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SHAPE OF CENTRAL BANK MONEY AIMS FOR DIGITAL PROGRAMMABLE COINS: FROM METAL AND PAPER TO A FULLY CONTROLLED DIGIT (DISPLACEMENT HYPOTHESIS)

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Abstract. The form of money used by central banks around the world has been constantly changing over time. The *purpose* of the study is to identify unpopular characteristics and the future role of CBDCs in terms of their likely impact on the social order. *Conclusions*. The benefits of implementing CBDCs for the state are enormous, and they are at least: (a) total income taxation, (b) total financial monitoring (public procurement, foreign investment, political party financing, etc.), (c) a political tool in the struggle for power, (d) an effective tool for reducing crime and corruption. On the contrary, the benefits of CBDC for the population are negligible, compared to the current system of electronic money/transfers: there is a reasonable probability of a significant loss of classical constitutional rights and freedoms: (a) loss of personal privacy, (b) limited political choice, (c) financial independence, (d) fiscal oppression, (e) negative interest rates, (f) introduction of time value of money. Based on this likely trend, from the perspective of legal regulation of CBDCs, they should be treated – in addition to money – as a database of big data on who, where, when and how uses and stores money in a given country, which affects the constitutional rights of citizens.

Key words: bitcoin, cryptocurrency, virtual assets, E-money, programmable CBDC, FinTech, GovTech, CashLess.

Introduction. The form of money of the world's central banks has been constantly changing over time and absorbing the best of the existing trends of the relevant time of human development. But such changes were even more influenced by certain characteristics of such new forms of money, which were certainly useful for the state budgets of issuing countries. In today's world, the influence of the following characteristics in the latest technologies that can be used in future forms of money no less influences the decisions of issuing states on their implementation in the near future.

Since ancient times, money has been minted, usually by the respective mints of different countries of the world, from precious metals, and it was most often gold or silver. This was accompanied by a struggle between the barter and monetary systems of commodity exchange. And of course, people could only perceive the form of money as made of precious metal, because otherwise they would have preferred any necessary property that could be exchanged for the goods they had. Later, due to the lack of sufficient precious metal, mints switched to minting lower-ranked coins from cheap metal. But when the struggle of barter exchange was lost to the monetary system, everything began to change. Then, more and more often, state mints minted all denominations of coins not from gold or silver, but from copper or brass. Over time, a new form of money was added: paper money. And at the beginning of such innovations, they (paper money – author's note) were the state's obligation to back them with precious metals. But later, these obligations on the part of states were simplified. And the form of money became exclusively paper, which was backed only by a promise from the state that something could be bought with it.

Michael Peneder from the Austrian Institute for Economic Research (WIFO) gave his view on the nature of Bitcoin's emergence. When the financial crisis of 2008–09 led to a significant loss of public

confidence in the monetary system and the institutions that support it, the subsequent expansionary monetary and fiscal policies raised fears that governments would lose the value of their debts through inflation. By undermining the legitimacy of the established system, the financial crisis thus gave impetus to proponents of alternative monetary concepts. Immediately after the crisis, one of the most significant developments was the introduction of the Bitcoin protocol (Peneder, 2022).

Literature Review and Preconditions. Cryptocurrencies today have different technical platforms (Hrytsai, 2022b) and extensive classification (Hrytsai, 2022a, 2023a). Virtual currency is different from fiat currency (also called "real currency", "real money" or "national currency"), which is: the coins and paper money of a country that is its legal tender, circulated and widely used and accepted as a medium of exchange in the issuing country. Virtual currency also differs from electronic money, which is a digital representation of fiat currency and is used to electronically transfer value (expressed in fiat currency). Electronic money is a mechanism for the digital transfer of fiat currency, i.e., it is used for the electronic transfer of currency, has the status of legal tender (FATF, 2014).

At the beginning of the study, will present and compare some of the latest definitions of CBDC provided by leading institutions in the field of global finance, whose opinion is undoubtedly considered highly expert and recognized worldwide as a trendsetter in the financial world system.

Board of Governors of the Federal Reserve System of the USA (FRS): "*It is a digital form of central bank money that is widely available to the general public. "Central bank money" refers to money that is an obligation of a central bank. In the United States, there are currently two types of central bank money: physical currency issued by the Federal Reserve and digital balances held by commercial banks in the Federal Reserve System. While Americans have long held money primarily in digital form – for example, in bank accounts, payment apps, or through online transactions – CBDC will be different from existing digital money available to the general public because CBDC will be a liability of the Federal Reserve, not a commercial bank"*.("FRS – Frequently Asked Questions," 2022).

International Monetary Fund (IMF): "*A digital form of existing fiat money that is issued by a central bank and serves as legal tender*" (IMFBlog, 2021; "International Monetary Fund," 2023).

European Central Bank (ECB): "*A digital form of fiat money that is publicly available, issued by the state and has the status of legal tender*"(Burlon, Montes-Galdón, Muñoz, & Smets, 2022; "European Central Bank," 2023).

Bank for International Settlements (BIS): "*An electronic form of a national currency issued by a central bank that is obliged to back it*"("Bank for International Settlements," 2023; "Central Bank Digital Currencies", 2018).

