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Digital Currencies and Central Banking: A Sense of Déjà Vu

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ABSTRACT

This paper examines the implications of digital currencies – both private cryptocurrencies and central bank digital currencies (CBDCs) – for central banking. We discuss some déjà vu episodes from monetary history in order to obtain a clearer understanding the present and potential implications of these currencies. We find that not only the current limitations of private cryptocurrencies, but also their conceptual underpinnings, argue against their replacement of conventional money. The two main potential problems with broadly accessible (general purpose) CBDC are a digital run and an excessive involvement of a central bank in the funding of the real economy. Meanwhile, alternative reserve-backed accounts or tokens (an implicit CBDC known as Tobin's alternative) would also be exposed to these problems, albeit in a less pronounced way. CBDC-related hopes for monetary policy to eliminate the effective lower bound constraint are found to be exaggerated, even in a cashless world. We argue that central banks' response to the digitalisation trend should be an integrative solution which satisfies the public demand for a safe means of payment, safeguards private innovations, and ensures financial stability. We conclude that there is no observable form of CBDC that would serve as a best-choice central bank response in advanced economies. Such a response might be considered as a temporary solution (if any), however, in emerging economies with weak financial inclusion.

Keywords: private cryptocurrencies, central bank digital currency (CBDC), fintechs, financial stability, monetary policy.

JEL codes: E51, E58, N20.

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1. INTRODUCTION

The current digitalization trend is transforming the economic and social life, with money and payments needing to adjust. Digitalisation has had a profound impact on jobs, commerce and transactions, education, and innovation. According to Mark Carney (2018, p.12), “people are increasingly forming connections directly, instantaneously and openly, and this is revolutionising how they consume, work, and communicate”. A growing decentralized service economy and evolving social attitude are driving efforts to build new and more decentralized forms of interactions (IMF 2018a, p. 6). Demographics are accelerating these developments, with millennials (“Generation Y”) now outnumbering Baby Boomers and steering the economy toward their world; one in which digital activity is central, and nearly second nature (IMF 2018a, p. 6). Adopting Carney’s (2018, pp. 11-12) apt question, central bankers might well ask themselves “how money and payments will need to adjust to meet societies’ changing preferences, particularly for decentralised peer-to-peer interactions”.

Digitalisation opportunities have raised especial hopes among emerging market authorities. Digitalisation has significantly altered the financial landscape in developing regions with an underdeveloped banking sector. Mobile payments have permitted access to affordable banking service to hundreds of millions across the developing regions. The drive to overcome a still weak financial inclusion is motivating some emerging market authorities to consider digital currencies (Barontini and Holden 2019, p. 9). In other cases, governments see digital currencies as a tool to bypass geopolitical sanctions and the US-led global financial system (e.g., in Iran and Venezuela), and even a silver-bullet solution to restore monetary credibility (Ecuador) or a functional economy (Venezuela) (Casper 2018).

The ongoing digitalisation trend forces academics and policy makers to critically reconsider the basic structure of the financial system. Could market-based private cryptocurrencies become a substitute for state-backed monies issued by both central banks and commercial banks, generally known as fiat money? Could bigtechs eventually prevail over banks thanks to the digitalisation of payments and credit? How might digitalisation change the role of central banks?

Should central banks respond to digitalisation by issuing their own new type of digital money, namely, CBDC? A range of arguments have been advanced in support of this decision, including the idea that it would constitute a pre-emptive move in light of the potential expansion of private cryptocurrencies; show adaptation to payment-related innovations and to digital progress in general; and open up new opportunities for monetary policy. As a counterbalance to factual or a potential decline in the demand for cash, it could also prevent central bank balance sheets from shrinking and promote the provision of an alternative safe asset (CPMI-MC 2018).

Currently, central banks issue their own digital money by opening wholesale settlement accounts for commercial banks and, to a very limited extent, for other private and public counterparties. Central banks provide digital money, called “bank reserves” (hereinafter, reserves) for commercial banks and some critical financial market infrastructures, such as central counterparties. This facilitates the interbank payments and integrates privately created money (deposits at banks) with central bank money. This nineteenth-century innovation dramatically improved the banking system’s sustainability and lending capacity.

While they are monopolistic creators of bank reserves, the central banks set their policy rates on reserve-providing/ absorbing operations to implement monetary policy. Central banks can also open reserve accounts for state treasuries in accordance with national security considerations, and for foreign central banks to provide their own currency or obtain foreign currency for purposes of financial stability or monetary policy. Centralised payment systems for transfers across reserve accounts in central banks have been conventionally applied.

CBDC is associated with the extension of access to central bank liabilities. Such extension would mean a deviation from the central banking principle of avoiding competition with banks for non-banking clients. All of the aforementioned topics have major implications for the monetary system¹, the financial market structure, and financial stability. Clearly, then, such issues warrant careful consideration.

An increasing number of central banks collaboratively monitor the digitalisation trend, conduct research, and investigate the potential implications of digital currencies. International monetary institutions – such as the Bank for International Settlements (BIS) and the International Monetary Fund (IMF) – provide influential survey-based analyses² and in-house research on this matter. Emerging market central banks in general are quite enthusiastic about CBDC, stressing motives of financial inclusion, payment efficiency, incorporation of the informal economy, and fighting financial crime. Majority of central banks in advanced economies consider these factors somewhat less important and identify payment safety and financial stability as their main motivations considering the costs and benefits of CBDC (Barontini and Holden 2019, p. 9–10). Faced with rapidly disappearing cash, however, the Riksbank has begun to work on the potential technical solution of CBDC. Its task nevertheless is to gain greater knowledge for a final decision on launching e-Krona at all (Riksbank 2018). Separately, while facing similar digitalisation, the Danmarks Nationalbank has announced that it has no plans to issue CBDC, since “the potential benefits of introducing CBDC for households and businesses in Denmark would not match the considerable challenges” (Danmarks Nationalbank 2017).

A collective decision by the major central banks on a widely accessible CBDC would be required for the orderly introduction and management of cross-border movements of this type of money. It is quite unlikely that a single central bank of widely used currency would pioneer a permanent issue of broadly available CBDC (if any). A technical distinction between residents and non-residents as well as domestic and foreign transactions would be largely symbolic. CBDC issuance on the part of a single central bank could lead to larger capital and exchange rate movements, in addition to other asset price effects, even during normal times. These features would be especially pronounced during times of generalised flight to safety (cf. CPMI-MC 2018).

Thus far, the majority of central banks have been not convinced that CBDC benefits will outweigh the costs. A 2018 survey based on a questionnaire administered to central banks on CBDC found that most central banks see themselves as either “somewhat unlikely” or “very unlikely” to issue any type of CBDC

¹ We define “monetary system” as a set of institutions by which types of money are chosen, trust about money is ensured, and money is supplied to an economy and thereafter adjusted.

² See Barontini and Holden 2019; CPMI-MC 2018; IMF 2018a.

within the next three years (Barontini and Holden 2019)³. Beyond this period, a slightly higher proportion of central banks consider the issuance of CBDC possible, while the majority still consider this move as very unlikely. A higher motivation for such issuance among emerging market central banks has been explained by differences in environment and priorities (ibid., pp. 9–12).

Meanwhile, an increasing number of enthusiasts among researchers aim to develop the still-crude ideas on CBDC into a new milestone in the evolution of money. Academic research is intensifying its efforts to devise promising schemes for CBDC. Researchers tend to interpret caveats optimistically and are vigorously attempting to construct conceptual CBDC schemes to achieve a positive balance of potential benefits and costs⁴.

In this paper, we selected episodes of déjà vu from monetary history in order to better understand the ideas behind digital currencies and their implications for contemporary banking. The paper aims to integrate findings from recent research on digital currencies with those of monetary history. We found the work of Glyn Davies (2002), Curcio Giannini (2011) and Charles Goodhart et al. (1995, 2015) particularly apt for this purpose. We sought to select déjà vu episodes from monetary history that are comparable to present ideas of private and sovereign digital currencies in order to evaluate the evidence on the potential outcomes of these ideas. Specifically, we wish to grasp what we could expect from private cryptocurrencies in the future and whether the monetary system would become more or less sustainable in the event of CBDC introduction.

The paper is structured as follows. Section 2 reviews the terminology related to digital currencies, which is still in flux and appears somewhat controversial, even misleading. Section 3 analyses the drivers, risks, and prospects of private cryptocurrencies. Section 4 provides an overview of the potential costs, benefits, and caveats of CBDC, and an assessment of the cost-benefit balance from the perspective of the main central banking activities. Section 5 discusses the digital future of central banking, and section 6 concludes. The Annex provides an extended list of CBDC observable benefits and caveats, broken down into the main central banking activities.

³ The survey of central banks on CBDC was conducted in the latter part of 2018 by the BIS staff with technical assistance of the World Bank. Sixty-three central banks replied, of which 41 are located in emerging market economies and 22 in advanced economies. Together, the respondents represent close to 80% of the world's population and over 90% of its economic output (ibid., pp. 1, 6).

⁴ See a set of such research, for instance, in Fatás (2019) and the references cited therein.

2. RELATED TERMINOLOGY: IN FLUX AND SOMEWHAT CONTROVERSIAL

2.1. TERMINOLOGY TO DEFINE PRIVATE CRYPTOCURRENCIES

The terminology related to digital currencies is relatively new and still in flux. Not surprisingly, the linguistic associations of these terms may appear somewhat controversial and even misleading.

The popular term “private cryptocurrencies” misleadingly has embedded within it the word “currency”. In fact, private cryptocurrencies emerged as market-based alternatives to traditional types of money (currencies in the broad sense). Private cryptocurrencies were going to conquer the world, employing new digital technologies to avoid the banking monopoly, centralised payment systems and “excessive” official regulation. In this way, it was thought, cryptocurrencies would provide a modern alternative to suspicious manipulations by central banks, such as quantitative easing⁵. Yet, private cryptos lack common – albeit not absolute – attributes of sovereign currencies, such as relative stability of value, wide acceptance and accessibility. Additionally, private cryptocurrencies have become the object of speculative investment and extremely large price volatility. It is for this reason that supervisory authorities have suggested replacing the term “private cryptocurrencies” with the term “crypto-assets” (Banque de France 2018; Carney 2018; G20 2018).

