

**THE EMERGING REVOLUTION  
OF DIGITAL CURRENCIES:  
A TECHNOLOGICAL OPPORTUNITY  
FOR REBALANCING THE  
INTERNATIONAL MONETARY  
SYSTEM**

July 2020





**Robert Triffin International**

***A watch on the international financial and monetary system***

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by *Christian Ghymers*

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*“The paradox of innovation is that it is only accepted as such once it has become an imitation”*

Piero Scaruffi (Stanford University)

## Abstract

*Technological innovations in payment systems are in a very fast and accelerating development that could affect deeply the conditions for ensuring financial stability and conducting monetary policy as well as the efficiency of the currency services for all citizens, including some geopolitical aspects to ensure less dependency from the dominance of US credit cards and the threat from Chinese and US Big Tech firms.*

*This strategic aspect and the implication for monetary policy and financial stability, joined to the attractive appetite of private sector for reaping the huge benefits from cost reductions and new smart functionalities for monetary payments, will force central banks to take over and regulate, but very probably to issue “Central Bank Digital Currencies” – CBDC – in close public-private partnerships with financial operators. The issuance of these CBDC will indeed – under conditions of interoperability – pave the way for a genuine “transmutation” of central bank monies from a local to a cheap and safe multilateral mean of settlements, in addition to the financial innovation and new functionalities provided by digital technologies.*

*Amazingly, CBDC could resolve the real obstacle posed by settlement risks (credit and liquidity risks) and the need to pass successively through multiple intermediaries and controls for acceding to Foreign central bank moneys. Indeed, the present cumbersome working modalities of the Forex will be radically simplified thanks to the “tokenization” applied to CBDC, resulting from some improved forms of permissioned “Distributed Ledger Technology” (DLT) i.e. not decentralized one, which allows for erasing resident - non-resident segmentation in international payments: DLT transfers instantaneously, peer-to-peer, payments or financial assets (like a “token”) digitally protected through a code. This safe technology not only skips all intermediary controls and implied delays required by the traditional sequencing of cross border payments (“PoP”), it also permits to conduct Forex transactions in digitalized central bank moneys (CBDC) like domestic payments.*

*The thesis we sustain in this paper has three related components: 1) the revolutionary improvement brought about by DLT with CBDC in financial integration required imperatively a global compatibility - or even a multilateral harmonization - arrangement for ensuring the interoperability of all national CBDC. This arrangement or coordination initiative between central banks and financial operators has also to be implemented as soon as possible for making possible during a transition period the working of the present Forex with the peer-to-peer DLT transactions. Such an initiative – whose operational technical modalities should still to be elaborated – needs to make compatible the automatic “tokenization” of CBDC implied by the use of DLT process with the traditional interbank Forex.*

*2) the most obvious and easiest way would be through the generalization of automatic conversion of all exchange-rate operations into e-SDR, which corresponds to the creation of an automatic virtual global clearing union. Anyway, such a centralized clearing should occur for benefitting fully from the advantage of tokenization of CBDC, making cross border transactions as cheap as domestic payments.*

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3) Inevitably, these new modalities will generate the conditions making possible and cost-reducing the issuance by the IMF of the e-SDR, first as a short-term overdraft facility for each central banks for smoothing the operational settlements on the Forex, but triggering the tangible opportunity to proof the costless availability of the missing lever for managing the global liquidity as a public good with an IMF acting as the multilateral LOLR by issuing/withdrawing e-SDR through the Forex.

Thus, the old Keynes/Triffin plans for establishing a rational system for global liquidity management more favourable to macroeconomic stability, could become at hands as a consequence of technological revolution in payment systems in order to ensure interoperability and full benefit of CBDC, ensuring central banks control of multilateral payment system in a more stable world.

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# The Emerging Revolution of Digital Currencies: a Technological Opportunity for Rebalancing the International Monetary System

*Christian Ghymers\**

## 1. The emergence of retail digital currencies

Among the numerous systemic effects, the COVID-19 is the increasing reason to consider seriously a fast issuance of digital currencies by Central Banks (CBDC) i.e. digitalised instruments issued by the central bank for payments and settlements on equal conditions with fiat money (bank notes or bank deposits) or an electronic extension of cash. Nevertheless, there are also private forms of digital currency i.e. a form of electronic money. It is a monetary value that is privately issued, and stored electronically on receipt of funds. Such money can be stored on cards, devices or on a server. Examples include pre-paid cards, web-based services like PayPal, electronic purses such as M-Pesa in Kenya (processing payments equivalent to just under half of Kenya's GDP), or mobile-money accounts (396 million users in Africa), or in China operated mainly by Alipay and Wechatpay (92% of mobile payments that amount to a total of \$5.7 trillion).

These crypto currencies are not to be confused with crypto-assets or virtual currencies<sup>1</sup> like the Bitcoin or the Ethereum and others, although CBDC would<sup>2</sup> probably use also some improved forms of permissioned "Distributed Ledger Technology" (DLT) i.e. not decentralized one (see glossary in Annex) as indicated by the fact that until now most CBDC projects have employed permissioned CBDC. The innovation rests in the "token" format<sup>3</sup> of central bank money. On the contrary, public blockchains like bitcoin have prioritized decentralisation and security over scalability (the capacity to process high volumes of transactions), leading to low transaction capacities, while financial firms need high speed and volumes, high security and less decentralization<sup>4</sup>, this means to use permissioned DLT.

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\* Vice-Chairman of Robert Triffin International

<sup>1</sup> The entire cryptocurrency market amounted in early May 2020 to a combined \$267 billion, of which \$181.5 billion for the Bitcoin and \$23.4 for Ethereum, the two major crypto-assets. Around 2000 cryptocurrencies with a positive market value were listed on coinmarketcap.com in April 2020. They represent only 2% of monetary aggregates in the Euro-area. However, in January 2018, the market capitalization reached a maximum of \$800 billion or about 6% of monetary stock.

<sup>2</sup> According to some analysts there is still some debates, see Scorer, S., in "Central Bank Digital Currency: DLT, or not DLT? That is the question", Bank Underground, June 2017; debates go on about DLT. However, more recent works tend to conclude that "permissioned DLT" would be the only option both for preserving the control capacity of the central bank and because they significantly cut risks, time and costs while improving safety thanks to the token-format which makes peer-to-peer payments instantaneous and safe.

<sup>3</sup> See glossary as well as on page 41.

<sup>4</sup> This is the "scalability trilemma" coined by Vitalik Buterin, Ethereum's founder, in which only two of three attributes can be simultaneously attained: decentralization, security and scalability. Presently, the scalability of

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Several new elements have suddenly appeared with the Pandemic making attractive arguments for moving faster than envisaged from theoretical analysis to operational decisions for issuing this new form of central bank money: the central bank's obligation to deal with contaminated banknotes and to clean vast amounts of their currencies, the imposed uses of credit cards for most retail payments during the lockdown which reduces the demand for fiat money, the possible need to organize fast and safe distribution of cash assistance in the future to large groups of citizens, are powerful new arguments that could spur their decision.

However, the decision was already under study well before the Pandemic and not for reasons linked with this kind of emergency situation, but to systemic, geopolitical and social arguments:

- The People Bank of China is the first to have launched operational tests of a digital yuan with the main commercial banks. It began analysing this option in 2014 and launched in 2017 a project named "Digital Currency – Electronic Payments". In April 2020, this project entered in an operational test in four cities, with the view to extend it later in 2020 in order to replace most of the cash in circulation by 2022. The official reason is that China has registered a spectacular shift from physical cash to electronic payments in less than a decade with the surge in mobile payments (\$5.7tn in 2019 dominated by only two firms, Alipay and WeChat Pay). Another clear reason is "to protect ...monetary sovereignty<sup>5</sup>" and the geopolitical longer-run plan to develop the Renminbi network as a tool for extending its influence while escaping from the dollar domination (or potential weaponization) and controls of international payments through the SWIFT platform<sup>6</sup>. This argument is not limited to China or Russia.
- The EU too is aware of geopolitical risks which have significantly risen with the Trump's unclear behaviour up to decide in 2019 to relaunched the initial project from 2007 to create a Pan-European debit card system in the Single Euro Payments Area<sup>7</sup> to rival Visa and Mastercard and the 2009 "Monnet Project" to create a European Card. The ECB has long-floated the idea of a home-grown cross-border scheme capable of ensuring more monetary sovereignty and lower costs for international transactions through full interoperability. Now, in a different geopolitical context created by the weaponization of the US dollar and the White House conflicting behaviour, it became consensual that European payments could be jeopardised in the event of a row with the US. European Union policymakers and central bankers expressed the need to reduce the very high dependency of the European payments from external powers and technologies. In addition to the geopolitical aspects, the ECB wanted to improve the efficiency and security of the international payment system and to allow Europeans to transfer money to each other instantly. For these purposes, since 2016, the

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the best DLT are reaching sufficient size for processing CBDC and researches go on with promising perspectives.

<sup>5</sup> According to Mu Changchun's declaration as Director of the People Bank of China Digital Currency Research Institute

<sup>6</sup> Russia has also developed an alternative to the SWIFT, as some European countries with the "Instrument in Support of Trade Exchanges" (INSTEX) with a view to prevent the weaponization of the dollar illustrated by the Trump's sanctions against Iran.

<sup>7</sup> the Euro Alliance of Payment Schemes (EAPS), an international alliance of European bank and interbank networks

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ECB has been studying the and assessing the DLT characteristics with the Stella project, with the Bank of Japan (see below), and in November 2019, the ECB has been pushing for a euro-denominated instant-payment system to handle all types of cashless payments, whether by card, transfer, direct debit or mobile, especially with the Pan European Payment System Initiative (Pepsi), associating 20 main European banks, trying to base the system on the Sepa credit transfer instant (SCT Inst) scheme. The reason is that it can so immediately capitalise on powerful and sophisticated existing infrastructures, such as the Eurosystem's TARGET Instant Payment Settlement (TIPS). The ECB announced it was ready to oblige payment service providers to adopt instant payments and to ensure that private clearing systems reach a full interoperability. In 2020, the project was confirmed under the name of "European Payments Initiative- EPI" for implementing an operational digital payment system for use anywhere in Europe able to supersede the fragmented landscape that currently still exists. This system will provide a Pan-European card, a digital wallet and "peer-to-peer" transactions, with the target to cover 60% of all payments for 2022.