As of the beginning of 2022, according to the Bank for International Settlements (BIS) statistics, there are three fully operational CBDCs in the world and at least 28 pilot projects are at various stages of implementation. And 68 central banks have publicly announced the start of their work on CBDCs (Auer, Cornelli, & Frost, 2020).

Also, data from another think tank, the Atlantic Council, as of the beginning of 2023, shows that more than 100 countries are actively studying CBDC at the research and development stage ("Central Bank Digital Currency (CBDC) Tracker," 2023).

Countries that are exploring CBDC in one way or another (Shumba, 2022) in 2022 can be conditionally classified as: researching CBDC, inactive CBDC (suspended CBDC research), developing CBDC (technical assembly and testing in the laboratory), having a CBDC pilot project, launching CBDC, canceling CBDC (Shumba, 2022):

– *Researchers*: The United States, Jamaica, Chile, Russia, Kazakhstan, Turkey, Iran, Pakistan, India, Israel, Palestine, Lebanon, Tunisia, Ghana, Kenya, Rwanda, Madagascar, Eswatini, Mauritius. Japan, Taiwan, Indonesia, Philippines, Australia, New Zealand;

– *Inactive*: Finland, Estonia, Lithuania, Denmark, Italy, Morocco, Egypt, South Korea, Haiti, Trinidad and Tobago. Uruguay;

– *Under development*: Canada, Venezuela, France, UAE, Cambodia;

– *pilot projects*: Dominican Republic, St. Vincent and the Grenadines, St. Kitts and Nevis, Antigua and Barbuda, St. Lucia, Grenada, Bahamas, Sweden, Ukraine, China, Thailand, Republic of Korea, Singapore;

– *launched for widespread use*: Brazil;

– *Canceled, i.e. decommissioned*: Senegal, Ecuador (S. O. Hrytsai, 2022c).

– *Pilot projects* of countries implementing retail (China and Ukraine (S. O. Hrytsai, 2022d, 2022e)), wholesale or mixed forms (China) can be classified separately (С. Грицай, 2023; S. O. Hrytsai, 2023).

In March 2022, the U.S. administration granted "highest urgency" status to research and development of potential CBDC design and implementation options in the United States. The Executive Order highlights a number of benefits of CBDCs, including expanding access to financial services, reducing the cost of transferring funds, and strengthening U.S. leadership in the global financial system. The Administration expects to receive a joint research assessment of the impact of CBDCs from regulators in the fall of 2022 (House, 2022). At the end of 2022, the head of the US Federal Reserve announced that there was no decision on the launch of the digital dollar (*Opportunities and Challenges of the Tokenisation of Finance*, 2022). In early 2022, the White House presented a concept for regulating the crypto industry ("Fact Sheet: White House Releases First-Ever Comprehensive Framework for Responsible Development of Digital Assets," 2022). Which plans to strengthen control procedures for providers of digital asset-related services. In addition, the United States has developed a bill that provides for a two-year ban on the issuance of algorithmic *stablecoins* ("House Stablecoin Bill Would Put Two-Year Ban on Terra-Like Coins", 2022).

The European Commission plans to propose a draft law in early 2023 to define the status and create a legal framework for the legalization of the digital euro. In his speech in March 2022, Fabio Panetta, a member of the Executive Board of the European Central Bank (ECB), emphasized that the digital euro project aims to provide access to central bank money in digital form for daily transactions, allowing users to enjoy the high standards of privacy provided by the CBDC ("Digital Euro Bill Due Early 2023," 2022; European Central Bank, 2022).

The People's Bank of China began its journey towards the digital yuan in 2014. The country is currently conducting large-scale tests in selected cities, and during the 2022 Olympic Games, e-CNY was one of only three available payment methods offered to visitors.

In February 2022, India's finance minister promised to launch a virtual version of the rupee by the end of the year, and the following month, the Philippines announced its own CBDC pilot ("Union Budget FY 2022–2023," 2022, pp. 2022–2023).

Some governments take a completely opposite approach to the classic idea of fiat money, when introducing a CBDC in the state. This approach involves the country's recognition of Bitcoin (BTC) as a legal means of payment, additional to the existing one. Salvador and Ecuador can be considered such states. Micronesia, Palau, East Timor, Zimbabwe and the Marshall Islands (S. O. Hrytsai, 2022b).

Aims and methods. The aim of the study is to identify their leading characteristics (which are attractive to the state) and the future role of CBDCs in the evolution of money forms, at the level of hypothesizing.

To achieve this goal, the following tasks are set: 1) to characterize the attractive properties of CBDCs for the state; 2) to determine the role of cryptocurrencies in the implementation of CBDCs; 3) to outline the evolution of the form of money against the background of CBDC development.

Limitations of the research. The study does not address the choice of platform, structure, and form of CBDC, nor its impact on the financial and credit system. It only considers CBDCs from the point of view of their inherent technological features that are likely to be attractive to the state: as a future mass form of money for the population.

The methodological basis of the study includes a combination of philosophical, general scientific and special legal methods of scientific knowledge. The chosen research methodology meets the tasks set and contributes to the creation of an optimal structure of the conclusions obtained and allowed to identify the main problems.