While relying on sophisticated technologies, private cryptocurrencies in fact resemble *the primitive monies known from early history*. Like private cryptocurrencies, primitive monies were traditionally used in limited and specific areas of economic activity. According to Davies (2002, pp. 24–25), these monies originated in various social practices. The object used could have been, at one and the same time, a religious symbol, livestock, an agricultural tool, an ornament, or money used for some particular purpose. Primitive communities commonly used different kinds of money for different trade purposes, each specific type performing only a concrete set of monetary functions. Scholars, however, disagree on primitive economies, and in particular on the issue of whether the aforementioned objects can be considered “money” at all. Davies (2002) notes that a monetary history that did not take into account the primitive money phenomenon would be far too narrow an inquiry (ibid.). We argue that private cryptocurrencies, hence, can be considered a kind of modern-day primitive money. It is indeed possible to conjoin the two terms, “cryptocurrencies” and “crypto-assets”, the former referring to the monetary aspect of this phenomenon and the latter the speculative one. Nonetheless, a clear distinction⁵ must be made between these terms and state-accepted money – that is, state-backed private money and state-issued money – in terms of relative stability of value and range of acceptance and accessibility.

⁵ For the proponents’ view of on the origins of cryptocurrencies and motivations behind, see Vigna and Casey (2015).

2.2. CBDC-RELATED TERMINOLOGY

Initially, the term “CBDC” referred to a conceptually new type of central bank digital money, a new sort of currency. CBDC was considered: (1) a potential response for central banks to the challenge of private cryptocurrencies, and (2) a digital substitute of cash (i.e., currency in circulation). Further discussions (see below), however, demonstrate that there is a great deal more to the issue. From an economic point of view, CBDC now refers to a number of concepts that fall within one rubric, which can be defined as any qualitative extension of digital access to central bank liabilities, whether this is wide access for households and enterprises or limited extension by selected types of state or market institutions (cf. CPMI-MC 2018, pp. 3–4).

In most scenarios, CBDC emerges as simply an additional form of the same currency in its broad sense (the euro, the US dollar, etc.). Most future scenarios of CBDC stress their similarities to existing types of central bank money. Only a specific and controversial case of CBDC would deviate from an exchange rate of 1:1 vs. a given currency, whereby quantity-ruled or price-ruled limits would be applied to contain CBDC quantity (Kumhof and Noone 2018, pp. 16–17).

The same choice between two technologies for holdings and transfers of existing types of money would be also applied for CBDC: accounts or tokens (value-based payment devices). Account balances are held on deposit accounts, while token value is stored locally on a payment device; for example, cash, card or mobile phone app (Riksbank 2018, pp. 15–16, 44–45). An account-based CBDC refers to open access for non-banks to the centralised reserve with the central bank. The term value-based CBDC, for its part, refers to local electronic wallets and peer-to-peer payments, which can be (but are not necessarily) executed by distributed ledger (blockchain) technology (DLT) (CPMI-MC 2018, pp. 3–7, 16). Typically, private cryptocurrencies are also value-based.

Depending on the scope of accessibility, all existing monies, as well as potential CBDC, can consist of “general-purpose money” or “wholesale money”. General-purpose money is widely accessible to the general public, while access to wholesale money is limited by a predefined group of users. A general purpose CBDC would be broadly accessible to households and all types of enterprises, together with cash and deposits at commercial banks. A wholesale CBDC refers to a limited extension of wholesale holders of reserve accounts with the central bank, most likely by some non-bank financial institutions (CPMI-MC 2018, p. 4).

In some sources, the term “CBDC” is replaced by the term “digital monetary base (DMB)”, which echoes the approach of money exogeneity. The European Central Bank (ECB) introduced this term, covering both CBDC and already-existing central bank digital money, that is, reserves (Mersch 2017). The linguistic structure of the term “DMB” reflects the concepts of money exogeneity, monetary base, and multiplier, that is, a stock of “outside money” of the central bank that initiates a multiplier of “inside money” of banks.

We prefer the term “central bank digital money” over “DMB”. The money exogeneity approach, which prevailed before the Global Financial Crisis (GFC), has been seriously challenged by the revived concept of money endogeneity (Turner 2012). The latter involves commercial banks creating deposits by making loans

ex nihilo (“out of nothing”) and triggering supportive issuances of central bank money on demand⁶. From the perspective of the endogeneity approach, applying the concept of a multiplying monetary base to describe central bank money is misleading for two reasons: (1) non-banks, as a rule, are not allowed to have accounts at the central bank and cannot receive loans and make deposits in reserves, in contrast to simplistic scheme of the multiplier theory; (2) while steering the interest rate, the central bank adapts rather than manipulates supplies of reserves and cash to meet the endogenous demand.

In some cases, CBDC is referred to as “sovereign digital currency” or “national digital currency”⁷, which may be misleading. These linguistically broader terms may leave the mistaken impression that e-payment systems, run by state-owned companies rather than central banks, can also be understood as national digital currencies. In some countries, state-owned companies, predominantly the post offices, provide safe-keeping and payment services. In developing countries, the focus is on fostering still-low financial inclusion (Casper 2018; Yerkes S. and Polcari J. 2017). In advanced economies, the spotlight is on providing basic banking services to unbanked poorer regions or segments of the population, supplementing rather than competing with or replacing commercial banks (Goodhart and Jensen 2015, p. 23, footnote 10; Juks 2018, pp. 94-95). One can see some parallels of e-payment service at the post office to CBDC, including safe-haven, financial inclusion, and modernisation of payments. While basic banking service at the post office is a widespread practice, it normally does not imply that clients have access to central bank liabilities or reserve-backed accounts. As we will see in Section 4, the implications stemming from the CBDC concept are far more complex than those of e-payment service by the post office.

3. IMPLICATIONS OF PRIVATE CRYPTOCURRENCIES

Private cryptocurrencies were introduced – and are sometimes still considered – as potential money substitutes. The primary driver of private cryptocurrencies relies on the radical edge of the market-based approach to money, which holds that money is best organized by markets. Thus, in this view, political authorities’ control of money should be abolished (Dodd 2014, p. 21). Some researchers have argued that monetary drawbacks of private cryptocurrencies could be overcome by technological improvements, a widened range of users, and an extended number of payments (Bolt and Van Oordt 2016).

While private cryptocurrencies have thus far lacked stability of value and wide acceptance, the main question is whether there are any conceptual factors preventing those cryptos from featuring these attributes. We argue that historical evidence and an institutional approach to money expose a conceptual flaw in claims of private cryptocurrencies to replace state-controlled money. Neo-classical economics has left institutions out of the paradigm. Neo-institutionalism, meanwhile, perceives money as a continuously adapting institution, the form of which is dictated by the constant interaction of the state and

⁶ For an introductory explanation of the endogenous money creation process in the modern economy, see McLeay et al. (2014) and Bundesbank (2017). The money endogeneity approach has been widely employed to explain the last credit boom and bust (Turner 2012) and a contained impact of quantitative easing (QE) on the broad money supply (Bundesbank 2017; ECB 2012).

⁷ See, for instance, Casper 2018.

market, often sustaining one another, sometimes in more or less open conflict (Giannini 2011, pp. xxi-6 and throughout).

While they have a modern appearance, private cryptocurrencies seem to follow the pattern of private monetary coalitions that have been observed in history. Giannini (2011, pp. 21–23) mentions that numerous examples of such coalitions “can be found in the history of money, starting with the exchange fairs of the late Middle Ages and going right up to the clearing houses operating in the United States in the decades up to the inception of the Federal Reserve System”. The same author notes two main features of historically known private monetary coalitions that we can readily recognise in private cryptocurrencies: first, payment technologies with high costs of confidence creation, and second, sensitivity to competition.

In the past, precious metals or convertible money were used by private monetary coalitions for final settlements, while special software and restricted supply were employed to ensure a scarcity of a given crypto-asset. In both cases, such means of payment lack an elasticity of supply, and thus tend to be deflationary. A deflationary mean of payment cannot be a universal solution as it fails to ensure a sufficient elasticity of money supply, a necessary precondition for a monetary economy that is by definition credit based.

Additionally, private monetary coalitions are sensitive to competition, which may increase suddenly and replace the existing coalitions with rival schemes. The long history of money has witnessed many collapses in state-accepted money due to abuse by sovereigns or political catastrophes. Private monetary coalitions, however, being exposed to market competition, have proven even less sustainable. Ambitious plans of powerful newcomers such as Facebook to issue own digital currencies (Libra Association 2019; Murphy 2019) create a sense of déjà vu. Pre-announced cryptocurrency Libra is expected to put pressure on all types of digital payment providers including banks. The latter, however, could better accommodate such shocks thanks to their diversified activity and integrity with central bank money. These outcomes suggest that the best way to achieve both monetary innovation and stability is the continuous interaction of markets and authorities rather than the dominance of one at the expense of the other.

Market volatility *per se* is a subject of new opportunities: the private cryptos pegged to traditional currencies or their baskets, called stablecoins, are an innovative response which, however, cannot eliminate their own anchors. Stablecoins (stable coins) aim to merge the technological benefits of cryptocurrencies with the stability of state-accepted money. While losing the ideological driver of being a true alternative, some stablecoins may have a chance if they offer innovative solutions for payments denominated in state-accepted money. Stablecoins, that are credibly-backed by fiat money and redeemable on demand, can be classified as fiat money payment techniques rather than a true alternative to fiat money. At the same time, a pegged subject cannot remove its own anchor, since the former cannot replace the fundamentals of endogenous money creation by credit through the interaction of commercial banking and central banking.

