

The Rise of Central Bank Digital Currencies*

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The revolutionary rise of digital financial innovations has heralded a new era in the operation of the banking system and central banks, which has brought about the digital transformation of money. Central banks must respond to challenges profoundly affecting and transforming the financial system. Central banks have been exploring the introduction of central bank digital currency (CBDC), in order to promote stability and sustainable development, to preserve competitiveness and to bolster the effectiveness of their monetary policies. In addition to smooth operation, the preservation of sovereignty and the effectiveness of the monetary policy also need to be ensured. Along with its expected advantages, the paper also discusses the risks relating to CBDC. CBDC appears in the international financial system, generating competition among global currencies. The rivalry between the dollar, the euro and the yuan may alter positions in the global financial system. A rearrangement of international power relations is at stake. Against this background, the paper also provides insight into Hungarian news on preparations for the introduction of CBDC.

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1. Introduction

In the recent past, digital economic development has affected nearly all facets of life, including the functioning of the financial and banking system. Digital financial innovations have transformed the payment system, as various forms of electronic payments have continuously gained ground, and at the same time, the use of cash has declined. Central banks – the institutions in charge of protecting legal tenders as

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the issuers of money – were also quickly affected by this rapid development process (Adrian – Griffoli 2019). Digital financial services, electronic payment instruments, indeed, private digital moneys, posed a challenge that needed to be tackled. The solution found by central banks was the creation and introduction of the central bank digital currency (Dolan 2021; Margulis – Rossi 2021).

In our analysis, we follow the process of central banks' work on digital currencies (CBDC) that has led from some initial trial applications to more than half of the world's central banks now exploring the concept underlying the introduction of such a payment instrument, together with its potential benefits.

To put it simply, CBDC is most like a digital banknote issued by a central bank. Such digital money does not, in principle, differ from traditional money or units of account conventionally issued by a central bank, backed by its reserves and the country's legal system making such money its legal tender. In fact, it is a dematerialised central bank money constituting a receivable from the central bank, available in digital form for all users. In other words, a person's or a company's receivable from the central bank takes on a digital form, as a new form of money.

The use of CBDC has some clear benefits but, depending on the way it is implemented, it may involve some risks, and some elements may even jeopardise financial and monetary stability. We will deal in more detail with the positive impacts: at this point, we only highlight that CBDC could enhance cooperation, the efficiency of the financial system and trade financing at the international level. On the one hand, this opportunity calls for international cooperation on the introduction of CBDCs and on the other hand, it generates competition among CBDCs functioning as key currencies, for dominance over the international market. Another important role of a central bank digital currency is to provide protection against the challenges posed by BigTech companies and private digital moneys and to safeguard the financial sovereignty of the country concerned.

First, we review the current international central bank digital currency landscape and then analyse the situation as regards the introduction of the digital dollar, the Chinese central bank digital currency and the digital euro. The likely impacts of the introduction of central bank digital currency should also be explored from a Hungarian perspective, particularly because this matter is also relevant in the national sphere of competence, as an EU Member State which is not a member of the euro area.

2. Processes necessitating the introduction of a CBDC

The fourth industrial revolution, including digitalisation, has become part and parcel of development over the last two decades. Digital financial innovations first appeared in the financial markets surreptitiously,¹ but then their impact and influence became explosive, forcing incumbent banks to change their business models and transforming payment and money use practices as well as the habits of banks' customers.

While these developments result in new challenges for central banks and incumbent banks, the roles they play in the economy still remain essentially unchanged. With the accelerating competition in innovation, central banks had to support and regulate the enterprises deploying financial innovations, while incumbent banks had to stand their ground in a competition in which they found it difficult to keep up with new rivals in terms of digital development.

Digital financial services transformed the financial intermediary system to such an extent by the end of the last decade that all market participants, including central banks, financial regulators, incumbent banks as well FinTech and BigTech type service providers could not but realise that the penetration and transformative impact of digital developments had become unstoppable.² The introduction of CBDCs was also driven by (i) cryptocurrencies, (ii) stablecoins, (iii) BigTech payment systems, and (iv) digitalisation enforced by the coronavirus pandemic (*Auer et al. 2021*).

A form of market referred to as an amazonised financial marketplace³ emerged in the future vision of development with the forerunners of digital moneys looming on its horizon. Bitcoin and stablecoins entered the scene, and Facebook announced its intent to introduce a digital money called Libra, to which they wanted to assign a global role. The international – and some national – financial systems reached a milestone when in addition to digital moneys the first attempts at the creation of CBDCs were made (*Müller – Kerényi 2021; Pistor 2021*).

The following is an overview of the situation and roles of CBDCs today, without discussing FinTech companies' digital currencies or BigTech companies' electronic payment instruments.

¹ The idea of retail accounts kept by central banks is not a new idea; the concept of cash in deposit appeared in professional circles as early as in the late 1980s.

² Transformation of the financial system was accelerated by the dynamically growing proportion of electronic payments and the decrease in the use of cash.

³ An amazonised financial marketplace is a customer-oriented interface on which retail and corporate customers can seek and find the products and services they need, with the most favourable terms and conditions. Such a digital financial marketplace may come to be a dominant element affecting the development of CBDCs (*PWC-LfF 2019*).

Central banks have been providing societies and economies with reliable, value-storing money, for hundreds of years. A reliable money is a public good. It provides a common unit of account and functions as a means of exchange for the sale of goods and services and for the settlement of financial transactions. The provision of public cash is an important instrument in the hands of central banks.

Initially, cash was an essentially precious metal-based commodity money in commodity-producing societies, which was gradually replaced by paper money.⁴ Even the latter however were backed by elements determining their value, such as, for instance, gold, and the safe existence of value was guaranteed by states. Paper moneys have so far appeared exclusively in the form of banknotes. Over time, central banks and commercial banks gradually introduced so-called credit moneys besides commodity money. For hundreds of years these were used as means of payment and savings; their value was guaranteed by central banks, whether in the form of cash or bank account money. The wide variety of monetary policy instruments used by central banks included, for instance, the quantity of money, its velocity and open market operations.

