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IMPLICATIONS OF CENTRAL BANK DIGITAL CURRENCIES FOR MONETARY POLICY AND GEOPOLITICAL EQUILIBRIUM: A REVIEW OF THE LITERATURE

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ABSTRACT

This research paper explores the implications of Central Bank Digital Currencies (CBDCs) for both monetary policy and geopolitical equilibrium. The analysis comprises two main sections. The first section delves into CBDCs' design characteristics, impact on monetary policy transmission, and implications for the banking sector. The second section focuses on the broader geopolitical implications, including the effects of CBDCs on monetary sovereignty and the competitive edge gained by the first CBDC-issuing nation, currency internationalization as well as financial sanctions. Through an extensive literature review, this paper attempts to shed light on the multifaceted potential repercussions of CBDCs on the global financial and geostrategic landscape.

ΠΕΡΙΛΗΨΗ

Η παρούσα εργασία εξετάζει τις συνέπειες των Ψηφιακών Νομισμάτων Κεντρικής Τράπεζας (Central Bank Digital Currencies-CBDCs) τόσο για τη νομισματική πολιτική όσο και για τη γεωπολιτική ισορροπία. Απαρτίζεται από δύο βασικά τμήματα, όπου το πρώτο τμήμα εμβαθύνει στα χαρακτηριστικά σχεδίασης των CBDCs, τον αντίκτυπο στη μετάδοση της νομισματικής πολιτικής και τις συνέπειες για τον τραπεζικό τομέα. Το δεύτερο τμήμα επικεντρώνεται στις ευρύτερες γεωπολιτικές συνέπειες, περιλαμβανομένων των επιπτώσεων των CBDCs στη νομισματική ανεξαρτησία, το ανταγωνιστικό πλεονέκτημα που αποκτά η πρώτη χώρα που θα θέσει CBDC σε κυκλοφορία, την διεθνοποίηση του νομίσματος καθώς και τις οικονομικές κυρώσεις. Μέσω μιας εκτενούς ανασκόπησης της βιβλιογραφίας, αυτή η εργασία προσπαθεί να θέσει επί τάπητος τις πολυδιάστατες δυνητικές συνέπειες των CBDCs στο παγκόσμιο οικονομικό και γεωστρατηγικό τοπίο.

To my family.

CONTENTS

1. INTRODUCTION

"We live in an age dominated by the fusion of geopolitics, money, and technology"

-György Matolcsy, Governor of the Hungarian National Bank (MNB)

In an era marked by the convergence of technology and finance, the landscape of global economies is undergoing a profound change. Central Bank Digital Currencies (CBDCs) have emerged as a transformative force, igniting debates and discussions across economic, policy, and academic spheres. The digitization of currencies by central banks represents a watershed moment in the history of monetary systems as digital versions of sovereign currencies, issued and regulated by central banks, stand at the intersection of technological innovation and financial policy.

To understand the significance of CBDCs it is imperative to delve into the historical and contextual background that underpins their emergence. Ferrari *et al.* (2020) assert that CBDCs were engendered due to competition from digital assets developed by the private sector, such as Bitcoin and Libra. To safeguard their monetary sovereignty from alien currency intrusions, central banks began researching a potential introduction of a digital manifestation of the sovereign currency in the economy, while certain monetary authorities such as the People's Bank of China (PBoC) eventually banned competing forms of "currencies" altogether. Furthermore, Ferrari *et al.* (2020) point to a significant first-mover advantage to the country that first issues a digital currency, as a domestic CBDC amplifies imbalances within the global monetary system by diminishing the capacity for independent monetary policy in foreign economies, while no such effect is observed domestically. This notion provides extra incentives for central banks to advance their research on CBDCs.

This paper embarks on a journey to clarify fundamental questions at the crossroads of economics, technology, and geopolitics. How do CBDCs influence the mechanisms through which the transmission of monetary policy occurs? What will be the potential impact for the banking sector and what is the risk of bank disintermediation? In addition, what are the geopolitical repercussions of CBDCs on the monetary sovereignty of nations, the internationalization of currencies, and the enforcement of financial sanctions? Through the investigation of current literature, this study aims to provide answers to these inquiries, shedding light on the transformative potential of CBDCs in the global economic landscape.

Within the broader context of CBDCs, this study zeroes in on two distinct yet interconnected aspects: monetary policy and geopolitical equilibrium. The first section delves into the potential design characteristics and their impact, then the relationship between CBDCs and monetary policy unraveling how these digital currencies alter the transmission mechanisms of central banks' monetary

measures. Additionally, this section delves into the consequences of CBDCs for the banking sector, illuminating potential disruptions. It discusses the potential impact of CBDCs on the effective lower bound, pass-through of policy, interest rates, money demand, credit creation, financial intermediation, and stability. It reviews the current literature on these effects and identifies the key factors that determine their magnitude and direction.

The second section of the paper pivots towards the geopolitical implications of CBDCs. It discusses the impact of how CBDCs may disrupt monetary sovereignty, as well as the possible first-mover advantage for the pioneering CBDC-issuing country. It explores the factors that determine the attractiveness of a CBDC as an international reserve currency and the potential effects of CBDCs on the current status quo. It also evaluates how CBDCs may affect financial sanctions imposed by major powers, analyzing potential transformations of the present landscape due to CBDC-based sanction evasion. By examining these dimensions, this paper aims to shed light on how CBDCs can potentially alter the existing geopolitical dynamics and redefine the role of currencies on the global stage.

2. DESIGN CHARACTERISTICS

The advent of Central Bank Digital Currencies brings forth a paradigm shift in our understanding of money, presenting possibilities & challenges in the realm of monetary policy. The specific design features chosen for these digital currencies—whether it's the nature of access, interest-bearing attributes, or transaction limits, among others—can significantly influence how monetary policy is transmitted through the financial system. Moreover, these design elements are intrinsically linked to the role of the banking sector, dictating its function in an economic landscape characterized by the existence of CBDC. This section delves into the core design characteristics of CBDCs, setting the foundation for understanding their broader implications for monetary policy transmission and the banking ecosystem.

Based on Eurosystem's comprehensive examination of potential characteristics in the "Report for a digital euro" (2020), there are multiple factors that can influence the final results of CBDC introduction in the economy. First, CBDC is the digital version of the physical currency, not a different kind of money. It should be on par with cash, central bank reserves, and bank deposits. Second, the digital currency must be backed by the monetary authority, making it reliable and under complete institutional control. Third, universal access for all domestic residents is vital for the system to function, in coordination with supervised intermediaries that would assist with payment services. Fourth, the introduction of a digital currency must not preclude other digital payment options. Lastly,

CBDC should be trusted on par with physical money. To accomplish this, proper design and communication is critical.

The design of CBDC demands rigorous assessment, particularly regarding its impact on monetary policy and financial stability, as exemplified by the above. It should be addressed whether households and firms access it directly or via intermediaries, and if it should bear interest. Moreover, deliberation is needed on whether there should be a cap on how much CBDC individuals can hold. To offset potential negative impacts on the financial sector and monetary policy, the central bank might consider varying interest rates on digital holdings according to a tiered system or putting restrictions on the amount held. Excessive holdings of CBDC, used as an investment vehicle could pose risks. Yet, if the allowed digital holdings are too restricted, it might become a less appealing payment option in comparison with competitors.

Retail use of CBDC presents numerous legal inquiries as it entails direct access of the general public to central bank money; however, restricting access—exclusively extending it to certain groups already utilizing central bank money—could simplify matters. Such an approach would align with current practices. Should the implementation of CBDCs involve an account system, individuals could establish accounts directly with the central bank or monitored intermediaries. Again, trusted intermediaries are likely to participate in distributing a digital currency that functions more akin to physical tokens. While the development of certain features of digital currencies cannot be outsourced, outside groups could potentially undertake select tasks that concern the practical implementation of CBDC.

As mentioned before, the design choices by policymakers will influence the potential implications of introducing CBDCs, as new challenges present themselves: a large inflow of capital may occur should investors outside the domestic economy transfer in an extensive portion of their investments. Consequently, it is anticipated that both the financial position and associated risks for the central bank would expand in such a scenario. Should the balance sheet expand, the monetary authority must secure assets such as loans or securities to support the digital currency. Unlike physical cash, interest can accrue on this digital currency; thus, potentially modifying profits derived by central banks from money issuance. Introducing a digital currency creates expenses akin to those associated with producing physical currency. Moreover, the central bank may need to increase its lending to offset deposit losses for certain banks and ensure their continued participation in the financial process. Thus, a significant role in shaping the central bank's profits will be played by interest rate differentials between long-term loans and CBDC.

The introduction of a digital currency will undoubtedly impact the operations of commercial banks and payment service providers. Therefore, the central bank must exercise caution not to impede existing private solutions targeting identical objectives. It should undertake only those roles necessary for optimal functionality of the digital currency in the economy: controlling the monetary base, guaranteeing secure transactions, and supervising service providers. The system must ensure not only user-friendliness and efficiency but also its adaptability to emerging technologies. Should foreign investors choose to substantially invest in digital currency, it may engender heightened financial risks for the monetary authority. Additionally, this influx could strengthen the currency—thus escalating competitiveness challenges for domestic firms.

The potential for larger international repercussions also exists: studies conducted by the ECB (Ferrari *et al.* (2020)) reveal that a digital currency could transmit the financial impact of policy decisions of one country across different nations. This effect occurs through currency substitution in economies whose currencies and economic fundamentals are found lacking. Further concern arises from this scenario as it presents an avenue through which global illegal activities such as funding terrorism or money laundering might exploit CBDCs.