Moreover, potential investors should assess the meaningful peg risks of stablecoins. Barry Eichengreen (2018) explains that a number of stablecoins have not been fully backed by risk-free assets denominated in anchor currency, or even by any fiat asset. From this perspective, three types of stablecoins have been distinguished thus far: “fiat asset-backed”, “crypto asset-backed”, and uncollateralized stablecoins that algorithmically adjust supply based on demand to maintain a constant price. Even underlying fiat assets are not necessarily risk-free, and there have not been any legal obligations yet to disclose coverage assets.

For instance, the US dollar-pegged and fiat-backed Tether – the main stablecoin in market capitalisation by mid-2019 – was apparently backed by deposits with a single Puerto Rican commercial bank (Gillick 2018).

The impressive current number of private cryptocurrencies⁸ can be explained by the early stage of the sector's development. A low interest rate environment provides plenty of available capital in search for profitable yields. Gambling on the expansion of private cryptocurrencies, one or more of them are expected to survive as a beneficial replacement for sovereign money. Devastating consolidation may take place in the later stages of the sector's development. Innovative solutions for payments, adapted for state-accepted money, could result in a promising outcome for some of private cryptos.

Although “(private) cryptocurrencies can never prevail as general money substitutes” (Constâncio 2017a), they reflect “a broader reorganisation of the economy and society into a series of distributed peer-to-peer connections” (Carney 2018, p. 12). Private cryptocurrencies are a demand-driven attempt to create a payment infrastructure for peer-to-peer transactions. Even if private cryptocurrencies have failed to meet their ambitious objectives, they send a strong signal to the existing payment systems and conventional banking: these must adapt, meeting the demands of reliable, instant, peer-to-peer transactions (ibid.).

4. IMPLICATIONS OF CBDC

4.1. GENERAL CONSIDERATIONS

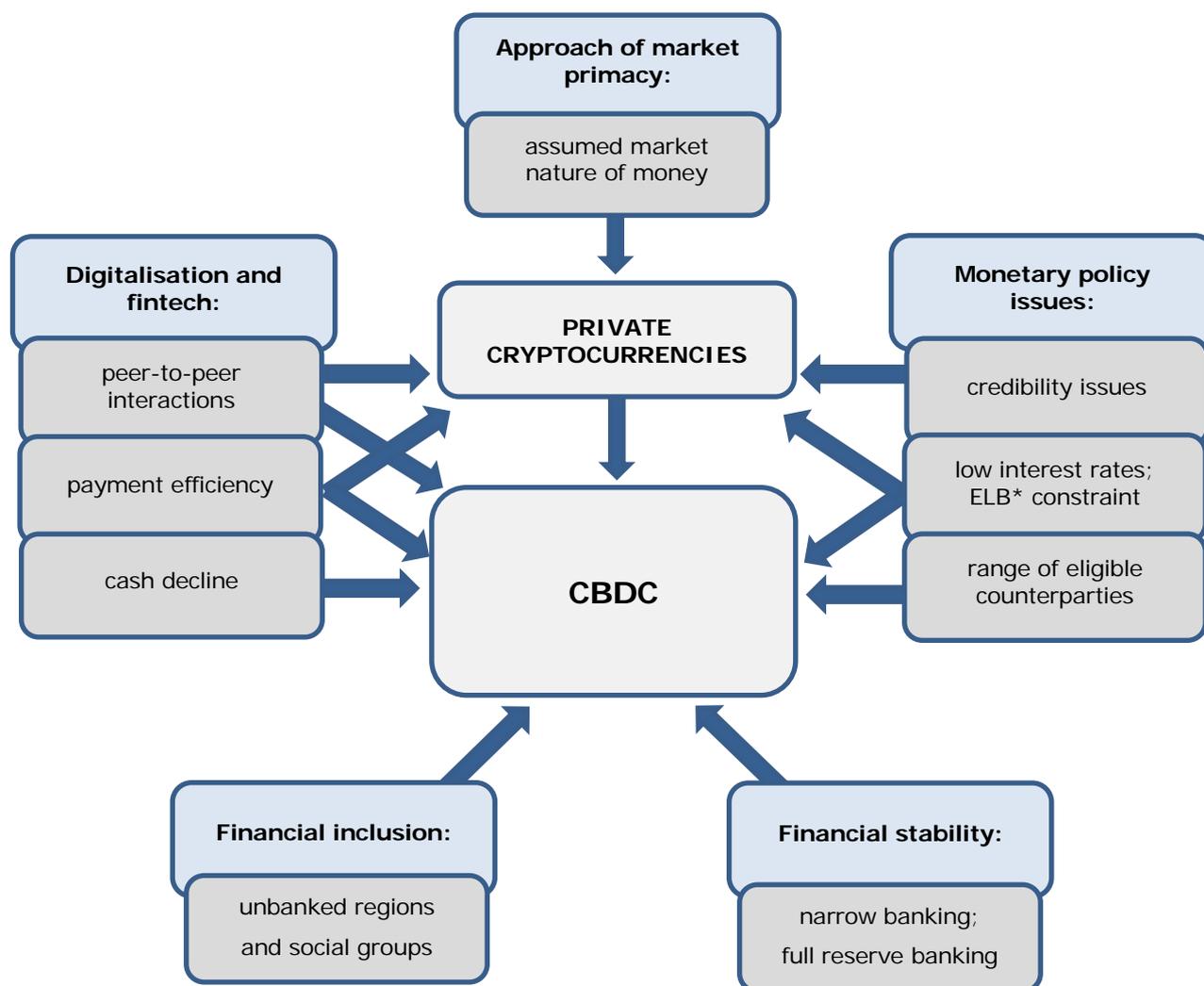
While private cryptocurrencies *per se* are not determinative with respect to launching CBDC, digitalisation issues and opportunities provide a number of other reasons for central banks to consider CBDC options. In-depth analyses of CBDC have demonstrated both new opportunities and caveats for all core activities of central banking, making CBDC a topical issue for a likely longer-term perspective. Figure 1 summarises the main drivers of private cryptocurrencies and CBDC in advanced economies. The leading motivations for CBDC in emerging economies are quite different from those covered in this figure. The specific factors of CBDC in emerging markets are also discussed in this section.

In the Annex, we summarise the wide range of potential implications of CBDC with either broad or restricted accessibility. Following the comparative analysis applied by the CPMI-MC (2018) report, the number and significance of caveats have exceeded potential benefits in the case of the general purpose CBDC. The implications of the wholesale CBDC appear to be less uncertain, while the net balance of potential effects is not so obviously tilted to the downside. Some central banks have been conducting experiments with CBDC in restricted formats and underlying technologies (in particular DLT), investigating new possible solutions for wholesale or, to lesser extent, retail payments (Bech and Garratt 2017, p. 66; Ponce 2018; Riksbank 2018, IMF 2018a, pp. 27-30). However, these experiments have not yet yielded significant benefits on the

⁸ At the end of May 2019, the number of available cryptocurrencies was over 2,200 according to CoinMarketCap. Meanwhile, according to DeadCoins, more than 1,600 cryptocurrencies have so far collapsed.

technological level, while macroeconomic considerations have raised many doubts, as can be seen in the Annex.

Figure 1. Main drivers of private cryptocurrencies and CBDC in advanced economies



Source: prepared by author.

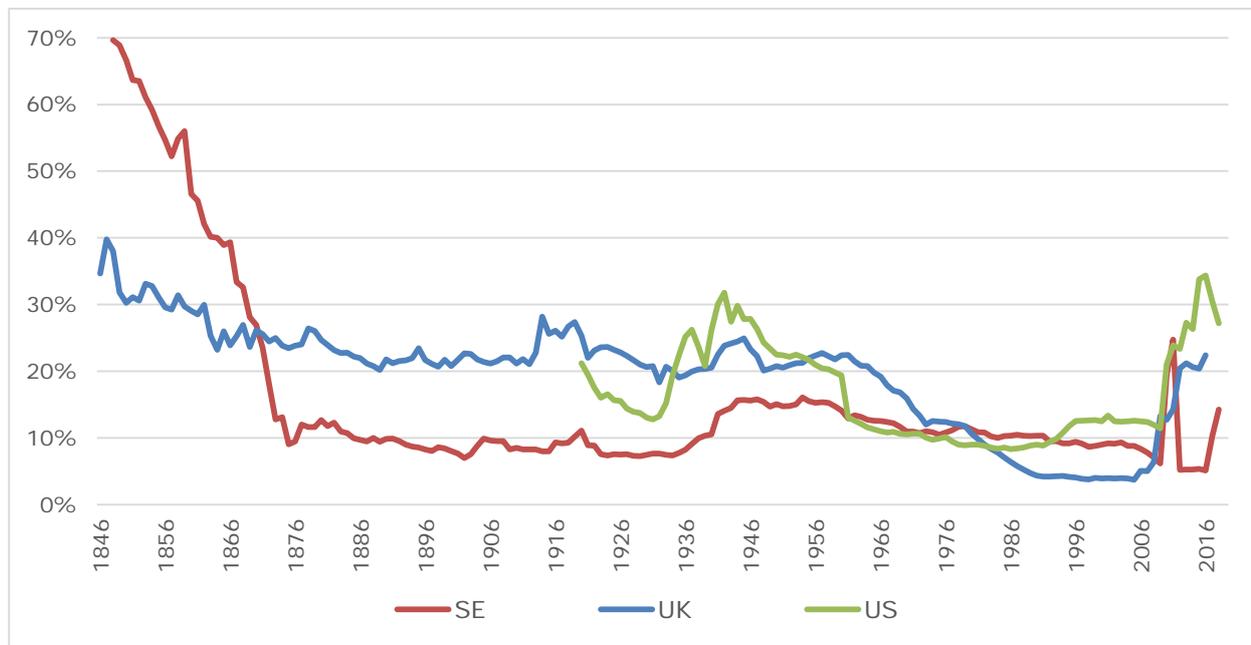
Note: *ELB - effective lower bound.