- Ukraine has been exploring since 2016 the issuance of a CBDC and experimented from December 2018 to February 2019 the e-hryvnia; however, in February 2020, the conclusions were mitigated, and the central bank wants to wait further progress in technology before to decide.
- Sweden, as one of the lowest cash user in the world, has developed the e-Krona. After a three years research, the Riksbank announced in April 2019 its intention to launch the e-krona as a retail CBDC with a view to abandon physical cash. In December 2019, it contracted with Accenture to test e-wallets, DLT and interoperability with banks, using a DLT through R3's Corda system. The purpose is to provide a 24/7/365 e-wallet able to work with smart-watches, apps and credit cards. In February 2020, a one-year experiment for the e-Krona was started.
- UK: in February 2016 the Bank of England announced it had partnered with researchers at University College in London to produce RSCoin, a digital currency designed for central bankers and based upon DLT. Intensive works has been made to analyse closely the issuance of CBDC; in March 2018 it announced its plan to run a DLT-based Real Time Gross Settlement (RTGS) with token and R3 for checking the connectivity between DLT based settlement systems with non-DLT-based RTGS technologies, concluding positively in a report on July 2018. More works and publications of the BoE dealt with CBDC. The Bank is part of the Cryptoasset Taskforce, created in March 2018 by HM Treasury for working with the Financial Conduct Authority on CBDC. Its report on CBDC and DLT was published in October 2018 presenting the benefits and risks, and the implications for regulations and international cooperation. The Bank undertook a Proof of Concept (POC) to test the current capability of DLT with PwC as partner, and created a specialized hub and a FinTech Accelerator to work with innovative firms and new technologies.

Also, in August 2019, the Governor Carney said in Jackson Hole Forum, that a global digital currency could replace the U.S. dollar as the world's reserve currency. He proposed a network of CBDC in order to dampen the domineering influence of the US dollar on the global financial cycle, helping to reduce the volatility of capital flows and the global liquidity trap.

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- Singapore: on May 2017, its Monetary Authority published its analysis of the applicability of DLT to cross-border transactions and in November 2017, on the liquidity saving. These works were done in cooperation with Hong Kong and Canada central banks, with joint reports on DLT in November 2017 and 2018.
  - Hong Kong: its Monetary Authority cooperates with Singapore Monetary Authority on the DLT related issues
  - Canada, although without intention to launch a CBDC, the central bank has managed several researches in order to be ready when the use of cash would decline sufficiently. In 2017, the bank piloted the project Jasper testing the DLT for payments; on November 2018, the bank published together with the Bank of England and the Monetary Authority of Singapore, a report on cross-border transactions concluding positively on the advantages of digital currencies.
  - Uruguay started a pilot experimentation of an e-peso starting in November 2017 for six months with 10.000 users; the main purpose was social inclusion and this project was declared successful in April 2018.
  - Israel: at the end of 2017, the central bank and the government announced their intention to create a digital shekel.
  - Venezuela: in December 2017, President Maduro announced the creation of the “Petro”, a digital currency backed by commodity reserves, including oil, diamonds, and gold, in order to help overcome the country’s “financial blockade.” By the US.
  - Thailand started a multi-phase testing of a DLT CBDC in August 2018, with 8 banks and R3 (Corda system), named Project Inthanon, extended to cooperation with Hong Kong Monetary Authority in May 2019. A joint report of both central banks concluded in December 2019 that DLT-based CBDC was successful, being secure and cost-cutting.
  - Germany: some studies were prepared on DLT with the Deutsche Börse in 2018. A debate has developed recently, with the Bundesbank on a very conservative positions against CBDC, asking to set first a regulatory framework, and the government which is favourable to a e-euro for not lagging behind other countries and private stable-coins. In January 2020, a first crypto law came into effect. It regulated licensing of crypto assets for private entities and is expected to incentivize banks to create services related to crypto assets.
  - South-Korea started a pilot programme in April 2020 for 22 months
  - Brazil, the central bank launched in February 2020 its own official payment networks, named PIX, to be open to public in November 2020 for reaching a mass adoption during 2021.
  - USA, the Fed is lagging behind the other central banks (or remaining more discreet), being reluctant when assessing the risk for the banking sector. However, the Facebook project Libra and the Chinese development brought a private initiative in January 2020 with the “Digital Dollar Project” (DDP), a joint venture between Accenture and the Digital Dollar Foundation, a non-profit created by J. Christopher Giancarlo, a former chairman of the Commodity Futures Trading Commission. Its aim is studying design options to introduce a tokenized Central Bank Digital Currency for the U.S., a “digital dollar”. In May 2020, DDP published a

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white paper “The Digital Dollar Project: Exploring a US CBDC”. The recent Pandemic provoked a growing interest for a digital dollar: in March 2020, in response to bipartisan proposals to distribute emergency funding to those impacted by COVID-19, the House Financial Services Committee and Senator Sherrod Brown proposed the “the Banking for all” Act, a new U.S. Federal Reserve infrastructure to distribute electronic payments directly to consumers that was termed “digital dollars” or a e-wallet for all Americans; in May the Fed of Philadelphia published a paper on CBDC, and in June 2020 several hearings on CBDC were organized by the Congress.

- Russia, although the central bank has expressed its intention not to issue CBDC, it continued to study this alternative, and in February 2020, it announced having experimented with success a platform for tokenization<sup>8</sup> of assets.
- France: the central bank is working on assessing the issuance of a e-euro with an experiment for interbank settlements with three objectives: to analyse the use of CBDC with traditional interbank settlement, the benefits and role for innovation, and the impacts on policies and regulation aspects; a report is expected for July 2020
- The Netherlands: the central bank wants to lead the technical aspects of a digital euro, in agreement with the ECB. In April 2020, it published a report on CBDC.
- Turkey: the President programme foresees the introduction of a digital lira for end of 2020
- South Africa: the central bank took the initiative to invite private firms to develop the infrastructure for CBDC and in March 2019, it started a feasibility project for assessing the usefulness of CBDC with a focus on security
- Australia: the central bank is actively exploring the implementation of a wholesale digital dollar setting an innovation lab for simulating the tokenization for banks based upon a private permissioned Ethereum network.
- Japan: no official project but central bank studies and growing pressures from public opinions and political parties for considering a digital currency; in April 2020 the main social network, Line created the Link for use in Japan.
- Pakistan: the State bank declared in March 2019 to prepare for 2025 a digital currency in order to improve social inclusion, to reduce corruption and to modernize the payment system.
- Iran: in reaction against US sanctions, in 2018 the government decided to prepare a digital currency in order to facilitate cross-border and to circumvent the US sanctions; a gold-backed crypto currency was created with banks under the name of “PayMon” for tokenize bank assets and properties: in December 2019, Iranian President called for the creation of a “Muslim crypto currency”. Iran also cooperates with Russia and Armenia through a trilateral blockchain Agreement
- Norway: central bank established a working group which published a first report in May 2018 with key considerations; in June 2019, a second report explored the purpose of CBDC and assessed the potential solutions; the third report will deal with the technologies options and their impacts.

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<sup>8</sup> See glossary

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- Mauritius: the central bank announced in November 2019 and confirmed in May 2020 it is about to launch a pilot plan for issuing a CBDC.

The Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, the Sveriges Riksbank and the Swiss National Bank, together with the Bank for International Settlements (BIS), have created a group to share experiences as they assess the potential cases for central bank digital currency (CBDC) in their home jurisdictions. Everywhere, the retail payment market is experiencing change in its structure in recent years, as the number of new disrupting actors – the FinTech firms – entering the market increases with the rapid progress of information technologies. But other reasons have also appeared.

On June 2019, Facebook's Libra project announced a global alternative for payments making it easier to make digital payments no matter from where the transactions are made. Libra project drew a lot of attention, because the potential use of such a payment device is enormous with Facebook creating a Libra association with many other global operators (like Booking Holdings, eBay, Mastercard, Mercado Pago, PayPal, Stripe, Visa and many other companies and associations reaching one hundred firms). In contrast to crypto-assets such as bitcoin which use "permissionless blockchains" (see glossary), Libra is not decentralized, relying on trust in the Libra Association as "a de facto central bank". However, the Libra project was postponed due to immediate official reactions from US, UK and EU, leading to M. Zuckerberg's commitment that Libra would not be launched anywhere in the world without first obtaining approval from United States regulators. The project is still alive but was scaled down in order to get approval from authorities. The Libra originated the creation in June of the G7 task force on crypto-assets and in September at the BRI.

Already in December 2016, the ECB launched with the Bank of Japan the Project Stella dedicated to experimental work and conceptual studies exploring DLT's opportunities and challenges for improving the payment infrastructures and settlements. Three phases have successively focused on the processing of large-value payments using DLT (Phase 1 September 2017), on securities delivery versus payment (DVP) in a DLT environment (Phase 2 March 2018) and on innovative solutions for cross-border payments (Phase 3 July 2019)<sup>9</sup>.

The Phase 1 analysis found that a DLT application could process volumes of payment requests comparable to those routed to the central banks' current funds transfer systems, and proved the feasibility of implementing the processing logic of liquidity saving mechanisms (queuing and bilateral offsetting) in a DLT environment. Phase 2 also confirmed that delivery-versus-payment (DVP) can run in a DLT environment, even without any connection among the multiple networks, which is not achieved by existing arrangements and is safer. It identified a new approach for settlement across ledgers that could potentially allow the mitigation of credit risks through the synchronisation of settlement. Phase 3 concluded that the safety of today's cross-border payments could potentially be improved by using payment methods that synchronise payments and lock funds along the payment chain. However, the report noted that further works are required before the possible implementation of such new methods could be considered (especially on the maturity of the technology and its cost-benefit).