In retrospect: a generally accepted, stable and efficiently functioning system evolved over decades in international financial and trade relationships. Gold played a key role in the reserves of central banks before World War II, while the British pound was the key currency of international trade. After the war, the US dollar took over the role of the No. 1 global currency under the Bretton Woods Agreement, but the British pound also remained a dominant currency. They were “joined” by the Japanese yen somewhat later, and by the euro a few years ago. The emergence of the yen and then the euro were still not regarded as a serious warning sign of the possibility of any profound change taking place in the global financial system. In 2016, the first warning signal was the appearance of the Chinese renminbi (also known as the yuan, or CNY) in the International Monetary Fund’s SDR (Special Drawing Rights) currency basket, taking the third place after the dollar and the euro in terms of weighted averages, overtaking the Japanese yen and the British pound.

This historical background confirms that the instrument for financing the international financial system and trade relationships needs to be found, and the digital currencies of central banks have to be created, made accepted and secure, during the new digital age. The introduction of CBDCs poses a new challenge to the national and international monetary systems and the roles and competitive positions of central bank moneys remain to be seen for now.

⁴ Paper moneys were, however, already credit moneys to a large extent (with some exceptions: banknotes issued on the basis of gold deposits) because they were issued by banks by discounting trade bills, or by central banks by discounting bankers’ bills.

3. What is a CBDC?

Let us take a closer look at what a central bank digital currency actually is. There is no fully, generally, widely accepted definition for what CBDC is, for the time being. A central bank digital currency is an official currency issued by a central bank in electronic form, *“universally available and is, like cash, suitable for peer-to-peer transactions without central intermediary”* (Bech – Garratt 2017:56).

In a recent study, senior experts at the Central Bank of Hungary (Magyar Nemzeti Bank, MNB) also applied the definition of the Bank for International Settlements (BIS) (2020): *“a central bank digital currency is a digital form of central bank money that is different from balances in traditional reserve or settlement accounts. It is a digital payment instrument denominated in the domestic currency and a direct liability of the central bank”* (Fáykiss – Szombati 2021:104).

According to a discussion paper released by the Bank of England, being systemic is an important feature of a digital money. The definition of what systemic is, however, still needs to be clarified in regard to such digital moneys (BoE 2021).

The introduction of CBDC will have a profound impact on users, central banks, financial institutions and the international monetary system. This will largely depend on the conditions developing in connection with the introduction and the model of the central money. The very name “central bank digital currency” contains the concept of money, i.e. it must fulfil the functions conventionally fulfilled by money, so it must have attributes relating to settlement, payment and value storing. Since central bank digital currencies have so far been issued under national jurisdictions, their status of legal tender is ensured by the laws of the countries concerned.

Depending on the issuing country’s legislative framework, CBDCs appear in three basic types: one is account, another is token, the third is hybrid based (Auer *et al.* 2021). In parallel with the introduction of a CBDC, the central bank concerned, and the incumbent banks, equally should be tasked with preparing the users, primarily the local population and with developing their digital awareness.

In China, where the money called eCNY (the abbreviation of the electronic Chinese yuan, hereinafter referred to as “digital yuan”), was intended to be used even before the 2022 Winter Olympics, the government and the central bank set about assessing the conditions for introduction and use early on. The People’s Bank of China (PBOC) distributes the yuans it has issued among the six largest commercial banks operating under its control, which in turn make the money available for smaller banks, people and companies. According to the PBOC’s analysis the commercial banks already have the infrastructure required for the spread of the digital yuan and thus the central bank does not need to develop a new system.

4. Factors motivating and calling for the urgent introduction of CBDC – Advantages of a central bank digital currency

As a result of the rapid spread of digital financial innovations, the use of physical cash is quickly decreasing, confirming at the same time the transformation of payment and banking habits. Speed, i.e. effecting transactions immediately and without presence in person, has come to be generally required. This was promoted by the Covid-19 pandemic by the suggestion that physical cash could function as a carrier of the virus and that contacts in banks' customer areas should be avoided. However, the impact of the pandemic could be clearly felt in several areas (e.g. number of cash payment transactions, cash withdrawal turnover of credit institutions in the branches and through ATMs, cash-in-transit company data) (Deák *et al.* 2020). It should be noted at the same time that transactions actually diminished, but the pandemic triggered a significant increase in liquid forms of savings, including savings in cash, and not only in Hungary (Végső – Bódi-Schubert 2020). The appearance of central bank digital currency is at least as profound a change as was the introduction of paper money, that is, banknotes, as well as metal coins.

Competition intensified through the increasing market penetration of digital financial services, triggering urgent steps at two levels. First of all, a growing demand for improving efficiency and speed, and for reductions of costs and thus service fees, appeared in the national money and banking markets, and the need for meeting these requirements became a motor for innovation. FinTech and BigTech companies using digital financial innovations appeared in and conquered the market so quickly and dramatically that in most cases it jeopardised financial stability and the effectiveness of monetary policies in the absence of adequate national and international regulations, creating situations that needed to be responded to.

The nominal value of a central bank digital currency is guaranteed, and reliability is one of the key benefits of its introduction. On the other hand, digital private moneys are exposed to operating, credit, liquidity and market risks and their reliability and convertibility must be ensured by external institutions and regulators.

Another major benefit of the introduction of CBDC is that it can be an efficient instrument for whitening the grey economy and fighting money laundering. This, however, greatly depends on whether the model of its introduction does or does not guarantee the anonymity of use.

Another important element of its introduction is a defence function of two key components: on the one hand, protection from the risks posed to the financial market and the monetary policy by BigTech companies and cryptocurrencies, and the protection of sovereignty at a national level, or – in the case of the European Union – even at the EU level. Another advantage for central banks during the

introduction of CBDC is that they can closely monitor the quantity of money in circulation, the demand for it and its circulation velocity.

These factors are supplemented by considerations of sustainability and environmental protection, as both printing paper money or minting coins require the use of many harmful materials and their storage, shipping and protection are expensive. This, however, does not mean that the introduction and operation of a CBDC has no costs; indeed, surveys conducted by the European Central Bank (ECB) and other central banks have found that a central bank digital currency and physical cash need to coexist in the financial market side by side for a long time.