Results of the study. What is important to understand: most CBDC projects start with stablecoins pegged to national currencies. You can create a stablecoin and, gradually updating the smart contract, building up the user base and experience, transfer it to CBDC, giving the asset under the control of the central bank. When the movement initially comes from the central bank, it is usually tied up in sandboxes and bureaucracy, so the process is very slow. Any blockchain wallet is a smart contract. This means that it is possible to create a multi-sig system for central banks and banks, and these flows can be divided: users have assets, and wallets, or rather the ability to set certain rules for it, can be given to banks. In other words, you can go to CBDC evolutionarily, through stablecoin, gradually introducing new rules and conditions into the smart contract. And this can be done almost imperceptibly for the user without causing any inconvenience ("What will the launch of a state digital currency change?," 2022).

Starting our research on this small technological excursion from leading experts in blockchain technology and CBDC in particular, it is impossible not to recall the famous phrase: "*the devil is in the details*".

1. CBDC & electronic money. There are many proponents of CBDC and they describe a different set of benefits.

The potential benefits of CBDC include lower transaction costs, easier monitoring of transactions, and the creation of a backstop to a privately managed payment infrastructure. In addition, well-designed retail CBDC can also broaden financial inclusion, a particular priority for developing economies, and serve as a backstop to the infrastructure of privately managed payments systems (E. S. Prasad, 2021).

The benefits and risks of CBDCs depend on their design and issuance, but Bank of America expects central banks in developed economies to focus on payments efficiency and those on developing countries to focus on financial inclusion. Still, CBDCs aren't without their risks. They may drive competition with bank deposits, and could lead to a loss of monetary sovereignty and inequality among countries globally (Canny, 2023).

It is unclear whether DLT offers unconditional advantages for a CBDC, including those designed to address financial inclusion barriers. Both traditional, centrally managed databases and DLT-based databases can store data multiple times in physically different locations. CBDC implementation poses other operational challenges. DLT-based CBDC infrastructures have lower transaction throughput, presenting impediments to widespread use except in small jurisdictions (Auer et al., 2022).

CBDC's American researchers note: "*[…] In the private sector today, Americans regularly use multiple forms of digital dollars. They send digital payments using credit cards, debit cards, prepaid cards, and several mobile applications (e.g., Zelle, PayPal, or Cash App). In fact, it's not just payments that have gone digital. Nearly every financial institution offers services–from savings accounts to mortgages–via mobile applications. So, there should be no misunderstanding: the U.S. dollar is already widely available in digital form.*" In addition, they emphasize the following: "*Proponents claim that a U.S. CBDC would promote financial inclusion, spur faster payments, protect the U.S. dollars' status as the world's reserve currency, and make it easier to implement monetary (or fiscal) policy. Yet, as this brief demonstrates, all four arguments fail to stand up to scrutiny*." (Anthony & Michel, 2022).

Further, CBDCs really don't add anything novel to the market in terms of benefits for consumers. To the extent people want it, many currencies are available in digital forms through debit cards, payment apps and even prepaid cards (Emergencies Act, n.d.).

Credit Union National Association commented on the lack of advantages of CBDC over existing banking technologies: "*While there are no doubt opportunities for improvement, we believe most, if not all, [of these opportunities] can be addressed by innovations in the current financial services framework and through continued public-private partnerships, without the introduction of a novel digital currency that could destabilize the system*." ("Central Bank Digital Currency Creation Needs 'Serious, Exacting' Consideration," 2022).

2. CBDC will displace everything: both cryptocurrency and cash fiat money (hypothesis). The Bank of America research report reflects that CBDCs are a natural evolution of the monetary and payment systems: "*CBDCs do not change the definition of money, but they will likely change how transfers are made in the next few years. Central bank digital currencies have the potential to revolutionize the global financial system, becoming the most significant technological advancement in the history of money.* " CBDCs can be issued and operated both centrally and using blockchain technology. Since CBDCs are issued by a specific central bank, such digital currencies can be controlled by the country's authorities, unlike cryptocurrencies (Canny, 2023).

2.1. People's Republic of China (PRC). China's experience very clearly confirms our hypothesis.

2019. According to Reuters, experts of the Chinese Central Bank said that the digital yuan should not be considered a weapon against cash. The new financial instrument, as conceived by the developers, should be a complement to fiat money ("China's national cryptocurrency will allow users to remain anonymous," 2019).

But at the same time, Mu Changchun, head of the People's Bank of China's (PBoC) Digital Currency Research Institute, said that the asset is intended to replace the existing fiat ("China's central bank reveals plan to distribute digital yuan," 2019).

2021. In late September 2021, the People's Bank of China (PBOC) banned all cryptocurrency transactions. The PBOC cited the role of cryptocurrencies in facilitating financial crime as well as posing a growing risk to China's financial system owing to their highly speculative nature. However, one other possible reason behind the cryptocurrency ban is an attempt to combat capital flight from China ("What's behind China's Cryptocurrency Ban?," 2022).