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<sup>9</sup> ECB-Bank of Japan, Synchronised cross-border payments, July 2019,

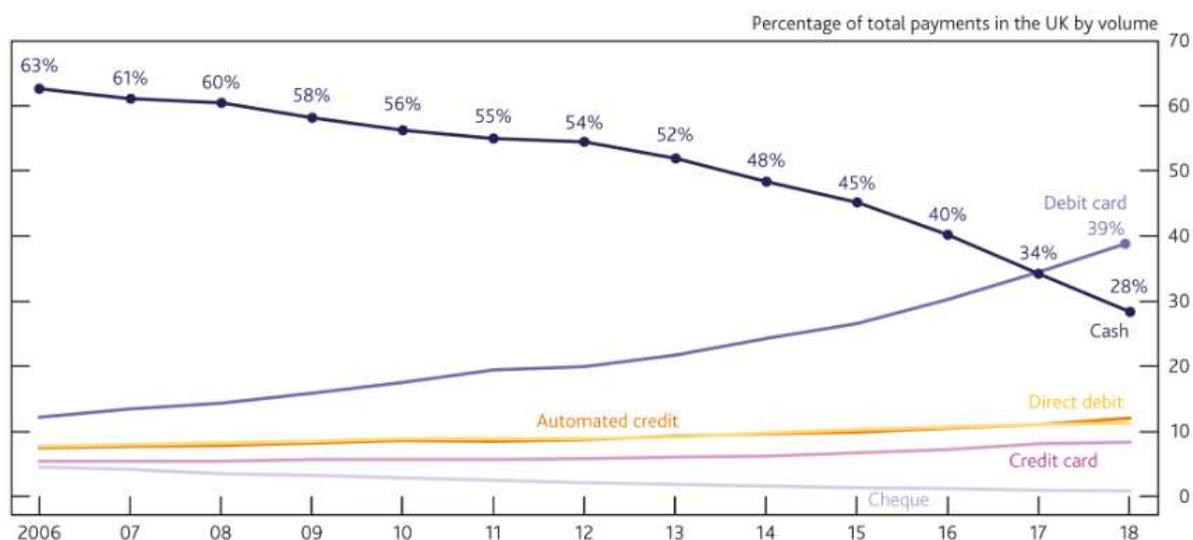
<https://www.ecb.europa.eu/paym/intro/publications/pdf/ecb.miptopical190604.en.pdf>

**Table 1. Main DLT-Related Initiatives by Central Banks**

European Central Bank	<ul style="list-style-type: none"> <li>Studied, in collaboration with the Bank, the applicability of DLT to (1) funds transfer and (2) DVP settlement (the report on (1) was published in September 2017; and the one on (2) in March 2018) [Project Stella].</li> </ul>
Deutsche Bundesbank	<ul style="list-style-type: none"> <li>Studied, in collaboration with the Deutsche Börse, the applicability of DLT to DVP settlement, etc. (the report was published in October 2018) [Blockbaster].</li> </ul>
Bank of England	<ul style="list-style-type: none"> <li>Conducted proof-of-concept on the synchronized movement of multiple currencies processed in different systems using DLT-related technologies (the report was published in July 2017).</li> <li>Conducted proof-of-concept on connectivity between a DLT-based settlement system and a non-DLT-based RTGS system (the report was published in July 2018).</li> </ul>
Bank of Canada	<ul style="list-style-type: none"> <li>Studied the applicability of DLT to (1) funds transfer and (2) DVP settlement (the report on (1) was published in September 2017 and the one on (2) in October 2018) [Project Jasper].</li> <li>Announced work on linking its DLT platform to that of the Monetary Authority of Singapore, to explore the applicability of the DLT to cross-border transactions (November 2018).</li> </ul>
Hong Kong Monetary Authority	<ul style="list-style-type: none"> <li>Exchanged a MoU with the Monetary Authority of Singapore to develop a DLT-based infrastructure that can be used to exchange information between Hong Kong's trade infrastructure and that of Singapore (November 2017).</li> </ul>
Monetary Authority of Singapore	<ul style="list-style-type: none"> <li>Studied the applicability of the DLT to (1) funds transfer, (2) the liquidity saving mechanism, (3) DVP settlement (the report on (1) was published in May 2017, the one on (2) in November 2017, and the one on (3) in November 2018) [Project Ubin].</li> <li>Announced work on linking its DLT platform to that of the Bank of Canada, to explore the applicability of the DLT to cross-border transactions (November 2018).</li> <li>Exchanged a MoU with the Hong Kong Monetary Authority to develop a DLT-based infrastructure that can be used to exchange information between Singapore's trade infrastructure and that of Hong Kong (November 2017).</li> </ul>
South African Reserve Bank	<ul style="list-style-type: none"> <li>Studied the applicability of DLT to funds transfer (June 2018) [Project Khokha].</li> </ul>

Source: Bank of Japan, "Payment and Settlement Systems Report", Report and Research Papers, March 2019

**Chart 1: Structure of payment means in the UK**



Source: Bank of England, <https://www.bankofengland.co.uk/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design-discussion-paper>

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## 2. Central Bank Digital Currency (CBDC) are essential for reaping the full benefits of digital payments

Central bank money in the form of banknotes and reserves are key to the core missions of central banks not only to achieve monetary and financial stability, but also for ensuring efficient cross-border settlements. This aspect is becoming essential and takes more importance. New payment technologies will bring many advantages, mainly linked to the token-form DLT gives to any payments or asset transactions, allowing to bypass most intermediaries through instantaneous peer-to-peer transactions and to enjoy many additional digital innovations for payment management. However, these advantages take all their dimension only if central bank monies are also digitalized in token-form (DLT) with an international interoperability. The reason is merely that in exchange-rate transactions, what a domestic bank generally buy is only a claim upon a Foreign correspondent bank (or other intermediary), not a direct claim upon the non-risky Foreign central bank's money.

Indeed, why a CBDC would be any different than the 'digital' money that the world spends in cross-border transactions with credit and debit cards every day? The key difference is that holding a claim in CBDC means a liability of a central bank - the most riskless-liquid asset - while the claim with a credit card is a liability of a commercial bank.

Of course, the US dollar used as the dominant reserve currency tends to blur this difference and its associated risks, which remains but are much more apparent for secondary currencies: central bank monies are merely convertible local claims, non-resident have no direct access to central bank monies. The crucial difference that will emerge with a generalization of issuance of compatible tokenized CBDC is to create a *genuine "transmutation" of central bank monies from a local to a potential, cheap and safe multilateral mean of settlements, in addition to the financial innovation and new functionalities provided by digital technologies*. CBDC have the potential to bypass the multiple intermediaries and security controls for acceding directly to Foreign central bank moneys. Indeed, the present cumbersome working modalities of the Forex will be radically simplified thanks to the "tokenization" applied to CBDC, resulting from some improved forms of permissioned "Distributed Ledger Technology" (DLT) i.e. not decentralized one, which allows for erasing resident - non-resident segmentation in international payments: DLT transfers instantaneously, peer-to-peer, payments or financial assets (like a physical "token") digitally protected through a code.

Although the central bank's main priority was initially dominated by domestic aspects of monetary policy and security, the essential quality of CBDC is becoming more apparent for cross-border payments. Of the 66 central banks that replied to the 2019 BIS survey, 80% of central banks are engaging in some sort of work on CBDC with dedicated team and/or in network cooperation. 40% have progressed to experiments and developing proofs of concept, and more will join. In April 2020, the Netherlands Bank declared to be ready to play a leading role in the launch of a euro-CBDC and offered a suitable testing ground for such an experiment<sup>10</sup>. In November 2019, the Association of German Banks released a detailed plan for a "crypto-based digital Euro". The ECB

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<sup>10</sup> De Nederlandsche Bank, Digitaal centralebankgeld Doelstellingen, randvoorwaarden en ontwerpkeuzes, Occasional Studies Volume 18 - 1 [https://www.dnb.nl/en/binaries/WEB\\_127593\\_OS\\_CBDC\\_tcm47-388318.PDF](https://www.dnb.nl/en/binaries/WEB_127593_OS_CBDC_tcm47-388318.PDF)

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has a dedicated team working on both wholesale and retail options for a digital euro, since 2016 and created a working group with the central banks of Canada, Japan, Sweden, Switzerland, and the United Kingdom to explore cross-border interoperability of national digital currency projects. In December 2019, the ECB published a paper<sup>11</sup> warning that it could issue its own digital currency if the private sector fails to make cross-border payments faster and cheaper. Banque de France launched its digital euro experimental program in April 2020 for exploring the potential of digital currency in "clearing and settlement of tokenized financial assets." Also the G7, G20, the BIS together with the Financial Stability Board are working on the issues raised by digital currencies and their potential to improve cross-border efficiency and lower their costs.

According to a survey conducted in February 2020<sup>12</sup>, central banks in 46 countries are considering creating a central bank digital currency (CBDC) using a constrained form of distributed ledger technology (DLT) i.e. not a decentralized (public) blockchain.

The Bank of England has been particularly active on CBDC, and there exists an active think-tank of central bank issues that has undertaken various analysis to the digital currency issues, the OMFIF, the Official Monetary and Financial Institutions Forum, based in London. It is an independent think tank for central banking, economic policy and public investment. It recently decided to open inside OMFIF a Digital Monetary Institute - DMI<sup>13</sup>.