CBDC might have an interest rate attached for several purposes, such as monetary stability, financial stability, and avoiding usage as an investment vehicle. This strategic decision could enhance its appeal within a digital landscape teeming with various digital currencies. However, this action could potentially contradict the central bank's primary goals. Central Banks, while acknowledging the reduced risk of CBDC compared to traditional bank deposits according to the literature, do not intend to outshine these banks; they continue playing an indispensable role in implementing monetary policy. Either the interest on CBDC may be permanently set or altered in due course. An apt comparison for a standard rate would likely be zero, resembling cash. Should remuneration vary, circumstances might necessitate adjustments to this rate potentially correlating with other central bank rates.

Various conditions may justify different interest rates: for instance, large CBDC holdings or international investors could merit lower rates. This approach potentially discourages the use of CBDC for investment purposes and stops a surge in foreign funds. Physical banknotes, due to their lack of interest cause unexpected effects, such as the varying preference of individuals depending on current central bank rates. Monetary policy could potentially benefit from the application of technology for providing interest on offline central bank money. However, extending interest to an offline digital currency would present unique challenges.

It would be critical for CBDC to possess legal tender status: its attractiveness then would not be determined based on features offered, resembling the various other electronic payment methods. If legal tender status is granted to CBDC, it implies universal acceptance and usability for all payments, perhaps through an offline device or a universally accessible digital wallet. Should CBDC attain legal tender status, its functionality across various payment systems becomes imperative. The rise of CBDC may prompt lawmakers to expand legal tender definitions, potentially incorporating online transactions. Such a strategy could enhance the CBDC's attractiveness and dissuade individuals from adopting alternative digital currencies.

Thus far, two methods facilitate the establishment of a digital currency: account-based in similarity to the modern banking system or as a bearer instrument, akin to cash. Within the account system exists an entity responsible for recording and verifying all transactions. These transactions are within the direct oversight of the central bank or via intermediaries it trusts. However, this method requires both parties and the verifying entity to be online. Conversely, in utilizing a direct digital form, transaction validation is managed by both the sender and receiver. The central bank does not directly manage this particular form; therefore, specific regulations such as user limits or transaction values can solely apply to the payment devices used. Furthermore, if this method of payment tools is chosen, a verification process confirming only authorized users are participating becomes imperative, as necessitated by central bank regulations.

Considering measures to restrict the excessive use of digital currency, monetary authorities could aim to forestall a mass transition from commercial bank money. As of the announcements of the ECB in September 2023, in the euro area, an upper limit on individual holdings is likely to be imposed when the digital euro is issued, thus safeguarding against surpassing a predetermined aggregate total. This necessitates identifying users upfront and eliminates any potential for anonymous usage, to prevent the circumvention of the limit by assuming multiple personas. A system could be implemented that sets users' maximum limit. When they receive payments pushing them beyond this threshold, an automated transfer of the surplus to their regular bank account could occur; however, it necessitates universal adoption--everyone must possess such an account.

Alternatively, the demand for CBDC could be managed through incentivization: if a user's balance in their account surpasses the predetermined limit - they might face less attractive interest rates or service charges. This approach empowers users to control their balances; however, it also discourages them from maintaining amounts exceeding this cap. When pursuing this incentive route, the complexity of offline payments increases as it involves variable remuneration systems. Different caps may be set for locals, foreigners, and businesses on the

amount of cost-free digital currency they may hold. However, under current monetary conditions, offering corporations unlimited zero-interest digital currency appears unachievable. If unrestricted access is offered at superior rates, it could provoke disruptions in the financial system and influence monetary policy. Two aspects could be addressed by implementing a tiered interest rate system: One, residents are permitted to possess an abundant yet restricted supply of CBDCs, ensuring that the rates do not fall below those for physical cash. Second, allowing unrestricted access for foreigners, without confining its use exclusively to local populations. When interest rates are positive, the task of granting users access to a zero-interest digital currency in such scenarios becomes markedly easier.

The equilibrium between personal rights and societal interest can dictate the degree of user privacy. Different payment methods present a spectrum of privacy levels, ranging from anonymous cash to thoroughly monitored bank transactions. Digital currency users would essentially enjoy transactional privacy if they did not undergo ID checks when first checking in with the system. However, current legal rules necessitate the tracking of electronic payments. Full privacy may not be attainable: legal constraints and user management--such as exclusion of foreign users or prevention from being misused as an investment vehicle—are potential obstacles. Despite initial ID verification for users, both the central bank and middlemen can establish varying privacy levels. Offline CBDC payments may provide complete privacy akin to cash utilization. However, certain transactions such as large-scale ones might necessitate user IDs. This system could enhance user trust through independent checks. Finally, the system operator may have full visibility over all CBDC transactions; however, they must still ensure user data protection – just as current electronic payments require.

A controlled and phased rollout rather than an outright unrestricted release contemplates constraining access to foreign citizens. However, it could potentially extend this consideration to visitors for only the limited duration of their stay. A digital currency without access restrictions would naturally accommodate international use. This strategy presents its unique dangers and it necessitates an alliance among central banks in a collaborative and collective stance. A restricted-access model for digital currency--if adopted--need not preclude international use. Tourists from foreign countries may continue using it even after their stay ends. However; this global proliferation raises concerns about currency substitution - particularly in foreign jurisdictions.

The introduction of a remunerated CBDC would face extra challenges. In a hypothetical scenario, the central bank must implement varying terms of remuneration based on factors like user location, residency status, or even nationality. For instance, this approach is applicable in discerning treatments for users from countries under international sanctions. The varying remuneration

rates of a certain CBDC could attract capital flows. This capital doesn't confine its movements solely within the CBDC realm; rather, it could significantly influence domestic-currency-denominated capital movements across the broader spectrum. A central bank that offers limitless investments in its CBDC could attract vast amounts of capital traditionally held as private money in other regions.

Users might utilize CBDC from the central bank or indirectly through supervised intermediaries. When accessing it directly, user services such as ID checks and support would be managed by the central bank. However, if supervised intermediaries are chosen to conduct this project, those services will be under their control. Using these intermediaries appears to be the superior choice; however, it remains imperative for the central bank to guarantee that such private services are up to central bank standards. Any actions must cultivate public trust in the digital currency. Intermediaries who provide the tech setup and user interfaces must ensure clarity in the status of CBDC as a central bank liability, thereby preventing any inadvertent creation of additional units.

Bilgen & Martin (2022) propose that concerning the economic aspects of CBDC, policymakers have two options: they can opt for limited or elastic quantities. This choice determines how central banks will adjust the amount of CBDC in circulation to align with their goals. Additionally, another aspect to consider is whether the digital currency should bear interest or not; either option is viable depending on specific monetary policy goals and objectives being pursued. Interest-bearing CBDCs provide a mechanism that enables steering through control over such rates and terms attached directly to transactions involving them. Usage also differentiates between CBDCs as either limited or universal; meanwhile, intermediaries play a pivotal role in examining cash-like versus deposit-like CBDCs. Political designs are split across three domains, into seven types: Ledger governance establishes the recipients of transaction access - this can range from exclusive central bank access to wide-ranging for multiple entities and individuals. Additionally, three application areas are identified: wholesale, retail, and a combined approach. CBDCs can in their legal aspect be with predetermined holding limits; others have no such restrictions.

Regarding technology factors for CBDC designs, programmability presents key distinctions: policymakers may opt for a programmable CBDC--enhanced with additional features via smart contracts; alternatively, they could choose a non-programmable CBDC akin to traditional electronic money. Moreover, the design of the ledger can take on several forms: it may be centralized—wherein all records reside under one authority's control—or adopt a semi-centralized, decentralized, or distributed model; each approach manifests varying levels of decentralization and spreads data across multiple points. The ledger architecture vividly demonstrates the central bank's involvement: Direct CBDCs enable users

to make direct claims from the central bank; however, indirect CBDCs function via intermediaries.

Various features highlight the operational aspects. The first feature is the varying operational structure: in a single-tier CBDC, all tech-related interactions with users are under the direct oversight of the central bank. Then, a multi-tiered or platform-based CBDC where intermediaries are involved in retail tasks for a two-tiered CBDC. Token-based CBDCs serve as digital cash, and account-based CBDCs directly link to a user's account; thus, the method of access varies. Further differentiating these is their operational presence: offline CBDCs function independently of internet connectivity—online capabilities require an ongoing connection for transactions. Regarding networks, scalability is examined. The limited CBDC is contrasted - capable of managing only a specific number of transactions at once - to its counterpart, the universal CBDC that can handle a significantly larger volume of concurrent transactions.

Infante *et al.* (2022) assert that a wide set of challenges accompanies CBDCs. The potential issues, varying based on their design, often elicit a common concern in the research: bank disintermediation. Disintermediation—when coupled with the rapid shifts that CBDCs make possible in financial assets—could disrupt accessibility to bank credit or pose a threat to financial stability. The introduction of CBDCs prompts the reevaluation of central banks' predominant role in finance: numerous studies imply that these institutions could extend their reach within the financial sector, potentially assuming a more pivotal function in aspects such as liquidity provision. Nevertheless, it must be underscored how significantly the projected outcomes from CBDCs hinge on their unique design characteristics. CBDCs, for instance, may exist in either token or account-based structures. The public and businesses can hold them directly—referred to as "retail" CBDC—or banks or fintech firms may manage them; this arrangement is known as an "intermediated" or “wholesale” CBDC. Whether universal or restricted to certain groups such as nationals or specific businesses, eligibility for holding a CBDC might apply accordingly. Moreover, potential limitations on CBDC supply might exist in terms of caps, transfer size, or frequency. One design aspect must be critically considered: how would remuneration for CBDCs occur - specifically concerning whether they would accrue interest and if so, is this interest fixed or variable based on holding size?

