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CENTRAL BANK DIGITAL CURRENCIES AND THE INTERNATIONAL PAYMENT SYSTEM: THE DEMISE OF THE US DOLLAR?

Abstract

The international monetary system is marked by a hierarchical relationship between currencies, where the US dollar is widely used. Recently, central banks have started to launch Central Bank Digital Currencies (CBDCs), which, in contrast to cryptocurrencies, are issued by monetary authorities. The purpose of this paper is (i) to analyse and explain domestic retail CBDCs in detail, and (ii) to assess whether the creation of CBDCs poses a threat to the US dollar as the key currency of the international monetary and financial system. It will be argued that, despite the innovations a CBDC may bring, the role of the US dollar will not be affected by the introduction of multiple CBDCs (mCBDCs) alone. Although mCBDC arrangements might decentralise the international payment system, the underlying structures supporting today's unipolar system would not automatically change. It is crucial that central banks work together to establish an alternative international monetary system.

Keywords: Central Bank Digital Currency (CBDC); Cross-Border Payments; Currency Hierarchy; International Payment Structures; International Monetary System; International Financial System.

1. Introduction

There is a strong belief that Central Bank Digital Currencies (CBDCs) have the potential to change the current monetary and financial set-up and address long-standing issues within that sphere, not only locally but also globally. Yet, misconceptions of what exactly a CBDC constitutes remain even with some countries having already introduced domestic CBDCs[1]. The reason for this may be the limited academic or accessible literature in this field. While central banks worldwide as well as supranational organisations (especially the BIS Innovation Hub) have widely published policy reports, especially over the past two years, a comprehensive analysis and full engagement with the theme from an academic point of view has yet to take place. This paper, along with other contributions to this special issue (e.g. Morgan (2022), Wang et al. (2022), Elsayed and Nasir (2022)) is one of the first academic papers dealing with CBDC and, in particular, with its international dynamic and significance for currency hierarchy, a literature that is often overlooked by economists.

The motivation to conduct research into domestic CBDCs differs across countries. While financial inclusion is a core motivator for both high and low-income economies, developments toward cashless societies and increasingly digital economies are the main motivators for high-income economies (Boar & Wehrli, 2021). Additionally, the development of money-like instruments in the form of stablecoins that could challenge the current two-tier monetary set-up nationally and, most notably, internationally, seems to have spurred interest in CBDCs (Catalini & Massari, 2021; Kosse & Mattei, 2022). Whereas first-generation cryptocurrencies, such as Bitcoin or Ethereum, are continued to be perceived as niche products that are unable to perform the functions of money (i.e. store of value, unit of account and means of payment) mostly due to their extreme price volatility, stablecoins attempt to address exactly this shortcoming (European Parliament, 2019; Bank of England, 2020; Group of Central Banks, 2020).

Recently, research into CBDCs has increasingly been concerned with the international dimension, especially concerning cross-border payments. Interoperable multi-CBDC (mCBDC) arrangements are investigated as one possible solution. When considering the international dimension, it becomes clear that the international monetary system has always been marked by a hierarchical relationship between national currencies (i.e. currency hierarchy). While a handful of central currencies from advanced economies (AE) are widely used for international transactions, most currencies from emerging markets and developing economies (EMDEs) play a limited or no role at the international level. This subordinate position in the international monetary system has detrimental implications for EMDEs, ranging from heightened external vulnerability, structurally high interest rates, and constraints on macroeconomic policy-making (Kaltenbrunner, 2011; Andrade & Prates, 2013; Fritz et al., 2014; de Paula et al., 2017).

At the heart of the current international financial and monetary system sits the US dollar. Although the share of the greenback as a reserve currency has recently fallen

[1] A retail CBDC is a CBDC that is available to the general public just like cash today to make everyday (retail) payments. It is the liability of the issuing central bank.

(Arslanalp et al., 2022), the US dollar not only continues to prevail as the international reserve currency, but also as the dominant currency for international debt, cross-border borrowing, global corporate borrowing, development finance, and international invoicing (Carney, 2019; Liu & Papa, 2022). This dominant role of the dollar is underpinned by systemic global infrastructures which require EMDEs to operate in US dollar. While research on CBDC is still very much in its infancy, the question of whether interoperable mCBDCs could potentially threaten the US dollar dominance has consistently been posed.

This considerably large dependence on the US dollar has also major geopolitical implications. The enactment of US economic sanctions, such as the exclusion of specific countries from accessing financial markets (Torres Filho, 2019) and the SWIFT (Society for Worldwide Interbank Financial Telecommunication) system, or as Wolf (2022) calls it "the weaponization of currencies", would hardly be possible within a more diversified international financial system. BRICS countries, especially China and Russia, are already actively working towards an international financial structure which does not rely on the US dollar, US-centered institutions (such as the IMF and the World Bank) or the SWIFT system that is highly influenced by the G10 countries. The establishment of interoperable CBDCs appears to be one of the focal points in achieving this objective (Chainalysis, 2021; Liu & Papa, 2022; Redman, 2022). And while some have questioned the feasibility of mCBDC arrangements replacing the US dollar (e.g. Eichengreen, 2021), others see the development of CBDCs and especially mCBDC arrangements as a clear threat to the US dollar dominance, albeit only in the longer term (e.g. Chainalysis, 2021). Our research contributes to this discussion while considering the hierarchical international monetary system.

More specifically, this paper discusses the potential impact of the introduction of a retail CBDC between EMDEs on the position of the US dollar in the international market and, consequently, on the currency hierarchy. It makes two main contributions to the literature on CBDC and currency hierarchy. First, to the best of our knowledge, this paper provides the most comprehensive definition and explanation of retail (or general purpose) CBDC and how its set-up is envisioned, which involves a deep analysis of various policy papers[2], as well as the technical and economic literature.

Second, this paper contributes to the embryonic literature on interoperable CBDCs and their implications for the structure of the international monetary system. Most CBDC literature focuses on domestic CBDC (exceptions are, for example, research by the Bank for International Settlements (2021), Auer et al. (2021) and Elsayed and Nasir (2022)). When considering the international level, a question that needs to be asked is whether this new, modern era of digital money will pose a threat to the long-established US dollar dominance and its position in the currency hierarchy. Not only could a multi-currency setup be possible under CBDC arrangements, but when looking at the CBDC research stage, the US seems to be quite behind other nations. Nothing has been

[2] A list of the most relevant papers to date can be found in the appendix.

published with an in-depth critical evaluation regarding the effects of the expansion of interoperable CBDC on currency hierarchies.