The interest for digital currencies issued by central banks, has started well before the Pandemic, for more fundamental reasons, especially the potential fast erosion of the monopoly of central bankers and the extraordinary potential provided by digital technologies for the quality, scope, costs and management of the payments, including the social inclusion as well as the sovereignty of the payment system by allowing direct safe access to digital accounts without need of bank and their Foreign intermediaries. Technological developments in the financial sector and changing consumer preferences like the fall in the use of cash and the distrust in banks, have opened new possibilities for making payments, saving and transferring money internationally. These innovative modalities for overcoming the shortfalls in the monetary system by a decentralized currency issuance show significant improvements in the cost-effectiveness of managing payment systems, like almost costless medium of exchange and saving, faster speed and better efficiency, lower counterparty risks, more financial inclusion through flexibility for tailoring services to various types of consumer and markets, especially for LDCs with poor banking infrastructure and riskier macroeconomic environment, and overall as a way to benefit from the digital wave which will imply a revolution for the banking business. *“One of the most interesting features that has emerged through developments in DLT is the potential to create ‘programmable money’. This can be implemented via the use of ‘smart contracts’ – pieces of code which are able to self-execute payments based on some pre-defined criteria.”*<sup>14</sup>

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<sup>11</sup> ECB, Innovation and its impact on the European retail payment landscape, December 2019

<sup>12</sup> King, Rachel, The Central Bank Digital Currency Survey 2020 – debunking some myths, Central Banking, 7 May 2020

<sup>13</sup> [https://www.omfif.org/dmi/?utm\\_source=announcement1.1](https://www.omfif.org/dmi/?utm_source=announcement1.1)

<sup>14</sup> Bank of England, “Discussion Paper: Central Bank Digital Currency Opportunities, challenges and design”, March 2020; <https://www.bankofengland.co.uk/-/media/boe/files/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design.pdf?la=en&hash=DFAD18646A77C00772AF1C5B18E63E71F68E4593>

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Digital currencies also tend to appear (or to be presented) as a citizen defence against financial abuse or “state conspiracy” in the populist mood of distrust in financial institutions and traditional incumbent powers, as well as against Foreign dependency. Nevertheless, this kind of dynamic innovation brings also new issues and risks, especially for the management of monetary policies and for the commercial bank funding, with potentially harmful impacts on the level of credit that banks could provide

This decentralization process makes unavoidable private interests to jump in what is still considered as a reserved field for the traditional monopoly of Central Banks. This emerging competition introduces some substitution away from existing forms of money. This creates not only an institutional challenge but rather a systemic one for the whole financial architecture and regulations, through the shift in the composition of bank funding, the resilience of the payment system, the financial stability and the management of monetary policy, as well as for fighting against money laundering and preserving citizen trust into sovereign currencies. Unregulated expansion of private digital currencies is thus an emerging threat for the main responsibilities of the Central Banks governance.

Therefore, the decrease in banknotes demand and the emerging new forms of money by Fintech firms represent a potential revolution in payments which creates pressures on the core missions of Central banks. This situation obliges them to react and to innovate for fulfilling duly their role. The positive result is the search for a more resilient and competitive payment system. Indeed, the provision of payment and settlement services is one of the vital functions that the financial system as a whole performs in an economy, together with ensuring the monetary and financial stability

The answers from Central Banks to the new challenges on payment system, consist mainly:

- First in making clear that the “crypto-currencies” like Bitcoin, have to be renamed “crypto assets” because they don’t reflect the inner social convention which characterizes the essence of money. Indeed, they do not perform satisfactorily the three essential functions of this social convention: these financial assets are not legal tender (not accepted as universal mean of payment), their value is too volatile for being a competitive store of value, they are unable to become the unit of account of a national monetary system. They remain highly speculative assets, and even as investment tool they present several flaws: no evidence of hedging against inflation, no dampening of volatility given historical volatility of 76%, not allowing for consistent diversification benefits given their unstable correlations.
- Second, in expressing the need for assessing the existing regulations and adapting them to the probable emergence of crypto-currencies leading probably to the need for strong regulations. Central banks would need to retain overall control of the CBDC network. This means it would always need to be a ‘permissioned’ DLT (see glossary).
- Stablecoins as digital currencies anchored to stable assets or third stable currencies are seen as powerful competitors that bring attractive cost reductions in cross-border operations, but raised many issues that need to be closely monitored and regulated.
- Most central banks are recently considering that genuine “cryptocurrencies” could be created by issuing themselves digital currencies as complementary central bank money, or “digital banknotes” i.e. part of their liabilities. The arguments for justifying this major

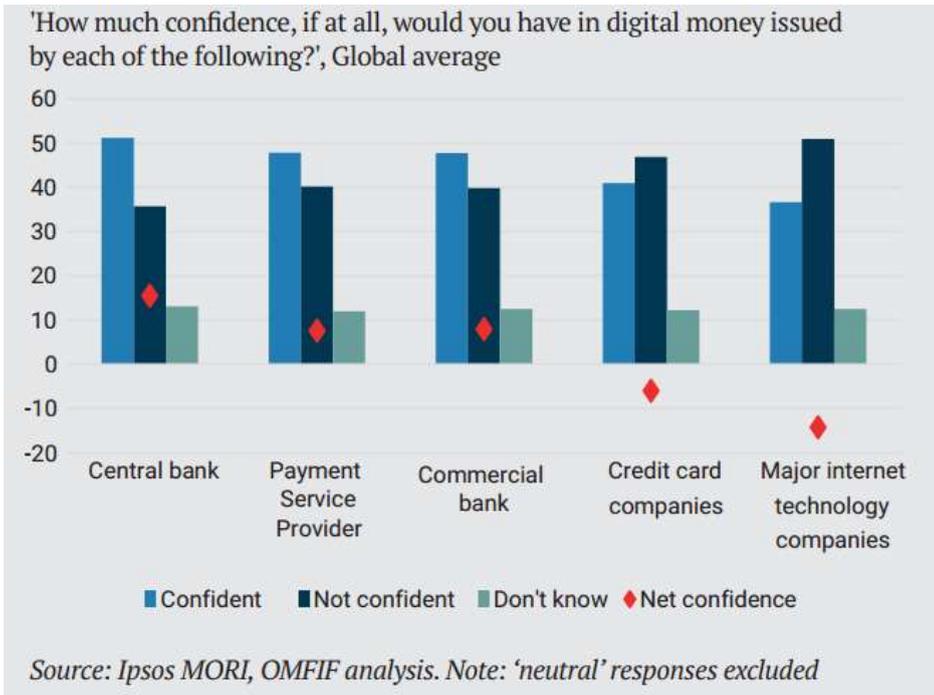
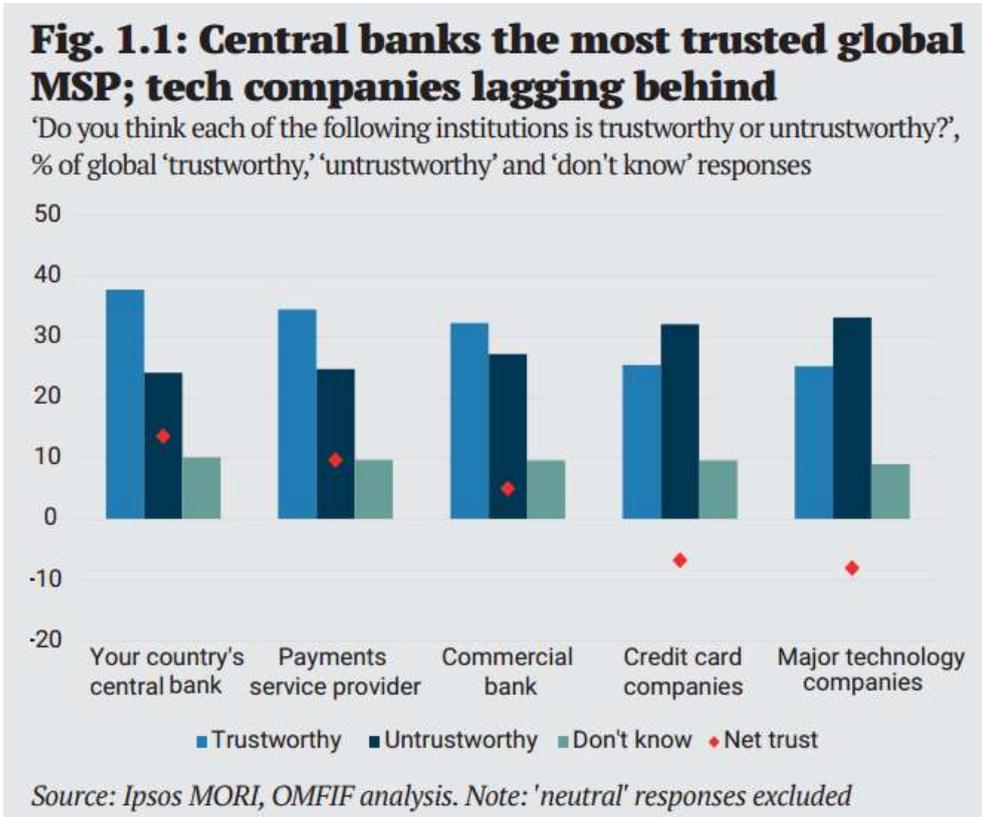
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change are both the opportunities and challenges that a “Central Bank Digital Currency – CBDC” present for their inner missions: taking over the creation of cryptocurrencies is the simplest way to make up for the competition in issuing means of payments while – under conditions – enhancing their ability to maintain monetary and financial stability in addition to providing clear additional benefits to citizens, that might not be offered by other payment systems or services.

- The most significant gains from CBDC relies in the socio-economic effects brought by the resulting contraction of risks, costs and time in cross border transactions, that central banks consider with reason as excessively high for the citizens, although until now they generally don't see such a contraction in cross-border costs as the main priority or argument for issuing CBDC.
- CBDC would ease the availability and distribution of central bank money and would increase the availability and utility of central bank money, allowing it to be used in a much wider range of situations than physical cash.
- Many central banks have undertaken cautious cooperative analysis of the numerous issues that need to be tackled before to be in position to launch efficient CBDC. These main issues are: the consequent changes for the stability of the monetary system, both their monetary policy conditions and the impacts for commercial banks, the resiliency and security aspects of the payment system safeguarding against potential shocks in global payments systems and ensuring resiliency against cyber-attacks as well as against excessive dependency of Foreign intermediaries for geopolitical reasons, the possibilities for contingency solution in case of failures or electronic breakdown, the technological choices (decentralized technics like blockchain DLT, permissioned or not, versus centralized platform) which have to identify the appropriate and optimal level of distribution or decentralisation for the CBDC core ledger, achieving the best combination of resilience, speed, efficiency and scalability, the money laundering and terrorist financing, the tax evasion, the trade-off between anonymity and traceability/supervision, the technical and legal interoperability, the cross-border aspects, improving the efficiency of payments and opening them to the many opportunities provided by digital innovations, business continuity arrangements, etc.