The overwhelming majority of central banks are scrutinising the possibilities and ways, as well as timing of introducing CBDCs. The various participants have different motivations and factors encouraging or urging this. For example, one of the People's Bank of China's objective is to boost competition and eliminate certain systemic risks stemming from much of the payment transactions being controlled by Alipay and WeChat Pay. By taking such a step they will, at the same time, enhance the stability of the financial system.

Some central banks have found themselves in a situation where they are forced to take action, as the efficiency and effectiveness of their monetary policies are threatened by crypto instruments such as Bitcoin, the above-mentioned Libra – launched by Facebook – or currencies and private digital moneys of other BigTech companies. At the same time, central banks are risk-free guards of value, and as such have a comparative advantage over the above issuers of other digital or crypto instruments, in which regard they are thus in a monopolistic position.

“Availability” is another motivating factor since with the introduction of CBDC a variety of innovative financial services make quick and efficient payments and banking transactions possible in certain countries or in some under-banked parts of the world. Accessibility and availability boost innovation in the banking system in that the technology and functionality of the experimental nature of CBDC enables the use of smart contracts and can help reduce the amount of cash in circulation.

Thus, according to analyses and trial applications to date, the introduction of CBDC can offer a variety of benefits, some of the most important ones of which primarily include an increase in the efficiency and effectiveness of monetary policy, the strengthening of financial innovations, and at the same time, a reduction of volatility in the banking system through competition, a reduction of the use, and thus the quantity, of cash, resulting in improved cost effectiveness and environmental protection, more effective protection of personal data and, consequently, banking secrets, and enhancing the security of bank deposits and savings, since they are kept in the central bank's

own money. Finally, it may also help improve the efficiency and effectiveness of international financial relations and the financing of international trade.

A more long-term objective of the introduction of CBDC is to create an ecosystem in the economy and in the financial market, which might enable – without prejudice to monetary policy, and in observance of the principles of the functioning of a two-tier banking system – efficient cooperation between the international financial system and those financing international trade. In such an imaginary framework of cooperation, the operation of today's corresponding banking systems would become easier; for instance, exchange rates and fees would become more transparent and manageable.

The establishment and operation of a wide-ranging retail DJBP system requires cooperation between institutions and continuous service. Among the institutions, the central bank, operator(s), payment service providers and banks play a prominent role in terms of functionality (*Fáykiss – Szombati 2021*).

Competition in international markets – i.e. how dominant the future roles and functioning of the digital dollar, the digital yuan and the digital euro will be in the future – is just as important as the positive principle of future cooperation. It is worth referring back to the fact that financial planners and regulators started to deal with the idea of CBDC during a real competitive situation (where the question was who overtakes whom in the first position), during a period of trade wars, when global economic growth was slowing down, right before the outbreak of the coronavirus pandemic. One aspect of the future vision is the question of which CBDC gains more ground and influence in the international financial market; in other words, power and security considerations of the future international financial system are also clearly taking shape.

5. Potential risks of the introduction of CBDC

The introduction of CBDC may pose risks to the stability of the monetary system at both the international and national level. The planning and preparation of its introduction should be such that its operation is regulated and that governments and the competent authorities control the monetary policy, exchange rate and financial stability, as well as the development of capital flows. Efforts should be made to ensure that the introduction of CBDC strengthens international cooperation and integration and does not lead to a digital divide. The introduction of a central bank money may impact the economic and financial stability of the country concerned. It should be ensured that the central bank money is reliable and equally available for all users.

The first potential risk from the aspect of the banking system is participants turning away from financial intermediaries and disruption of the normal chain of the financial intermediary system (disintermediation) when customers transfer their bank deposits to CBDC accounts.⁵ In this scenario banks have no choice but to pay higher interest rates if they are to keep deposits or to raise more expensive funds and thereby reduce their profits, which will eventually increase the costs of lending or force them to reduce collaterals.

Such a situation might occur if the central bank digital currency is much more reliable for users as a payment instrument, a value store or a guarantee of convertibility than private digital moneys or any other electronic money. This is why particular attention is to be paid to the banking sector, lest banks suddenly lose a large number of customers to the attraction of a very successful CBDC, lest they convert bank deposits *en masse* into CBDCs and lest the process of bank lending be jeopardised. This risk might be mitigated by the currently operating system of bank deposit insurance.

Some of the incumbent banks may oppose the introduction of CBDC because it might increase their financing costs, reduce capital investments financed by banks and this new form of value storage, provided by the CBDC, and available for all, might make large numbers of customers quit their banks, i.e. trigger a bank panic. These are potential risks; the impacts on banks and financial stability largely depend on the conditions of the application of the given CBDC and the relevant monetary policy (*Andolfatto 2021*). In the case of a bank run, however, CBDC makes it possible for a central bank to quickly take more targeted action to prevent or mitigate the risks that occur.

Another potential risk in the introduction of CBDC is that in the case of economic or financial shocks it might significantly amplify their spillover effects and thus their international combinations. Such impacts – or their likelihood – largely depend on the nature and conditions of the operation of the CBDCs to be introduced (*BIS 2020*).

6. CBDCs in the international financial environment

As noted above, plans for the introduction of central bank digital currencies quickly emerged as a consequence of the rapid penetration of digital financial innovations. This was followed by increasingly intensive analyses of the conditions and requisites of their application and preparations of schedules. The next step was the test introduction of CBDCs, primarily in national jurisdictions. After the first

⁵ It should also be noted that analyses preparing the introduction of CBDCs do not envisage CBDCs without any limitation whatsoever; they are based on assumptions of instruments with quantity limits to mitigate this risk.

successful trials, the so-called Digital Sand dollar was introduced on the Bahamas.⁶ The central banks of an increasing number of countries started thereafter to assess the conditions for, and the urgency of, the introduction of CBDCs.

Because of the continuous progress, we review the developments without intending to provide an exhaustive overview of the international landscape. All of the central banks that have currencies of global relevance are prioritising the possibilities of introducing and using central bank digital currencies. The first concrete steps in this field were taken by the People's Bank of China, but the European Central Bank and the competent financial authorities of the USA are also assessing the conditions and requisites for the introduction of the digital euro and the digital dollar.