The rest of the paper is organized as follows. After the present introduction, section 2 provides a detailed explanation of retail CBDC and its domestic architecture, which is mostly discussed in highly technical reports with little research about this recent topic in the academic literature. Section 3 analyses the possible set-up of multiple-CBDC (mCBDC) arrangements in the international market that would allow efficient cross-border payments. Section 4 presents the role of the US dollar in the international monetary system and the potential use of mCBDC arrangements as a way to reduce the dominance of the greenback in cross-border payments. Section 5 brings our findings together while concluding that first, more than the establishment of mCBDC arrangements is needed if the current hierarchical set-up of the international financial and monetary system is to be changed and that second, these changes, if they do take place, will only happen in the medium to long term.

2. Central Bank Digital Currencies: Definition and Possible Domestic Set-Up

The current monetary system consists of three types of money: (i) cash, in the form of coins and banknotes created by the central bank, (ii) central bank reserves, which are the reserve balances of commercial banks held at the central bank and (iii) commercial bank money in the form of deposits held by the private sector at commercial banks. An important distinction between these types of money is that reserves at the central bank as well as cash are both the liability of the central bank, while commercial bank deposits are the liability of commercial banks (Group of Central Banks, 2020). Since commercial banks carry default risk, commercial bank money is not risk-free. However, both reserves and cash constitute a form of risk-free money, since the likelihood of a central bank as the currency issuer going bankrupt is minimal[3]. Therefore, the credit risk of both forms of central bank money is minimal (Bank for International Settlements, 2020). While commercial banks have access to risk-free money via their deposits at the central bank, the only access the general public has to risk-free money is in the form of cash.

Cash, as part of central bank money, plays a crucial role in ensuring that central banks can achieve their policy objectives specifically regarding monetary and financial stability. Especially for fiat currency regimes, the trust in central banks' ability to preserve the functions of money is crucial for not only stability but also for the overall system to work. In such systems, cash is not only a unit of account, means of payment and store of value, it is also used to settle payments with finality[4] (Group of Central Banks, 2020). Thus, money in the form of cash constitutes a public good contributing to the stability of the overall monetary system (Bank for International Settlements, 2020). However, money in electronic form is progressively dominating the payment landscape at the cost of cash usage (Bank of England, 2020). This is possible due to lower costs, greater payment convenience, and the increasing digitalization of the overall economy. Consequently, to evolve within the digital environment, ensure continued access to risk-free money and fulfil their public policy objectives, central banks are looking toward the creation and issuance of a domestic retail (or general purpose) CBDC.

2.1 Retail CBDC: Definition and Objective

A retail CBDC can be seen as a technologically advanced, digital form of central bank money (Carstens, 2021), and here specifically a digital representation of cash in the form of a digital banknote (Group of Central Banks, 2020). This new digital form of central bank money is, by definition, issued and governed by the monetary authority of

[3] Although countries with monetary sovereignty minimise their risk of default as they have the monopoly of their currency, they are still bounded to policy decisions as well as the market reactions. These constraints are particularly stronger in countries with lower degree of policy space, such as developing and emerging countries (Prates, 2020).

[4] To settle a payment with finality means that there are no credit risks involved given that it is paid with central bank money, not commercial bank money.

a country or region which is in stark contrast to cryptocurrencies[5], such as the above-mentioned stablecoins that are all issued by private companies. A retail CBDC is different to, and sits alongside, central bank reserves and cash, while being accepted as legal tender (Bank for International Settlements, 2018; European Parliament, 2019; Group of Central Banks, 2020). It is intended to be used by the private sector to increase the convenience of payments that are in electronic form or remote, while it must be directly convertible into cash or deposits (Bank of England, 2020). In this way, a CBDC gives households and businesses continued access to risk-free money, albeit in digital and not physical form. Any CBDC is not only denominated in the national unit of account but, similar to cash, it is also a direct liability of the issuing central bank (Bank of England, 2020; Group of Central Banks, 2020; Carstens, 2021). As the central bank is the issuer of the CBDC, payments made using this type of central bank money are settled with immediate finality. Credit risk as is the case with commercial bank money would not occur (Carstens, 2021).

While CBDCs may use the same technology as privately issued cryptocurrencies (e.g. blockchain), the overall objective is not profit-driven. Since CBDCs are issued by public institutions, already existing goals of monetary and financial stability, among others, will continue to play an important role. However, it should also be noted that a CBDC will not be enforced to discourage the usage of cash (Bank of England, 2020). Instead, part of the monetary Hippocratic oath encourages the "coexistence" of different types of central bank money (CBDC, reserve and settlements accounts and cash), whereas central banks should continue to provide cash for as long as there is demand for it. This oath also stresses that new forms of central bank money should be aimed at supporting central banks' objectives of ensuring monetary and financial stability (labelled as "Do no harm" under the oath). At the same time, it is understood that central banks themselves must innovate to ensure payment efficiency. In this way, it is hoped that currency users will not opt for less safe cash-like instruments or cryptocurrencies to make payments (labelled "Innovation and efficiency" under the oath) (Group of Central Banks, 2020).

2.2 Possible Retail CBDC Architectures in the Domestic Context

There are three possible models of how a domestic retail CBDC could look like, namely, an indirect (also called synthetic) CBDC, a direct CBDC or a hybrid CBDC (Auer & Böhme, 2020).

Within the synthetic CBDC (sCBDC) model, households and businesses would not have a direct claim on the central bank. Instead, the claim would be against an intermediary. This intermediary would fully back the amount of outstanding sCBDC via its holdings at the central bank. Whereas the intermediary would handle all customer-related issues, retail as well as wholesale payments, the central bank would only be

[5] Central banks have been stressing the clear distinction between a CBDC and cryptocurrency (issuance of risk-free money by central authority vs. the creation of crypto assets in the form of cryptocurrencies by private entities). While at times this distinction is not clearly recognized in the literature or media, it is a fundamental and an important one specifically when looking at the liability structure (CBDC as the liability of a central bank vs. unclarity where liability lies with most crypto assets).

concerned with the settlement of existing wholesale accounts that belong to the respective intermediaries (Auer & Böhme, 2020). However, since one prerequisite of a retail CBDC is that the general public would, similar to cash today, have a direct claim towards the central bank, a synthetic CBDC is generally not considered a CBDC (Bank of England, 2020; Group of Central Banks, 2020).