Indeed, if central banks don't issue themselves digital money for retail and wholesale transactions, private firms will do (as some of them are already doing) by offering “stable” crypto assets, known as ‘stable coins’. These competitors seek to provide stability of value via some form of backing. However, the degree of value stability and convertibility to the legal tender cannot be as high as the result of what could be reached by the issuer of the ultimate means of settlements, which is the national Lender-of-Last-Resort: a CBDC enjoys a direct and full backing to risk-free central bank money. With a decentralized issuer competing with a central bank, a liquidity risk does inevitably exist, depending upon the coverage ratio of the backing and the credibility of this backing. Liquidity cannot be injected unless the underlying asset is purchased. In addition, a private digital currency presents other inefficiencies, other risks or aspects like technical operation collapse, security, interoperability and convertibility. In comparison to what a traditional central bank is legally and financially endowed for fulfilling its mission to preserve the efficiency of the payment system and to ensure a safe access to Foreign central bank monies, it remains clear that private “stable coins” cannot compete with most of the advanced economies currencies. In particular, the degree of security and coverage for users is

higher with a CBDC than with a private crypto currency, especially for the essential interoperability required by international payments. Survey respondents regard central banks as the preferred institution to issue a digital currency<sup>15</sup>



<sup>15</sup> OMFIF, Digital currencies: a question of trust, OMFIF report on global public confidence in monetary, financial and payment institutions, by Bhavin Patel & Pierre Ortlieb, 2020

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### 3. Impacts of digital currencies on monetary policy

More fundamentally, the creation of digital currencies – private or CBDC – have direct impacts on the structure of the monetary system through changes in the balance sheets of the Central Banks and of commercial banking system. In particular, the implementation of DLT will bring significant reduction of liquidity needs. These impacts are not the same for private issuances or for CBDC.

First, for the central bank balance sheet, a development of digital currencies by private firms is not equivalent to digital currency issued by the central bank. In the first case the liability side of the central banks is reduced by a substitution of part of the monetary base (central bank money, whatever from banknotes or from bank deposits) for private crypto currency, while in the second case the CBDC affects only the composition of the monetary base and not its total volume, because a CBDC remains a form of central bank money i.e. the substitution is only inside the monetary base: cash in notes against digital-cash, since CBDC becomes a new component of the liabilities at sight of the central bank, but also in case of a shift entirely from bank-deposits to CBDC, because the reduction in the private account with the deposit bank implies the same reduction in the reserves the deposit bank holds with the central bank for buying the new CBDC for its client. Also, the difference is that CBDC creates a direct link between non-bank agents and the central bank. Before creating CBDC, the liabilities of the central bank are only through the deposits by banks. With the creation of CBDC, non-bank agents hold also this form of deposit. As explained in section 2 this change brings a genuine systemic transformation by almost eliminating the distinction between residents and non-residents for cross-border transactions, explaining the quantum leap tokenized CBDC create for international payments and their liquidity requirement which will diminish. However, this does not mean that central banks should deal with individual customers directly because the operations of a CBDC are likely to rely on some sort of public-private partnership. Central banks could easily outsource the operational distribution of the CBDC to private financial institutions.

Second, for banking system balance sheet, in case of a switch between bank deposits for CBDC, the liabilities of the commercial banks are cut but obliging them to cut also their asset counterparts. The commercial banks are losing part of the cheapest and more stable source of their funding. This shrinking in their balance sheets is a so-called “disintermediation” which obliges the banks either to increase their liabilities by attracting funding with higher interest rates (anyway more expensive than for customer deposits), or to cut their lending to the economy. In both cases, the costs of credit will raise<sup>16</sup>.

In the case of private stablecoins, an additional risk appears for economies whose currencies are less stable than the basket (or the foreign currency) warranting the value of the digital currency. Indeed, citizens would move to the stablecoin, even for savings, when they perceived a

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<sup>16</sup> The Swedish Riksbank, for example, has estimated that the adoption of an e-krona could raise the cost of bank funding by up to 25 basis points

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too high difference of stability or strength between their domestic currency and the backing of the stablecoin. So the effectiveness of the country's central bank and monetary policy would be affected.

More generally, for monetary policy and financial stability, the impacts on the balance sheet of the central bank and commercial banks mean a crucial, systemic difference. It is important to examine the possibility to make the demand for CBDC, vis-à-vis bank deposits, manageable. In particular, the competition that would appear between bank deposits and CBDC raises the question of the possibility of financial destabilization for commercial bank in case of a rapid substitution: this shift could turn to a run on the banking system. Contrary to a run for cash which has its own limit due to the costs and risks to hold notes (and could not necessarily affect the totality of the banks), CBDC would be costless, riskless and able to affect the whole banking system. It could represent a more attractive option that might increase the case of a run out of bank deposits, even more if the CBDC would get positive interest rates on the held amounts. CBDC might represent a systemic risk of financial instability as far as it becomes easier to move money out of the banking sector. Nevertheless, in addition to standard increase by the central bank in the interbank liquidity, there exist several tools for controlling a too fast shift towards CBDC: to impose limits per account or per month, to impose fees or penalties for big amounts (negative interest rates). However, interest-bearing CBDC could find an argument (at least theoretically) as a way to increase the transmission mechanism of monetary policy. Regulatory response, however, should allow for managing these effects.

Another consequence of CBDC is the lower bound it implies on unconventional monetary policies, namely the limit on negative nominal interest rates they will create for bank deposit. Indeed, in case of negative rates, the holders could opt out of deposits by shifting to physical cash. This substitution carries however costs (physical custody and security aspects, amount limits etc.) that explain the possibility to "tariff" deposit with a negative yield especially for larger corporate clients, at least in the limit of the costs for holding cash. In case of a costless cash alternative option through digital deposits, this competition effect puts a zero-bound floor to interest rates, unless other measures could be imposed upon CBDC holdings.

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#### 4. Digital currencies could trigger a momentum of rapid changes in payment systems and raise deep societal issues with an inner multilateral aspect

As briefly outlined above, all the risks have to be assessed previously and the tools for managing them should be urgently studied. This explains the intense collegial works recently engaged by central bankers for analysing the possible options for issuing these CBDC in order not just to make sure the advantages outweigh clearly the new risks (something which looks highly probable from a pure efficiency point of view) but for selecting and designing the optimal modalities not only for the stability of the monetary system and the efficiency of monetary policy, but also for the customers and a democratic society. This assessment exercise is urgent and very complex. It cannot be limited neither to the impact upon national central bank tasks nor to technological aspects. Important democratic questions impose deeper analysis and broader debates across citizens and countries on collective security and payment system sovereignty, individual right protection, democratic governance, fiscal and social inclusion, and international cooperation.

Digital currencies, as the whole digital wave, raise a global major issue which cannot be solved separately by national authorities alone. It is a multilateral issue that needs to be tackled cautiously but urgently and cooperatively, upon genuine expertise preparing the grounds for democratic and multilateral debates leading to transparent political decisions. It also opens new opportunities for changes which question the status quo.

*We sustain the structured thesis that digital currencies using some DLT represent a revolutionary change which will oblige soon central banks to issue their own CBDC, and simultaneously to ensure their interoperability through a cooperative multilateral arrangement, in order to get the spectacular result – not yet sufficiently dealt with until now<sup>17</sup> - of eliminating almost all of the cost differences between resident and non-resident for Forex transactions, thanks of the “tokenization” which gives to CBDC the faculty not only to eliminate settlement risks but to warrant direct access to central bank monies (CBDC) among residents of different countries.*

In consequence, the key question about managing global liquidity should be the focus of monetary authorities, offering a nice opportunity to be back to the Keynes/Triffin proposals and the asymmetrical aspect of the present IMS.

The purpose of this short overview is ambitious because this subject is very large and technical while submitted to very fast moving innovations. In spite of these difficulties and risks, this paper takes the view that the digital waves in payments offer an opportunity for systemic changes by putting pressures upon the monetary authorities as well as upon traditional Forex operations. Conscious of these limits, we consider that the most crucial point for digital currencies is the cross-

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<sup>17</sup> One referee to this paper (written in May 2020) informed us on 5/07/2020 about his own works on course on this aspect, sustaining the same position on spectacular potential gains of using CBDC with DLT for cross border payments. See Ousmène J. Mandeng’s draft paper “Foreign exchange trading with instant settlement in central bank money” 2/06/2020 ([https://www.economicsadvisory.com/comments/CBDC\\_and\\_foreign\\_exchange.pdf](https://www.economicsadvisory.com/comments/CBDC_and_foreign_exchange.pdf)).

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border payments because they bring back the deepest flaw of our monetary system: the public good nature of the international monetary system asymmetrically managed by some national authorities and wild financial markets leading to an undersupply of adequate multilateral tools with very costly segmentation of liquidity, and therefore unnecessary systemic risks in absence of a regulated multilateral reserve currency. As developed in section 5 below, the DLT technology and its ability to issue “tokenized” CBDC, allow for eliminating open position in Forex operations by extending the instantaneous access to central bank monies skipping the intermediary claims on correspondent banks and changing the liquidity issues.

## **5. Cross-border payment issues reveal some inner multilateral public good aspects that point to the need for cooperative options in order to make possible a systemic improvement**

The digitalization of currencies, either private or managed by central banks, leads inevitably to tackle the issue of easing the international payments. This is the question of the full interoperability of the national systems which is not only an issue of technical harmonization, but opens also deeper systemic questions like the necessity for multilateral legal harmonization compatible with technological standards, the excessive costs on the Forex and the missing of a symmetrical international standard or reserve currency for warranting global stability.