Various markets may find appeal in CBDC depending on its design elements and potential functions. For example, the attractiveness of a non-remunerated CBDC as a long-term store of value could diminish when market interest rates significantly exceed the Effective Lower Bound[1]. In these instances, convenience compared to other monetary alternatives determines whether individuals would

[1] Explained in the "Monetary Policy Transmission" section.

adopt CBDCs that are cash-like. Many studies frequently discuss the convenience benefit of Central Bank Digital Currency (CBDC), emphasizing its intangible advantage.

Simply stated, the issue of bank runs involving CBDC arises from the very similar functionality of bank deposits and digital currency. Often, solutions concentrate on reducing interchangeability between these two assets or imposing limits for one to substitute another. However, there are specific design features that can mitigate potential risks associated with a large-scale transition to CBDC. For example: some propose the design of a digital currency with low transfer limits, thereby reducing its suitability for large payments. Another concept involves structuring CBDC in such a way that its remuneration will diminish as held amounts escalate. Such a design could deter shifts from bank deposits to CBDC; simultaneously, it remains attractive for individuals maintaining small balances. Determining the precise design to discourage such shifts might pose a challenge, needing adjustments in response to market and technological changes. Mitigating these risks can also involve setting individual or overall limits on CBDC holdings.

Kumhof & Noone (2021) suggest principles to avert a potential mass transition from bank deposits to CBDCs. They highlight two key ideas: firstly, Central Banks would not guarantee an immediate exchange between CBDCs and other assets such as reserves; secondly, banks could not promise depositors instant conversion of their deposits into CBDCs. Thus, a clear division emerges between CBDCs and reserves which limits significant fluctuations between them. Their model implies the potential for price disparities among central bank assets, mitigated by market players. However, the events of March 2020 are noted, demonstrating that markets can be unreliable in non-normal times[2]. Fundamentally: it remains challenging to conceive of numerous central banks renouncing direct CBDC-reserve exchange – even if this entailed enhanced financial stability.

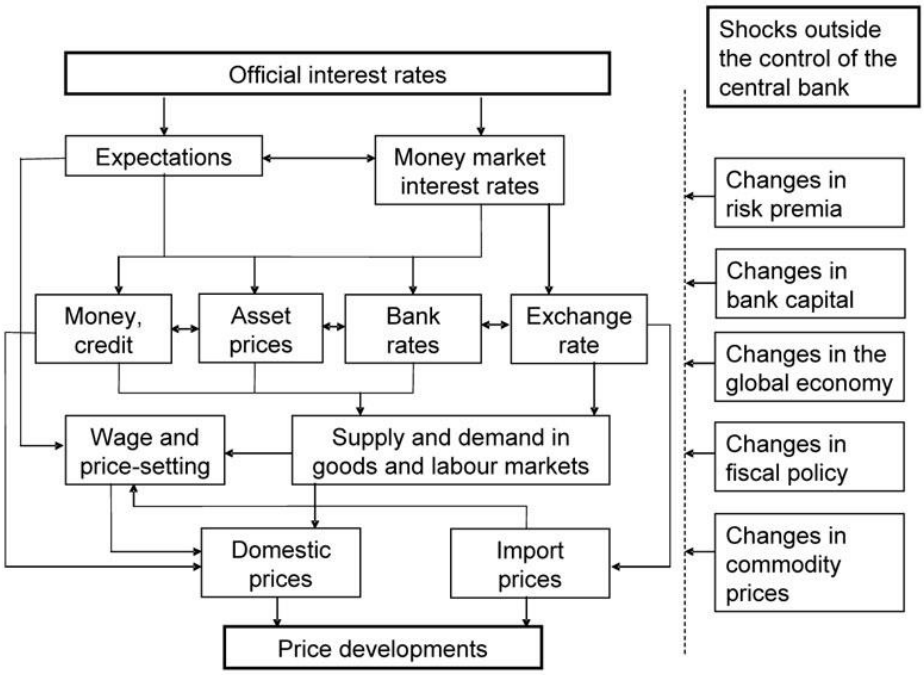
Bindseil (2020) concludes that should monetary authorities consider launching an easily accessible CBDC with appeal as a safe asset during market turbulence, potential concerns for financial stability will surface. Therefore, it is likely that incorporating risk management elements into this venture will be desired; possibilities might include tiered interest rates–or even limited holdings or usage volumes.

[2] The US Treasury market faced unprecedented volatility during the breakout of the pandemic, urging the heavy-handed intervention of the Fed to stabilize the situation.

3. IMPLICATIONS FOR MONETARY POLICY

a. IMPLICATIONS FOR THE TRANSMISSION OF MONETARY POLICY

The European Central Bank defines the mechanism of monetary policy transmission as "the process through which monetary policy decisions affect the economy in general and the price level in particular"[3].



Source: https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

The process of monetary policy transmission is intricate and involves various channels, encompassing:

- The money/credit channel: As the central bank decreases the policy rate, it reduces borrowing costs for businesses and consumers, encouraging increased investment and consumption, and ultimately contributing to economic growth.
- The asset price channel: A reduction in the policy rate can lead to higher asset prices, such as stocks and bonds, promoting increased spending.
- The bank lending channel: Lowering the policy rate can result in an increased supply of money from banks to businesses and consumers, fostering higher investment and spending.

[3] https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

- The exchange rate channel: A decrease in the policy rate may lead to a depreciation of the currency, enhancing export competitiveness.

During periods of downturn, central banks may opt to set policy rates to negative levels, charging commercial banks for holding their excess reserves. This is done to encourage commercial banks to provide credit to the economy, through the bank lending channel. In setting negative rates, central banks face the obstacle of the effective lower bound (ELB). Kimball and Agarwal (2015) propose that "the effective lower bound (or zero lower bound) materializes when a government authorizes the issuance of paper or coin currency, guaranteeing a fixed nominal interest rate of zero across all time frames, available in unrestricted quantities upon exchange for bank money. This establishes a minimum interest rate threshold, discouraging lending at rates significantly lower than zero." The effective lower bound historically has presented a substantial challenge for policymakers. Following the Global Financial Crisis, central banks implemented aggressive monetary policy measures, including cutting policy interest rates to historically low levels. However, as rates approached zero, the impact of further rate cuts on borrowing costs and spending diminished. At this point, central banks faced limitations in using conventional monetary policy tools to stimulate the economy. In response to this situation, central banks adopted unconventional monetary policy measures to address the issue of ELB, such as quantitative easing and forward guidance.

Kimball and Agarwal (2015) propose the introduction of an interest-bearing CBDC to eliminate the effective lower bound on nominal interest rates. This can be achieved by firstly implementing a digital currency as the unit of account in the economy and secondly a time-varying fee[4] on cash. The economy would be operating on two distinct fiat currencies at the same time, with a flexible but managed exchange rate between the physical and digital central bank liabilities. It is asserted that in times of negative interest rates, depositors would not be able to circumvent the intended effect of policymakers by withdrawing and storing paper currency. There would be no imposed limits on how low the interest rates could go, allowing central banks to boost the economy by further lowering rates, even in an already negative environment. However, Meaning *et al.* (2018) suggest that such a co-existence of central bank liabilities would not be realistic, as it would provoke confusion as to which of the two functions is the unit of account in the economy. If the usage of both currencies is widespread, quotation of prices in both media would be necessary, thus extracting a perhaps heavy administrative toll. Moreover, Meaning *et al.* (2018) think that the concurrent circulation of two fiat currencies would be problematic for monetary stability in general.

[4] According to the paper, the exchange rate between paper currency and electronic money can be established by levying a time-varying deposit fee on net deposits. This deposit fee would establish an exchange rate between paper currency and electronic money, and the rate at which paper currency trades (or "the exchange rate") will be equal to (1 - deposit fee).

Bordo & Levin (2017) outline a framework in which the implementation of monetary policy is radically reshaped by the adoption of a CBDC. The authors point to the elimination of the effective lower bound and of "inflation buffers" set by central banks, as well as the need for alternative monetary policy tools, such as quantitative easing[5]. The remuneration rate of the CBDC would be the main tool of monetary policy, with the implied secondary target of transparency and public accountability. Moreover, the authors warn policymakers and central banks against prolonged inactivity on the front of digital currencies. Potential consequences could include 1) loss of monetary control as the economy transitions from physical central bank liabilities to private-issued digital currencies, 2) systemic risks, as the payment system faces the risk of becoming quasi-monopolistic due to expanding economies of scale in the case that private entities don't face competition from a CBDC, 3) susceptibility to severe downturns. The post-GFC "new normal" policy rates are already lower than in the past, leaving even less room for central banks to maneuver in times of crisis until they are limited by the effective lower bound.

Meaning et al. (2018) suggest that the issuance of an account-based, universally accessible CBDC would have an uncertain effect on the transmission of monetary policy, but could possibly enhance it. The central bank could keep functioning as it does now, guiding the economy by adjusting the remuneration and the aggregate quantity of the digital currency. The introduction of competitive money to traditional bank deposits could affect the speed of pass-through[6], although this would depend on the degree to which CBDC would act as a substitute for deposits. The effect of changes to the policy rate would increase, mainly through heightened pass-through from policy rates to other rates of interest. Potentially, the range of policy rates set by the central bank to stabilize the economy could fluctuate less throughout the cycle. It is also noted that CBDC could bolster the potency of quantitative easing, as well as reinforce the bank lending channel of transmission by making bank funding costs more responsive to changes to the policy rate.