A direct CBDC architecture on the other hand would establish direct claims of CBDC users towards the central bank. The central bank would be the only institution in the system handling CBDC payments. Hence, a central bank would keep track of all transactions while making the needed adjustments to the respective CBDC balances. While this setup would eliminate the reliance on intermediaries, it would also extend the central bank's field of activity way beyond its current mandate (Auer & Böhme, 2020). The most likely approach to a retail CBDC seems to be, therefore, a mix of public and private institutions. This is known as hybrid CBDC.

Within the hybrid CBDC setting, the claim of the public would still be directly against the central bank. But different to the direct CBDC set-up, intermediaries would handle all customer-facing business (such as the KYC[6] process), while simultaneously taking care of retail payments. In this hybrid model, there are two possible system set-ups, an account-based and a token-based CBDC system (Bank for International Settlements, 2018; European Parliament, 2019; Bank of England, 2020). The key distinction between those two systems is the required form of identification and the process of moving funds. In token-based systems, such as cash and many cryptocurrencies, the state of the system is recorded via a list of individual tokens with a specific value and an individual owner. To initiate a transfer of funds, the payee must prove that they are the owner of the token that is to be transferred. Within the electronic environment, this is done by signing the payment instructions using the unique private key of the respective payee (Bank for International Settlements, 2018; Bank of England, 2020; Carstens, 2021). Most CBDC proposals, however, are account-based[7] (Carstens, 2021). In an account-based system, such as balances in reserve accounts and commercial bank money, the state of the system is recorded as a list of accounts. Each account is tied to a specific identity (person or company) and has a specific balance attached to it. To initiate a payment in such a system, the payee must either prove their identity or they must demonstrate that they know the relevant account information (e.g. passwords) to make such payments (Bank for International Settlements, 2018; Bank of England, 2020; Carstens, 2021). Once transfers of funds take place, the account balances of the respective accounts are adjusted (up and/ or down).

However, and in contrast to most (privately issued) cryptocurrencies, both forms of systems would require some sort of identification of CBDC users not only to be able to make payments but also to comply with Anti-Money Laundering and Countering

[6] KYC – Know Your Customer are mandatory procedures where the identity of bank account holders is verified (upon opening an account and periodically after).

[7] It is worth mentioning that, depending on the wallet type, the Bahamian Sand Dollar is both, an account- and token-based system (Atlantic Council, 2021).

Terrorist Financing (AML/CFT) frameworks in place (Auer & Böhme, 2020; Bank of England, 2020). Hence, the level of anonymity that cash currently provides as means of payment, where no reference of payer or payee is made and recorded, would not be available through any CBDC[8], even if AML/CFT requirements were left aside. On the upside, if a CBDC system was to be tied to identified users (via, for example, a national digital identity), then so-called helicopter drops during times of crises, such as cash transfer programmes, could be easily made straight into citizens' accounts (Group of Central Banks, 2020).

Other instrument designs for CBDCs currently under consideration try to answer the question of whether or not a CBDC should be interest rate bearing or whether there should be caps or limits in place for how much CBDC a user can hold or transact (Bank for International Settlements, 2018; Group of Central Banks, 2020). Technically, within both, account and token-based systems, interest rates could be implemented. The interest rate could be the same as the policy rate or it could be different to encourage or discourage the usage and holding of a CBDC (Bank for International Settlements, 2018). However, implementing interest rates on a CDBC could potentially speed up the process of disintermediation away from commercial bank deposits towards a CBDC, especially for currencies at the top of the hierarchy during the introductory phase or during times of crisis. This could have far-reaching implications for overall financial stability tied to the rapid reduction of liquidity for commercial banks. And considering that a retail CBDC seems to be more representative of digital cash without deposit-like attributes and without (credit) risk attached, it is questionable whether interest-bearing CBDCs are the way forward (Group of Central Banks, 2020). Instead, limits on how much of a CBDC user can hold or transact could be implemented. The cash-like attributes of a CBDC would be retained while disintermediation from commercial bank accounts could be controlled and mitigated. Hence, most current CBDC proposals are non-interest bearing (Agur et al., 2022) while already established domestic retail CBDCs such as the Bahamian Sand Dollar have indeed not opted for an interest-bearing CBDC but have instead imposed limits on how much of a CBDC can be transacted and held (Central Bank of the Bahamas, 2022).

Although the focus for both, EMDEs and ADs lies on the establishment of a domestic CBDC (Boar & Wehrli, 2021), the importance of enhancing cross-border payments has been recognized especially after the commitment made by the G20 to improve such payments (Committee on Payments and Market Infrastructures, 2020; Auer & Böhme, 2020; Bank for International Settlements, 2021). While research into cross-border CDBC arrangement is very much in its infancy, the next section will attempt to bring theoretical elaborations on possible setups together.

[8] Or, in fact any cryptocurrency.

3. The Use of CBDC Beyond the Domestic Market

3.1 Cross-Border CBDC: The Importance of Interoperability

According to the G20, a case can be made for cross-border payments to be cheaper, faster, more transparent and inclusive, if economic growth, international development and international trade are to be supported (Committee on Payments and Market Infrastructures, 2020; Bank for International Settlements, 2021; Carstens, 2021). Interoperability between payment systems is key to achieving this objective. Interoperability will ensure the seamless transfer and settlement of payments across different jurisdictions, payment providers and (technical) systems all without the need for banks or payment providers to have to participate in multiple systems or jurisdictions as is the case now with correspondent banking (Boar et al., 2021). In this context, the establishment of interoperable CBDCs is being considered as one possible way forward (Committee on Payments and Market Infrastructures, 2020).

The establishment of interoperable CBDCs would require a coordinated international approach led by central banks and policymakers (Bank of Canada & Monetary Authority of Singapore, 2019; Bank of England, 2020, 2022; Group of Central Banks, 2020). The reason for this coordinated approach is clear. If domestic CBDCs are created without the international dimension in mind, different standards and a variety of diverse CBDC models could potentially emerge and cause major issues for the operability of the international financial system (Atlantic Council, 2021). Improvements to cross-border payments would then not take place (Bank for International Settlements, 2021). Instead, the general public might turn to stable money-like instruments to make international payments potentially increasing overall financial instabilities, especially if mass adoption of those alternatives was to occur.

An advantage that cross-border CBDC payments would have when compared to improvements made to the current system is the fact that any CBDC design would start from a clean slate. Thus, legacy issues, such as fragmented data and messaging formats, complex and time-consuming compliance checks, long transaction chains especially for currencies from EMDEs, differences in banks' opening hours and high funding costs to settle international payments, experienced within the current international payment landscape could altogether be avoided (Bank of England, 2020, 2022; Bank for International Settlements, 2021; Carstens, 2021).