As the situation is changing continuously, we only make note of some of the central banks that have, according to literature, achieved results in this field. The Bank of Japan (BoJ) started the introduction of the digital yen in 2020 (*BoJ 2022*). The electronic money intended to be introduced by the Bank of Indonesia is in an advanced research phase. The Bank of Canada is scrutinising the possibility of the introduction of the CBDC in the context of its programme entitled "Model X Challenge". The central bank of Sweden (Sveriges Riksbank) is in the vanguard with its pilot programme of introducing its central bank digital currency (*Sveriges Riksbank 2018*). Similar endeavours have been reported by the Russian central bank (Bank of Russia).

In a survey conducted by BIS in late 2020, some 86 per cent of central banks were already analysing the benefits and drawbacks of the introduction of CBDC and its effects on the monetary policy and financial stability. 60 per cent of them were conducting trial projects and 14 per cent had started preparations for pilot phases of the introduction of their CBDCs (*Boar – Wehrli 2021*).

Given the continuous evolution process it would be difficult to provide a clear picture of the real international penetration of CBDCs, but this brief overview is suitable for drawing some conclusions. Besides the fact that the introduction of CBDC in the financial system is inevitable, for the time being central bank digital currencies are introduced, for the most part, in national contexts and systems and under national conditions, with the exception of the European Union, particularly the euro area.⁷

In national jurisdictions, in the countries where CBDCs have been introduced, the experiences of its use are mostly positive. At the same time, as already mentioned, going beyond national boundaries is not merely a possibility inherent in the nature

⁶ In 2021, Nigeria also launched its own digital currency, called e-Naira.

⁷ Mention should also be made of the East-Caribbean monetary union which has – besides People's Bank of China – come the closest to the introduction of a central bank digital currency. They have been testing the conditions and requisites for introduction since early 2021.

of CBDCs, but in many cases it is a conscious effort towards the acquisition of markets and enhancing power.

The introduction of CBDCs in the international financial market may have a profound impact on the stability of the monetary system. Therefore, the conditions of its use and regulation should be so designed when it is launched that the various countries have the instruments required for controlling in order to preserve their monetary policies and exchange rate stability. It should be accomplished at the same time that CBDCs strengthen the integration of payment systems and do not result in fragmentation into regional blocs.

International organisations are closely monitoring the cross-border impacts of CBDCs and are making efforts to outline the framework for prospective international cooperation. The finance ministers and central bank governors of the G7 countries issued a joint declaration in 2021 on compliance with the requirements expected to be met by central banks' digital currencies (*G7 2021*). They pointed out, *inter alia*, that every CBDC must operate in accordance with the conditions of the existing public commitment and meet the requirements of transparency, the relevant legislation in place and effective economic governance. A CBDC must not only not impede but should actually support central banks in their monetary policies and in their efforts aimed at fulfilling their obligations to preserve financial stability. The introduction of a CBDC must be accompanied by simultaneous application of strict norms of data protection, ensuring the protection of customer data, guaranteeing the security of information and the transparency of its use. The conditions for the use of a CBDC should generate user confidence. A CBDC should be resistant to cyber fraud and attacks (*G7 2021*).

A position statement issued by the IMF Executive Committee, summing up the mandate the International Monetary Fund does and should have in this process, is of particular relevance to the expected development of the international environment and the future cross-border use of CBDCs. The strategic goal of its operation is to ensure and strengthen international financial and economic stability. The appearance and spread of digital forms of money is and will pose new tasks and challenges for the Monetary Fund, since they have an impact on the international monetary system and their spill-over effects and cross-border penetration affect the stability of national and international economies.

Since the IMF has a well-nigh universal membership, it has unique relations with the member states, it is mandated to closely cooperate with other organisations in the shaping of macro-level financial policies and in matters relating to the international monetary and financial system. This is why it can provide guidance concerning the international use of CBDCs, the elaboration of policies, while it should facilitate processes by providing consultancy.

The International Monetary Fund may function as a bridge; it may intermediate between its member states' experiences and the shaping of international financial policy. The Executive Committee's position statement points out that the new digital forms of money must not jeopardise the integrity of the international financial system. Public and private partnership (PPP), the smooth transition of banks' roles and equal and fair competition (or *level playing field*) must be ensured during the planning process. The Monetary Fund regards the prioritisation of the tasks, and the provision of adequate funds to assist its members as its mission in order to mitigate the risks stemming from the penetration of digital money and its spill-over effects (*IMF 2021*).

The international monetary system (IMS) needs to remain stable and effective; the digital money must be so designed and regulated that the various countries can retain control over their own monetary policies, financial conditions and exchange rate policies. Payment systems also have to become more and more closely integrated even after the introduction of digital moneys; the digital divide must be avoided.

The Bank for International Settlements (BIS) set itself a goal of helping research activities of central banks scrutinising the conditions and requisites of the introduction of CBDCs and of facilitating the sharing and exchanging of the results and findings of trials and pilot projects. To this end, they created a centre for assisting the promotion of innovative research, called CBDC Innovation HUB (*Carstens 2021*), one of whose projects is Dunbar. In December 2021 the French and the Swiss central banks – in close cooperation with the BIS Innovation Hub – implemented a remarkable “test operation” of a CBDC's international application. The experiment is named “Project Jura”, and was joined by Accenture, Credit Suisse, Natixis, SIX Digital Exchange and UBS (Union Bank of Switzerland). The hitherto unparalleled experiment was a test of public and private cooperation where wholesale digital securities, tokenised under the French law, were issued against EUR wCBDC. At the same time, digital EUR- and CHF-based transactions were also effected between banks having their registered offices in France, and ones having theirs in Switzerland (*Project Jura 2021*).