Ferrari *et al.* (2019) develop a theoretical model that simulates the effects of shocks and includes a home and a foreign economy. The authors suggest that the introduction of a CBDC may not only affect the issuing economy but also carry consequences for the international monetary system. Specifically, a CBDC can potentially reduce monetary policy autonomy in the foreign economy. The remuneration rate and the cross-border exchange rate are linked together[7]. As such, the rate of safe foreign assets essentially becomes a markup on the CBDC rate. Macroeconomic shocks can then be transferred across borders, increasing

[5] CBDC could allow policymakers to push market interest rates below zero in response to severe adverse shocks, providing an appropriate degree of monetary accommodation without resorting to measures like QE.

[6] How quickly changes in the policy rate are reflected in loan or saving rates and in the real economy in general.

[7] As the authors mention: "This is quite intuitive as households, for the same remuneration, strictly prefer to hold CBDC relative to a foreign bond given that the CBDC provides liquidity services. This leads to stronger exchange rate movements in response to shocks in the presence of a CBDC — foreign agents rebalance much more into CBDC than they would into bonds, if the latter were the only internationally traded asset, because of the CBDC's hybrid nature."

global interconnection. The authors note that this property of CBDCs heavily depends on their design characteristics. Limitations on holdings and transactions by non-domestic agents in addition to a dynamic remuneration rate can preclude loss of monetary control by the foreign central bank. Results also imply that adjusting the remuneration rate of the CBDC by following the Taylor rule[8], could be a more efficient way of limiting the international spread of volatility than quantitative restrictions. Finally, it is asserted that the aforementioned loss of capacity of the foreign central bank to implement its policies could point to a "significant first-mover advantage" in the introduction of a domestic CBDC.

A report released in 2020 by the Eurosystem ("Report on a digital Euro") concludes that CBDC would not enhance monetary policy transmission at this certain point in time, however it possibly could, due to future developments. CBDC should be remunerated at an adjustable rate from the central bank if it is to be used as a monetary policy tool. The authors find that since the central bank can modify the remuneration rate of a CBDC, the digital currency can be used to manage aggregate consumption and investment. However, the actual effectiveness of this process is not yet clearly understood. In the same manner, widespread CBDC adoption and substitution of cash could eliminate the effective lower bound on interest rates, but as long as cash remains a staple, ELB elimination is a tentative scenario. The usage of the digital euro as an investment vehicle is considered undesirable due to risks to the transmission of monetary policy, as the central bank is forced to widen the money supply to respond to high demand. Additionally, due to its digital nature, CBDC can have high day-to-day demand volatility, negatively impacting the ability of the central bank to estimate liquidity demand. This problem can be solved by implementing a floor mechanism, which would guarantee a certain minimum level of liquidity in the market. Lastly, the authors adopt the conclusions of Ferrari *et al.* (2020). where possible problematic effects on monetary policy transmission in underdeveloped, foreign economies are created, as the digital euro replaces the local currency and the foreign central bank loses control over monetary policy.

Malloy *et al.* (2022) conducted a stylized balance sheet analysis to determine the effects of a retail CBDC on monetary policy transmission. It is supported that those effects mainly depend on the state of the central bank's balance sheet as the CBDC is introduced to the economy, meaning the aggregate amount of reserve deposits that commercial banks hold to the central bank, as well as the current cost of capital. If the adoption of CBDC coincides with a relatively small balance sheet, the interest rates may rise due to the shift of traditional reserves to digital currency. Substitution could lead to a decrease in the total commercial bank deposit supply, thus resulting in higher interbank lending rates. On the other hand, if the Federal Reserve’s balance sheet is initially large, meaning an ample quantity of reserves is available, then the impact of substitution of traditional deposits to CBDC would be smaller. The authors also argue on how already existing monetary policy tools can be implemented to control unwanted effects of CBDC issuance. Open market operations, where the central bank expands its balance sheet, could be used to mitigate the drop in the aggregate

[8] The Taylor rule is a guideline used by central banks to set their target interest rates. It provides a systematic way to adjust interest rates in response to changes in economic conditions.

supply of reserves. Adjusting the interest on reserves to attract deposits from commercial banks is another way to maintain an appropriate quantity. Central bank lending rates like the discount window and the standing repo facility, can be used accordingly to offset the lack of liquidity after the CBDC introduction, by making it easier for commercial banks to acquire funds.

Keister and Monnet (2022) suggest that in times of distress, outflows from commercial bank deposits to CBDC can be tracked and used as a means of monitoring the state of the financial system, providing real-time information to policymakers, and implementing monetary policy in a timelier manner. Financial institutions possess confidential information about their solvency and liquidity. Bound by the process of maturity transformation, they require continuous funding from depositors and short-term lenders, particularly in periods of stress. There are possible incentives for banks to withhold information from the public and regulators about their position in the case it is vulnerable, hence policy responses are delayed. Through the tracking of digital currency flows, the monetary authority can expedite the extraction of conclusions. Policymakers, according to the authors, can adopt policies based on CBDC that improve welfare compared to the best viable policies available without the existence of a digital currency.

According to Infante *et al.* (2022), if the design of CBDC renders it a substitute for traditional deposits, it could reduce the demand for short-term safe assets such as sovereign bonds. The neutral interest rate that neither stimulates nor slows economic growth would be higher. Central banks would need to raise policy rates to create demand for short-term, risk-free assets, while at the same time making commercial bank lending more expensive, thus maintaining equilibrium. A higher neutral rate would reduce effective lower bound episodes. In addition, the authors propose that short-term interest rates would be affected more than long-term interest rates, perhaps due to their higher sensitivity to demand changes.

Mishra & Prasad (2023) construct a general equilibrium model with an account-based, remunerated CBDC. They conclude that demand for digital currency does not approach zero when negative policy rates are imposed by the monetary authority, as it continues to carry advantages as a medium of exchange. CBDC offers the ability to the central bank to set negative rates directly on private money to counteract a deflationary environment and bypass the effective lower bound. Even when it is negatively remunerated, according to the authors, it offers lower transaction costs and faster payments by eliminating intermediaries, as well as greater security due to its nature as a central bank liability. In addition, it is supported that holdings in digital currency can be strengthened by government taxation of cash holdings and implementation of countercyclical helicopter drops of CBDC.

b. IMPLICATIONS FOR THE BANKING SECTOR

In the modern financial system, banks play a fundamental role in multiple ways. They can create liquidity through the process of maturity transformation, in which they fund long-term, illiquid assets through short-term, liquid liabilities. This process raises the availability of private credit in the economy and thus the aggregate level of investment and consumption. Furthermore, banks contribute to financial stability and in the management of risk that economic activities carry, by assessing the creditworthiness of potential borrowers. They also perform the vital task of matching borrower and lender preferences thus increasing economic efficiency, as well as promoting financial inclusion by providing access to banking services.

One of the more widespread concerns about the introduction of a central bank digital currency (CBDC) is the risk of bank disintermediation. Commercial banks might get bypassed by customers searching for traditional financial services like deposit-taking. Indeed, a remunerated CBDC can act as a substitute for bank deposits and reduce demand. To counteract this phenomenon, banks may choose to raise their deposit interest rates in order to attract depositors, increasing their funding cost for providing loans and lowering their profit margin. A possible result, as loans become more expensive and the traditional banking business model comes under stress, is the reduction of available liquidity in the economy and the reduction of total investment and consumption. However, most of the research coming out in recent years seems to not corroborate the aforementioned.

Meaning *et al.* (2018) propose that the introduction of a central bank digital currency (CBDC) will likely not lead to bank disintermediation through the aggregate reduction of deposits, as central banks control on what degree CBDC will act as a deposit substitute. In addition, it is suggested that CBDC may reduce the probability of bank runs, as in times of disruption, depositors with a low tolerance for (real or perceived) deposit credit risk will have already made the gradual switch from bank deposits to digital currency as soon as CBDC is available. The proposed means of management of bank run risk and degree of deposit substitution by the authors are frictions like notice periods, transfer limits, and fees.

Chiu *et al.* (2019) developed a general equilibrium model with imperfect competition in the deposit market, calibrated on U.S. data. Two points are asserted, first that a (remunerated) CBDC does not necessarily cause disintermediation, second that CBDCs should be judged not based on their adoption and usage, but on their effect on deposit and lending rates or quantities. Banks with market power limit the supply of deposits to lower the rate of deposits[9]. A CBDC with remuneration creates increased competition, leading to increased deposits and loans. When the interest rate is set between an intermediate range (0.30% to 1.49%), it can lead to increased deposits and lending, as well as to decreased loan interest rates. (At the maximum, CBDC increases checkable deposits and loans by 1.57% and reduces the loan rate to around 3.10% from about 3.70%). However, If the remuneration rate is too low,

[9] A reduced number of potential depositors means that banks can offer reduced deposit rates as demand for deposits by customers is high while supply remains low.

then the CBDC does not affect the equilibrium. If the CBDC rate is too high, disintermediation occurs.

Brunnermeier & Niepelt (2019) construct a generic model of money and liquidity. They suggest that CBDC issuance in combination with central bank funding to commercial banks which passes through to the real economy, may lead to a decreased risk of bank runs and might not necessarily mean a shortage of credit and general financial instability. The suggested findings seem to contrast the argument that the introduction of CBDC could lead to a reduction in the demand for bank deposits, which could in turn lead to a decrease in the availability of credit. The authors imply that this concern may be overstated, and contend that CBDC can be introduced in a manner that aligns with the existing financial system, without posing a risk to financial stability.