3.2 Possible CBDC Architectures in the International Context

Theoretically, two different approaches to cross-border payments using CBDCs can be identified (Bank for International Settlements, 2021). The first option would be a domestic retail CBDC that is available to anyone in and outside the jurisdiction. Within this scenario, the international usage of the respective CBDC would be without restrictions as to who is using the CBDC and where the CBDC is used. Coordination between central banks would not have to take place while the underlying CBDC design would allow for the anonymity of participants. However, as mentioned previously, complete anonymity is not plausible due to existing regulatory requirements. Similarly, restrictions on cross-border CBDC usage seem more likely than not. Hence, this type

of CBDC setup for international payments appears improbable (Bank for International Settlements, 2021).

The second CBDC set-up would entail some form of interoperability between different CBDCs. Under this scenario, access and settlement arrangements would be established among various CBDCs to simplify and encourage cross-border payments. One possibility would be for central banks and regulators to allow foreigners of participating jurisdictions to access domestic CBDCs via specific CBDC arrangements (Committee on Payments and Market Infrastructures, 2020). Citizens of the respective jurisdictions could hold numerous CBDCs in an electronic wallet to make payments within various jurisdictions using the relevant currency. In this way, both the payer and payee could use the same currency to initiate and receive payments independent of their geographical location.

Alternatively, multiple CBDC (mCBDC) frameworks could be established aligning legal and technological aspects as well as market infrastructures to enable frictionless cross-border payments. Different to a scenario where the public would hold multiple CBDCs in one wallet to make international payments, within such aligned frameworks CBDC conversion would take place. Hence, whereas the payment would be initiated in one domestic CBDC, the payee would receive the funds in a different (domestic) CBDC (Committee on Payments and Market Infrastructures, 2020; Bank for International Settlements, 2021). The agreements between the monetary authorities from different countries to allow CBDC conversion could, in practice, lead to reduced dependence on international currencies, such as the US dollar. In practice, one possibility would be for collaborating central banks to establish currency corridors with upper and lower bounds within which the respective currencies could fluctuate against each other. At the same time, one local currency could be directly exchanged for another local currency via established smart contracts. In this way, currency triangulation would not have to take place while theoretically not only the US dollar but also US financial infrastructure could be circumvented.

3.3 Theoretical Set-Ups within the Interoperable CBDC Framework

Within the mCBDC framework, conceptually, three possible set-ups for interoperable cross-border systems can be identified, namely compatible CBDCs, interlinked CBDCs and a single system for mCBDCs (Auer et al., 2021). Compatible CBDC systems would be achieved via the establishment of compatible standards within various payment systems. Participating jurisdictions would individually decide on their own rulebook, governance, participation criteria and technical infrastructure of their respective CBDC. Agreed upon basic technical, regulatory and legal standards would ensure compatibility of systems located in various jurisdictions. Hence, a compatible CBDC system would look very similar to the current payment system where transfers between CBDCs in the form of cross-border and cross-currency services would be offered by a multitude of intermediaries and competing private companies. Improvements to cross-border payments could then be achieved through increased competition in the market leading to quicker, cheaper and more transparent international payments. However, achieving the desired and needed level of compatibility, even in a very basic form, is a long process. Specifically, legal and regulatory compatibility across borders appears

to have the greatest potential for lengthy disagreements among participating jurisdictions (Group of Central Banks, 2020; Auer et al., 2021; Eichengreen, 2021).

Linking multiple CBDC systems often requires some sort of compatibility among participating jurisdictions and their payment systems. Achieving such a degree of compatibility is, similar to compatible systems discussed above, highly complex. Each CBDC system would be tied to a specific jurisdiction and would therefore have its own CBDC rulebook, governance, participating criteria and infrastructure. Joint contractual agreements among participating central banks would then underpin the interlinkages of different CBDC systems.

While linking multiple CBDC systems is technically feasible and offers a huge variety of design choices, interlinking various CBDC systems would be an enormous undertaking that could only be accomplished in the long term (Auer et al., 2021). Some would even argue that the amount of needed legal agreements among participating central banks make interoperable and linked CBDCs practically an impossibility (Eichengreen, 2021).

Different to compatible CBDC systems and interlinked CBDC systems, integrating multiple CBDCs into a single mCBDC system may offer deeper integration with greater functionality and payment efficiency. Within such a system, participating central banks would agree to a single rulebook, a single set of participation criteria and a single infrastructure. Through the usage of Decentralized Ledger Technology (DLT), various CBDCs could be issued onto a shared distributed ledger. Technically, this approach would be simpler than the above-mentioned CBDC systems. Another proposal for a single mCBDC system includes the establishment of a shared corridor network with a jointly controlled operator (e.g. Inthanon-LionRock project). However, a single mCBDC system could raise policy issues for participating central banks. For example, frictions and difficulties could emerge through the shared management of the rulebook and the overall governance of the shared system (Auer et al., 2021).

Similar to compatible CBDCs, the integration of systems where infrastructures combine certain functions will need agreement on international standards for not only the CBDC system itself but also for proposed supplementary systems and data services (Group of Central Banks, 2020). And as previously mentioned, especially different legal and regulatory frameworks across jurisdictions may lead to lengthy debates. Additionally, such a highly integrated system seems to move closer to a monetary union (similar to the EMU). Depending on the circumstances and the observable difficulties within such monetary unions consisting of sovereign states it appears highly questionable that this type of integration is envisioned on an international scale by not only central banks but also governments (Auer et al., 2021).

While all three proposals require CBDCs to be interoperable, all of them also have the potential to improve cross-border payments. Whereas work on interoperable CBDCs is mostly exploratory and still in its infancy, mCBDC arrangements are not merely theoretical discussions (Committee on Payments and Market Infrastructures, 2020; Auer et al., 2021). Particularly, research on interlinking CBDCs has increasingly been under consideration as one way forward to diversify the international payment landscape away from the US dollar (Carstens, 2021). Similar to the domestic context,

the introduction of a retail CBDC to make international payments would have far-reaching implications promising an overhaul of the existing international retail payment landscape. With the introduction of internationally interoperable retail CBDCs, the general public could be connected across borders allowing CBDC payments between jurisdictions (Bank for International Settlements, 2021). Hence, depending on the technological and regulatory set-up of these interlinking mCBDC systems, the usage of local currencies for international trade and settlement could be encouraged or even enforced circumventing the presently dominant US dollar.