CBDC issues have renewed interest in the origins of banknote monopoly and the emergence of modern central banking⁹. The monopolization of banknote issuance by the nineteenth-century forerunners of the central banks encouraged the cashless activities of commercial banks, while the former, over time, terminated their own commercial cashless activity (Goodhart et al. 1994). Comparing CBDC with banknote monopoly, we might bear in mind a further, even more crucial, aspect of central banking emergence: ceasing competition with banks for private non-banking clients and separation from short-term profit motives. Gradually developed advantages of deposits at commercial banks over physical

⁹ On parallels between CBDC and the origins of banknote monopoly, see, for instance, Söderberg (2018).

banknotes have worked as a significant barrier against deposit exchange to banknotes, and even bank runs. The potential advantages of digital deposits at banks over CBDC might be much less effective in preventing bank runs during stressful periods. A move to general purpose CBDC, then, would reflect a fundamental shift of power in the monetary system.

Figure 2. Ratio of central bank money-to-broad money supply in selected countries: long-term perspective



Sources and notes:

Data for Sweden (SE) for the period of 1846-2016: data for the period of 1846-2012 from Edvinsson R. and Ögren A. (2014); later data from Riksbank statistics. Broad money supply is represented by monetary aggregate M3.

Data for UK for the period of 1844-2016: FRED database, Federal Reserve Bank of St. Louis. Broad money series was constructed by the Bank of England as part of the Three Centuries of Macroeconomic Data project using money supply aggregates M3 and M4.

Data for US for the period of 1913-2016: all data of monetary base and data of monetary aggregate M2 from 1959 taken from FRED database, Federal Reserve Bank of St. Louis; older data of M2 from US Department of Commerce (1975). The structural shift in M2 composition caused one-off increase of this variable from 1959.

For the purpose of more adequate comparison for the period after the GFC, we enlarged the money stock of the Riksbank (monetary base) for the period of 2007-2016 by liquidity-absorbing monetary operations (deposit facility, fine-tuning operations and certificates of deposits) which were massive. The Bank of England and the US Fed, meanwhile, left unabsorbed the bulk of reserves, created by QE.

CBDC could prevent the central bank balance sheet from shrinking under a weakening demand for cash, but this is not only way to implement monetary policy in a cashless society. The historical contraction of cash and consequently the share of central bank money-to-total money supply have not been associated with a reduction in the effectiveness of monetary policy, but rather the opposite. While digitalisation may accelerate the reduction of cash, another type of central bank money, namely, reserves,

would still be needed, thus providing the channel for monetary policy transmission¹⁰. The heyday of modern-day monetary policy was observed from the mid-1980s until the late-2000s, when the ratios of central bank money-to-broad money supply had been at historically low levels (Figure 2). It is important to note that central banks can effectively expand their balance sheets to a significant extent, if necessary, as they did in response to the GFC and subsequent sluggish recovery. CBDC is not the only way to extend the central bank balance sheet and the volume of monetary operations.

4.2. IMPLICATIONS OF GENERAL PURPOSE CBDC

4.2.1. Explicit general purpose CBDC

The idea of a general purpose CBDC creates a déjà vu situation in monetary debates about the role of central banks in money-supply creation. A general purpose CBDC implies a structural shift in money supply with a likely bigger share of publicly available central bank digital money at the expense of bank deposits. This contrasts with the development of the two-tiered banking system over the course of the past two centuries. In the nineteenth century, controversy between Currency and Banking Schools led to the monopolization of banknote issuance by the privileged chartered bank under the gold standard in order to stabilise the monetary system¹¹. While at that time banknotes, together with coins, had been considered the “true money”, limitations on banknote issuance encouraged cashless activities by commercial banks as a response to a growing demand for money in the broad modern understanding of the term. By the end of the nineteenth century, deposits at banks had become a major component of money supply, while the share of the banknote-issuing bank(s) – the predecessor of the central bank – in the national banking system had decreased dramatically (Triffin 1964, Giannini 2011, p. 72, 91). In parallel, the banknote-issuing bank(s), having gold reserves and support from the government, gradually accepted responsibility for the stability of the banking system, becoming the central bank in the modern sense. Goodhart et al. (1994, pp. 65-80) clarify that the process by which the earlier entities gradually turned into central banks included the function of lender of last resort and an ideological shift from a competitive relationship with banks towards the acceptance of responsibility for overall financial stability. A general purpose CBDC would therefore reflect, at least to some extent, a deviation from the latter principle of the modern-day central banking.

The potential implications of a general purpose CBDC include a rekindling of a long-forgotten competitive relationship between central bank and commercial banks. CBDC consequences may be far more serious than the structural outcomes of the nineteenth-century Currency–Banking controversy. In those times, commercial banks adapted to the prohibition of banknote issuance by developing another kind of money (i.e., deposits) and related services. Now, banks would be forced to compete with CBDC in the same field of retail digitalised deposits, which currently comprises their core and most stable funding. This would be

¹⁰ The central bank policy rate on reserves can play a role in the monetary policy stance even if no minimum reserve requirements are applied, and the banking system is able to reduce the actual balance of reserves to zero at the end of the business day thanks to central bank standing facilities. The central bank is only one in town that can promptly close any gap between demand and supply of reserves, eliminating liquidity shortages or absorbing surplus at policy rate.

¹¹ On the controversy between the Currency and Banking Schools and its consequences for nineteenth-century monetary systems, see Giannini (2011) and Spahn (2010). About the implications of this controversy for later monetary debates, including contemporary ones, see Goodhart and Jensen (2015).

true even if central banks made an effort to reduce the comparative advantages of CBDC, as discussed below. The exchange of deposits into CBDC is a reserve-draining operation and central bank liquidity support to banking sector is necessary to implement this exchange and restore a level of bank reserves. Therefore, the permanent dependency of the banking sector on central bank liquidity support would increase. Juks (2018, pp. 84–85) has pointed out that the only feasible strategy to restore bank market-based funding stability under a decreased stability of the retail deposit base would be the replacement of some short-term wholesale market funding by a long-term one. This, in turn, would reduce the maturity transformation and permanently increase bank funding costs and lending interest rates.

Discussions on a general purpose CBDC revisit another déjà vu situation in monetary debates, providing parallels with the old idea of separating money from credit. This heterodox concept entails the separation of money creation from bank credit activity, thus eliminating the current banking practice of creating private money (i.e., deposits) and transforming commercial banks to the true financial intermediaries. The idea is based on the money endogeneity approach to the process of money creation and a verdict that the private banking sector is the core driver of credit booms and busts. Proponents aim to replace money endogeneity with an exogenous money supply created by central banks either directly or through so-called narrow banks, with deposits being fully backed by reserves. Proposals to separate money and credit are a radical response which periodically re-emerges with variations during great crises periods such as the Napoleonic wars (ideas of the Currency School), the Great Depression (the Chicago Plan), and the GFC (the Chicago Plan revised, the Sovereign Money Initiative, etc.). The mandatory replacement of bank deposits by CBDC could be an option for money and credit separation; meanwhile, banks would be split into narrow banks and investment trusts. The balance of potential costs and benefits of such a radical monetary reform is beyond the scope of this paper. Notably, the idea of separating money and credit has been the object of wide-ranging criticism and has been marginalized by today's central banking community and the academic mainstream¹².

From the perspective of the current monetary and financial framework, the main concern about a general purpose CBDC comes from the financial stability side. The point is that CBDC would be a potential alternative not only for physical cash but also for digital deposits. Theoretically, broadly available CBDC and an adequate liquidity-backstop by the central banks could even be deemed positive factors for financial stability. For instance, Markus Brunnermeier and Dirk Niepelt (2019) argue that CBDC – “reserves for all” – may make bank runs less likely: the central bank would become the largest risk-free depositor on demand, providing adequate funding for bank activity, if customers prefer to exchange some of their deposits for CBDC¹³. In fact, central banks would satisfy the public demand for safe money, opposing rather than supporting the banking sector. We suggest that such expansion of the central bank would have strong negative implications, outweighing potential benefits, as discussed below.

During normal times, banks can be expected to be able to prevent the bulk of the deposit base from shifting to CBDC. Private banks could provide higher returns and better ancillary services compared to

¹² Patrizio Lainà (2015) provides an overview of old and new ideas to separate money from credit, placing them under the single umbrella of a full-reserve banking approach. Goodhart and Jensen (2015) summarize the criticism of these ideas. Mainstream discussions on the future of monetary policy framework typically ignore the idea of separating money from credit (see, for instance, Constâncio 2018; Papadia with Välimäki 2018, pp. 277–281).

¹³ Brunnermeier M. and Niepelt D. (2019). Digital Money: Private versus Public. In Fatás A. (Ed.) (2019), pp. 49–56.

those provided by public institutions, including central banks, as discussed by Goodhart and Jensen (2015, p. 23). Even in normal times, however, bank funding costs would likely increase, with negative implications for lending and risk-taking (CPMI-MC 2018, p. 15). Moreover, widely expected continuation of low interest rate environment would contain bank benefits from maturity transformation, limiting bank ability to provide higher returns for depositors. There is a risk that significant exchange of bank deposits into CBDC could take place even under normal circumstances (Cecchetti and Schoenholtz 2017).

The GFC provided recent evidence on how a digital run can be devastating during stressful times.

At that time, a number of systemically important banks in advanced economies suffered a so-called “silent bank run”, when “bank savers ran at the click of a mouse” thanks to developed online banking (Stevenson and Slater 2008). This kind of digital run is sudden, quick, and can generate devastatingly huge outflows. The most damaging aspect of a digital run is the speed at which not only households but also business customers can move away (ibid.). The magnitude of a digital run could be even larger if unlimited CBDC were available. We can see from the experience of banking crises that deposit insurances can alleviate but not eliminate bank runs, depending on the credibility of an insurance framework, the covered ratio of deposits, and the efficiency of compensation procedures.