Kim and Kwon (2019) develop a general equilibrium model in which competition between commercial bank and central bank deposits exists, with a remunerated, account-based CBDC. The study proposes that the introduction of such a digital currency may lower the credit supplied by commercial banks, which may in turn raise the nominal interest rate of loans and decrease the reserve-deposit ratio[10] of commercial banks. Thus, the possibility of bank runs in which commercial banks will be lacking liquidity might be higher even in the presence of minimum reserve requirements. On the other hand, once the central bank is able to supply commercial banks with funds equal to the deposits that shifted to central bank liabilities, this can potentially increase the aggregate quantity of private credit, as CBDC deposits do not require reserves and can be loaned at 100%.

Keister and Sanchez (2019) built a New Monetarist model in the style of Lagos and Wright (2005). They conclude that while a remunerated CBDC causes a reduction in the aggregate level of investment in the economy due to reduced lending by commercial banks, it also encourages an increase in the levels of trade. A digital currency may lead to shifts from traditional bank deposits to the new medium as agents are attracted by its rate of return, thus raising the funding costs of the banking sector. The authors support that the introduction of a CBDC can either increase or decrease welfare, depending on the choices of the issuing central bank. Setting the remuneration rate to maximize welfare ensures that CBDC cannot decrease welfare, as the rate can be adjusted accordingly. When the convenience of investing is high, the monetary authority might choose a high interest rate, to make the usage of the digital currency widespread. On the other hand, if loan rates reach high enough levels that reduce welfare, the remuneration rate should be decreased with the aim of making deposits more attractive thus reducing bank funding costs.

Andolfatto (2020) constructs a monopolistic banking sector model. The author asserts that the introduction of a CBDC has no negative effects on private credit supply and under specific conditions it may even cause a total increase. The monopolistic commercial bank matches the deposit rate of the remunerated

[10] Banks will have to fund their loans with diminished deposits, so they must charge a higher interest rate to maintain their profit margin. In order to keep loan rates relatively low while having fewer deposits, might need to keep fewer reserves, hence increasing liquidity risk.

CBDC to compete, losing profits and making depositors indifferent to which medium their deposits are held on. As such, the bank offers better services to depositors with the aim of attracting them, expanding the deposit base through incentives for existing depositors to save more, and unbanked individuals to access the banking system. It is implied that as long as commercial banks are able to acquire funding through the central bank, a prudently designed CBDC is not likely to reduce private credit or threaten financial stability.

A report released in 2020 by the Eurosystem ("Report on a digital Euro") proposes that the introduction of a CBDC can potentially have adverse effects on the intermediation capacity of commercial banks as well as financial stability. Contingent upon its design characteristics, it might cause depositors to shift from commercial bank deposits to central bank liabilities, increasing the cost of funds for banks and thus the loan interest rates. This will lower private credit available in the economy, diminishing aggregate levels of investment and consumption. To mitigate this effect, commercial banks could either provide incentives to depositors through additional services or borrow from the central bank while putting up adequate collateral. The latter will likely cause rates for safe assets to rise as demand for collateral rises, in addition to higher risk exposure for the central bank as its balance sheet expands. The authors also mention that the diminishing of the role of banks as deposit-accepting institutions might lessen the extent to which they can assess the creditworthiness of their clients, as well as the possibility that commercial banks will follow riskier strategies in order to restore the profits lost to CBDC, hence harming financial stability.

Auer *et al.* (2021) argue that commercial banks are impacted negatively by the issuance of a remunerated CBDC, as to prevent depositors from shifting to a more attractive digital currency, they need to adjust the deposit rates thus making deposits more expensive as a source of funding. In a banking system of perfect competition, banks cannot absorb the increased cost and they pass it through to borrowers, decreasing aggregate lending and investment. In an imperfectly competitive environment, introducing CBDCs with moderate remuneration, as shown by Chiu *et al.* (2019), can lead to better allocative efficiency[11] and even increase aggregate investment as deposits become more attractive. In the case that a CBDC gets launched, central banks can decrease the lending facility rate for commercial banks to balance the increased cost of deposits. The writers accept the conclusion of previous studies such as Brunnermeier and Niepelt (2019) that under specific conditions the equilibrium of a no-CBDC economy can be also achieved with a CBDC in circulation.

Kumhof & Noone (2021) indicate that under a set of specific principles, the introduction of a CBDC need not necessarily lower bank funding as well as decrease credit and liquidity available to the private sector. Additionally, the systemic risk of bank runs may decrease. One novel principle the authors suggest is that no guaranteed convertibility of bank deposits to CBDC at commercial banks is instituted, and by implication at the central bank. This will encourage the creation of a private market of free exchange between deposits and CBDC,

[11] Higher allocative efficiency refers to the ability of an economic system to allocate resources in a way that maximizes overall welfare or utility.

with arbitrageurs ensuring that prices will be kept in line. The market dynamics will ensure through demand and supply equilibrium that bank runs are discouraged. However, as noted by Meaning *et al.* (2018) the option of exchanging commercial bank money for central bank money at par should always be present, as it is a foundation of trust in bank deposits, and many central bank functions such as liquidity regulations, deposit insurance and lender of last resort aim to support this option.

Burlon *et al.* (2022) develop a micro-banking DSGE model that includes various expected effects of a CBDC introduction to bank intermediation and the economy. They conclude that specific CBDC policy requirements that maximize welfare are potentially effective at lowering the risk of bank disintermediation and lead to significant welfare gains for both CBDC-holding and non-holding households. According to the authors' quantitative results, the optimal amount of CBDC circulation in the Eurozone is between 15% and 45% of quarterly real GDP in equilibrium, while it would reach approximately 65% in the case of issuing without quantity limitations. As additional support to the hypothesis that the actual effects of a CBDC on private credit supply depend on its design characteristics, evidence from bank stock valuations in the eurozone is presented, suggesting that stock prices depend on market opinion about: 1. the amount of circulating CBDC and 2. reliance of banks on deposit funding.

4. IMPLICATIONS FOR GEOPOLITICAL EQUILIBRIUM

a. MONETARY SOVEREIGNTY

Tentori and Rosa (2021) propose that the issuance of currency in circulation has been closely linked with the notion of "sovereignty," which signifies the highest authority within a specific area. This has historically connected the state with symbols like its flag and the currency issued by the governing body of that territory. When the exclusive right to issue currency in circulation was granted to the central bank, the institution itself emerged as a representation of sovereignty, acting as the supreme authority in matters of currency within its jurisdiction. Hence, the introduction of central bank digital currencies (CBDCs) by a nation's central bank serves as a means of reaffirming the nation's sovereignty over its virtual monetary realm. This is supported by Boros and Horváth (2022) as China initiated its CBDC research to safeguard monetary sovereignty due to concerns about cryptocurrencies and Facebook's Libra project.

According to Peruffo *et al.* (2023), the rise of private digital currencies has sparked discussions about the potential to challenge the state's monopoly on monetary issuance and financial regulation. However, private agents lack attributes of public authorities, like the ability to establish and enforce legal systems. They operate under public authority jurisdiction and cannot pay taxes with their self-issued currency. Private money's inability to serve as legal tender for a sovereign entity hinders its role as a unit of account. Despite its temporary

viability as a value reserve among private actors, it ultimately cannot function as a comprehensive currency. The study then examines the concept of dollarization, which represents a form of monetary invasion from foreign state-issued currencies, where a currency's reach extends beyond its issuing state's borders. “Dollarized” states might face challenges in enforcing their monetary norms, and in some instances, might be forced to officially adopt the use of foreign currencies, potentially impacting the autonomy of their policy decisions.

Addressing concerns in the 2020 "Retail Payments Strategy for the EU" published by the European Commission, the study acknowledges risks associated with the rapid adoption of cashless payments and the dominance of foreign players in the EU's domestic and cross-border payment market. Despite these concerns, previous attempts to establish a pan-European card scheme have encountered challenges. The European Payments Initiative (EPI), launched in 2020 by a consortium of European banks to create a unified European payment solution by 2022, has faced difficulties. Although politically endorsed by the European Central Bank (ECB) and the European Commission, the EPI has encountered setbacks, with several banks withdrawing from the project. As of December 2021, only French, Belgian, and German member banks expressed a commitment to continuing with the EPI initiative.

Edwards (2021) delves into three key questions for emerging markets (EMs) that CBDC issuance raises, from the scope of monetary sovereignty: 1. If an EM adopts CBDC, how will it impact monetary policy and financial markets? 2. How do CBDCs affect overall regulations, especially macroprudential policies, in the issuing country? 3. What are the repercussions if major advanced economies (AEs) like the U.S., Eurozone, U.K., or Canada adopt CBDCs and allow cross-border transactions? The author cites Milton Friedman’s opinion that a stable demand for domestic money is crucial for effective monetary policy. Foreign CBDCs and Global Stable Currencies could promote currency substitution and amplify vulnerabilities arising from currency mismatches. These developments might limit the effectiveness of monetary policies set by EM central banks. In the absence of proper safeguards, they may facilitate illegal financial flows and complicate the enforcement of exchange restrictions and capital flow management measures. Additionally, sudden currency value fluctuations can heighten the susceptibility of the domestic financial system, impacting the ability of businesses with foreign currency-denominated debts to fulfill their obligations to banks and other financial intermediaries.

Per Sewall & Ming (2022), CBDCs provide central banks with direct and instant access to the digital history of currency transactions, encompassing transaction specifics like amount, timing, origin, and recipient. It may be possible that monetary incursions will be turning into matters of national security. Therefore, as states develop CBDCs, they must meticulously address concerns related to data privacy and security, ensuring measures are in place to safeguard this extensive repository of information.

b. FIRST-MOVER ADVANTAGE

Ferrari *et al.* (2020) support that the presence of a CBDC appears to create imbalances in the global monetary structure. A nation possessing a robust economy and currency has the potential to dominate the monetary sphere of a less economically stable nation, leading to currency substitution. Consequently, this may restrict the central bank of the less stable nation from making autonomous monetary decisions, while such limitations are observed for the "invading" nation. As a result, the timely introduction of a CBDC could yield a substantial first-mover advantage of monetary influence to pioneering states.