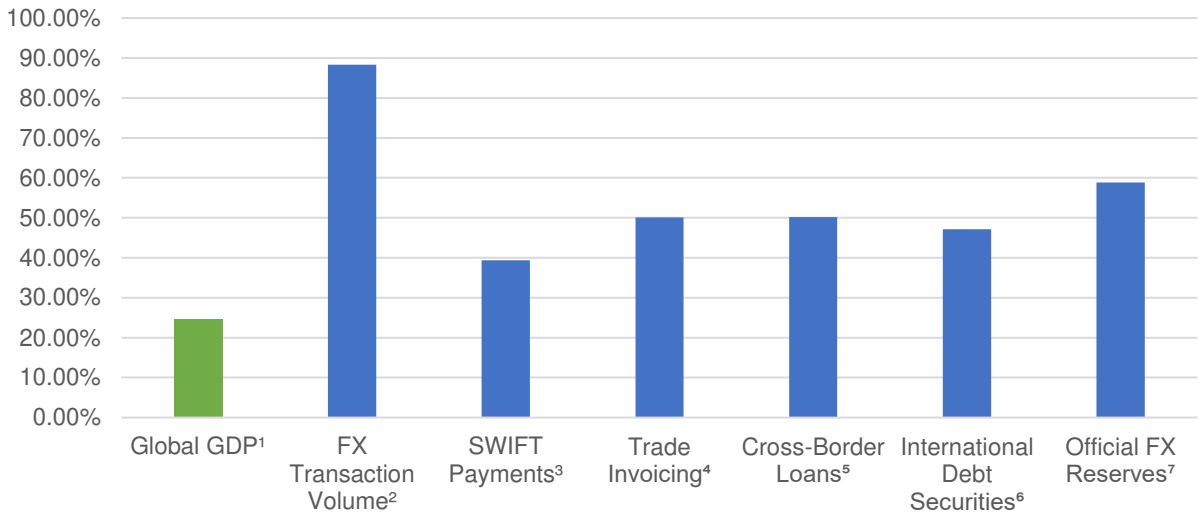
The development of BRICS Pay to establish a common payment system for retail payments among member states (and partners) where citizens' credit or debit cards are linked to an online wallet is a case in point. The clear aim is decoupling from SWIFT as well as the US dollar for cross-border retail payments between member states by using local currencies. This not only requires uncoupling from US-centred payment networks (such as Visa), but it also necessitates the establishment of national payment systems. If these national payment systems are then connected via BRICS Pay, the US dollar including US-based infrastructure can altogether be circumvented (Liu & Papa, 2022). The following section will, while explaining the current US dollar status in the hierarchy of currencies, elaborate on the potential of and the need for mCBDC arrangements. It will become clear why moving towards a more multi-polar financial and monetary system is desirable. And while infrastructure changes are an important precondition, with mCBDC arrangement playing an important part, it must also be mentioned that mCBDCs alone will not be able to change the current international system.

4. Multiple CBDC Arrangements: A Potential Threat to US Dollar Dominance?

4.1 The Power and Dominance of the US Dollar

The use of currencies for international transactions is often analyzed in terms of the functions of international money, following the pioneering work of Cohen (1971). As shown in Graph 1, the US dollar remains the key currency within the international monetary system across all of these functions. In particular, the US dollar has a leading position in terms of cross-border payments. This is illustrated by the data on foreign exchange (FX) transaction volume published by the BIS (2019) and international payments based on messages registered by SWIFT. Although the US accounts for nearly a quarter of the share of the world's GDP, the US dollar largely dominates international transactions. This creates an inherent demand for the US dollar and an asymmetric relationship among currencies in the international monetary system, as EMDEs also hold a large share of the global GDP, but their currencies represent only 20% of FX transactions, pulled by the Chinese renminbi, which alone accounts for 4% (Bank for International Settlements, 2019).

Graph 1: The Role of the US Dollar



Source: authors' elaboration based on BIS (Committee on the Global Financial System, 2020)[1] . Data refer to 2020 from the World Bank. [2]Data refer to 2019 from BIS. [3]Data refer to 2021 from SWIFT. [4]Data refer to 2019 from IMF. [5,6]Data refer to 2021 from BIS. [7]Data refer to 2021 from IMF.

Today, according to the most recent data from the Triennial Central Bank Survey, published by the BIS (2019), roughly 88%[9] of international transactions take place using the US dollar. Technically, this means that most international foreign exchange operations rely on the American payment system via correspondent banking. The US dollar is used across the globe for various purposes and, in many of them, the demand for the dollar has an end in itself, e.g. payment of goods and services which are priced

[9] As there are two currencies involved in every FX transaction, the sum of the percentage shares of each currency totals 200%.

in US dollars. However, given the lack of liquidity in many other foreign exchange markets, the US dollar is also used to access other currencies, which is a process known as currency triangulation.

This key role of the US dollar is not a result of the efficiency of the American-dominated system. It is, in fact, an outcome of the Bretton Woods system, when the US dollar was established as the reference currency of this fixed exchange rate regime, in which the value of the dollar was believed to be as good as gold. The US dollar retained its leading role within the international financial and monetary system even after the Bretton Woods system had fallen apart. The grown dependency on the US dollar was further reinforced during and after the Global Financial Crisis, when the US government was providing financial aid in the form of US dollar loans to help European banks to recover from the recession (Helleiner, 2014; Tooze, 2018), very similar to the policies helping Western European nations to recover after the Second World War.

The geopolitical implications of a US-dominated international financial and monetary system are far-reaching. Under the current setup, the US has the power to disconnect a country from the international monetary system, which is currently, the US dollar-based system. The dominant political and monetary power of the US has been illustrated several times, such as by banning Iran from trading oil in the international market (Torres Filho, 2019). Although this strategy clearly illustrates the dominant international power of the US, the 'safe heaven' status of the US dollar assets has not yet been brought into question. According to recent data from the IMF, nearly 60% of the world's central bank reserves are still held in US dollar-denominated assets[10]. Given the highest position of the US dollar in the so-called 'currency hierarchy', currently, there is no other currency that can provide the same 'power of disposal'[11] as the US dollar-denominated assets.

Moreover, the current international monetary and financial structure is highly dependent on SWIFT, a messenger system[12] overseen by the G-10 central banks, including the Federal Reserve (FED), which allows interbank information exchange related to international payments (SWIFT, 2022). Banks and financial institutions that are excluded from the SWIFT messaging network may still do transactions with the rest of the world by using intermediaries that are connected to this system, which significantly increases the costs of international transactions. The recent exclusion of Russian banks from SWIFT was led by the EU in consultation with the US, Canada and the UK as members of SWIFT in an attempt to hinder Russia from accessing international financial markets[13].