These brief episodes in the international arena clearly illustrate that CBDC will not, and cannot by its very nature, in the long run, remain confined within national boundaries; therefore the possible conditions of its performance in the international arena are being intensively researched, and the regulation of its operation is the subject of focused analyses. The likely benefits of international application are not disputed by analysts. Central banks and international financial organisations are working on elaborating guidelines for regulation, transparency and risk mitigation. This is the context in which high level international principles are being worked out to help achieving consensus on matters of regulation, finance and economy,

because the development of mutually acceptable technical and regulatory standards is indispensable for the smooth international and cross-border operation of CBDCs. There is, however, a considerable distance to be covered before this goal can be reached. The distance to be covered also depends on the number of CBDCs that will be operating alongside one another, or competing with each other in the international arena and on their respective shares and weights in international financial transactions or in international trade financing. And the latter might trigger a strategic interaction that might provide one or another participant with benefits, cutting their costs.

The likely weight of the appearance of CBDCs in the international arena might be forecasted by the ratios of the currencies of international trade and financing in the SDR currency basket of the International Monetary Fund. Recent data show that the Chinese yuan, which joined the SDR basket in 2016, has taken the third position after the US dollar and the euro, surpassing the British pound and the Japanese yen.

As already noted, a considerable number of central banks are examining the possibilities of, and planning, the introduction of CBDCs, but in the international arena it is competition, or possibly cooperation, among the United States, the euro area and China, that is, the digital dollar, the digital euro and the digital yuan is what we need to be prepared for. Fabio Panetta, a member of the ECB's Executive Committee, quoted a Latin saying when he said that in this fight "*one has to be a lion*" (Panetta 2021a).

At least as important as the positive principle of prospective cooperation is the aspect of competition, i.e. the question of which CBDC gains more ground and influence in the international financial market. In other words, the power and security considerations of the future international financial system are also clearly taking shape. Competition in international markets – i.e. how dominant the future roles and functioning of the digital dollar, the digital yuan and the digital euro will be in the future – is just as important as the positive principle of future cooperation. The initial conditions characterising this competition are well illustrated by *Figure 1* which first appeared in an ECB analysis.⁸

⁸ International trade and financial exposures were measured based on 2019 data. Trade exposure is established in view of the extent to which the combination of export and import, the processes of supply and use, affect international and global processes in international value chains. Financial exposure is established in view of the total portfolio of investments, and liabilities, that are related to the USA, the euro area or China (the financial exposure to China includes in this case exposures to Hong Kong as well). All data were calculated in dollars. The supply and use data in the tables reflect the entire economy in a breakdown by industry and product. They link the various institutional sectors of the economy with the details of the imports and exports of goods and services, public spending as well as those of households and non-profit institutions that serve households and capital accumulation.

Figure 1
International trade and financial exposures of the countries of the world to the United States, the euro area and China (2019)

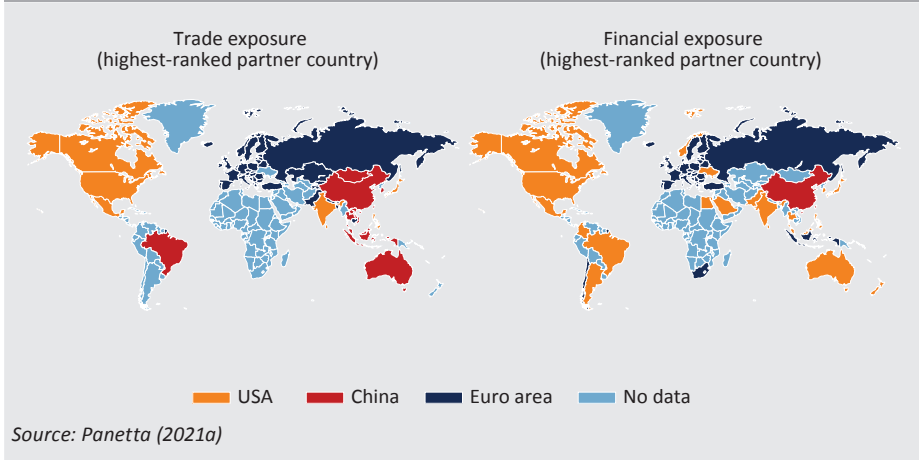


Figure 1 illustrates the expected materialisation of competition among the above digital currencies, their potential integrative capability and their risks as digital money surrogates, by showing the trade and financial exposure to, and dependence on, relations with the euro area, the USA and China, based on 2019 data. In terms of trade exposure, the euro area and the USA have nearly equal shares, while China is in the third position behind them. It should be noted, however, that China is the dominant player not only in the Far East, but also in Africa and Australia. In terms of financial exposure, on the other hand, the USA is first, the euro area is second and China is again in the third position. The coming years are likely to be a period of intense competition, the outcome of which is difficult to predict.

A CBDC can – by its very nature – be used not only in the country or jurisdiction, in which it was issued. And if this is true, it might increase the risk of digital currency substitution. For instance, if the digital dollar is widely used in another country, a phenomenon referred to as “digital dollarisation” occurs, entailing the risk of the domestic currency losing its conventional roles, such as storing value, being used as a unit of account or an instrument of conversion. This, in turn, will impede the effective functioning of the domestic monetary policy and weaken financial stability. This problem might intensify in the case of international reserve currencies, because international trade and financing are interlinked and mutually complement one another.

7. The Chinese central bank digital currency

Planning for the early introduction and trial use of a central bank digital currency has been prioritised in China. The key factors driving this process were, on the one hand, that China is a country pioneering the use of digital financial innovations, and on the other hand, that during the past decades China has become a major participant in the global economy and global trade. Against this background, China has been sparing no effort to make its currency, the renminbi, a dominant factor in the international financial market and international trade financing. China's international economic relations have definitely grown stronger in Asia, among the Arab countries and in Africa as well. A major role in strengthening China's international economic and trade influence was played by its "One Belt, One Road" economic policy initiative, in the framework of which they have created strong bonds with a number of countries through infrastructure development and long-term lending. It became clear in this situation that it would be more beneficial for China if these relations were not financed in US dollars; emphasis was laid on the international use of the renminbi as a vehicle for a breakthrough with the digital yuan.