Isaacson et al. (2022) find that current literature does not seem to suggest a first-mover advantage concerning the introduction of a CBDC in the domestic or international payments market and payments technology market. Additionally, no effects are expected on the reserve currency and assets market. The rapid change in markets and technology makes long-term competitive advantage improbable. The authors suggest that for central banks would be preferable to focus on appropriate policy end-goals and digital currency designs rather than targeting their efforts on being the first to issue a CBDC.

In the realm of global digital competition, Bilotta & Voloder (2023) propose that countries are actively pursuing a first-mover advantage to influence development models and standards, potentially culminating in an asymmetrical international monetary system. With an emphasis on international cooperation, Beijing aims to capitalize its frontrunner advantage by establishing the benchmarks through their CBDC initiatives. Only as recently as 2021, Western countries—specifically the G7--sought to wield their influence over CBDC development through policy principles. The study underscores a striking disparity between mobile phone ownership and bank account access in Africa; this contrast presents rich potential for e-CNY internationalization on the continent. In pursuit of its objectives, Beijing aims to integrate the e-CNY with Belt and Road Initiative partners' international mobile banking market. The e-CNY's potential as a settlement currency may incite demand for minor retail payments. In an effort towards equilibrium and leveraging its regulatory expertise in the digital landscape along with trusted international standing for credibility, EU undertakes developing an alternative: a privacy-ensured and reliable cross-border digital currency. The study also highlights that implementing negative interest rates and imposing restrictions on deposits and transactions might render global adoption of the digital euro impractical.

In her 2022 publication, Shagina asserts: The People's Bank of China's exhaustive research has afforded China a first-mover advantage in the CBDC arena; consequently, the digital renminbi will likely be a catalyst for heightened global adoption of Chinese currency. This edge potentially positions China to not only influence but also determine digital currency design and standards on an international scale – thus further consolidating their sway over this market. A strategic move like incorporating their digital currency into Belt and Road Initiative may foster cross-border interoperability. Dethroning the US dollar, however, necessitates substantial transformations for China: in order to internationalize the digital yuan, Beijing must embark on domestic regulatory, governance and institutional reforms. Yet in terms of foreign participants China's financial markets still maintain their restrictions and exhibit weakness.

Attracting foreign investments may be an issue of loosening capital controls; however, it remains crucial to the financial stability of the Chinese export economy that they retain control over exchange rates. Deterrents also include geopolitical and geo-economic concerns: policies in Xinjiang and Hong Kong directly influence these investment decisions. If China removes these limitations it would significantly clear a path for its CBDC. The foundational element of currency ultimately remains unchanged, despite its digital nature; paramount importance is still placed on trust in the issuing entity. If this trust wavers, digital renminbi could become just as undesirable as its physical counterpart.

c. CURRENCY INTERNATIONALIZATION

Currency internationalization refers to the process by which a country's currency becomes widely used in international trade, finance, and as a store of value. The focal point of the discussion occurring around CBDCs is the status of the US dollar as a global reserve currency and its potential disruption by emerging rival, China's renminbi (RMB) through its digital form, the e-CNY. The increased use of a currency in international transactions can provide economic and geopolitical benefits to the issuing country, including reduced transaction costs, increased demand for the currency, and enhanced global influence. There has been a notable gap between the size of the Chinese economy and the influence of its currency on the global stage. This section attempts to investigate the economic and geopolitical factors that impact currency internationalization, as well as potential causes of the aforementioned gap according to the literature, providing insight into the evolving dynamics of international monetary systems in an increasingly digital world.

Boonstra (2022) supports that the international position of the US dollar remains dominant, but its unassailability is gradually eroding, partly due to changes in the US international asset position. As the world's largest debtor in absolute terms and with a sharply deteriorating international asset position as a percentage of GDP, the US finds itself in a two-way relationship. While the dollar's centrality in international trade and investments allows the US to finance its foreign liabilities in its home currency, any decline in the dollar's importance as an international trade currency could lead to the US having to finance some of its international obligations in foreign currency. This shift could accelerate the dollar's decline and potentially result in a significant depreciation of the US currency against other major currencies. On the other hand, concerning the euro, China's strategic efforts to promote the use of its Digital Currency Electronic Payment (DCEP or e-CNY) in Africa could be interpreted as a targeted action aimed at undermining the position of the euro. By seeking to establish the renminbi as a trade currency in Africa, China may be aiming to challenge the dominance of the euro, particularly in regions where the European-oriented CFA franc is viewed as a relic of colonial times. As the renminbi gains importance as a trade currency, it could also gain traction as a reserve currency, further challenging existing global currency dynamics.

Boros & Horváth (2022) assert that the international expansion of China's (digital) currency encounters significant challenges, primarily stemming from aspects related to the Chinese exchange rate and financial system. One key factor is the managed rate of the yuan, which operates within a specific currency band and is anchored to parity against a currency basket. This arrangement has inherent limitations as it ties yuan issuance to some extent to the US dollar. Furthermore, the movement of financial capital between Mainland China and the global economy faces hindrances due to Chinese capital restrictions. These restrictions impede the establishment of a deep and liquid market for the Chinese yuan (CNY), which is crucial for its successful transition into a global reserve currency. According to the authors, China's historical economic model, which relied heavily on export-driven growth until the 2010s, also poses challenges. The persistent external surplus characteristic of this model has limited the availability of international yuan liquidity[12]. However, with the adoption of the new dual circulation model, which prioritizes domestic consumption, the conditions for yuan outflows from China are expected to improve over time. Lastly, it is noted that the acceptance and adoption of China's digital currency, the e-CNY, are influenced by geopolitical considerations and trust. In particular, concerns revolve around the potential information flow to Beijing through the digital currency. The West may be reluctant to embrace a currency that provides real-time economic data to China, as it could undermine its ability to impose sanctions and potentially compromise its economic and strategic interests.

In his 2022 speech delivered at the Harvard National Security Journal's Symposium on Digital Currencies and National Security, Daleep Singh emphasizes the importance of the United States taking a leading role in the development of a U.S. CBDC from a national security perspective. The speech highlights that while a finished CBDC product or a final decision to issue one may not be required at this stage, it is crucial to have a well-defined technological model. The most critical reason for the U.S. to develop a CBDC, according to the speech, is to reinforce the primacy of the U.S. dollar in the global financial system. The speaker emphasizes the need to connect the dots between the potential loss of dollar primacy and the geopolitical and economic motivations of other countries, particularly China, to challenge the dollar's status. The example of China's focus on cross-border payment technology is used to illustrate this point, contrasting with the inefficiencies in the current international wire transfer process and the potential benefits of a distributed ledger technology (DLT)-based infrastructure for reducing costs and processing times. The speaker explores a scenario in which China's cross-border payment technology gains traction, leading to a higher share of cross-border transactions denominated in renminbi. This could lead to increased renminbi deposits and financial claims held outside of China, potentially strengthening the renminbi's role as a unit of account and store of value. Overall, the speech underscores the need for the United States to prioritize the development of a CBDC not only for economic

[12] When a country consistently exports more goods and services than it imports, it accumulates foreign currency reserves from its trading partners.

reasons but also as a national security imperative, particularly in the face of evolving global dynamics and potential challenges to the dollar's dominance.

Sewall & Ming (2022) examine the implications of CBDCs and their potential to introduce a shift in the global financial system's power dynamics. The authors highlight that, regardless of China's intentions, its role as a pioneer in CBDCs could facilitate the gradual reshaping of certain aspects of the international financial system to align with Chinese Communist Party (CCP) interests. CBDCs have the capacity to disrupt elements of the current international financial system, which has significantly benefited the United States and bolstered its global influence. The existing prominence of the U.S. dollar as the preferred reserve currency grants strategic advantages, ranging from reduced borrowing costs to the ability to influence global norms through sanctions enforcement. One potential outcome of CBDC adoption is the ability of a government to expand the usage of its currency beyond its borders, facilitated by real-time settlement that eliminates the need for intermediaries like credit card companies, SWIFT, or mobile payment platforms. Moreover, governments can utilize CBDCs to establish new localized cross-border payment systems, encouraging commercial reliance on their national digital currencies. Additionally, the paper emphasizes that states that lead in technological innovation have historically taken the lead in shaping international standards governing such technologies. This raises questions about whether the United States can effectively guide the global transition to CBDCs if China assumes the role of the primary CBDC pioneer.

Heijmans & Dekker (2023) discuss the argument that the limited role of a currency on the global stage in relation to the size of its economy reflects a lack of trust in the country's political and institutional framework. This notion highlights the importance of trust in institutions, particularly central banks and governments, in influencing the global acceptance of a currency. The authors point out that China, despite its economic significance, faces challenges in establishing the international credibility of its currency, the renminbi (RMB). Decades of policy decisions, such as strict capital controls and opaque exchange rate manipulation, have also limited the foreign use of the RMB and hindered its path to internationalization. Furthermore, while internationalizing a national currency may facilitate fund mobilization and lower foreign currency risks and costs, it could also lead to its appreciation on foreign exchange markets. negatively impacting exports, potentially leading to trade imbalances and financial dependencies. The authors delve into the e-CNY's technological aspects, particularly its "programmable" nature through smart contracts, inspired by Ethereum's decentralized cryptocurrency model. The PBoC's adoption of smart contracts has enabled traceable and self-executing programs that enhance transparency, reduce transaction costs, and eliminate intermediaries. Case examples, such as invoicing private tutoring lessons and apartment-rental supervision using e-CNY-based smart contracts, exemplify its extended functionality beyond a mere cash substitute. These features grant the PBoC greater control over spending behavior and offer insights into the PBoC's ability to access transaction-related personal information, albeit with "controllable anonymity”.