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[10] Data retrieved from IMF, Currency Composition of Official Foreign Exchange Reserves (COFER) in October 2022.

[11] Term used by Keynes (1936) to describe 'liquidity premium', a characteristic of money.

[12] SWIFT is not a payment or settlement system, but a messaging system that communicates cross-border payments around the globe.

[13] These institutions may, nevertheless, access other messaging systems, such as the Financial Messaging System of the Bank of Russia (SPFS), which was created by Russia in 2014 after invading

The importance of those financial infrastructures has become particularly visible over recent years with the increased dismantling of the correspondent banking system and the use of financial sanctions. The next section will give a brief overview of the current state of corresponding banking affecting particularly EMDEs. While interoperable mCBDC arrangements may alleviate some of the current issues, changes to the existing infrastructure alone may not be enough if one aims to decrease dollar dependence.

4.2 Multiple CBDC Arrangements and the Current Financial Infrastructure of Emerging Markets and Developing Economies

Currently, most cross-border payments take place via correspondent banking networks, in which one (or more) intermediaries conduct financial transactions in a foreign country on behalf of domestic banks[14] (Bank for International Settlements, 2020). Currencies that are used more regularly for international transactions and, hence, are higher up in the currency hierarchy (such as the US dollar, the Euro, or the British Pound) typically require fewer intermediaries for these transactions resulting in shorter transaction chains. This, in turn, makes cross-border payments not only faster but also more affordable. Currencies from EMDEs, on the other hand, typically require multiple intermediaries, which results in lengthy transaction times and higher costs (Bank for International Settlements, 2021).

Especially since the Global Financial Crisis, corresponding banking relationships have declined among currency areas, as fewer banks engage in cross-border payments (Rella, 2019). Explanations for the decline in correspondent banking relationships can be found in declining bank revenues associated with cross-border payments and the strategies employed by banks to reduce risk and operational costs stemming from AML/CFT regulation. These types of de-risking strategies have, in turn, predominantly affected the Global South (Auer & Böhme, 2020; Bank of England, 2022). The reason for this could be the increased costs for cross-border payments incurred by international financial institutions that are especially noticeable for regions that have limited financial markets employing currencies that are not commonly used in international trade (The World Bank, 2016).

Not only have cross-border payments become harder to conduct but the time needed to make such transactions has also increased. Thus, the changes in correspondent banking specifically concerning currencies from EMDEs have resulted in higher than average transaction costs, hitting low and middle-income economies hardest (Bank for International Settlements, 2020). Under the banner of financial inclusion, private companies from the fintech sphere (including cryptocurrency providers) and increasingly Big Tech companies have entered the market attempting to capitalize on these shortcomings (Rella, 2019; Bank for International Settlements, 2020; Carstens, 2021). These highly competitive and profit-driven players offer more convenient, often

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Crimea, or the Cross-border Interbank Payment System (CIPS), developed by China in an attempt to reduce their reliance on the US dollar system.

[14] The correspondent bank can either be a subsidiary of the domestic bank abroad or a foreign bank where the domestic bank has a bank account.

cheaper, and faster payment options, circumventing traditional financial service providers while falling outside traditional banking regulations. Hence, it is no surprise that EMDEs, especially African countries, are driving cryptocurrency adoption to carry out cross-border transactions in the form of remittances (Chainalysis, 2021).

Arguably, multiple interlinked CBDC (mCBDC) arrangements could provide the same services that make payment options offered by private companies so attractive to the public. However, these services would, similar to domestic CBDCs, not focus on profit but on efficiency, true financial inclusion[15] and international monetary and financial stability. With the potential employment of blockchain[16] technology on mCBDC arrangements, cross-border payments would see a reduction in costs while settlement would immediately (or near instantaneously) be possible (Rella, 2019; Committee on Payments and Market Infrastructures, 2020; Auer et al., 2021). Similarly, the decline in correspondent-banking relationships could be counteracted by using mCBDC arrangements tied to bi- or multilateral agreements between two or more central banks.

These bi- or multilateral agreements would be far-reaching and include compatibility requirements in terms of technical standards (such as message formats and data standards), interoperability of the employed systems (such that information and data are interpreted uniformly) as well as regulatory standards (e.g. who has access to the system, how much of a CBDC can be transacted and held). The compatibility across all these standards would all ensure the interoperability of various CBDCs (Boar et al., 2021). Hence, and as mentioned above, domestic CBDCs could be used to make cross-border transactions. EMDEs using local currencies for cross-border transactions could reduce their dependency on the inefficient correspondent banking network and their excessive reliance on the US dollar for currency triangulation. However, this also raises the question of whether a provision of alternative infrastructures can really weaken the dominance of the US dollar in the international monetary system. This is what the next section turns to.

4.3 Multiple CBDC Arrangements: the Answer to the US Dollar Dominance or Potential Hurdles in Replacing It?

Beyond the increased efficiency and the reduction in costs for international settlements, mCBDC arrangements could also be used to establish a more diverse and balanced international financial and monetary system by moving away from the dominant US dollar. This would not only counteract the asymmetric usage of the US dollar internationally, but it could potentially also lead to increased global financial stability. The observable spillover effects emanating from the US to the EMDEs could altogether be avoided if multiple currencies had the same or similar international weight with regard to reserve currency status.

[15] For a critical analysis on how fintech companies offer anything but financial inclusion see Bernards (2019, 2022).

[16] Blockchain is one possible type of Decentralised Ledger Technology (DLT).

Additionally, with interlinked mCBDC arrangements, international payments between the participating jurisdictions could take place using domestic currency, enforcing the notion of multiple reserve currencies. Hence, currency triangulation using the US dollar would no longer be necessary. For example, China's digital currency could in the future become a vehicle currency for trade between China and its trading partners, pushing the e-CNY (digital yuan) into reserve currency territory (Carney, 2019; Wolf, 2022). This type of promotion in using the yuan internationally via China's proposed CBDC also supports efforts in decoupling from the US dollar and, at least in the long run, from SWIFT (Chainalysis, 2021). Within an mCBDC system established and controlled by China, both the US dollar and the SWIFT system could be circumvented by using interoperable, local CBDCs. The aim of creating a more diversified international system could however be at stake if the US dollar was simply swapped by the e-yuan and the US financial hegemony were to be replaced by Chinese financial hegemony.