Neil Kashkari, president of the Federal Reserve Bank of Minneapolis, has this to say about China's chosen strategy: "*I understand why China is doing this. If they want to track every transaction you make, you can do that with central bank digital currency. You can't do that with Venmo. If you want to introduce negative interest rates, you can do that with central bank digital currency. You can't do that with Venmo. And if you want to directly collect taxes from customer accounts, you can do it with central bank digital currency. You can't do that with Venmo. I understand why China is interested in this. But why would the American people be in favor of it?* "

Yet, as Cornell economist Eswar Prasad warns in his new book, The Future of Money: How the Digital Revolution Is Transforming Currencies and Finance, "*digital central bank money is only as strong and credible as the institution that issues it*". More importantly, "*In authoritarian societies, central bank money in digital form could become an additional instrument of government control over citizens rather than just a convenient, safe, and stable medium of exchange*." (E. Prasad, 2021).

James A. Dorn believes that the real intentions of introducing a digital yuan are likely to be greater government control over the payment system and close monitoring of transactions and even personal behavior (James A. Dorn, 2021).

2.2. Countries of the Eastern Caribbean. The Bahamas. In the Bahamas, all supervised financial institutions can operate Sand Dollar wallets. This includes commercial banks, credit unions, money transmission businesses (MTBs) and other PSPs. Sand Dollar wallets exist on customers' smartphones. To date, the main providers of Sand Dollar wallets are MTBs and other PSPs. At the time of interview, only one commercial bank and one credit union were participating in the Sand Dollar scheme.

Allowing for remote onboarding of customers, using e-KYC methods, was highlighted as an important CDD feature. Wallets with higher balance or transaction limits will be subject to standard CDD, while those with lower limits will be subject to simplified rules. Wallets with lower limits will be subject to simplified rules. Such "basic" wallets or accounts have been offered under DCash in the Eastern Caribbean and Sand Dollar in the Bahamas.

Some central banks observed an additional layer of data security when using a DLT-based infrastructure. In the Eastern Caribbean, DCash is built on a private permissioned blockchain architecture. The central bank has access to the entire retail transaction record and can locate all information pertaining to a specific account. Personal information (ie the identity) of account holders is kept separate from the transaction record and is accessible only by the institution that established the account. None of the interviewed central banks anticipates a design where PSPs or commercial banks have access to personal and transaction information beyond that necessary for the execution of their clients' transactions.

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2.3. Nigeria. Central bank Governor Godwin Emefiele said, "The destination, as far as I am concerned, is to achieve a 100% cashless economy in Nigeria." ("Shunned Digital Currency Looks for Street Credibility in Nigeria," 2022).

The Nigerian government has encouraged CBDC adoption in every way possible, but nothing has been effective. In August 2022, it lifted access restrictions so that bank accounts were no longer required to use CBDC. Then, in October 2022, it offered discounts if people used CBDC to pay for cabs ("Shunned Digital Currency Looks for Street Credibility in Nigeria," 2022).

Having failed further, the Nigerian government redoubled its efforts and moved on to more drastic measures – limiting cash. In December 2022, the Central Bank of Nigeria began limiting cash withdrawals to 100,000 naira ($225) per week for individuals and 500,000 naira ($1,123) for businesses (*Revised Cash Withdrawal*, 2022).

The Nigerian government also decided to redesign the currency during this period to "restore the Central Bank of Nigeria's (CBN) control over currency in circulation" and "further deepen the move toward a [cashless] economy," according to a press release from the Central Bank of Nigeria (*CBN Update*, 2022).

After this design reform, not only are citizens limited in how much they can withdraw, but commercial banks do not have cash to dispense because many are still waiting for new cash to arrive.

By imposing these restrictions, the Nigerian government has succeeded in depriving the economy of cash and setting the stage for the CBDC to finally come into focus.

In Nigeria, citizens have taken to the streets to protest the nation's cash shortage, further objecting to their government's implementation of a central bank digital currency (CBDC). The shortage came about due to cash restrictions aimed at pushing the country into a 100% cashless economy. Yet, instead of adopting the CBDC, Nigerian protesters are demanding paper money be restored.

The country's experience strongly suggests the average citizen understands that CBDCs present a substantial risk to financial freedom while providing no unique benefit. That much should be clear from the abysmal adoption rate in Nigeria, where less than 0.5% of Nigerians have used the CBDC. To put that number into perspective, more than 50% of Nigerians have used cryptocurrency (Emergencies Act, n.d.).

According to a recent blog by IMF, several Sub-Saharan African (SSA) central banks are exploring the use of digital currencies to enhance payment systems, following Nigeria's October introduction of the e-Naira. South Africa and Ghana are in the pilot phase of a digital currency, while Uganda, Kenya, Rwanda, Mauritius, Madagascar, Zimbabwe, Eswatini, Namibia, and Zambia are researching the process.(Bailey, 2022).

2.4. Other examples. In India in 2019, a draft bill that was in the works envisioned a complete ban on cryptocurrencies, but at the same time excluded the proposed official digital currency. The bill even proposed prison terms for individuals who "*extract, generate, hold, sell, deal, issue, transfer, dispose of or use cryptocurrency in India*". Although this bill did not make it to parliament, in 2021 a study by the Under Secretary (Economic Affairs) revived the legislative push for a ban "*all private cryptocurrencies, except for any virtual currencies issued by the state*" ("Cryptocurrency Regulations Around the World," 2023).

