern Ireland.⁵⁰⁹ Such banknotes are not accorded legal tender status but are accepted in payment as a matter of practice.⁵¹⁰ By law, these banknotes are required to be fully backed by earmarked sterling obligations of the Bank of England.⁵¹¹ Similarly, in the scenario envisaged under this option, commercial banks in the Union may be authorised to issue e-banknotes, fully backed by CeBM.

6.3 Final observations:

1. In all scenarios, a central bank, whether the ECB or an NCB, will keep its position as a facilitator or catalyst as well as an overseer (or even regulator) of

⁵⁰⁷ With regard to which we recognise the need for government intervention as in Ben Fung, Scott Hendry and Warren E. Webber, *Swedish Riksbank Notes and Enskilda Bank Notes: Lessons for Digital Currencies*, Bank of Canada Staff Working Paper 2018-27.

The experience with the old system is discussed by Ben Fung, Scott Hendry, Warren E. Weber, *Canadian Bank Notes and Dominion Notes: Lessons for Digital Currencies*, Bank of Canada: Staff Working Paper 2017-5 ([link](#)).

⁵⁰⁹ See *Banking Act* Part 6, particularly s. 213, 2009 c. 1. For HM Treasury Consultation Document, *Banknote issue arrangements in Scotland and Northern Ireland*, July 2005 ([link](#)), accessed 1 June 2018.

⁵¹⁰ See e.g. Briefing Note 122/08, *The Status of Scottish and Northern Irish Banknotes* (Research and Library Service Northern Ireland Assembly, 24 July 2008) available online: <http://archive.niassembly.gov.uk/io/research/2008/12208.pdf> accessed 1 June 2018

⁵¹¹ *Scottish and Northern Ireland Banknote Regulations* 2009, SI 2009/3056 issued by the Treasury under ss, 215-220 of the 2009 *Banking Act*.

the check-claim e-banknote system.⁵¹² Only in the scenarios set out above in Subsections 6.2.1 and 6.3.2, being involved to one degree or another in distribution and transfer, it will also be an operator or direct provider.

2. Operationally, the scenarios set out above in Subsections 6.2.4 and 6.2.5 may be the same. In each case, a commercial bank earmarks funds from its reserve account with its NCB against which it issues the e-banknotes. However, as explained, in each such scenario, the legal implications of the ECB/NCB's liability and legal tender status are quite different.
3. While in the scenarios discussed above in Subsections 6.2.4 and 6.2.5 commercial banks' funds in their reserve account are earmarked, in scenarios addressed above in Subsections 6.2.2 and 6.2.3, a commercial bank uses such funds to pay its NCB for the e-banknotes to be purchased by it. The difference appears to be that in the scenarios dealt with in Subsections 6.2.4 and 6.2.5, funds are debited from the reserve account only upon the redemption of each e-banknote, while in scenarios discussed in Subsections 6.2.2 and 6.2.3, funds are debited to the commercial bank's reserve account as soon as the e-banknotes are purchased by it.
4. Commercial banks' reserve funds at the respective NCB are not involved in the scenario addressed above in Subsection 6.2.1. In that scenario, a holder 'purchases' the e-banknote directly from the issuing ECB/NCB.

⁵¹² For these central bank functions in the payment system see in general: Ben Fung, Miguel Molico and Gerald Stuber, *Electronic Money and Payments: Recent Developments and Issue*, Bank of Canada Discussion Paper/ 2014-2 at 19.

7 Conclusion

7.1 Summary

Part 2 sets the stage by showing that several reasons, but above all the overall accelerating decline in the demand for cash, will likely induce central banks to issue a digital equivalent of cash in the near future. With regard to the admissible forms of such equivalent, we address the question of whether a digital coin can be a 'banknote' from a broad perspective covering history, statutory interpretation and general principles of law. Being a negotiable instrument, the banknote historically emerged as an unconditional promise in writing signed by a banker, engaging to pay on demand a sum certain in money to the bearer. It is transferrable by delivery free from claims and defences. For its part, an electronic or digital coin is a distinct entity consisting of data in the form of a unique string of bits expressing a specified number of units of value. Digital coins are transferrable by control and like physical coins and banknotes, they are not paid out of bank accounts. A 'cryptocurrency' denotes a digital coin in which encryption techniques are used to regulate the generation of units of currency and verify the execution of payment transactions on a decentralised network. Conversely, bit-minted money is not hinged on a mathematical riddle that even as it cannot be solved at present, may be solved in the future. A digital coin could also be a digital representation of the fiat currency banknote. We evaluate each format and argue eventually that a digital coin in any discussed format falls into the definition of a 'banknote' and fulfils the functions of a banknote.