The stablecoin initiatives played a trigger role on accelerating national and multilateral authority’s reactions and awareness of the need for international coordination. Recently, a number of stablecoin initiatives have emerged with the sponsoring of large technology or financial firms providing large customer base with cross-border activities. These new stablecoins have the potential to scale rapidly to achieve a global impact. Authorities consider that these global digital stablecoins “could potentially contribute to the development of global payment arrangements that are faster, cheaper and more inclusive than present arrangements”<sup>18</sup>. In parallel to this preoccupation, some geopolitical aspects use also to play a role in the authorities’ reactions, namely for the US who could lose control of payments in case competing stablecoins, as the Chinese digital Renminbi or the Russian System for Transfer of Financial Messages as well as the European INSTEX and the European Payment Initiative pointing to reduce excessive dependency of US firms and Foreign technologies. These considerations explain the development of intensive works in international forum.

The G7 Finance Ministers and central bank Governors at their meeting in Chantilly in July 2019, asked for a report from their Working Group on Stablecoins. The BIS issued this report on the results of the G7 working group in October 2019, underlying that digital “*Stablecoin initiatives have highlighted shortcomings in cross-border payments...[which] remain slow, expensive and opaque, especially for retail payments such as remittances*”. The G7 working group “*recommends that relevant public stakeholders (finance ministries, central banks and standard-setting bodies such as the CPMI), in collaboration with relevant international organisations, develop road maps for supporting and scaling up ongoing efforts to improve the efficiency and inclusiveness of payment and financial services*”<sup>19</sup>. G7 and BIS

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<sup>18</sup> G7 Working Group on Stablecoins: Investigating the impact of global stablecoins, BIS, October 2019

<sup>19</sup> G7 Working Group...op. cit.

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acknowledge that cross-border payments are clearly inefficient, and new reports are under process. The Financial Stability Board (FSB) and standard setting bodies are intensifying their efforts with a view to issue a final report for the G20 in July 2020.

## 6. How does the present Forex work?

Let's deal first with the technical cross-border operations. Indeed, digital currencies and payments would make no sense if they would be limited to national payments. The latest BIS Triennial Survey<sup>20</sup> (2019) shows that global foreign exchange trading (net-net, eliminating double counting in inter-dealers' transactions) increased to \$6.6 trillion per day, or a multiplication by 5 since 2001. These \$6.6 trillion translated by the BIS into gross payment obligations worth \$18.7 trillion for which operators have to manage settlement risks. The BIS estimates that after deducting the bilateral netting (\$3.5 trillion) and the \$6.3 trillion organized as PvP or "Payment versus Payment"<sup>21</sup> which eliminates the settlement risks, \$8.9 trillion or 60% remain fully exposed to settlement risks<sup>22</sup>.

Thus a majority of Forex transactions involves a settlement risk and this share has been rising since 2013 with a reduction of inter-dealer trading, an increasing share of transactions taking place outside the PvP mechanism organized by a consortium of banks, the "Continuous Linked Settlement" or CLS. CLS is an international Bank, based in New York, created in 2002 and owned by the world's largest banks which settles payment instructions relating to FX transactions in 18 currencies. Originally created for interbank use it is now also available for non-bank Financial Institutions and Corporates. The recent trend of increasing transactions outside the CLS is namely due to the faster development of Forex transactions in currencies of emerging economies not covered by CLS banks and to more risk-taking attitude. This trend means that the potential benefits that DLT could bring are also rising with the risks implied by the present traditional Forex.

As the exchange of the two currencies involved is not simultaneous, the party that sells a currency before receiving the currency purchased from the counterparty is exposed to a certain risk. In the current banking system, a trusted third-party intermediary between two parties in a transaction is always necessary because the two-sides of an operation – "delivery versus payment or DvP<sup>23</sup>" – are separated: there is no automatic guarantee that the counterpart of the transaction would occur safely once the payment is done first, or vice-versa. Settlement takes place through accounts in the correspondent banks in the countries where the relevant currencies are issued.

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<sup>20</sup> "Seizing up global foreign exchange markets", Schrimpf, A. and Sushko, V. in *BIS Quarterly Review*, December 2019

<sup>21</sup> PvP means a settlement mechanism that ensures that the final transfer of a payment in one currency occurs if and only if the final transfer of a payment in another currency or currencies takes place.

<sup>22</sup> The "credit risk" when the payer or its intermediary defaults prior to final settlement plus the "liquidity risk" when the effective payment is delayed.

<sup>23</sup> DvP, Delivery on Payment, is a way to prevail that one party fails to deliver the payment or the security when the other party has already delivered the security or the cash when settling a Forex or a security trade. It involves the simultaneous delivery of all documents necessary to give effect to a transfer of securities in exchange for the receipt of the stipulated payment amount.

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Because the various national payment systems are located in different time zones around the world, one side of a foreign exchange transaction will likely be settled before the other side of the transaction. For example, dollar payments are settled later than euro payments, which in turn are settled later than yen payments. Thus, someone buying in dollars and paying in euros will have settled the euro side of the payment before receiving any dollars. If the counterparty were to fail in the midst of this transaction, the transaction initiator would have paid dollars but lost the offsetting euros.

Banking industry's response to this settlement risk and to the increased regulatory concern about settlement associated with the growth of FX trading, was the creation and initial expansion of the CLS system, that eliminates settlement risk through the PvP mechanism. Although improving the efficiency, this CLS daily settlement cycle remains a traditional PvP i.e. it operates with settlement and funding occurring during only a five-hour window when all real-time gross settlement (RTGS) systems in the CLS settlement currency jurisdictions are open and able to make and receive payments. This enables simultaneous settlement of the payments on both sides of an FX transaction but at a significant cost for the intermediaries and the narrow five-hour window per day with liquidity constraints. Furthermore, the observed recent decline in the share of CLS in Forex transactions means that the costs implied by the Forex risks are also increasing. According to Ousmène Mandeng<sup>24</sup>, these costs are estimated at a minimum of an annual \$130 bn.

This is precisely what the new DLT system through the tokenization permits to save. DLT allows for instantaneous settlement, making sure both sides are effectuated simultaneously because both parties have visibility and proof of the respective changes of ownership (tokenization). This means that transactions recorded on DLT could on aggregate be considerably cheaper than transactions recorded across multiple siloed accounts as usually made up to now. A 2017 Accenture study estimated that full-scale blockchain adoption among global investment banks could reduce reconciliation and other infrastructure costs by 30% on average<sup>25</sup>.

Furthermore, DLT innovations imply more than this microeconomic aspect of reduction in transaction costs. Indeed, each currency does not benefit the same liquidity conditions as the dollar, and leads to consider the systemic aspect of the asymmetrical role of the dollar on the Forex. Although DLT could make costless some direct peer-to-peer transactions across different currencies and diminishing liquidity needs (at microeconomic level), it could not solve all the respective differences in liquidity conditions of all currencies (at macroeconomic level). This macroeconomic aspect explains the significant remaining transaction costs when digital currencies, even perfectly harmonized, are exchanged between different secondary moneys, like for examples the Canadian or Australian dollar against the Korean won. Even across main reserve currencies, liquidity gaps and exchange-rate volatility or recurrent instability do usually occur and are responsible for costs and remaining risks. Of course, for wholesale traders, there are (microeconomic) standard hedging or equivalent technics, but anyway the customers are charged and this represents a useless microeconomic barrier ending up to a significant macroeconomic barrier. The OMFIF works using a recent McKinsey survey, indicate that this cost provoked by the liquidity gaps across currencies, represents 35% of cross-border costs, the highest share in the bank total costs for international payments.

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<sup>24</sup> "Foreign exchange trading with..." op. cit.

<sup>25</sup> Accenture, 2017 Using distributed ledgers: Blockchain moves to early adoption,

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Therefore, the more systemic questions to know are the liquidity impacts of DLT and whether another modality different from abandoning to financial markets and to new technologies such a “public good” aspect might be conceived.

Currently, the international monetary system ensures smooth and apparently efficient cross-border payments through the global banks and the Forex, which is an open interbank market processing the wholesale operations. In any case, international payments are more cumbersome and expensive than domestic payments due to the number of financial intermediaries necessarily involved in the process and the uncertainties linked to differences in numerous legal dispositions and in their different enforceability degrees. The cross-border operations are however not efficient for small payments.

A recent McKinsey Global Institute study<sup>26</sup> on cross-border payments found that the bulk of costs (nearly 35%) in existing international transactions methods are related to “nostro-vostro” account liquidity and their verification. However, in this process, operations across global banks or Swift network have already relatively low costs of international transfer for big operations. But smaller banks suffer disadvantage<sup>27</sup> and for small amounts and retail operations their costs are clearly disproportionate. Authentication, verification and data-sharing are usually manually undertaken by different intermediaries, representing significant fixed costs. While it is understandable for current customers since fixed costs for retail banks have to be covered, the issue takes another dimension for lower income or poor people like migrants sending remittances to their countries. According to the World Bank, global remittances were valued at \$689bn in 2018, of which \$529 bn went to low- and middle-income countries. This represents more than three times the size of official development assistance to these countries and close to the amount recorded through inward foreign direct investment. The average costs for sending \$ 200 to those countries are 7%<sup>28</sup> and reach 9,3% for Sub-Saharan Africa (with big dispersion up to 22% for some destinations). This gives an indication that the major potential effects of digital currencies rely in these cross-border payments and will provide very important social inclusion and development consequences.