Peruffo *et al.* (2023) highlight the longstanding tension arising from the disparity between China's significant economic stature and the limited international use of its currency. The study emphasizes that the internationalization of a currency is a complex process influenced by both economic factors and the distribution of power in the international system. While economic size and market preferences play a role, the international use of a currency is inherently tied to the political power of the issuing state. The authors argue that even in the era of emerging private cryptocurrencies, the power of states in controlling and shaping currency dynamics remains pivotal. The e-CNY's introduction is situated within the broader context of China's ambitions to enhance its currency's international appeal. While the digital form of the renminbi does not alter its underlying nature, it provides opportunities for the currency to occupy spaces that traditional physical currencies cannot. The authors acknowledge that China's CBDC is unlikely to pose an imminent disruption to the current international monetary system. Despite China's economic rise, the dollar's role in global transactions remains substantial due to a lack of viable alternatives. While the digital yuan's emergence warrants attention, it is essential not to overestimate its immediate impact, as various factors, including economic and geopolitical dynamics, continue to shape the international currency landscape.

Kumar (2023) examines emerging challenges associated with cross-border experiments involving CBDCs. One primary challenge is the need to harmonize legal and regulatory guidelines across different jurisdictions. The study notes that legal issues encompass the basis for transferring and issuing CBDCs, which ultimately determine the validity of transaction settlements. Regulatory obstacles include disparities in privacy, cybersecurity, digital identification, and other standards among countries. These variations in standards will influence the design choices made and how effectively they align with expectations. The question of overall governance also arises, drawing a parallel to the cooperative model followed in the case of SWIFT. Questions are raised on how governance will evolve as countries advance in their CBDC development as well as the challenge of reconciling mismatched incentives inherent in these CBDC experiments.

Sandner & Gross (2023) claim that by facilitating convenient, cost-effective, and swift cross-border transfers via digital devices, digital currencies could enable non-domestic actors to access domestic currencies efficiently. This accessibility could elevate the global significance of the issuing country's currency, as seen in the potential impact of the digital yuan in China, on businesses exporting to China or operating in collaboration with Chinese enterprises in resource-rich regions like Africa. The digital yuan's infrastructure could potentially host other currencies, such as the euro or the US dollar, alongside the yuan. This could have implications for the dominance of the US dollar and the role of the euro in the global financial system, potentially leading to a more prominent role for the yuan. While the exact scope of the Chinese CBDC's application is not entirely clear, it is plausible that it is designed for use within the economy, industry, and the capital market. Initial test projects related to the digital yuan have been carried out, particularly concerning international payments for imports into China, which could impact European exporters who may need to interface with the Chinese payment infrastructure for invoice settlements.

d. FINANCIAL SANCTIONS

Financial sanctions are economic penalties imposed by governments or international organizations on individuals, organizations, or countries and they are designed to disrupt the targeted entity's financial functions. There is a growing debate about the potential impact of CBDCs on the effectiveness of financial sanctions. Some experts argue that CBDCs could make it more difficult to enforce sanctions, as they would allow sanctioned entities to make payments without using the traditional financial system, which is dominated by the US dollar and strongly influenced by the United States. Others argue that CBDCs cannot really alter the current US-centered status quo of cross-border transactions, thus having little to no power in reducing the effectiveness of sanctions.

Shagina (2022) asserts that Central Bank Digital Currencies could have an impact on the efficacy of American sanctions by reducing the use of the US dollar in cross-border payments. The US Treasury's 2021 Sanctions Review acknowledges the risk posed by digital currencies and alternative payment platforms. This possibility, though initially limited, could have more substantial implications over the long term. The author contends that Russia's cross-border payments heavily rely on Western financial infrastructure like SWIFT, with transactions mainly settled in US dollars. Transactions involving a US correspondent grant the Office of Foreign Assets Control (OFAC) jurisdiction for sanctions enforcement. China, on the other hand, boasts an advantage in the form of widespread cashless payments facilitated by platforms such as WeChat and Alipay, enhancing the adoption of the digital renminbi. The compatibility of Russian and Chinese CBDC models offers a foundation for potential international payment arrangements. While separate governance and infrastructure would be established by central banks, common standards, and data requirements could streamline transactions. However, past efforts at cooperation between Russia's System for Transfer of Financial Messages (SPFS) and China's Cross-Border Interbank Payments System (CIPS) have seen limited success. A Memorandum of Understanding was signed in 2019, yet progress remained largely at the technical consultation level. The asymmetry between the two systems, with more Russian banks connected to CIPS than Chinese banks to SPFS, underscores the mistrust, concerns over financial sovereignty, and the reluctance to share payment information that hinders successful collaboration.

According to Boros & Horváth (2022), the desire for a geopolitical role of the Chinese digital currency is evident, amplified amidst the Russia-Ukraine conflict. China's concerns over Western sanctions against Russia have underscored the vulnerabilities of dollar reserves and the reliance on SWIFT. Zhou Xiaochuan, former governor of the People's Bank of China (PBOC), has indicated the feasibility of replacing SWIFT. While not aimed at replacing the USD, the digital yuan could enhance China's maneuverability in monetary and financial matters. The authors claim that the e-CNY, in connection with multilateral CBDC platforms, presents a significant challenge to the dollar system. Offering a direct,

swift, and cost-effective payment solution, it emerges as an attractive alternative. Beyond aiding in bypassing Western sanctions, the e-CNY's adoption holds the potential to accumulate substantial transactional information, aligning with the evolving role of money as a store of information.

Boonstra (2022) supports that the global financial messaging system, SWIFT, facilitates swift and reliable transactions, but it is largely under the control of the United States due to the predominance of the dollar, involvement of US banks, and use of US software within its operations. This influence empowers the US to monitor and exclude countries from SWIFT, as exemplified by compliance with US sanctions on Iran despite EU non-participation. Central bank efforts to interconnect national CBDC systems could potentially offer an alternative settlement mechanism outside SWIFT, enhancing the EU's autonomy from the US. This would enable European companies to bypass US sanctions and align with EU political positions. China's digital renminbi, the e-CNY, presents a pathway for foreign parties to transact directly using e-CNY. Additionally, in response to prior sanctions, Russia developed an alternative to SWIFT, SPFS, in collaboration with countries like Belarus, Kazakhstan, Turkey, and Iran. Integration discussions between SPFS and China's CIPS (Cross-Border Interbank Payment System) suggest the potential to establish a network enabling trade between affected nations independently from the US. As this system matures, it could undermine current sanctions against major oil-exporting countries like Russia. Some German and Swiss banks have already linked to SPFS, further indicating its growing relevance.

Sewall & Ming (2022) state that the adoption of CBDCs has the potential to disrupt key components of the international financial system, posing challenges to U.S. financial influence and norms of international behavior. The SWIFT messaging service, instrumental in facilitating cross-border money movement and enforcing financial sanctions, is identified as a vulnerable target for disruption. CBDCs, with their ability to facilitate seamless cross-border transactions, hold the promise of reshaping global payment systems. However, they also raise concerns about the potential fragmentation of these systems and the emergence of spheres of financial influence, particularly a Chinese sphere aimed at reducing reliance on the U.S. dollar and mitigating exposure to U.S.-led sanctions. China's efforts to promote its currency's international use are multifaceted, encompassing initiatives like the Belt and Road Initiative, the proliferation of Chinese mobile payment platforms, and the establishment of alternatives to SWIFT, such as the Cross-border Interbank Payment System (CIPS). The integration of CIPS with CBDCs, especially the digital e-CNY has the potential to further streamline international payment processes. The authors note China's partnership with SWIFT to enhance functionality in international transactions, while concurrently exploring alternatives that leverage the capabilities of the e-CNY. China's participation in the Multiple CBDC (mCBDC) Bridge Project, aiming to establish a multi-currency cross-border payment system, further underscores its collaboration with other Asian nations.

Heijmans & Dekker (2023) note that the digital yuan (e-CNY) operates within constraints, as its issuance requires an exchange of fiat currency with the People's Bank of China (PBoC), making it a digital representation of the national

currency rather than a new currency. Only the PBoC recognizes it as legal tender, with an exchange rate mirroring the renminbi's and utilizing established financial infrastructure like SWIFT, a global banking messaging system. This design aligns the e-CNY's international trajectory with the fate of the renminbi, diminishing its suitability for evading international sanctions. Despite suggestions by Guan Tao from the Bank of China and Ming Ming from Citic Securities, transactions involving the e-CNY remain traceable (Guan 2022; Tang 2022), allowing for potential secondary sanctions[13] by the United States. Notably, the absence of e-CNY discussion in the "no-limit" Sino-Russian partnership highlights its limited role (Finneseth 2022). Beyond its potential as a shield against sanctions, evaluating the e-CNY's weaponization should extend to its broader geopolitical and economic implications for the Chinese Communist Party (CCP) within the boundaries of the renminbi.