Figure 3 illustrates the hypothetical large-scale changes in balance sheets of the central bank and commercial banking sector after the CBDC introduction and, later on, during a systemic digital run to CBDC.

Let us suppose that before a digital run, commercial banks could be holding reserves (20 of currency units), high-quality bonds (130) and providing loans to the real economy (850). On the liability side, commercial banks borrow 50 units from the central bank through reversed monetary operations and accumulate deposits in the amount of 950. Meanwhile, the central bank had granted 50 units to banks by reversed monetary operations and issued 50 units by outright purchases of bonds. On the liability side, central bank-issued money had been distributed according to demand, stemming from the banks for reserves (20) and from the public for cash – banknotes and CBDC (40 units each).

During a hypothetical systemic digital run, dramatic changes in the two-tiered banking sector balance sheet occurred in our example.

Let us say that commercial banks suffered a huge deposit outflow of 300 units (one third) into CBDC. Let us further suppose that banks increased their demand of reserve balance (+20) due to liquidity pressures and the impairment of the interbank market. The central bank would in this case be obliged to provide adequate liquidity support ($300+20 = 320$) to maintain the functioning of the banking sector and prevent the targeted market interest rate from an uncontrolled jump. Both purchases and lending through traditional monetary operations would be adding liquidity in an equal amount of 40. Consequently, banks would have to sell 40 units of their bond holdings to the central bank and to pledge the last unrestricted 40 units, in addition to 50 units pledged before the systemic digital run. While all bond holdings eligible for monetary operations had been sold or pledged, the central bank would be compelled to provide an emergency liquidity assistance on a large scale (240), accepting lower-quality collateral (part of a bank loan portfolio, in this case).

This would imply serious issues for the future development of the banking sector. The central bank would be forced to accept higher and less-known credit risk. Such a rescue of the banking sector would imply a moral hazard stemming from the heavy involvement of a central bank in the funding of the real economy and the government through banks and the bond market. While the situation around bank funding would become less stable, bank lending to the real economy and maturity transformation could be damaged too.

Figure 3. Hypothetical changes in balance sheets of a central bank and commercial banking sector after the introduction of a general purpose CBDC

Panel A. Stocks before a systemic digital run

CB balance sheet			
Monetary lending	50	Reserves	20
		Banknotes	40
Outright purchases	50	CBDC	40
Total:	100	Total:	100

Consolidated balance sheet of commercial banks			
Reserves	20	Monetary borrowing	50
Bonds (of which pledged: 50)	130		
Loans	850	Deposits	950
Total:	1000	Total:	1000

Panel B. Stocks and flows at the peak of a systemic digital run

CB balance sheet			
Monetary lending = 50+40		Reserves = 20+20	
		Banknotes	40
Outright purchases = 50+40		CBDC = 40+300	
Emergency loans +240			
Total:	420	Total:	420

Consolidated balance sheet of commercial banks			
Reserves = 20+20		Monetary borrowing = 50+40	
Bonds = 130-40 (all remaining 90 pledged)			
Loans	850	Emergency loans +240	
		Deposits = 950-300	
Total:	980	Total:	980

Source: prepared by the author.

Although the potential magnitude of a digital run to CBDC is subject to assumptions under limited historical evidence, we consider a large-scale run with significant probability. A general purpose CBDC is expected to be close substitute for cash and current accounts, given that otherwise it would make no sense to implement this sophisticated project at all. Consequently, CBDC would be more attractive than those

rare historical examples containing similarities. For instance, deposit accounts offered by the Swedish National Debt Office became bank-run assets in 2008/9. The run was limited in scope, amounting to less than 2 per cent of total bank deposits from the real sector (Juks 2018, p. 95). Juks (ibid.) noted that a run to CBDC would have been “somewhat larger” because of the comparative advantage of CBDC over accounts at the National Debt Office, which are treated as saving accounts subject to various restrictions. As was mentioned above, the devastating digital runs that occurred during the GFC even without CBDC provide a rationale for serious concern.

4.2.2. Implicit general purpose CBDC (Tobin’s alternative)

Alternative reserve-backed accounts or tokens could be issued by private banks or payment institutions with adequate support of central bank. Bech and Garratt (2017, pp. 59–62) call this kind of money “deposited currency accounts”, referring to James Tobin’s 30-year-old proposal. Impressed by the US savings and loans association crisis that occurred in the 1980s, Tobin (1987, p. 172) argued that central banks should “make available to the public a medium with the convenience of deposits and the safety of [central bank] currency, essentially currency on deposit”. Essentially, he aimed to avoid relying too heavily on deposit insurance. Deposited currency accounts in fact means that the full reserve-backed accounts at commercial banks would be available to the general public. Tobin’s radical proposal was not adopted by the relevant authorities. Although we have not been able to explicitly account for why the Tobin alternative was left aside, we assume that it had to do with an undesirable degree of involvement of a central bank into market funding, as discussed above. Nowadays, Tobin’s proposal has been reincarnated in the context of ongoing digitalisation, creating one more episode of déjà vu.

Whereas the central bank would be involved to the provision of underlying reserves on demand, reserve-backed accounts or tokens can be classified as an implicit CBDC. Reserve-backed accounts would differ from “narrow banking”, since commercial banks would be allowed to both issue reserve-backed accounts and continue their conventional activity, e.g. to attract traditional deposits, lend to the real economy, and engage in other risk-taking activities. Reserve-backed accounts refer to the indirect access of the general public to central bank liabilities through a private bank balance sheet, a kind of implicit CBDC. An explicit general purpose CBDC, by contrast, involves public claims to central bank liabilities without intermediaries¹⁴. Whereas CBDC-related terminology has remained in flux, this particular kind of CBDC is also known as “deposited currency accounts” (Bech and Garratt 2017 with reference to Tobin 1987), “universal (central bank) reserves” (Cœuré 2018, Fegatelli 2019), and “synthetic CBDC” (Adrian 2019).

Although reserve-backed accounts or tokens would also be potential victims in a digital run, the effects of such a run can be expected to be of a lower magnitude. Paolo Fegatelli (2019) elaborates the potential implications of this particular kind of CBDC, calling it “universal central bank reserves”. This author concludes that this scenario of CBDC would be “less [but still – our remark] disruptive”, since, *inter alia*, “banks with good-quality collateral could replace any outflow of customer deposits with interbank and central bank credit” (Fegatelli 2019, pp. 9, 14, 33). We have come to the similar conclusions.

¹⁴ In practice, even explicit CBDC would likely be distributed to the public through private banks and other financial intermediaries - much like cash, which is currently distributed through banks.

Figure 4 provides an illustration of hypothetical changes in the balance sheets of the central bank and commercial banks in response to a digital run, if reserve-backed accounts are available for the general public. During times of stress, banks would have a chance to preserve the deposit base from the outflow thanks to these accounts, which are backed by safe assets. Consequently, an important driver of bank runs – depositors’ fears of run-induced bank liquidity shortage – would be eliminated. One can assume that banks would even not increase the demand for reserves for precautionary purposes, in contrast to the run to an explicit CBDC (Figure 3). Another driver of bank runs – the fear of bank insolvency – however, could trigger some exchange of conventional deposits to reserve-backed accounts (150 units, in our example). Nevertheless, eliminated liquidity risk would reduce insolvency risk too, since banks would not be forced to quickly liquidate some parts of their assets, likely suffering some losses.

If reserve-backed accounts are available, a digital run would likely be less-intense, implying a lower need for liquidity support of banking sector by the central bank. The shortage of high-quality collateral for central bank monetary operations would be less pronounced, as would the need for emergency loans. Compare Figure 4 to Figure 3, bearing in mind that the differences in hypothetical outcomes depend on assumptions. Precautionary prudential measures by authorities could further reduce bank insolvency risk and potential digital runs.

Prudential measures can even more efficiently reduce the risks of a digital run if no broadly accessible CBDC of any type is available. Based on the abovementioned argumentation, we suggest that the development of a conventional crisis-preparation framework is a better way to satisfy the public demand for financial stability and safe money than the launch of widely accessible CBDC. A crisis-preparation framework has been preventively introduced across jurisdictions in response to the GFC, and integrates the coordination of supervision, micro- and macroprudential measures, and liquidity backstop.

While unlimited access to CBDC would put financial stability at additional risk, potential measures to manage the quantity of broadly available CBDC have serious drawbacks. Although the distribution of restricted CBDC amounts is a common practice in the pilot tests, ideas to actively manage a quantity of permanent CBDC should be considered from the perspective of a currently highly homogeneous money supply. Several potential proactive measures of a central bank have been discussed in the literature, namely, quantity limits, active pricing, and the issuing of CBDC directly to the public against specific asset classes (Kumhof and Noone 2018, pp. 11–12; Juks 2018, p. 96). Quantity limits of CBDC under unstable demand would lead to a volatile deviation from parity in the exchange rate or differential in interest rates between CBDC and other types of money. This would negate one of the crucial achievements of central banking – a high homogeneity of money supply – with likely negative implications for financial stability and monetary policy. Under active pricing, the central bank would apply time-varying pricing of CBDC, cooling demand if necessary. One could assume, however, that sooner or later it would not be able to avoid contradicting the main monetary policy instrument, i.e. steering interest rates. Moreover, it would be politically unacceptable to impose technically unjustified costs of owing CBDC on the general public, even if central banks communicate the necessity to link CBDC costs to those of physical cash or to eliminate ELB constraint. During a period of stress, an intentional hike of CBDC costs by the central bank to prevent a bank run would definitely provoke a negative reaction from the public, coupled with disappointment with economic and financial development.