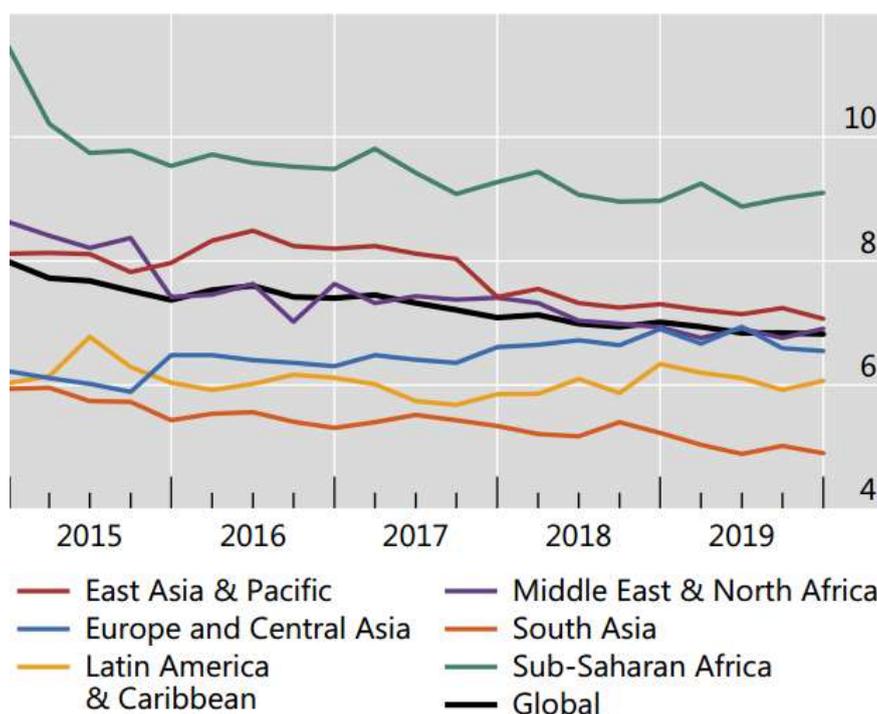
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<sup>26</sup> OMFIF-DMI, The role of blockchain in banking Future prospects for cross-border payments, 2020, <https://www.omfif.org/wp-content/uploads/2020/05/The-role-of-blockchain-in-banking.pdf>

<sup>27</sup> According to a 2018 World Bank report, since the global financial crisis a fast decline (around 30%) in the number of active correspondent banks has been increasing the costs of cross-border, especially for peripheral and poorer regions.

<sup>28</sup> Migration and Remittances Recent Developments and Outlook, World Bank, April 2019 <https://www.knomad.org/sites/default/files/2019-04/Migrationanddevelopmentbrief31.pdf>

**Chart 2. Average remittance costs by region (source: BIS<sup>29</sup>)**



It is for international transactions that the digital currencies represent the biggest advantages since they could bypass most of the intermediaries and manual interventions, ensuring better traceability, more security and rapidity, with almost no cost, but also creating a big disintermediation: most or even all the banking intermediaries would disappear, with impacts on the banking business because these digital payments allow for peer-to-peer transactions without bank intermediaries or need for central clearinghouses, without even central banks in case to be privately issued.

However, these big advantages could remain illusionary as far as the interoperability between different countries and monies as well as across different forms of digital currencies, is far from being ensured. Although intensive efforts mixing competition with cooperation through consortiums are presently developing by private banks and firms, the difficulties are not only technical but organizational. Either private or CBDC will face three kinds of serious obstacles to solve for benefitting fully from the efficiency advantages of digitalization:

- The cross-border payment has to comply with the legal requirements in two successive different countries (such as Anti-Money Laundering - AML and Countering the Financing of Terrorism Act – CFT, Know your Customer –KYC, and others like intellectual rights, consumer and data protection, fiscal aspects etc.)
- Differences in technical variables (such as different in underlying blockchain standards and applications) may constitute an obstacle which hurts the efficiency of CBDCs across borders. The differences between the major blockchain protocols remain significant, but there is an open dialogue for finding possibilities to deal with assets on different technics and to result in successful cross blockchains.

<sup>29</sup> BIS Quarterly Review, March 2020

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- Exchange-rate costs of the Forex procedures remain and should be processed in an adequate way for benefitting from technological innovations

Obviously, duplication risks are high and competition cannot be efficient when regulation aspects, sunk-costs and increasing return to scale are so strong. There is a clear case for intervention because only a preparatory work of harmonization for ensuring the interoperability could tackle these obstacles.

According to the joint report by OMFIF and the China Construction Bank University<sup>30</sup>:

*“several notable use cases in which bank consortia have developed capabilities in this area include We.Trade, a blockchain-based platform that was developed in 2017 by nine banks (Deutsche Bank, HSBC, KBC, Natixis, Nordea, Rabobank, Santander, Société Générale and UniCredit) to simplify cross-border trades. A similar platform, Batavia, was developed from a proof of concept initiated by UBS and IBM in 2016, and brought on board the Bank of Montreal, CaixaBank and Commerzbank as additional partners. We.Trade and Batavia were both built on the Hyperledger Fabric platform and merged their trade finance blockchain platforms in 2018. Other trade finance blockchain initiatives include Marco Polo and Voltron, which use R3 Corda’s framework, and komgo, which is based on Quorum.”*

For private digital currencies, the market being monopolistic, contractual formulas of cooperation between firms are necessary for finding compatible technical standards but even in case of perfect self-organization, could not resolve the regulatory aspects. For CBDC, the international cooperation is all the more necessary, by intergovernmental decisions and ad-hoc international and central bank cooperation agreements with private-public partnerships. CBDC cannot remain neither a national public issue nor a sovereign choice for not losing a significant part of the benefits of digital currencies and not deceiving the expectations of public opinion. Therefore, it is logically inevitable that central banks will turn to look for an international big deal although the solution would not be so easy to bargain.

The difficulty to find out a consensual technical-legal interoperability through a cooperative solution could be seen as an additional opportunity for rethinking more systemic aspects of the global payment organization as well as for central banks to consolidate their mandate by taking the lead and ruling what is a fundamental international public good. Indeed, this interoperability leads not only to the need for a strong leadership in harmonization but also to the question of the present asymmetrical working of the Forex operations. Obviously, this second step in any cross-border operations is not new and has anyway its existing modalities. Furthermore, major banks and financial institutions are actively working on new modalities for improving the efficiency of cross-border transactions and analysing the opportunities of DLT process versus alternative ones.

Private firms issuing digital currencies or central banks issuing their own CBDC anyway might process as usual the money conversion on the Forex. But the wholesale traders do operate mainly in dollar as it is the technical vehicle for more than 80% of the parts of currency deals. The reason is the operational need for using a single standard for working on the interbank daily operations together with the raising economies of scale which make cheaper to convert two secondary currencies by passing through the dollar hub, which offers cheaper bid-ask spreads with all the

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<sup>30</sup> CCCU, a corporate university with many specialized campuses in China, New-York and London that fosters new finance.

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secondary currencies against the most efficient dollar interbank market, than by exchanging them directly using less liquid and thinner markets. So, the DLT could eliminate some costs of liquidity differences by making instantaneous the Forex operations and allowing a better access and distribution of central bank monies, but it cannot change the inner differences in liquidity conditions between the US dollar and other currencies.

This resilient feature of the Forex is considered as an unavoidable matter of facts. However, it is not exempted of systemic problems that might be questioned on this opportunity because the new technics oblige to re-think the whole working of the international monetary system (IMS). Digital currencies, and especially CBDC, are changing radically the payment operations by bypassing most of the intermediaries, but without an organized interoperability or harmonization, their cross-border operations would still suffer significant costs for technical or legal discrepancies. What is the present situation?

The main financial actors already joined their efforts in several consortiums or collective groups sharing the research for analysing the options for adapting them to their needs by focusing mainly upon DLT with “permissioned systems” i.e. system allowing some centralization which do not need as much computational capacity (and energy costs) to secure the network, allowing for the greater scalability (volume), speed processing and security that banking operations require. The financial sector is prioritising blockchain models that can offer security and scalability rather than decentralization as the Bitcoin model. In these recent works, most of the participants confirm that the highest returns of DLT (digital systems which allow any anonymous individual or entity to perform transactions without a trusted third party) rely in applying it to cross-border payments. Major banks as well as multinational firms and governments, are aware that some blockchain technics or DLT could improve significantly the speed while cutting impressively the costs of cross-border operations. With DLT, transactions can be executed directly between the parties who have entered into a bilateral agreement on the platform, thereby reducing the need for interpersonal trust between transacting parties:

*“Blockchain is a ledger offering visibility into the entire lifespan of a transaction or value exchange within a bank’s operations. It can reduce the need for expensive and time-consuming third-party verifications along a payment process or funds transfer. Documents can be linked and accessible through blockchain and reviewed and approved in real time, reducing the time it takes to initiate the shipment of a good or delivery of an asset” ....*

*“Enabling direct transmission of information and assets between parties could optimise the operational costs of cross-border payments, as any lack of standardisation can be minimized. DLT in crossborder payments can achieve key cost savings – by avoiding having to channel foreign exchange through a cumbersome network of pre-funded legacy banks” ...*

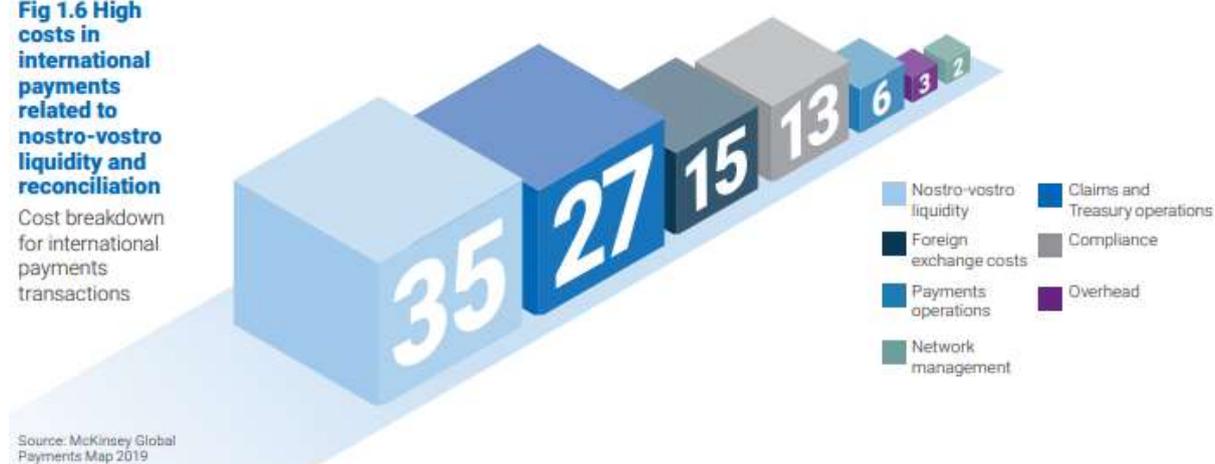
*The lengthy and costly infrastructure for intermediaries, compliance and verification procedures are essential to conduct transfers of claims upon payments recorded within an account. DLT-based transactions could allow for the authenticity and value of exchanged payment objects (tokens) to be verified independently, precluding the need for messaging, clearing and settlement systems<sup>31</sup>”.*

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<sup>31</sup> OMFIF-DMI, The role of blockchain in banking... op. cit.