Juda Agung, the assistant governor of Bank Indonesia, talked about cryptocurrency and central bank digital currency (CBDC). Juda Agung said that digital currency would be one of the tools to fight crypto. His said that Bank Indonesia has been looking at launching a digital currency since the beginning of 2021 year and wanted to issue a digital rupiah for the following reasons: 1) For using digital currency as legal tender to fight cryptocurrency; 2) A CBDC would be one of the tools to fight crypto; 3) CBDC would be part of an effort to address the use of crypto in financial transactions (Aditya, 2021; "Indonesia's Central Bank Sees CBDC as Means to 'Fight' Crypto," 2021).

Globally, nations' actions have demonstrated that they want a CBDC specifically to hold on to their monopoly over national currencies. In the United States, Representative Jesus "Chuy" Garcia (D-IL) – who would later cosponsor a bill to introduce a CBDC – announced the "Keep Big Tech Out of Finance Act" in an attempt to prohibit large technology companies from offering financial services (e.g., cryptocurrencies). Such bans may not be inherent to the design of a CBDC, but there is no denying that CBDCs are being used across the world to combat the existence of cryptocurrencies (Anthony & Michel, 2022).

3. CBDC characteristics acceptable to the state. In its 2015 study, the FATF noted that certain features of cash, including anonymity and the absence of a control log, make it attractive for illegal transactions (FATF, 2015).

Some central banks interviewed are considering programmability features of CBDC to enforce rules or to apply conditions to payments. Programmability refers to the ability to automate or to direct transactions, eg to make a payment contingent on certain pre-specified conditions. This can allow for a range of new features, including self-executing protocols ("smart contracts"). Programmable money features have already been used by some Chinese districts within the e-CNY pilot, where the CBDC, distributed through "red envelopes", would expire in a few days if not used by the recipient. In its CBDC research the NBU has assessed the potential of programmability for government payments and for likely new business models and products in the financial markets. Programmability using smart contracts is embedded within DLT systems. However, it can also feature in non-DLT-based CBDC. Central banks need to apply strict controls on how programmability is applied to avoid possible fraud and misuse of a CBDC (Auer et al., 2022).

Most central banks interviewed described a system where privacy will be maintained, but without full anonymity. The provision of CBDC with full anonymity is not being considered by any of the central banks that participated in the study, including those that described financial inclusion as a primary motivation for researching CBDCs. For example, in the Bahamas the CBB is taking a centralized approach to record-keeping, maintaining the ledger of all individual holdings of the Sand Dollar. Individual transaction information will be maintained by the service provider managing the customer wallet (Auer et al., 2022).

In their work, Nicholas Anthony and Norbert Michel emphasize the importance of the: While a CBDC would not offer any unique benefits to Americans compared to existing technologies, it would pose serious risks (Anthony & Michel, 2022).

Arthur Hayes, the former SEO of the BitMEX Bitcoin exchange, called CBDC "pure evil" and an ideal tool for governments and an encroachment on sovereignty over honest transactions between people. The main difference between modern fiat and digital currencies of central banks, Hayes said, is the possibility of full control of the latter by the authorities. Hayes considers commercial banks to be allies in the fight against national digital currencies. In his opinion, with the introduction of CBDCs, these financial institutions will become unnecessary intermediaries between people and the Central Bank (Hayes, 2022).

The General Manager of the Bank of International Settlements (BIS), Agustin Carstens, sent a message regarding the future direction of CBDCs: "*We don't know who's using a $100 bill today and we don't know who's using a 1,000-peso bill today. The key difference with the CBDC is the central bank will have absolute control on the rules and regulations that will determine the use of that expression of central bank liability, and also we will have the technology to enforce that."* (The Market Sniper, 2021).

Speaking at the IMF-World Bank Annual Meeting 15.10.2022, Deputy Managing Director Bo Li said that a CBDC could improve financial inclusion through programmability: "*A CBDC can allow government agencies and private sector players to program, to create smart contracts, to allow targeted policy functions."* He proceeded to give a couple of examples, such as welfare payments, consumption coupons, and food stamps. Money can be programmed a targeted for one type of use, he stated*; "This potential programmability can help government agencies to precisely target their support to those people that need support*" (IMF, 2022).

3.1. Loss of personal privacy. Representatives of the Central Bank of China, as reported by Reuters, said: "The Chinese digital yuan will not be a tool for controlling the country's citizens. The latter will be able to keep their transactions anonymous. The national cryptocurrency is designed to balance privacy concerns and provide the authorities with the necessary information. Mu Changchun, head of the Digital Currency Research Institute at the People's Bank of China (PBoC), said: "*We understand the need of the public to maintain the anonymity they receive when using fiat money. We will give people the opportunity to remain anonymous*" ("China's national cryptocurrency will allow users to remain anonymous," 2019).

At the same time, Mu Changchun noted that the holders of the digital yuan will not receive any interest payments: therefore, the digital currency will not cause negative consequences in the country's monetary policy ("China's central bank reveals plan to distribute digital yuan," 2019).

Cyber security is another challenge that can affect data privacy. A CBDC infrastructure is an attractive target for cyber criminals given both the funds and types of information it stores. As such, it should be subject to at least the same cyber resilience expectations as other critical financial market infrastructures. While the key vulnerability differs between a conventional and a DLT-based CBDC infrastructure, all parties connected to this infrastructure – the central bank, financial intermediaries, mobile phone operators, merchants etc. – should have effective cyber security safeguards and processes in place. Applying a cyber resilience framework such as that of the US National Institute of Standards and Technology (NIST) and regularly conducting penetration testing is important to shield the target information. This is similar to the work central banks already undertake for real-time gross settlement (RTGS) and other payment systems (Auer et al., 2022).