Figure 4. Hypothetical changes in balance sheets of a central bank and commercial banking sector after the introduction of reserve-backed accounts (an implicit CBDC)

Panel A. Stocks before a systemic digital run

CB balance sheet			
Monetary lending	50	Reserves*	20
		Banknotes	40
Outright purchases	50	Encumbered reserves	40
Total:	100	Total:	100

Consolidated balance sheet of commercial banks			
Reserves*	20	Monetary borrowing	50
Bonds (of which pledged: 50)	130	Deposits:	
Encumbered reserves	40	Reserve-backed accounts	40
Loans	850	Rest deposits	950
Total:	1040	Total:	1040

Panel B. Stocks and flows at the peak of a systemic digital run

CB balance sheet			
Monetary lending = 50+40		Reserves*	20
		Banknotes	40
Outright purchases = 50+40		Encumbered reserves = 40+150	
Emergency loans +70			
Total:	250	Total:	250

Consolidated balance sheet of commercial banks			
Reserves*	20	Monetary borrowing = 50+40	
Bonds (pledged) = 130-40		Emergency loans +70	
Encumbered reserves = 40+150		Reserve-backed accounts = 40+150	
Loans	850	Rest deposits = 950-150	
Total:	1150	Total:	1150

Source: prepared by the author.

Note: *Reserves denoted by asterisk are held by banks for conventional purposes to maintain liquidity buffers or required reserves (if any). Encumbered reserves are held for the purpose of fully covering reserve-backed accounts.

Issuing CBDC directly to the public against eligible assets may have some advantages, but the overall effect appears to be disappointing. There is a prevailing assumption that CBDC can be issued only in exchange for already-issued banknotes and deposits. Researchers have suggested an alternative supply mechanism to issue CBDC directly to the broad public against good collateral, such as Treasury bonds (Kumhof and Noone 2018, pp. 11–12 and Juks 2018, p. 96). This scheme should not affect the total amount of deposits in commercial banks, the level of reserves, and the availability of collateral held by banks. Initially, potential investors of CBDC would buy eligible assets in the market, paying with their deposits remaining in banks. Next, investors would sell these assets to the central bank in exchange for newly created CBDC. One can assume, however, that typical bond traders are the wholesale financial institutions, while many CBDC investors would be retail depositors, implying a shift in deposit structure towards less stability. Digital runs would consequently still be possible and would create in asset markets extreme pressure, bubble pricing, and even a physical shortage, compromising the whole CBDC scheme.

4.3. IMPLICATIONS OF WHOLESALE CBDC AND FINTECH EXPANSION

Decisions on a wholesale CBDC depend on considerations from the perspectives of monetary policy transmission and development of payment system. The financial stability implications of a wholesale CBDC are limited by definition in contrast to the unrestricted general purpose CBDC. A limited extension of reserve account holders by certain additional type(s) of wholesale institutions is referred to as “an issuance of a wholesale CBDC” (CPMI-MC 2018, p. 4). From this perspective, a few central banks have been issuing the wholesale CBDCs for either monetary policy or payment purposes. Below, we discuss these still rare examples and whether they can become permanent solutions.

From a monetary policy perspective, the decision on a wholesale CBDC depends on whether the range of eligible counterparties should be widened beyond banks¹⁵. If central banks decided to extend a range of counterparties in addition to banks, it is likely that some non-bank financial institutions (such as money market funds) would be preferred over non-financial entities. Thanks to their intermediation role, financial institutions would better spread monetary policy signals and be less exposed to idiosyncratic shocks than non-financial entities. On the potential benefit side, a broader and more diverse range of counterparties might better transmit monetary policy signals, bearing in mind the global decline of bank importance in funding real economy. On the cost side, the execution of monetary policy operations would be complicated due to a variety of potential counterparties, while bank wholesale funding would get additional uncertainty due to emerged possibility for some non-bank financial institutions to park their liquidity at the central bank. The activity of banks across various financial markets, including those determining market reference rates (albeit to a smaller extent these days¹⁶), is an argument in favour of the current bank-based framework of eligible counterparties.

¹⁵ Whether the range of eligible counterparties for monetary operations should be extended beyond banks is one of important questions for the future framework of monetary policy. See, for instance, Cœuré (2018) and Constâncio (2018).

¹⁶ Ongoing reforms of market reference rates aim to measure bank funding costs more precisely, including data not only of interbank transaction, but also transactions between banks and non-banks. Nevertheless, banks will normally remain as at least one side of transactions. See, for instance, ECB (2019) and EMMI (2019).

The range of eligible counterparties can be extended by some non-bank financial institutions under special circumstances on a temporary basis. For instance, in 2013, the Fed introduced the overnight reverse repurchase agreement (ON RRP) facility, making it available to a broader set of counterparties (Frost et al. 2015). This set includes not only banks, but also money market funds and government-sponsored enterprises that are active in money markets. Counterparties are allowed to buy eligible debt securities from the Fed portfolio on condition that they sell them back during the next business day at a price increased by the policy rate. Thus, the Fed absorbs excess liquidity not only from banks, but also from other active money market players which traditionally do not have direct access to central bank liabilities. Consequently, the Fed established a firm floor on money market rates which would decline deeper, if only banks were allowed to place the QE-induced liquidity surplus on the central bank facility at policy rate. The Fed announced, however, that it intends to apply this unconventional measure only to the extent necessary and will phase it out when it is no longer needed to help control money market rates. The reasons for this policy are very similar to those concerning CBDC implications on market functioning and financial stability, i.e. distortion of bank funding market functioning and potentially destabilizing outflows from the banking sector into the central bank during stress periods (Frost et al. 2015, p. 2 and thereafter). Overall, we believe that a bank-based framework of eligible counterparties with an option for temporary *ad hoc* extension is a promising model for a future monetary policy framework. It is a matter of interpretation whether such a temporary and special extension of access to the central bank liabilities could be considered a launch of a wholesale CBDC.

From the perspective of payment systems' development, the decision on a wholesale CBDC depends on whether and to what extent non-bank payment institutions should be allowed to have accounts with a central bank. New market-based payment technologies (such as mobile payment platforms) accelerate the diminishing demand for banknotes and claim to redistribute the market of payment services. "Narrow finance solutions" is a term introduced in order to capture the various forms of private money backed by central bank liabilities (IMF 2018a, p. 13). Narrow finance accounts have been developed by some non-bank payment agencies mostly in emerging economies, such as Alipay in China or PayTM in India (ibid.). In advanced economies, some central banks have allowed the limited access of own liabilities to e-money institutions and payment institutions¹⁷ (Bank of England 2018; Bank of Lithuania 2017). Thus far, regulators have tolerated or even encouraged fintech developments in order to facilitate technological progress, competition, and diversity in the field of payment services (Bank of England and Financial Conduct Authority 2017). However, narrow finance solutions have not yet gained wide acceptance by authorities across countries.

We support the view that the holdings and usage of accounts with a central bank (if any) by e-money and payment institutions should be a subject of restrictive regulation. E-money and payment institutions should not be allowed to hold all their clients' funds at a central bank at their own discretion. This is necessary to maintain a level playing field in competition with conventional banks and prevent narrow

¹⁷ The key difference between *e-money institutions* and *payment institutions* is that the former have been granted authorisation to issue e-money in addition to their ability to function as payment institutions by providing payment services. In turn, *e-money* is defined as an electronic store of monetary value on a technical device as represented by a claim on the issuer which is issued on receipt of funds (i.e., already-created money – our remark) for the purpose of making payments to entities other than the e-money issuer (Directive 2009/110/EC of the European Parliament and Council). Therefore, e-money and payment institutions do not create new money.

banking activity. Since banks create deposits by lending, by definition, they cannot be fully covered by reserves at a central bank. Reserves normally comprise a small fraction of deposits, being obtained from a central bank for the purposes of interbank settlements, liquidity buffer and required minimum reserves (if any). Meanwhile, e-money and payment institutions attract clients' money that is already created by banks. Full coverage of clients' money by reserves would require unconditional liquidity-backstop by a central bank and would create privileged conditions that are not accessible for bank clients. Therefore, a requirement for e-money and payment institutions to use their accounts with a central bank solely for settlement purposes and payment obligations¹⁸ is well-grounded.

Fintech expansion to the areas of payment service and credit provision cannot replace bank credit in money creation and, therefore, banks in the role of central bank's counterparties. Fintechs usually start with digital payments, getting the licenses of e-money institutions or payment institutions. Frost et al. (2019) point out that some fintechs, particularly bigtechs, expand into the provision of credit and other financial services, either directly or in cooperation with financial institution partners. While conventional bank acquires soft information from its clients by developing long-term personal interactions, fintechs typically exploit patterns of consumer preferences and behaviour using big data. Fintech lending has particularly advanced in some developing countries with less competitive banking sectors and less stringent regulation (ibid.). Three channels can be identified through which fintechs provide credit in state-accepted money: by organising peer-to-peer lending platform; by partnership with banks; or by acquiring a bank license (ibid., 11–14). The first two channels employ money created by banks. In the third case, fintech evolves into a true bank capable of creating money, being a subject of banking regulation and supplementing banking by a big data-driven business model.

Hopes or fears that fintechs may eventually gain a bank deposit base create one more déjà vu episode in debates between concepts of money exogeneity and endogeneity. A textbook neoclassical concept of money exogeneity suggests that a medium of exchange is a leading function of money, banks operate only as intermediaries, and money supply can grow by multiplying exogenous central bank money. Consequently, the accumulation of deposits by successful non-bank payment agencies is supposed to leave banks without their core funding. Fintechs would gain credit markets, too, by lending pre-accumulated deposits. Meanwhile, the need for central bank liquidity support to the financial system through fintechs as new counterparties is expected to diminish, thanks to new payment technologies. In this view, CBDC can be considered the only way for central banks to preserve their capacity to implement monetary policy.