The spread of mobile payments has even started to replace the use of cash in some places in China. It is now indisputable that China plays a ground-breaking, leading role in the world in the development of a national digital currency, on which they started working in 2014. The official name of the Chinese CBDC is the Digital Currency of Electronic Payments, and it is issued by the People's Bank of China.⁹

China kicked off the introduction of the digital yuan with a testing process, for which they used a number of different scenarios. The Chinese central bank reached a milestone in the development of the e-RMB in the spring of 2020 – in spite of the coronavirus crisis – when the testing of the central bank digital currency was launched in four major cities (Shenzhen, Suzhou, Chengdu, Xiong'an) in actual payment transactions: use of the digital money is being tested for the second year now in these four cities (*Boros – Horváth 2021*).

Against this background, in April 2021 the PBOC announced the experimental introduction of the digital currency, after the above cities, in four provinces as well. "In the future, digital money issued by the central bank is likely to compete and compliment the private sector's electronic payment platforms. The digital currency trials are now being conducted in a "closed environment" and are not connected to the existing sovereign currency issuance and circulation system," according to a senior official from the PBOC (*China Daily 2020*). At the same time, the Chinese

⁹ It should be noted that the PBOC's key motive in the introduction of the Chinese CBDC is to boost competition in the market of digital payments and reduce the system-level risks posed by Alipay, WeChat Pay and Tencent.

central bank announced that a new trial of the regulation would be launched in the provinces concerned (*Xinhua 2020*). In doing so, China was among the first countries where in parallel with the introduction of a digital money, its regulation was also started.

At the time of the introduction of the so-called e-yuan, the most profound question was how this digital money would work. The ways of distribution and use were scrutinised primarily. The digital yuan is used in a so-called two-tier system, where the PBOC distributes the digital yuan to commercial banks, which, in turn, will be tasked with passing the digital currency on to consumers. This might include services enabling consumers to convert their coins and cash into digital yuan. Chinese commercial banks already have the necessary efficient infrastructure for delivering the digital yuan into the hands of consumers.

The digital yuan functions in the economy as cash, i.e. as the instrument of final settlement. The issuers and operators charge users no fee for conversion or use for payment, nor do they pay interest on the balances. One particular feature of the digital yuan is that, unlike other cryptocurrencies, it is not issued in a blockchain environment; instead, it retains its “controllable anonymity”, enabling the People’s Bank of China to control and monitor financial transactions, including the personal identity of those executing transactions. This attribute of the digital yuan provides the central bank with a number of possibilities. On the one hand, it is effective in the fight against money laundering and terrorist financing, and on the other hand, unlike other crypto moneys, it does not permit speculation against the digital yuan. Moreover, it will be impossible to counterfeit, as only the PBOC will be able to issue it. The PBOC will strictly control to make sure that there can be no difference between the value of the digital yuan and the banknotes and coins and that price movements do not trigger volatility. The PBOC also announced that during the introduction phase it would limit the amount of digital yuan private individuals are permitted to have, so they can monitor velocity and strengthen user security (*Areddy 2021; O’Grady – Waters 2021*).

China was encouraged by the rapid development of its international trade relations to enhance the international role of the renminbi as well, which might provide a strong support to the digital yuan’s global role, in spite of the fact that at present it is intended primarily for domestic use. Trials on its use in cross-border transactions have been started. One suitable venue for this is provided by the cooperation launched between the PBOC and the Hong Kong Monetary Authority for the technical testing of the cross-border use of the digital yuan. Similar forms of cooperation are underway with the central banks of Thailand and the United Arab Emirates. In February 2021, China joined the Multiple CBDC (mCBDC) project coordinated by the BIS and conducted by the above-listed central banks.

8. The digital dollar

In light of the digital financial innovation process of the fourth industrial revolution, there can be no doubt about the inevitability of the introduction – or rather preparation for the introduction – of the digital dollar. Its implementation will profoundly impact not only the financial system and monetary policy of the United States of America, but also global financial processes.

One of the requirements at the end of World War II was to stabilise the financial systems. This was the aim of the conclusion of the Bretton Woods Agreement in 1944. The values of the global currencies were fixed on the basis of the US dollar, the value of which was tied to gold, at a fixed exchange rate. The position of the dollar is bolstered, as well as by the United States' global economic, trade and financial power, also by the fact that the SWIFT (Society for Worldwide Interbank Financial Telecommunications) is the world's largest cross-border clearing house which settles transactions in US dollar, with at least one "leg" of each transaction being an American financial institution.

The dollar retained its role as a reserve currency for decades and developed into a global currency. One of the big questions in the years to come is whether the digital dollar will be able to preserve and strengthen this position, as the system of international payments and transactions are being forced to go digital. Preparation and planning of the digital dollar's introduction is greatly facilitated by the existence in the United States of a forerunner of the CBDC in the form of the Federal Reserve Bank's accounts. Those accounts are completely secure and pay interest. Payments through those accounts take place through the real time gross clearing system, called Fedwire operated by the Federal Reserve (*Andalfatto 2021*).

The US dollar is still considered by many as an actual global currency. As regards international financial payments and transactions this is undoubtably true. On the other hand, the introduction of central bank digital currencies, including the digital euro and the digital yuan, is expected to generate some strong competition, particularly in international trade financing. Trade wars, the US's sanctioning of major trade participants, or for instance the prevention of the execution with the EU of the Transatlantic Trade and Investment Partnership Agreement, restricts the use of the dollar in the financing of trade in the areas concerned. The introduction of the digital euro will also lead to its growing use not only in the euro area but also other member states, as well as third countries maintaining close trade relations with them. The digital yuan will also very likely play a significant role in areas that are under growing Chinese economic and trade influence, for example in the Far East, Australia and Africa.

Nonetheless, if and when the digital dollar appears in the international financial system, it will have some positive impacts: it may strengthen international cooperation, stability and predictability, as well as the security of financial funds (Greenwald – Margolis 2021). The digital dollar may, however, also entail risks and negative impacts. Owing to its major role in the international financial system for example in the case of financial shocks it might aggravate the situation, accelerate the process and generate spillover effects. This, however, will largely depend on the legal background and regulatory framework of the digital dollar.