3.2. Loss of financial independence. By managing CBDCs, you can control how they are used or even block them completely. Purchase management can be expressed as a restriction on the purchase of certain goods, and in regulating the time and even the place of their purchase.

Examples include the regulation of CBDC spending for children: limiting the purchase of alcohol and tobacco. Or here's an example of CBDC supporters who see advantages in setting the time and

amount of sweets for children ("Digital Newspaper & Magazine Subscriptions," 2021). But we need to think bigger, because no one is safe from the fact that restrictions can be used for bad reasons. For example, restrictions on political opponents or their sponsors during election campaigning; or persecution of those who are not acceptable to the totalitarian regime in the form of a complete freeze of CBDCs under a false pretext. The options for using CBDC to restrict the rights of citizens are much wider and are incredibly important.

But as long as there is a cash form of money, people have a choice along with the electronic form. This right to choose may disappear if CBDC displaces the cash form of money – which is our theory of its displacement by CBDC.

3.3. Fiscal dominance of the state. Many authors conclude in their studies that replacing cash with CBDCs will lead to fiscal dominance of the state, which is one of the factors of public rejection of financial innovations (E. S. Prasad, 2021).

CBDC can make taxation easier, safer and more reliable for the state. Key features include real-time taxation, automatic auditing, and automated integration with public and private registries. Instead of placing the accounting burden on individuals and companies, governments can receive taxes automatically and in real time (Lazorenko, A., 2022).

We believe that fiscal dominance of the state at the digital level, based on historical experience, can border on lawlessness in a difficult situation in the state (low GDP, war, etc.), as the properties of programmable CBDC are a great temptation to cross it.

3.4. Application of negative interest rates for CBDC storage. In our everyday consciousness, there are positive interest rates, for example, on a bank deposit or an account balance. But there are already many supporters of negative interest rates. This means that if you keep money in your account for a long time, the bank takes a certain annual percentage of your savings for it. And this is justified in the theory of stimulating purchases. With the help of CBDC, this is a fairly easy to implement financial and economic idea of the future (Buiter, 2023; Rogoff, 2020).

3.5. Timing the validity of CBDCs as a time limit for their use. The majority of comments on the Federal Reserve's (Fed) proposal for a central bank digital currency (CBDC) continue to be negative about CBDC. Specifically, more than 66 percent of the 2,052 commenters expressed concern or outright opposition to the idea of a CBDC in the United States. The most common concerns related to financial privacy, financial oppression, and the risk of disintermediation of the banking system (Anthony, 2022).

In fact, Rohan Grey, assistant professor at Willamette University, said it's already an established trend with some types of government-issued digital money. In the U.S., for instance, food welfare programs like Electronic Benefit Transfer (EBT) set barriers around what can be purchased as well as time-limits within which the benefit must be spent ("EBT – Electronic Benefit Transfer," n.d.; "If Money Is Speech, CBDCs Should Be Tools for Freedom," 2022).

4. Digital prison. The authorities of many countries (China, Canada, etc.) have repeatedly drawn attention to the organization of punishment and deprivation in the form of a "digital prison". As practice has shown, financial restrictions for those who are undesirable to the government are very effective (below are examples).

In our cashless society, we need to take digital jail seriously. The move to a cashless society, which has been accelerated by Covid restrictions, makes it almost impossible to function in society without a bank account and a credit card. Now, without a working bank account, you can't pay for a telephone or internet. You can't make car payments, rent, or travel. You also can't exercise most basic rights from freedom of speech to freedom of assembly. You can't even pay a lawyer to defend you. The government doesn't need to break down your door anymore to effectively remove you from society. They can do it with the press of a button (Anglin, 2022).

4.1. Protests in Canada in 2022 (trucker protests). The trucker protests in Canada earlier this 2022 year forced a closer look at the desires and motivations of this key demographic of voters. Although their grievances are different, these truckers are united in their demand for change. Because the trucking industry plays a vital role in Canada's economy, their voices cannot be ignored. The question now is what impact these protests will have on Canadian politics ("Canadian Trucker Protests News, Insights & Impacts," 2022).

At that protest time, the government's decision to invoke the Emergency Act (Emergencies Act, n.d.) in response to trucker protests may have a lasting legacy in Canadian public life. One aspect of the Canadian government's response that may have particularly significant implications in the future is the use of "digital jail," or the freezing of bank accounts and digital assets. The Canadian government's actions targeting the assets of those associated with the protests have demonstrated both the potential for such measures and the lack of applicable legal protections (Lavoie, 2022).