From the perspective of money endogeneity approach, these interpretations are misleading. The possible success of some fintechs in payment services would lead to the redistribution of existing deposits at a given loan portfolio and offsetting transactions between banks and fintechs, likely with some support from a central bank. The redistribution of pre-accumulated deposits from banks to fintechs would not provide resources to beneficiaries for new lending. Existing deposits remain counterparts of existing loans even after redistribution, and, therefore, these deposits cannot be used for funding new loans. By granting new loans, banks create the matching new deposits that fund these loans. Redistribution of deposits is executed by offsetting transactions between involved entities (e.g., bank and fintech) rather than the premature repayment of loans. Meanwhile, the repayment of loans not only cancel bank claims to borrowers on the bank

¹⁸ See Bank of England and Financial Conduct Authority 2017.

asset side, but also destroys their funding (i.e., deposits) on the bank liability side (cf. McLeay et al. 2014). Consequently, without becoming banks, non-bank payment agencies are neither able to replace bank lending nor to create money.

4.4. CBDC PECULIARITIES IN EMERGING MARKETS

Digitalisation is altering the financial landscape of emerging economies more intensively than those in advanced economies. Emerging economies are benefiting disproportionately from fintech innovations through mobile payment systems, digital platforms, and expansion in the banking service area. Central banks in these regions are more enthusiastic about the development of CBDC than those in advanced economies, and some of them have already pioneered an actual implementation of CBDC (Barontini and Holden 2019, p. 9–10; Berkmen et al. 2019, pp. 32–34). What do these trends tell us? Should we adjust our cautious approach on digital currencies in advanced economies?

It is notable that the weaknesses of emerging markets rather than a modern view play a leading role in their financial digitalisation and political initiatives on CBDC. An underdeveloped banking sector, a still-heavy stake of government in bank capital, and weak financial inclusion are widespread features in these regions (Casper 2018). In some cases, governments see digital currencies as a potential way to bypass geopolitical sanctions and/ or the US-led global financial system: China, Iran and Russia can be suspected of such a motivation. The stagnating Venezuelan project of the oil-backed sovereign digital currency, “Petro”, is a striking example of a desperate search for a silver-bullet solution to intractable social-economic problems (Casper 2018). The geopolitical motivation behind CBDC is too biased and condition-driven to be a fundamental rationale of sovereign digital currency. Even well-intentioned digital projects to increase financial inclusion and reduce the costs of physical cash have struggled to make significant progress for conceptual and technical reasons (see below).

To the best of our knowledge, dinero electrónico, issued by the central bank of Ecuador, is the only example of an attempt to permanently introduce a general purpose CBDC. After a hyper-inflation crisis in 1998–99, Ecuador replaced its currency with the US dollar in 2000. Ecuador’s politicians attempted to regain control of their own country’s monetary resources by launching CBDC. The government’s explicit goals were to foster financial inclusion and reduce the replacement costs of damaged US dollar banknotes. The law allowed the public to open accounts at the Ecuadorian Central Bank and use these accounts for payments using their mobile phone applications. Actual services started in February 2015 (Berkmen et al. 2019, p. 33).

Ironically, the very same factors that allowed a CBDC launch in Ecuador without a digital run led to its decommission just three years later. Following the abolishment of the national currency, the Central Bank of Ecuador has not become free of default. White (2018) has noted that Ecuadorians consider dollar deposits at private commercial banks less risky than those at the central bank, given its possible inability to repay its debt. Their memory of the last default of government dollar-denominated bonds in 2008 is still quite vivid. The project of dinero electrónico did not gain much popular ground, and even failed to cover expenses to launch and maintain the scheme (ibid.). In December 2017, the Ecuadorian parliament phased out the CBDC scheme beginning in 2018, and instead, has allowed private mobile payment platforms (Berkmen et al. 2019, p. 33).

There are some more successful but still-incomplete digital initiatives by emerging market authorities, for instance, in Uruguay. The Central Bank of Uruguay implemented a pilot program of a retail CBDC for six months (November 2017–April 2018). The case for CBDC is proactively considered as a potential tool to reduce the transaction costs of cash, improve financial innovation, and foster financial inclusion by reaching out to unbanked segments of the society. Before a final decision on CBDC, the central bank will undertake additional work on the payment systems in Uruguay and investigate the impact of CBDC on the traditional banking system (Berkmen et al. 2019, p. 32). It is notable that Uruguay's banking sector is still small and suffers from insufficient competition; a couple of public banks dominate the peso market and the foreign banks have a highly dollarized deposit base and loan portfolio (IMF 2018b).

With the goal of expanding financial inclusion, the Tunisian Post (La Poste Tunisienne) has run the electronic platform “e-Dinar plus” for a widening range of postal financial services since 2000, but progress is still limited. The Tunisian Post plays a constitutive role in the country's financial system. The Tunisian banking sector is relatively undeveloped and suffers from the aftermath of having been fully controlled by the previous political regime. The Post offers a mobile payment platform for the public to pay for goods and services online, send remittances, and pay salaries and bills. That is a good start, but comparison with other middle-income countries shows that a great deal of progress should still be made in terms of access to financial services (Suedekum and Berthaud 2014). Yerkes and Polcari (2017) suggest that the biggest challenge to the further utilization of e-money stems from authorities' concerns over money-laundering and terror financing. The slow rate of expansion was one of the reasons for the bankruptcy of the Swiss fintech “Monetas”, which had been invited by the Tunisian Post to adopt a blockchain-based technology with the aim of reaching more people and providing a wider range of services (Allen 2019; Casper 2018).

It can thus be concluded that specific problems in emerging economies render the motivations for CBDC in those regions different than the motivations in advanced economies. The conjoining of these motivations – as in, for example, Barontini and Holden (2019) – appears to be artificial. Large-scale government initiatives to foster still-low financial inclusion through state-owned companies – either by running electronic platforms for retail financial services or, with less certainty, by launching CBDC – can be beneficial for some developing countries for a while. In advanced economies with a developed banking sector, poor accessibility to financial service is not a universal issue. Broad-based measures like those taken in emerging economies would be disruptive from financial stability perspective.

5. SOME CONSIDERATIONS ON THE DIGITAL FUTURE OF CENTRAL BANKING

Millennials and coming generations will likely marginalise the use of cash, which will become increasingly anachronistic. The elimination of cash, as happened with metal coinage, will end the long gradual decline of this kind of money. Eventually, the marginalised cash will probably remain in contingency plans for emergency situations, such as war and massive cyber-attacks.

The demand for some degree of money anonymity might be satisfied by private digital solutions. The demand for anonymity of money may be overestimated. Anonymity properties of banknotes are likely to have emerged from convenience or historical happenstance rather than intent (Bech and Garratt 2017, p. 65).

Nonetheless, people may prefer some degree of anonymity (IMF 2018a, p. 10). Meanwhile, technologies can provide digital money with varying degrees of anonymity properties, even in the case of CBDC (ibid., p. 15).

The disappearance of cash will likely not imply the necessity of a general purpose CBDC. If the potential CBDC benefits do not outweigh the costs – as now seems to be the case – central banks will prefer to avoid a complicated trade-off with inevitable financial stability issues.

The specific theoretical construct may suggest that policy rates could go deep into negative territory if CBDC were adopted widely and cash were eliminated. One can suppose that, in a cashless society, a negative policy rate on CBDC would promote banks to transmit negative interest rates to remaining deposits and lending rates (Agarwal and Kimball 2015; IMF 2018a, p. 15).

Hopes to eliminate the ELB constraint of monetary policy in a cashless society by launching CBDC appear to be exaggerated. The negative nominal interest rate policies launched by some central banks from the mid-2010s target primarily financial assets and investors' behaviour rather than retail deposits and household savings. In applying negative policy rates on reserves (the bank asset-side component), central banks aim to affect investment activity rather than consumption induced by the penalising of savings. Cash is not only obstacle to transmit negative policy rates to retail deposits. In some countries, there are legal restrictions on the application of negative rates to depositors (Demiralp et al. 2019, p. 9), and a cashless society may wish to maintain this protection of savings. Additionally, there is some evidence that negative interest rates on household savings are likely to have a negative net effect on consumption (ING 2015). Moreover, in a crisis, a cashless society's disappointment with economic development coupled with negative (penalised) rates on CBDC and deposits would likely be considered as unfair wealth tax, with destructive consequences for the credibility of banking sector and authorities (cf. Constâncio 2017b; CPMI-MC 2018, p. 12).

Improvements in financial inclusion, while one of the potential benefits of CBDC, can be achieved by alternative measures. One can argue that CBDC can increase financial inclusion through its ability to reach people and businesses in remote and marginalized regions or social groups (IMF 2018a, p. 16; Riksbank 2018, p. 3). The private market may lack sufficient intentions to fully cater to these areas. If so, governments could offer basic services through their own agencies (e.g. post offices) or encourage private sector initiatives via regulation, funding, or improving infrastructure.

It is desirable that future substitutes for cash provide an integrative solution that simultaneously satisfies the public demand for safe and efficient payments, safeguards private innovations, and ensures financial stability. CBDC are not the only option: its déjà vu drawbacks and side effects can thus be avoided. A reasonable alternative is a set of intertwined conventional activities. The modernisation process of retail and wholesale payment systems by public and private cooperation is one such activity (Cœuré 2019). Another direction is a managed trade-off between fostering fintech innovations and a bank-like regulation of fintechs to the extent that these entities provide banking services (c.f. Merch 2019). While avoiding CBDC and its drawbacks, this approach is likely to be complex and conflictual, since the combination of public and private intentions implies not only synergy but also potential conflicts.

We expect that the sole market-based alternative for money creation will be private bank credit granted by both digitalised banks and fintech banks. The essential banking functions of credit creation and maturity transformation should be preserved. Conventional banks, however, should adopt new

technologies of online banking and payments in order to preserve their deposit base. Some fintechs will succeed in lending and money creation, supplementing rather than replacing banks by the big data-driven business models and interactions with customers.