While the overall stability of the international financial and monetary system would arguably increase if multiple currencies were equally important, there is an array of opposing realities that could hinder the (fast) re-organisation of the international system towards a more multipolar one. While interlinked mCBDC arrangements promise to address the issues of the current US dollar-based monetary system, the establishment of these systems will, as indicated previously, only happen in the long run (Carney, 2019). And even once these systems are established, the belief that an interoperable CBDC alone can solve most or even all of the issues attached to the current system is misplaced, specifically when it comes to US dollar dominance (Eichengreen, 2021).

Indeed, as the literatures on the dominant currency paradigm (e.g. Gopinath & Itskhoki, 2021; Gopinath & Stein, 2021) and currency hierarchy (e.g. Andrade & Prates, 2013; Kaltenbrunner, 2015; Orsi, 2019) have highlighted, the US dollar dominance is underpinned by deep structural factors. According to the dominant currency paradigm, network effects and economic size cement the dominant role of the US dollar as an international trade invoice currency. While the dominant currency paradigm highlights, in particular, the US dollar's role in denominating international trade, Post-Keynesian scholars have more focused on the role of the dollar as a unit of account and means of settlement in international financial relations.

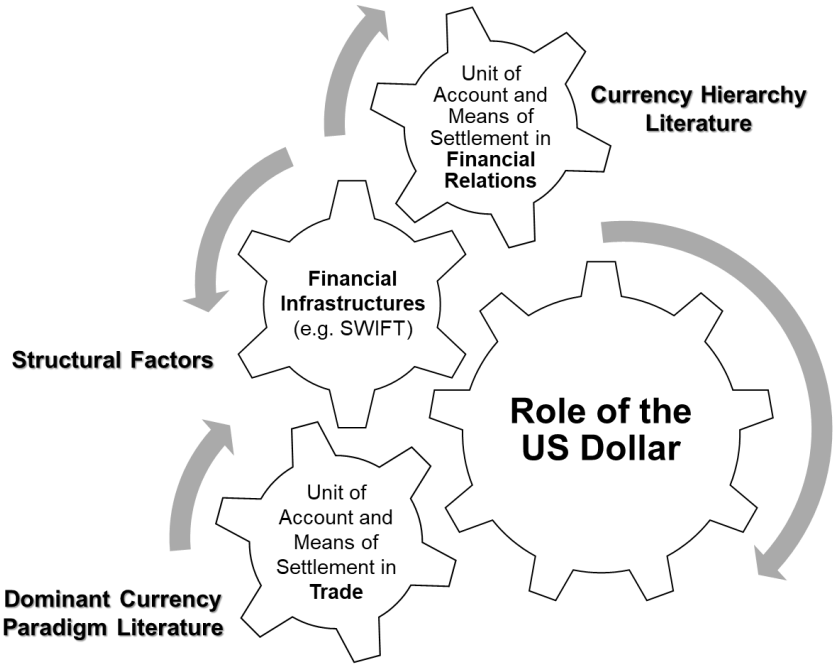
In the Post-Keynesian literature, emphasis has been particularly placed on the role of the US dollar as the dominant international funding currency, which creates a latent demand for the US dollar. Specifically, given the spatial agglomeration of financial activities and financial institutions in developed economies, and the willingness of the Federal Reserve (FED) to act as a lender of last resort, the US dollar is used as the global means to denominate financial liabilities. This creates an inherent demand for the US dollar as the only currency that can settle those international liabilities, and thus cements its dominant role in the international monetary system. Thus, for these approaches, besides the utilization of the same (or similar) technology to ensure interoperability and the establishment of agreed regulations, major structural changes would have to take place if a truly balanced international system was to emerge.

Additionally, Fritz et al. (2014) argue that the hierarchical relationship between international currencies is explained by the different levels of liquidity premia[17]. In that sense, currencies do not go through a process of Darwinian competition in the international market where they struggle for the survival of the fittest. Instead, long-standing power relations and economic strength have been crucial to explain the use of the US dollar. International investors, particularly in times of financial distress, are willing to hold a currency asset that yields a small profit just for the benefit to have the 'power of disposal', i.e. the liquidity premium, in which this money can be used in the payment of goods and services as well as in the settlement of debts without losing its value. Therefore, although low transaction costs are, by definition, necessary for a currency to be liquid, it is precisely the trust that international actors have in the US dollar that grants its position as the key currency of the international monetary system (on the role of trust in making money, "money" see also (Lawson and Morgan,2021 who argue what matters is not the materiality of money, but its "positioned" nature). Similar to previously voiced concerns, the introduction of multiple CBDCs may offer lower transaction costs and further efficiency, but this in itself is not enough to take away the position of the US dollar, which holds a long-standing trust relationship with international investors.

Figure 1 summarises our main conceptual argument. It shows the three main determinants of US dollar dominance (trade invoicing; dollar funding; and financial infrastructures). Only if all these factors change, can the US dollar be de-throned. Therefore, although CBDCs may help to reduce inequality in terms of financial inclusion and reduce costs, the introduction of a CBDC from sovereign states will not alone take the position of the US dollar, i.e. it will not reduce the monetary power of the US.

[17] Liquidity premium is a concept initially developed by Keynes (1936) that can also be applied in the international market.

603 **Figure 1: The Determinants of the US Dollar International Dominance**



604

605 Source: authors' elaboration.

5. Conclusion

This paper was mostly driven by the fact that there is little understanding in academia of what a CBDC is and the potential economic and financial impacts of this digital currency in a sovereign country. Given the high technicality of reports and the lack of financial and economic research on this topic, this paper mainly addresses this issue by providing an extensive and detailed explanation of how this system could work within a domestic context, where much has been published specifically with regard to retail CBDCs. Domestic retail CBDCs will be a new type of central bank money, with cash-like attributes[18], only in digital form. While various set-ups of this new money can be envisioned, including existing or new technology, and various regulatory set-ups, such as limits on how much can be held or transacted at any one time, under all scenarios the anonymity that cash currently provides would be lost.

On the other hand, and in contrast to private payment solutions in the form of stablecoins, domestic retail CBDCs could boost financial inclusion and payment efficiency with a focus on overall financial and monetary stability. Recently, research by central banks and supranational organisations has increasingly been concerned with the international dimension, particularly in terms of cross-border payments in the context of multiple CBDC (mCBDC) arrangements. With this, arises the question as to whether CBDCs will represent a threat to the current hegemony of the US dollar, where CBDCs issued by various countries could replace the current US dollar-based system.