In Part 3 we deploy a goal based perspective. We argue that, first and foremost, the issuance of banknotes stipulated in Article 128(1) TFEU justifies and requires the issuance of a digital equivalent of cash. With the marginalisation of physical cash, the public will ultimately miss out on benefits that public money provides. These benefits include, amongst others, an issuer that acts in the general interest, an adequate level of privacy and inclusive access to a credit-risk free monetary value. In essence, Article 128(1) TFEU not only provides for a right for the ECB to issue cash, but is also accompanied by a duty to make use of that right, which cannot be fully waved or delegated. Accordingly, it must be interpreted in such a way that it also includes the issuance of a digital functional equivalent of the paper banknote since, with the dwindling demand for cash, the fulfilment of the ECB's task to issue a credit-risk free public money would otherwise become impossible.

In addition, we highlight that the fulfilment of the basic tasks set out in Article 127(2) TFEU, in particular the conduct of monetary policy, requires as an essential precondition the issuance of traditional banknotes or, in case of their (further)

marginalisation, a digital functional equivalent. Issuance of e-banknotes may become necessary, in particular, to prevent or reduce the switch of the public to funds not denominated in euro. The latter could impair the monetary transmission mechanism, prompting the ECB to loosen monetary policy control. This effect cannot be addressed appropriately by regulation alone. We reject, however, any option, whereby an e-banknote would be designed to be interest-bearing and/or have other variable features in order to be used as an instrument that itself generates monetary policy impulses.

In Part 4 we explore the ECB's powers to issue or authorise the issuance of an e-euro from a constitutional perspective. A historical, teleological and systematic interpretation of Article 128(1) TFEU reveals that the ECB possesses the power to issue an e-euro to the extent that this e-euro is designed as a functional equivalent to cash. The ECB's powers are exclusive in the sense that they prevail over any remaining national competences, which are strictly limited to the issuance of physical coins as subsidiary cash. As an accessory argument, we then explore the ECB's powers to issue an e-euro in case that e-euro were not to qualify as 'banknote' or 'coin' according to Article 128 TFEU, but were to represent a different monetary object. These powers are implied in the ECB's monetary mandate, as the issuance of a public money constitutes a precondition of monetary policy. We also address the issue of when an e-euro would possess legal tender status and when such status would be excluded. While it would be preferable for an e-euro to be legal tender due to network effects, there are other ways to clarify the legal status of an e-euro.

Finally, we balance the ECB's issuance of an e-banknote against the interests of third parties in light of their fundamental rights to conduct a business and to privacy. With respect to the former we find, based on the available evidence in the literature, that the risk of disintermediation associated with the issuance of an e-banknote might to some extent even reduce existing distortions of competition. Moreover, such risk can be contained by mitigating measures and an adequate design of the e-banknote itself. With regard to privacy, we find that e-banknote needs not be designed in a completely anonymous way, but that it will suffice to replicate the status quo of physical banknotes through its technical design. While anonymity ought to be maintained for transactions below a certain threshold, transactions above that threshold would be trackable for the benefit of overriding public interests, including the financial market and tax system integrity.

Elaborating on rCBDC design options in Part 5, we reject an account-based model both on policy grounds and as a matter of statutory interpretation. We examine and assess three token-based rCBDC systems: Libra, WingCash and BitMint. Finally, we present possible issuance models in Part 6, each complying with Article 128(1)

TFEU. Reflecting various degrees of responsibility-sharing between the ECB and NCBs on the one hand and commercial banks on the other, these models address issuance, distribution, operating a transfer system and redemption of e-banknotes.

7.2 Recommendations

[to be provided]