The dollar's role as global key currency has already been a source of problems such as the USA's ability to refuse transactions requested by foreign banks when it presumed that legal regulations had been violated, illegally acquired funds were to be moved or national security risks were involved. Some years ago even Swiss banks were forced to do away with part of their traditional bank secret system, but similar situations occurred in connection with the USA's opposition to Iran's and North Korea's nuclear programmes. The US Treasury – i.e. the finance ministry of the United States of America – created a database called Specially Designated Nationals and Blocked Persons List which it can, at its discretion, apply against any country or person. With a digital dollar in place, such sanctions can be applied more widely and virtually immediately.

The Fed, functioning as the US central bank, initiated a public dialogue in early 2022 concerning the possible introduction of a CBDC by preparing studies and discussion papers, reviewing and discussing CBDCs in general and analysing in a transparent and detailed way the possible benefits and risks of the introduction of an American model (Fed 2022a; Fed 2022b). The penetration of the digital dollar in the international financial system might trigger a dual effect: on the one hand, it might strengthen international cooperation and improve the efficiency of international financial processes, and on the other hand, it might force certain nation states affected by its use, to give up the sovereignty of their monetary policy.¹⁰

9. The digital euro

The rapid progress of international digital financial innovation developments forced the European Union to face the challenge of the inevitable and complex task of the introduction of a digital euro. The complexity of the task stems from the need to strengthen the euro itself, together with the euro area, while maintaining the Union's digital competitiveness. The Union must not become dependent on American and Asian digital financial infrastructures. After its introduction, however,

¹⁰ "In exchange for the advantages of dollarisation, nation states must relinquish their monetary policy sovereignty" (Horváth – Horváth 2021:24).

the digital euro must be made available in all EU Member States under the same terms and conditions; therefore all member countries need to be consulted regarding each and every phase of the preparations. These considerations require the participation of the member countries in the preparation of the introduction, planning and design of the digital euro. Time is an important factor because the Union cannot afford to fall behind in the digital race. Accordingly, the preparation process is also a race against time.

The definition of the concept and content of the digital euro is still in the making. The digital euro will be a central bank money offered in a digital form, for use by private individuals and businesses for payments in small amounts, supplementing the existing cash supply. The digital euro might contribute to a rapid transformation of the market of small amount payments, provided the Eurosystem has the means for its prospective issuance (ECB 2020). The ECB defines the digital euro as a risk-free form of central bank money, a digital currency that can only be issued by a central bank and that constitutes a receivable from that central bank. Similarly to the euro currently in circulation, its stability and purchasing power is guaranteed by the ECB through its monetary policy (Maan 2021).

The following is a brief overview of the main steps taken so far in preparation for the introduction of a digital euro. In April 2020, the *European Commission (2020)* launched two comprehensive consultations entitled Digital Finance Strategy and Retail Payments strategy. During the preparations, the Union's decision-making bodies take into account a wide variety of perspectives, including the importance of the time factor.

A document released by the Council in June 2020 started the conscious process of the EU's digital transformation, including the introduction of a digital euro. This was followed by steps by the EU's competent institutions, whose objective is to introduce the digital euro in 2025 at the latest and to start within this time frame an extensive, 24-month consultation. In the guideline summing up the basic principles and cornerstones of the preparation process, the Council underlines that *"the Member States and the EU institutions should continue to intensify efforts to foster the digitalisation of the Single Market in which the digital economy is characterised by a high degree of trust, security, safety and choice for consumers, as well as strong competitiveness based on a framework which promotes transparency, competition and innovation, and which is technology neutral."* It also stresses *"the importance, in the post-crisis environment, of protecting and reinforcing digital sovereignty in the EU and leadership in strategic international digital value chains as key elements to ensure strategic autonomy, global competitiveness and sustainable development"* (European Council 2020).

Ferreira et al. (2021) and *Reynolds (2020)* also point out the strong emphasis that the first comprehensive report published by the European Central Bank places on the time factor. The latest comprehensive report on the possible introduction of a digital euro, which came out in October 2020, is fully in line with the Council's guidelines quoted above. The report underlines that the digital euro must be designed and elaborated, and the legal grounds for issuance must be established in a manner that it has no negative and unwanted impacts on the Eurosystem. For this very reason, the Eurosystem should analyse the legal framework and consequences of introduction, along with the applicability of the EU regulations to the Eurosystem as an issuer (*ECB 2020*).

Events relating to the introduction of a digital euro accelerated in 2021, due to the above time factor and temporary easing of the Covid pandemic. In the spring of 2021, the ECB published the results of the public consultation that had been conducted on the digital euro (*ECB 2021*). The feedback shows that respondents support the introduction of a digital euro, but they consider the protection of privacy and financial stability as very important preconditions. The protection of privacy does not necessarily mean anonymity. The suggestions call for the digital euro and regular cash to function alongside each other and that their relationship with the traditional banking systems should be smooth and undisturbed. The digital euro would supplement cash without replacing it, and the Eurosystem would continue to issue cash. For the sake of security – including that of the banking system – some suggested that the amount of the digital euro that can be stored by private individuals should be limited, but no agreement on such a limit amount has been reached so far in the wake of the consultation.

The suggestions aiming at tackling this problem included limiting the convertibility of the CBDC in situations threatening financial stability, to prevent sudden withdrawal of bank deposits. Setting limits per user might be possible in order to protect the financial intermediary system and prevent bank runs. Stability can be similarly protected by setting up limits for users above which all payments or transfers are credited to the account of a financial intermediary or bank. Such an account is referred to as a “waterfall” account (*Bindseil et al. 2021*).

The next important step was an analysis by the ECB's expert working group, in which experts from the 19 national central banks of the euro area worked out scenarios outlining conditions and prerequisites for the introduction of a digital euro. This operation, launched in October 2021, is called “Digital Euro Project”; a time frame of 24 months is available for analysing the conditions, with the aim of providing EU citizens and businesses with the safest and most secure form of money, central bank digital currency, in the digital age. One important element of the project is to highlight the changes that may need to be adopted in the Union's legislative

framework and that need to be continuously coordinated among European co-legislators.