The dominant role of the US dollar in the international monetary and financial system is a long-standing concern for EMDEs. On the macroeconomic level, this dominance has led to these countries' heightened external vulnerability, structurally high interest rates, and constraints on domestic monetary policies often driven by the global financial system. On the microeconomic level, the dominance of the US dollar and the power of the US in global financial infrastructures has meant substantial additional transaction costs, loss of efficiency and loss of power for EMDEs. Indeed, the dependence of those countries on those financial infrastructures has been identified as one of the main impediments to creating a more balanced international monetary system, which seems an increased use of those currencies for international trade and financial transactions.

Although the spread of CBDCs may represent a change in terms of the payment system, multiple CBDCs cannot replace the current asymmetries among currencies in the international market. In all of the various CBDC arrangements, the decisions of disconnecting or forbidding any operations do not belong to a single country, it would be instead a collective decision of all participating countries in this system. For instance, in recent events such as the conflicts between Russia and Ukraine or the turbulent relationship between the US and China, the US would no longer have the power to decide whether these countries can operate internationally, as CBDCs would be used in the context of multilateral agreements between countries. Although this

[18] Such as being the liability of the central bank or immediate (or near instantaneous) settlement both underpinning the risk-free nature of this type of money.

could create lengthy discussions and disagreements about how these systems operate, which could potentially increase inefficiency in this system, the US could lose the power to decide which countries may have access to this system.

At the same time, the introduction of CBDCs alone is not enough to challenge the asymmetries in the international monetary system. As our conceptual framework drawing on the dominant currency paradigm and the Post-Keynesian currency hierarchy framework has shown, the US dollar dominance is also determined by deep structural factors, such as dominance in invoicing international trade, and the US dollar's role as a global funding currency. The latter, in turn, is the result of the spatial agglomeration of financial activities in developed economies, which means the US dollar remains the key currency for denominating and settling international financial obligations. Moreover, demand for the US dollar is underpinned by deep trust in the institutions and governance of US financial markets and the ability and willingness of the US Fed to act as a global lender of last resort. Thus, whilst the de-dollarization of global financial infrastructures is a necessary condition for reducing US dollar dominance, sadly it is not a sufficient one.

In this sense, reducing the US dollar dominance will require a three-dimensional approach that tackles this issue across infrastructures, international trade and financial markets. We have discussed the first element in detail in this paper. Policy measures related to international trade could include the enhancement of regional payment and settlement mechanisms that foster actively the use of local currency in denominating and settling regional trade. The Eurozone is a prime example, but EMDEs across the globe are taking active steps in reducing the role of the US dollar in denominating regional trade transactions. With regard to the dominant role of the US dollar in the financial sphere, researchers have advocated a strategic decoupling from international financial markets through encouraging local financial markets and their respective currencies, macroprudential regulations (e.g. local funding requirements), and selected capital controls. These measures would both reduce demand for the US dollar and enhance the demand for the domestic currency. Hence, mCBDC arrangements are not the silver bullet to the discussed international financial and monetary asymmetries. They could, however, be one of the puzzle pieces in addressing and solving these issues.

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Appendix

Table of literature review on CBDCs

Domestic retail CBDC

Auer, R. and Böhme, R. 2020. The technology of retail central bank digital currency. *BIS Quarterly Review*. (March), pp.85–100.	• Introduction of retail CBDC architecture • Three possible scenarios: indirect, direct and hybrid CBDC model • Hybrid CBDC model most likely to be employed by Central Banks (CBs)
Bank for International Settlements 2018. *Central bank digital currencies* [Online].	• Detailed explanation of wholesale and retail CBDCs • Introduction and detailed description of CDBC taxonomy (money flower) • Discussion of CBDC properties • Analysis of CB role, monetary policy and financial stability under CBDC regime
Bank for International Settlements 2020. Central banks and payments in the digital era *In*: *BIS Annual Economic Report 2020* [Online]., pp.67–96.	• Detailed account of (retail) CBDC drawing on recently published BIS research
Bank of England 2020. *Central Bank Digital Currency Opportunities, challenges and design*.	• Thorough account of CBDC (definition, set-up, technological requirements, policy implications, potential benefits and drawbacks) with focus on UK
Boar, C. and Wehrli, A. 2021. *Ready, steady, go? – Results of the third BIS survey on central bank digital currency*.	• BIS survey of more than 60 CBs regarding stage of CBDC research and CBDC development including likelihood of CBDC introduction and reasons for CBDC introduction
Carstens, A. 2021. Central bank digital currencies: putting a big idea into practice. , pp.1–14.	• Detailed explanation of wholesale and retail CBDC • Analysis of current vs. CBDC payment system employing blockchain • Benefits and potential drawbacks of CBDC system • Mentioning of international dimension via mCBDC

	arrangements referring to Auer et al. (2021)
European Parliament 2019. *The Future of Money: Compilation of Papers* [Online]. Luxembourg: Policy Department for Economic, Scientific and Quality of Life Policies.	<u>Paper 2</u> • Identifies decline in cash as one of the main drivers of CBDC development • Gives an initial explanation of CBDC including potential benefits and risks • Includes a useful elaboration on CDBC taxonomy <u>Paper 3</u> • Move towards cashless societies and especially emergence of stablecoins identified as main drivers for CBDC research • Explanation of what a CBDC is • Theoretical elaborations on sCBDCs
Group of Central Banks 2020. *Central bank digital currencies: foundational principles and core features* [Online]. Available from: www.bis.org.	• Detailed explanation of CBDC including benefits and challenges • Introduction of three foundational principles (later also referred to as monetary Hippocratic oath)

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849 **<u>CBDCs for cross-border payments</u>**

Auer, R., Haene, P. and Holden, H. 2021. *Multi-CBDC arrangements and the future of crossborder payments*.	• Introduction and explanation of potential cross-border CBDC architecture • Three conceptual approaches: compatible CBDC systems, interlinked CBDC systems, single system for mCBDC (multi – currency system)
Bank for International Settlements 2021. *Central bank digital currencies for cross-border payments: Report to the G20* [Online]. BIS.	• Initial and early-stage research on cross-border CBDC arrangements to address G20 focus on increasing cross-border efficiency – CBDCs as one possible solution • Brings together recent publications on CBDCs

	(including mCBDC arrangements) • Discussion on benefits and potential drawbacks of cross-border CBDC usage
Bank of Canada and Monetary Authority of Singapore 2019. *Enabling Cross-Border High Value Transfer Using Distributed Ledger Technologies* [Online].	• Jasper Ubin Design Paper investigates cross-border payments with multiple parties transacting across different DLT (decentralized ledger technology) networks in different jurisdictions with no single trusted entity

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