As during the October Crisis, the lack of legal safeguards regarding government action increases the likelihood of mistakes. Given that many of those who donated to the convoy do not seem to have a good understanding of the law and how their donations might be used, the abandonment of questions of mens rea (guilty intent) and the usual burden of proof means that the government can freeze first and ask questions later. By then it may be too late. A lawyer interviewed by the CBC suggested that in some cases, risk-averse banks "might just decide to close a person's account" without bothering to separate the guilty from the innocent. The long-term consequences of such excessive policies would be worse than temporary incarceration. The government's actions are disturbing enough, but what should really worry us is the ease and stealth with which it is done. When we do not see the consequences of government action, the risk of government misconduct increases. It also shows how powerful the technology is for the governments and companies that control our digital world. When they work together – whether it's financial de-platforming of extremist minorities or blocking unwanted speech – there is literally no way to escape their influence, nowhere to hide. The fact that the use of the financial system against nonviolent protesters and their distant supporters has become the government's first resort should worry anyone who understands the role of civil disobedience in democracy (Anglin, 2022).

4.2. Comments. In the context of examining the Canadian case of the "trucker protests," it would be appropriate to quote William Luther of the American Institute for Economic Research: "At some point the CBDC, which does not provide a high degree of financial privacy, will be used to monitor and censor the transactions of its political enemies. It is foolish to think otherwise."

'If you give me six lines written by the hand of the most honest of men,' the French cleric and statesman Cardinal Richelieu said in the 17th century, 'I will find something in them which will hang him.' (Luther, 2022).

Discussion. There is an unspoken, and even rumored, opinion in society that cryptocurrencies and CBDCs are allegedly being tested in the so-called "third world" countries. And this is indeed based on fact. Let's recall which countries have introduced Bitcoin as a legal tender at the legislative level along with fiat money: El Salvador in 2021, Central African Republic in 2022. And here is a list of countries that have recognized Bitcoin's exchange and payment functions as one of the main ones inherent in fiat money; and Bitcoin is legally in circulation in these countries at the level of fiat money, where you can safely pay for goods and services with it: Mexico, Argentina, Brazil, Venezuela, and many other "third world" countries ("Cryptocurrency Regulations Around the World," 2023). Thus, it can be argued that the so-called "third world" countries are really the pioneers.

1. *Natalie Smolenski*, in her paper "*The Bitcoin Policy Institute*, " very properly expressed the view of the political trend of introducing CBDC: "I*n other words, those calling for the implementation of CBDC naively believe that it can be done without creating a centralized surveillance system for all financial transactions. Simply put, even if such surveillance is not included in the [initial] design, it*

would be trivial to add it at a later stage. Once the door to surveillance is open, it is virtually impossible to close it." (Smolenski, 2022).

The 2022 study "*Behind the Scenes of Central Bank Digital Currency: Emerging Trends, Insights, and Policy Lessons"* showed the political goals of introducing CBDC (Soderberg et al., 2022). However, based on our research, we can state that it is incomplete (S. O. Hrytsai, 2022a).

The main conclusion drawn by the group of authors of the study "*From Bitcoin to Central Bank Digital Currency: Making Sense of the Digital Money Revolution"* is that the introduction of CBDCs will spread around the world in the near future, and although there is no consensus on which model should be adopted, one thing is certain: there is a particular need for careful planning of such a model. The success of CBDCs depends on the extent to which they meet the expectations of potential users and minimize the effects of the current negative economic dynamics (Cunha, Melo, & Sebastião, 2021).

We can agree with the authors of the study that CBDC will spread in the near future. However, we believe that the conclusions drawn are incomplete because they do not highlight the threats that CBDCs pose to the freedom and democracy of society. Although it is impossible to ignore the obvious benefits of the introduction of CBDCs, such as their positive prospects in the fight against corruption (Hrytsai, 2023b). Nevertheless, the trend of our study is closer to the conclusions drawn in our work *Nicholas Anthony* and *Norbert Michel*. In particular, they argue *"[…] The experiment should be left on the drawing board because CBDCs will ultimately usurp the private sector and jeopardize Americans' basic freedoms. They have no place in the American economy. Congress should explicitly prohibit the Federal Reserve and the Department of Treasury from issuing CBDCs in any form.*" (Anthony & Michel, 2022).

This applies not only to the loss of financial privacy. Because its loss leads to a loss of personal privacy, for example, in transportation (it will be visible not only when, but also where transportation tickets were bought), political expression (it will be visible to which political party you donate) and many others.

Notwithstanding the current trend in the world of digitalization of public services (Hrytsai, 2023c). Today, personal data (including financial data) is scattered among various financial institutions. With the introduction of CBDC, all information will be in the central bank. As well as the bulk of the tokens, CBDC will be stored there as well. Against this backdrop, we should not forget about the threat of hacker attacks on such assets, which have been rife in the history of the last ten years. And the stakes here will be on the scale of the whole country – the loss of personal data of all (the vast majority) of the country's residents and the direction of their spending.

2. Many authors have written about the displacement of cash by CBDC in the future (Hrytsai, 2023d, 2023e). Some wrote in a positive light about this course of events during the introduction of CBDC.

Mohammad Davoodalhosseini and Francisco Rivadeneyra noted in their article: "*One benefit of a CBDC could be to allow monetary policy to break below the effective lower bound (ELB). This would require removing cash or restricting cash holdings (e.g., removing large-denomination notes). But this alone would not be a sufficient condition to potentially realize the benefit of breaking below the ELB during downturns. […] The caveats around the potential monetary policy benefits of a CBDC stem from knowledge gaps and implementation challenges. These include: questions about the feasibility and consequences of removing cash […]* " (Mohammad Davoodalhosseini, Francisco Rivadeneyra, & Zhu, 2020).