Other tasks in the analysis phase include an assessment of the digital euro's potential impacts on the financial market and the identification of the planning conditions that ensure the protection of privacy and help avoid risks that might threaten the citizens of the euro area, the financial intermediary system and the economy as a whole (*Panetta 2021b*). Planning of the digital euro's operating principles is facilitated by the existence of an infrastructure enabling digital access to central bank moneys in the TARGET system¹¹ (*Panetta 2021c*).

The European Banking Federation, representing the national banking associations of 31 European countries, published the standpoint and recommendations of the European banking community regarding the introduction of a digital euro. The community of European banks unanimously accepts and supports the idea, the preparation and the implementation of a digital euro.¹² The European Banking Federation has specified the guidelines that should, in the banking community's opinion, be taken into account in planning the introduction of a digital euro. These include the protection of financial stability and the financial and monetary system, the promotion of financial innovations, uniform regulation and supervisory conditions, and cost effectiveness, as well as safe and secure infrastructure.

Analyses so far confirm that the introduction of a digital euro will profoundly transform the entire European payment environment. European payment service providers must offer competitive payment methods for users; this is the only way to preserve Europe's financial sovereignty. This will require the creation of a single payment market, including electronic payments.

10. Assessment of the central bank digital currency in Hungary

A variety of different currencies in different versions have been in circulation in Hungary during the country's tumultuous history (e.g. the korona and the pengő, in the past; the currently used forint was first issued in 1946, became partly convertible in 1996 and has been fully convertible since 2001). The appearance and development of digital financial innovations has also made it imperative for the MNB and the Hungarian banking system to monitor the possible consequences of this process.

¹¹ The services of the TARGET (Trans-European Automated Real-time Gross settlement Express Transfer) system are developed and managed by the Eurosystem. It guarantees free movement of cash, securities and collaterals across the whole of the European Union. Such transactions are accounted in central bank money finally and irrevocably (*Panetta 2021c*).

¹² "A central bank digital euro should first and foremost be a viable and optimal solution to a clearly defined unserved need in the market, for which no other more efficient solution exists. In addition, it should benefit private individuals and corporates and the economy as a whole, while avoiding destabilising the financial system." (EBF 2021:1)

Consequently, the introduction of a Hungarian central bank digital currency has been put on the agenda. The MNB assessed domestic digital developments and evaluated the level of digitalisation in the Hungarian banking sector in April 2020 (MNB 2020). The result was a ‘strong medium’. Since then, however, the digital capabilities of the banks and the FinTech companies have continued to develop and catch up with the international mainstream (MNB 2021a).

The MNB’s analyses continuously monitor international research and the results of trials on the introduction of such currencies. The conditions for the introduction central bank digital currencies and their likely impacts on payments were published by the Hungarian central bank in a comprehensive volume of studies¹³ (MNB 2021c) and a payment systems report (MNB 2021b), which analysed the impacts of the introduction of a CBDC on payments turnover. *“Based on the characteristics of electronic payments in Hungary, making CBDC widely available may theoretically contribute to the development of electronic payments in various respects. At the same time, it also needs to be considered that the development objectives may be achieved by other means as well, and therefore, this issue requires further analysis”* (MNB 2021b: p. 65).

Accordingly, the assessment of a possible introduction of a CBDC might also be of relevance for the promotion of international competitiveness and convergence, as well as the fine-tuning of the regulation of digital financial innovations.

11. Summary and conclusions

As a result of the digital revolution, digital financial innovations have penetrated the banking system, generating profound, fast-moving impacts. Digital financial innovations have transformed the payment system; various forms of electronic payments have spread continuously, driving the transformation conventional banks’ business models. Giant digital technology companies have evolved, crypto currencies, stablecoins, digital private currencies and for example Bitcoin found their way to the market. In order to protect economic stability and competitiveness, monetary policy has had to respond to these digital challenges. The idea of creating central bank digital currencies appeared on the agenda. This will result in a gradual, but inevitable digital transformation of conventional money. This process of transformation is already underway in the financial system. In this study, we assessed the progress made in the preparation of the implementation of CBDCs and the possible impacts in the international arena.

¹³ *“The study volume is also unique internationally, as in addition to the conceptual and design considerations of the possible forms of central bank digital currency, it also covers their monetary policy, financial stability, and cash flow effects, as well as the issues of infrastructural implementation.”* (MNB 2021d)

According to the generally accepted, permissive definition, a central bank digital currency is a digital form of central bank money, denominated in the domestic currency, embodying the central bank's direct liability. Accordingly, CBDC is a new, third type of central bank money, which may operate alongside cash and central bank account money. A new milestone has been reached in the history of money in accordance with the requirements of the digital age. The digital transformation of money has commenced, along with the preparation of monetary policy for this turn of events. According to international surveys, most of the world's central banks are examining the conditions and prerequisites for the introduction and use of CBDCs. The basic conditions of regulation are being analysed in national contexts and legal systems, and in some countries, for instance in China, trials have started on the use of the national central bank digital currency. CBDC has its likely and indisputable benefits, such as transparency, security, and strengthening the competitiveness of the economy and the effectiveness of monetary policy. Its defensive capability should also be emphasised: it affords protection for the financial system, the payments system and the banking system, against impacts of private digital moneys, stablecoins and giant tech companies which threaten stability. Another important defensive capability is that of guarding the sovereignty of the national financial and monetary system. CBDCs may, however, involve risks as well. The regulatory conditions under development and the operating trials are aimed at mitigating those risks.

In view of the development of digital financial innovations, CBDCs are expected to appear in the international arena before long, where they will play an important role in the financing of the international financial system, the capital markets and international trade. This process may take place based on a variety of scenarios. The first one certainly involves competition among global currencies, i.e. the US dollar, the euro and the Chinese yuan, where the financial and power positions that the digital variants of these currencies can secure themselves in the international markets are at stake. The CBDC variants of the global currencies may bring about highly positive results, for which, however, rules on their international use need to be formulated and introduced. From this aspect, the three key participants have certain advantages stemming from their particular geopolitical positions and financial market roles, as discussed in our analysis.

In this digital financial development process, we also provided a brief overview of the Hungarian central bank's publications and informative materials concerning the central bank digital currency. The Hungarian central bank continuously updates its analyses of the results of relevant international research and trial applications.

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