Billota & Voloder (2023) point to the potential of technology innovation to create alternative payment infrastructure beyond SWIFT or the US dollar and reference the conclusions of the US Treasury, which recognizes the risk to US sanctions efficiency (US Department of the Treasury 2021). The authors suggest that despite being a Belgium-registered "neutral" entity, SWIFT has faced allegations of susceptibility to US foreign policy due to its reliance on the US banking system for cross-border transactions, leading to US laws affecting transactions outside its borders. This was evident when SWIFT complied with US sanctions against Iran in 2018, overriding EU opposition (Peel 2018). Although the EU launched an EU–Iran payment vehicle, INSTEX, in 2019 to bypass US sanctions, it proved relatively ineffective against US secondary sanctions. While a global system of CBDCs theoretically offers the potential to bypass SWIFT's central node and facilitate direct interoperability between central banks, SWIFT is actively working to integrate into the future global CBDC infrastructure. The influence of US secondary sanctions is derived from the United States' economic, geopolitical, and financial centrality in the global economy, extending beyond the US dollar or SWIFT itself (He et al. 2022). The study adopts an EU point of view, mentioning that the development of new independent payment infrastructure, though potentially valuable, alone is inadequate to enhance the EU's economic autonomy. Nevertheless, it could serve as a tool to mitigate the EU's reliance on the US dollar.

Fantacci & Gobbi (2023) propose that the decision of the United States and the European Union to disconnect certain Russian banks from SWIFT and freeze Russia's foreign reserves is expected to have profound implications for the global monetary system. This action is likely to accelerate efforts to diversify away from the US dollar-dominated financial system. The move sets a historical precedent, raising concerns globally that any country could potentially be isolated from Western-led financial infrastructure. Russia, as a G20 nation, faced the freezing of its central bank reserves, a remarkable measure that further eroded confidence in the US dollar as a reserve asset. The study presents data that reveal noteworthy trends over recent decades: the dollar's use as a reserve asset has

[13] Secondary sanctions punish third parties that have economic or other interactions with the sanctioned entity.

gradually declined; its role as a means of payment remains stable; and its employment as a unit of account to denominate financial assets has increased. Simultaneously, banks' exclusion from SWIFT has spurred the creation of alternative payment systems, such as China's Cross-Border Interbank Payment System (CIPS), Europe's INSTEX, and Russia's System for Transfer of Financial Messages (SPFS). This has also fostered the use of local currencies in bilateral trade. The authors add that while the European Union is progressing more cautiously towards a Central Bank Digital Currency (CBDC), top officials of the European Central Bank emphasize the necessity of a digital euro to uphold the international standing of the currency beyond the eurozone as other countries, including Russia, are also developing their own CBDCs.

5. DISCUSSION- CONCLUSION

Determining the impact of CBDC design is pivotal; such digital currencies whether token or account-based can be held by the public, banks, and fintechs, made accessible to all or specific groups. They may also have varying availability: either continuously open for transactions, or capped in some form. Central banks will be aiming to regulate the replacement rate of bank deposits from CBDC, to balance potential benefits against possible disruptions to banking and overall financial stability. Remuneration holds crucial significance. Primarily serving as a medium of exchange, the value of a non-interest-bearing CBDC is predominantly determined by its convenience - particularly when market rates are above the ELB. The research suggests implementing an interest-bearing, intermediated and widely accessible digital currency could potentially yield public benefits, as well as offer competition to private initiatives. However, it is crucial to note that introducing caps on holdings, transaction limits or tiered interest rates might help address potential concerns regarding financial stability. The existence of uncertainties implies that any decision to move forward with CBDCs will invariably carry a certain level of risk.

Regarding the realization of the digital euro project, as of September 2023, the last announcements by Eurosystem officials confirmed that the Eurozone CBDC will be retail and account-based, in addition to holding legal tender status[14]. There had been essentially no mentions from EU researchers in the literature about introducing a wholesale or token-based option in the economy. It was likely a necessity to adopt those design characteristics, as to prevent disintermediation of commercial banks and safeguard financial stability. Specifically, controlled use of the digital euro, with limits on the amount that can be held (favoring retail over wholesale) in order to prohibit investment use, as well as access through identified accounts (account-based rather than token-

[14] https://www.ecb.europa.eu/press/key/date/2023/html/ecb.sp230904~8f5dff1e57.en.html

based) such that multiple entrance points in the system are not possible. Bank disintermediation could have multiple consequences: not only might it cause total lending to decrease due to deposit substitution; but it also, potentially engenders a lack of credible customer credit assessments, as deposit funding is replaced by central bank funding to retain stable loan rates. Moreover, access will primarily occur via commercial bank accounts (digital currency through supervised intermediaries). Such an arrangement effectively excludes holders from non-Eurozone countries and stops any possible "currency incursions" (currency substitution in foreign economies), a decision consistent with the dogma of international central bank cooperation.

Regarding transmission mechanisms, researchers hold diverse viewpoints on the implications of CBDCs for monetary policy. Some propose that CBDCs might replace inflation buffers and alternative monetary policy tools, with the CBDC remuneration rate becoming the primary policy instrument. Others assert that CBDCs could reshape the current policy landscape by potentially eliminating the constraint of the effective lower bound on nominal interest rates. This could be achieved by establishing CBDCs as the unit of account and applying a varying fee on cash transactions. A more balanced perspective acknowledges that the effects on policymaking could hinge on the size of the central bank's balance sheet, as a larger balance sheet could mitigate the negative consequences of deposit substitution. This stance also suggests that CBDCs could enhance monetary policy transmission, potentially leading to more efficient pass-through of policy rates and improved effectiveness of quantitative easing. However, some experts caution that the impact of CBDCs on monetary policy remains uncertain at this juncture. The complete elimination of the effective lower bound is contingent upon the continued circulation of physical cash, and the coexistence of both digital and physical currencies with CBDCs as the unit of account presents challenges. CBDCs could offer real-time crisis information to the central authority allowing for more informed monetary policy decisions, yet it might also pose a risk to the monetary sovereignty of neighboring countries due to currency substitution.

Considering the implications for the banking sector, the consensus seems to be that if certain conditions are fulfilled, the adverse effects of introducing a CBDC to the economy can be mitigated. Central banks have control over how much they will allow digital currencies to replace traditional bank deposits by setting an appropriate remuneration rate or adjusting the aggregate quantity or possible individual holdings of CBDC. The increased competition for deposits may encourage commercial banks to reduce inefficiencies or offer more attractive services to depositors and the unbanked population, likely maintaining or even expanding the deposit base. Lost deposits of commercial banks can also be replaced with central bank funding, analogous to the deposit volume that shifted from private money to central bank liabilities, increasing total liquidity as CBDC deposits do not require reserves to be held in order to be loaned out. However, borrowing from the central bank requires collateral. In the case that central bank funding systemically replaces funding from deposits, the interest rate of safe assets used for collateral will increase. In addition, financial stability could be at

risk, for the following reasons. If banks are to maintain their loaning activities with diminished deposit-taking, they will have reduced knowledge of the creditworthiness of their customers, and to maintain their profit margins, commercial banks may pursue riskier strategies.

On the front of geopolitics, there seems to be a general agreement the introduction of a digital currency likely is a necessary step for state authorities that wish to reaffirm their monetary sovereignty over the digital realm. Agents of monetary incursions can be private digital assets or foreign state-issued CBDCs. Despite China's banning of cryptocurrencies, the literature seems to consider such private incentives as largely non-threats to central bank monopolies, given their inability to function as legal tender. However, EU authorities officially acknowledged the risk associated with the widespread use of non-EU payment solutions in the domestic market and tried to incentivize local alternatives. Emerging markets face a higher degree of risk to independent monetary policy due to public preference for more stable currencies and substitution being enabled by the digital nature of CBDCs. Researchers expressed apprehension regarding the extensive transactional data accessible to the CBDC-operating monetary authority, as the utilization of foreign digital currencies might raise concerns regarding national security.

Certain sources highlight the potential for a first-mover advantage in adopting a CBDC, which could disrupt global monetary structures and limit foreign central banks' independent monetary policies through currency substitution. It is suggested that China's early entry into the CBDC space with the digital yuan would give it a significant edge in shaping international standards, despite the need for domestic reforms and geopolitical considerations. On the other hand, it is argued that the rapidly evolving markets and technology make long-term competitive advantage unlikely for CBDC adopters and central banks should prioritize appropriate policy goals and digital currency designs rather than aiming to be the first to issue a CBDC. Trust in the issuing entity remains crucial for the success of any digital currency.

Currency internationalization entails the widespread adoption of a nation's currency for international trade, financial transactions, and as a store of value. Conversations regarding CBDCs revolved around the global reserve status of the US dollar and the potential competition posed by China's e-CNY. The gap between China's economic magnitude and its currency's sway was examined. Specifically, the status of US dollar dominance is acknowledged, but its stability is challenged due to a declining international asset position and the recent designation of the US as the world's largest debtor. Preserving the existing state of affairs is regarded as a matter of national security, as China's pioneering efforts could gradually align the financial system with the interests of the CCP. However, it was deemed improbable that Chinese initiatives would displace the US dollar at the present moment. The e-CNY serves as the digital manifestation of the renminbi; thus, state policies affect both physical and digital currency. Controlled exchange rates by the state, capital controls, and underdeveloped financial markets hindered trust in the Chinese financial system, as observed by the limited global role of the RMB. Conversely, there was recognition that states

leading in technological innovation historically assumed a lead in shaping international standards governing such technologies.

CBDCs might have implications for the efficacy of financial sanctions by reducing the use of the US dollar in cross-border payments, thus enabling sanctioned entities to make payments outside the traditional system which is under US influence. Others believe CBDCs won't particularly alter the US-centric status quo. It is recognized that disconnecting Russian banks from SWIFT and freezing reserves could shift global monetary dynamics, accelerating efforts to diversify into independent initiatives like CIPS, SFPS, and INSTEX. However, such structures remain vulnerable to US secondary sanctions and past cooperation attempts between Russian SPFS and China's CIPS have seen limited success due to mistrust and concerns. China's e-CNY geopolitical aspirations have the potential to challenge the dollar system and establish international payment arrangements, although for the time being e-CNY is aligned with the renminbi's fate thus severely limiting its effect.

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