The hypothesis we put forward differs from the known ones, since we are talking about the displacement of CBDC not only by cryptocurrencies but also by the cash form of fiat money – and all of this has a reasonable basis. In the text of the article, we have provided modern evidence with examples that the rumors about the so-called "cryptocurrency rollout" in third world countries are far from

groundless. *So, as for the hypothesis we put forward, which is that the rise of the CBDC era will be followed by the rise of cryptocurrencies, we have actual examples of its current use in some countries*.

For example, Ecuador has issued a ban on the circulation of all cryptocurrencies, except for the government-issued SDE token (in effect from 2014 to 2018) ("Cryptocurrency Regulations Around the World," 2023). China, which is one of the leaders in the development and launch of its own CBDC, has introduced a complete ban on the circulation of cryptocurrencies.

In a 2022 study, the *Bank for International Settlements* recognizes the problem of loss of confidentiality and the possible use of the CBDC tool in political reprisals. And as an option, they offer one of the solutions to this problem.

Concerns regarding end users' privacy within CBDC systems, and the trade-off with financial integrity, could be addressed with various legal, regulatory and technical choices. In CBDC systems where personal information (eg identity) is separated from transaction information, it may be easier to promote privacy, but adjustments in AML/CFT requirements may be required. For instance, it is possible that information on user identities would be gathered and stored only by PSPs, and that the central bank would not have any information on the identity of users in any specific transaction. If there were a need to collect such information, for instance for law enforcement purposes, there would need to be clearly delineated processes for doing so, similar to today's bank secrecy laws. These features could help to safeguard against abuse of user data for political purposes (state surveillance), and to protect the operational independence of central banks from pressure by political authorities. In the case of insolvency of the financial institution with users' identity information, it would still be necessary to transfer this information and account balances to a different provider. Legal and regulatory reforms could help to further protect CBDC end users and to combat money laundering and the financing of terrorism by specifying the conditions under which information could be used (Auer et al., 2022).

3. Summarizing the evolution of money forms, we can build a progressive series of them, which looks like the theory of the evolution of money forms over time: 1) metal money made of precious metal; where high-denomination metal money is made of precious metal and low-denomination metal money is made of non-precious metal; 3) metal money, usually not made of precious metal; 4) metal money made of non-precious metal and paper money backed by precious metal; 5) metal and paper money that do not have the actual value of the material from which they are produced (hereinafter referred to as classical fiat money); 6) classical fiat money and electronic money as an issuer's obligation to pay out classical fiat money (hereinafter referred to as electronic money); 7) classical fiat money, electronic money and, as an alternative to the latter, cryptocurrency (which is formally or informally given some of the functions of fiat money: exchange, payment, accumulation); 8) classical fiat money, CBDC (at this stage, electronic money, which has functions that duplicate CBDC, will disappear) and cryptocurrency (which will increasingly be used outside the law); 9) classical fiat money (limited version) and programmable CBDC, – at this stage, classic fiat money in the form of cash is likely to disappear, and cryptocurrencies will be outlawed in most countries.

Conclusions. From the above analytical material, we can draw a number of conclusions on the topic of our study:

1. Cryptocurrencies are a catalyst for innovation in classical finance and act as an experimental technological step, i.e. an evolutionary stage towards the main goal of the world's central banks – the introduction of programmable CBDCs. We have proved, based on the current financial and political trend, that the heyday of the CBDC era will be the beginning of the decline of the cryptocurrency era. This will be reflected in the fact that cryptocurrencies will be increasingly restricted in the world, until they are officially banned.

2. The benefits of implementing CBDCs for the state are enormous, to say the least: *(a) total income taxation, (b) total financial monitoring (public procurement, foreign investment, political*

party financing, etc.), (c) a political tool in the struggle for power, (d) but also an effective tool for reducing crime and corruption.

On the contrary, the benefits of CBDC for the population are negligible, compared to the current system of electronic money/transfers (instant transfer systems, bank cards, etc.), such as the high probability of a significant loss of classical constitutional rights and freedoms: *(a) loss of personal privacy, (b) limited political choice, (c) financial independence, (d) fiscal oppression, (e) negative interest rates, and (f) introduction of time value of money.*

3. CBDCs, in addition to the fact that they are likely to be granted the status of official money in the future, we believe that they should be prioritized from the perspective of legal regulation, – *as a big database*. Which will be presented in the form of state accounting records on who, where, when and how uses and stores money in a particular country.

4. CBDCs have the potential to become instruments of state coercion or censorship. Since the threat to classical constitutional rights and freedoms from CBDCs' properties begins with financial restrictions on an individual and his or her privacy, for example: the right to movement, to choose goods, to political views and their financing, and others.

The widespread introduction of CBDCs will have its own internal natural development, which is already evident in the form of a trend towards the study of programmable CBDCs. And this change in the form of money, as it has historically been at the dawn of monetary relations, will be dictated solely by the characteristics of the newest forms of programmable CBDCs that are attractive to states. In general, based on the characteristics that programmable CBDCs may have, for the state it is the strengthening of power in the form of total control in their countries; and for the population, it is the probability of losing a significant part of constitutional rights and freedoms.

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