The central banking community will continue to monitor and discuss the digitalisation of the economy and society, which is diverse and changing rapidly. The process of steering the economy and financial services towards the digitalised life of millennials is broad-based and gaining momentum. Within this context, central banks will navigate their own role across their core functions. Motivations for CBDC in emerging economies can be expected to converge to those in advanced countries if the former's lagging in financial sector development is reduced and market-based solutions are applied to diminish the involvement of central banks.

6. CONCLUSIONS

Digital currencies have been associated with fundamental changes in the economy and social life. They have thus become a major topic of inquiry for central banks and scholars.

Historical evidence and the institutional approach to money yield the fundamental reasons to deny the claims of private cryptocurrencies to replace state-accepted money. While possessing a modern appearance, private cryptocurrencies follow the pattern of unstable private monetary coalitions that have been observed in history. Devastating consolidation may take place in the later stages of the sector's development. Nevertheless, private cryptocurrencies signal an ongoing reorganisation of the economy and society. The term "cryptocurrencies" reflects the monetary aspect of their nature while regulators' preferred term, "crypto-assets", refers to its speculative aspect. Innovative solutions for payments, adapted for state-accepted money, could result in a promising outcome for some schemes of private cryptos.

Digitalisation issues and opportunities indicate several reasons for central banks to seriously consider the CBDC idea and its various options. Discussions about CBDC have demonstrated ambiguous potential implications for payments and monetary policy. The financial stability implications of broadly accessible (general purpose) CBDC constitute the biggest concern for institutions in advanced economies, with a cost-benefit balance that inclines toward the negative side.

Specific problems in emerging economies make the motivations for CBDC in those environments rather different than those in advanced economies. Weaknesses rather than an advanced approach play a leading role in financial digitalisation and political initiatives on CBDC in most emerging markets. These regions feature an underdeveloped banking sector and weak financial inclusion. In some cases, governments perceive digital currencies as an option to bypass geopolitical sanctions or the US-led global financial system. Motivations for CBDC can be expected to converge to those in advanced countries if the lag in financial sector development is reduced.

The potential implications of a general purpose CBDC for advanced banking systems revisit forgotten competitive relationships between the central bank and banks. In normal times, banks are assumed to be able to prevent the bulk of the deposit base from shifting to CBDC. The GFC provided recent

evidence, though, on how a digital run on banks can be devastating in stressful times. The availability of a CBDC alternative could further escalate a digital run.

While unlimited access to CBDC would put financial stability at additional risk, potential measures to limit a quantity of broadly available CBDC to contain digital run have serious drawbacks. These measures would abrogate an essential achievement of central banking, namely, the high homogeneity of money supply. This is likely to lead to an excessive involvement of a central bank in the funding of the real economy and have negative implications for financial stability and monetary policy implementation. Issuing CBDC directly to the public against eligible assets may have some relative advantages, but the overall effects to prevent a digital run and stabilise the deposit base appear to be disappointing.

Another option of CBDC under consideration, reserve-backed accounts or tokens issued by private banks (so-called Tobin's alternative), would remain exposed to a digital run – albeit less so. During times of stress, banks would have a chance to preserve the deposit base from the outflow, offering these alternative accounts backed by safe assets. Although an important driver of bank runs – depositors' fears of run-induced bank liquidity shortage – would be eliminated, the fear of bank insolvency could trigger some exchange of conventional deposits to reserve-backed accounts. The crisis preparation framework for the coordination of supervision, prudential measures, and liquidity backstop seem to be a better way to satisfy the public's demand for safe money than launching widely accessible CBDC in any form.

Consideration of a general purpose CBDC reopens another déjà vu situation in monetary debates, namely, the old idea of separating money from credit. This concept, however, is the subject of diverse criticism beyond the CBDC case. The central banking community and leading scholars have marginalized this concept when they discuss financial stability issues and the future of monetary policy framework.

The financial stability implications of a wholesale CBDC would be limited, and decisions on this type of money will depend on considerations from the perspectives of monetary policy and the payment system. A bank-based framework of eligible counterparties with an option for temporal ad hoc extension seems to be a promising model for the future monetary policy framework. From the perspective of payment system developments, decisions on a wholesale CBDC depend on an answer to the question of whether non-bank payment institutions should be encouraged by having accounts with the central bank. The concern is the risk of potentially destabilizing outflows from the banking sector through payment institutions into the central bank.

Millennials or the next generations will likely marginalise the use of cash, but theoretic hopes to eliminate the ELB constraint of monetary policy are exaggerated. The experience of negative policy rates in the 2010s suggests that central banks primarily target investment activity rather than savings. The targeting of household deposits by a negative interest rate policy would likely have a negative effect on consumption and destructive consequences for central bank credibility. Additionally, negative nominal interest rate policies *per se* can only be seen as an unconventional tool to be used in extreme circumstances with limited room for manoeuvre in terms of their size and duration.

Future cash replacement should be based on an integrative solution to satisfy the public demand for safe and efficient payments, the safeguarding of private innovations, and the ensuring of financial stability. Our analysis reveals that no type of CBDC can serve as the best option. A reasonable alternative is a set of intertwined conventional activities: the modernisation of payment systems and a

managed trade-off between fostering fintech innovations and a bank-like regulation of fintechs, to the extent that these entities function as banks. Although some fintechs may succeed in core banking activity, they will supplement rather than replace endogenous money creation by private bank credit. The dragon is dead, long live the dragon!

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ANNEX. OVERVIEW OF CBDC OBSERVABLE BENEFITS AND CAVEATS IN CORE CENTRAL BANKING ACTIVITIES

Potential implications for the CB activities	General purpose CBDC	Wholesale CBDC
Payment framework		
Benefits:	<ul style="list-style-type: none"> • Safe payment tool, reducing credit risk in payments • Alternative of currency in circulation in line with the modern digitalisation trend • Facilitation of competition in payment services • DLT may enhance settlement efficiency, particularly for wholesale transactions involving securities and derivatives 	
Caveats:	<ul style="list-style-type: none"> • Current payment systems have earned public confidence; adopted or expected technologies offer even more opportunities to enhance payments • DLT not clearly superior to existing payment systems; issues of interoperability • CB are less experienced and efficient in technological development vs. private sector • Cyber-security issues: availability of cash helps to ensure even greater resilience of payment systems 	
Monetary policy		
Benefits:	<ul style="list-style-type: none"> • Elimination/ mitigation of effective lower bound (ELB) constraint • Hard floor for money market rates due to CBDC accessibility by non-financial sector • Making pass-through stronger and more direct • Preventing CB balance sheet from shrinking due to weakening demand for cash • Permanent expansion of CB balance sheet lowering bond yields 	<ul style="list-style-type: none"> • Reduced scarcity of safe short-term assets • Harder floor for money market rate • Improved monetary policy transmission under heterogeneity and segmentation of post-crisis financial markets
Caveats:	<ul style="list-style-type: none"> • To eliminate the ELB constraint, at minimum, a discontinuation of higher-denomination banknotes is needed (not likely in most countries in the medium term) • Even if cash disappears, it is uncertain how the deep negative rates could work and could be politically tolerated • Pass-through can be strengthened by alternative monetary tools (CB bills, time deposits, reverse repo facility) • Monetary policy can still remain effective even without cash • Reduced maturity transformation of banks (eroding deposit base and increasing price-sensitivity of retail depositors), increased funding costs, service fees and lending spreads • Volatility and forecast errors of autonomous factors would likely increase • Expansion of eligible assets' universe; CB engagement in 	<ul style="list-style-type: none"> • More complicated implementation, a decline (probably unavoidable) from simplicity of pre-crisis operational framework • Deviation, albeit in limited range, from fundamental principle of CB to avoid competition with private banks for clients

	<p>various kinds of maturity, liquidity, and credit risk transformations</p> <ul style="list-style-type: none"> • Limits, caps, or adjustable interest rates on CBDC to prevent systemic digital run would reduce the homogeneity of the money supply, weakening monetary policy pass-through • Increased cross-border movements, volatility of exchange rates and asset prices, and deleveraging pressures 	
Financial inclusion and stability		
Benefits:	<ul style="list-style-type: none"> • Safer alternative to bank deposits • Financial inclusion can be improved, reaching people and businesses in remote or poor regions and marginalized social groups; the private market is not expected to fully cater to these groups 	<ul style="list-style-type: none"> • Not significant
Caveats:	<ul style="list-style-type: none"> • Fundamental challenge for the two-tiered banking system • Higher instability of bank funding and risk of systemic digital run at unprecedented speed and scale • Larger role for central banks in financial intermediation, reduced role of the market • Barriers to using digital money can be even higher than those of cash 	<ul style="list-style-type: none"> • Not significant
Financial supervision		
Benefits:	<ul style="list-style-type: none"> • Non-anonymous CBDC could improve application of AML/CFT* 	<ul style="list-style-type: none"> • Not significant
Caveats:	<ul style="list-style-type: none"> • Banks could lose a valuable interface with their consumers, while CBs would take on a much larger role, for which they are not well equipped. (These issues, however, can be resolved by decentralized distribution of CBDC.) 	<ul style="list-style-type: none"> • Not significant
General considerations		
Caveats:	<ul style="list-style-type: none"> • Difficult to anticipate all unintended consequences of such a big bang • Overall economic losses due to a greater role for less efficient public sector (CB) in allocating economic resources • Risk of greater political interference with CB activity • The current monetary system and financial structure function rather well, and the potential net benefit from such a structural change should be high to be justified; in contrast, there is no evidence that the benefits will outweigh the costs 	<ul style="list-style-type: none"> • Not significant

Sources: prepared by the author, using CPMI-MC (2018) and to a lesser extent Barrdear and Kumhof (2016); Danmarks Nationalbank (2017); IMF (2018a); Riksbank (2018). Note: *AML/CFT – anti-money laundering and counter-terrorism financing requirements.