**Fig 1.6 High costs in international payments related to nostro-vostro liquidity and reconciliation**

Cost breakdown for international payments transactions



Source: McKinsey Global Payments Map 2019

**Source:** OMFIF, The role of blockchain in banking: Future prospects for cross-border payments, 2020

Whatever the capability of private operators to adapt DLT for cutting costs, the most important obstacles to date remain:

- (i) The lack of harmonisation across national jurisdictions,
- (ii) The absence of global standards, that, by definition the financial markets seem unable to fix alone, and
- (iii) The liquidity differences and instabilities between national currencies. The fundamental shift from “account-based” to “token-based” payments systems that DLT brings (the so-called “tokenization”), constitutes a genuine revolutionary change for international payment system. It could already improve access and distribution of central bank money, and so the liquidity conditions of currencies. However, these significant changes cannot by themselves put all the currencies on the same foot, structural differences do remain and the “technical” centripetal power for working in a single standard, as the US dollar, could even be strengthened.

These three obstacles provide convergent opportunities for rethinking the respective roles between financial markets and their operators, central banks and the IMF, with a view to provoke a beneficial systemic improvement in the working of the Forex. The obstacles due to legal and regulatory aspects are not only an issue of international cooperation across authorities, it is rather an issue of adaptation to the new technologies, especially the DLT given its decentralised nature. Existing regulations are national in their enforcement while cross-border data sharing with DLT poses challenges to data localisation which may fall under disjointed regulatory authorities creating legal ambiguities over territoriality and liability. With DLT on permissioned networks, where there is a ‘central’ administrator, automated, autonomous processes with features such as smart contracts used to automate contract execution on-chain, it might be possible to work out technical solutions if all stakeholders work together and would accept common global standards. Furthermore, it is necessary to agree also upon dispute resolution mechanisms in order to reduce uncertainties about enforcement and liabilities depending from different national authorities.

Another example of conflict is with the EU’s General Data Protection Regulation establishing the right to be forgotten and the right to rectification which are in total contradiction with the

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immutability of a DLT system: ensuring that distributed records are tamper-proof is the basis of the efficiency of DLT. Also, some technics based upon totally decentralized networks owe much of their appeal to their anonymity features, which are incompatible with anti-money laundering - AML and Know Your Customer - KYC rules. But the DLT permissioned network faces the issue that up to now, the AML and KYC procedures followed by banks are based upon the correspondent accounts (nostro-vostro system), with waste in effort duplication across institutions and jurisdictions. With DLT, a unique digital identity of each participant can solve streamline authentication processes across a shared KYC infrastructure implementing tamper checks, proof of origination and designated acknowledgement in business-to business processes

## 7. The proposal

Our proposal relies upon a simple technical assumption that should still need to be confronted to a deeper analysis by the DLT and Forex experts: national central banks under IMF coordination would organize a harmonized global “tokenization”<sup>32</sup> i.e. the simulation of the materialization of the digital currency into a bearer instrument like a bank note or a coin which is a cash value in the hands of the bearer. This tokenization would be managed in close cooperation with global banks and financial operators for tackling the three remaining barriers mentioned above and reaching a permanent efficient platform for cross-border settlements. However, making the Forex more efficient and safer has to be organized while allowing for a transition period in which the current system could be compatible with the new one based on interoperability of the national CBDC among themselves and with traditional bank deposits.

Our proposal relies also upon the argument that there is a clear case for strong public intervention, through the central bank community, whose common interests and core functions are at stake but could only be dealt with a multilateral cooperation i.e. IMF coordination, all the more that central banks score the highest net trust rating in public opinions<sup>33</sup> in both advanced and emerging economies, contrary to banks, financial firms and large technological companies, which are affected by a growing distrust.

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<sup>32</sup> Although the concept of tokenization is a key for understanding the quantum leap a DLT means, there is no clear definition of tokenization which needs to be approached by an analogy with a materialization of a coin or a currency note i.e. instruments where ownership does not need to be recorded against any legal entity like a bank account but is entirely denoted by the ability of a person to produce a digital signature. So, the value is transferred not between two accounts but from one holder to another one, simulating a transfer of a bearer asset.

<sup>33</sup> According to OMFIF report on a survey conducted in 2019 by Ipsos- MORI, “Digital Currencies: A question of trust, An OMFIF report on global public confidence in monetary, financial and payment institutions”, 2020. The main findings suggest that central banks are well-positioned to issue digital currency. In almost all countries, respondents indicated that they would feel most confident in digital money issued by the domestic monetary authority. Respondents globally expressed a lack of confidence in digital money issued by a tech or credit card company, particularly respondents from advanced economies.

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## 8. The necessary complement at the global level: the macroeconomic need for a multilateral e-currency

The spectacular reduction in payment costs inside a monetary area conflicts with the remaining costs linked to the Forex for all operations and more notably for the small amounts. Therefore, part of the digitalization purpose for ensuring a better social efficiency and inclusion could fail if the cross-border operations would lag behind and remain too expensive, or if the “rent-seeking” of major operators would solve for themselves the technical aspects and capture so most of the gains they could reap by adjusting DLT to their own needs while wasting another part of the gains in undue monopolistic competition with duplication of infrastructures and standard struggles.

Our conviction that the case for multilateral public intervention is all the more justified that there is a priority need to organize cooperatively the exchange-rate operations for spurring the same digital interoperability as for national payments. This action needs to use efficient new platforms able to seize the advantages of digitalization as a global public good, while preventing the risks for dysfunctionalities. Therefore, a crucial aspect of the multilateral coordination is the need to ensure a transition period in which the new methods and technologies would be fully compatible with the existing practices, something which could take years, and implies therefore a strong leadership from public authorities for embarking also LDCs and peripheral regions and preventing so a further “digital gap”.

Private solutions for improving the Forex are under intensive researches and could emerge anyway as many powerful interests are intensively working on it in order to capture “first movers” competitive advantages, transforming so the technological progress into pure rents for banks and FinTechs. But the extension of digitalization to retail exchange-rate transactions makes clear this is not only a technical problem of market structure or oligopolistic control. It is a key opportunity for questioning the private versus public good sides of Forex and the way international payments use to work. In particular, one should consider what would be the most probable option for financial markets in the absence of initiatives and regulations from monetary authorities.

By extrapolation and taking on board the strong inertia of the current features of the international interbank market managed by a few global banks, the “natural response” for liquidity reasons, would be that global banks working in dollar would capture this market concentrating even more on the dominant reserve currency, the US dollar, making it the single standard of digitalization, but worsening both the distrust feeling of citizens and the ‘Triffin dilemma’<sup>34</sup> with all the destabilizing costly spillovers the dollar issued upon the rest of the

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<sup>34</sup> The Triffin dilemma expresses the logical impossibility to regulate global liquidity and to manage an optimal policy-mix in the US if the dollar is used as the main international reserve; the reason is the simple fact that increasing international liquidity means increasing the external liabilities of the US economy, because the demand for dollar as international reserve is an automatic cheap Foreign loan to the US economy.

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world<sup>35</sup>, with the high dependency of global liquidity upon too narrow safe-assets in dollar<sup>36</sup>, creating unnecessary fragilities and macroeconomic imbalances, biasing the world saving flows towards over consumption in the US, impeding to finance the decarbonisation<sup>37</sup> and the whole policy-mix leading to global destabilization<sup>38</sup> etc. The now well-known reason is that the international currency cannot be a national currency managed under domestic priorities which cannot be compatible with the global needs and interests.<sup>39</sup>

The fast private development for applying an adequate DLT to Forex from a microeconomic perspective, cannot solve the macroeconomic dysfunctional asymmetry due to the fact that the Global Liquidity is functionally determined mainly by safe-asset in dollar - a national debt in dollar which cannot adapt sufficiently to the world needs for liquid safe-asset and push the US economy into over indebtedness. Indeed, Global Liquidity appears as a risky reversed pyramid relying upon a proportionally shrinking base of the most liquid collaterals, the availability of which becomes abruptly too scarce in periods of crisis. This disproportion provokes a recurrent deleveraged run towards genuine “safe-assets” mainly in dollar, such a rush towards pure international liquidity risks to be multiplied into a global liquidity crunch with a simultaneous liquidity trap in dollar, the too high demand for dollar assets pushing their yields too low, with perverse effects on excessive financial activities and increase of financial fragilities with financial moral hazard.

The ideal and definitive solution<sup>40</sup> is merely to extend the “case for intervention” up to its logical end and goal: to make global liquidity determined collegially through a new global safe-asset i.e. an official liability which is not anymore a national debt but a multilateral one which pursues only global stability according to objective indicators without any conflict of interests: IMF will be the only legitimate multilateral agent endowed optimally for being allowed to issue official e-SDR<sup>41</sup> (i.e. the IMF multilateral official basket made-up from the five main reserve

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<sup>35</sup> See Triffin, R., “The IMS (International Monetary System...or Scandal?) and the EMS (European Monetary System...or Success?)”, Jean Monnet lecture, European University Institute, Florence, Banca Nazionale del Lavoro, Quarterly Review, n°179, December 1991. Also see Ghymers, C. “Réagir à l’emprise du dollar”, in *L’Ecu et la Vieille Dame*, Aglietta, M., Economica, Paris, 1986

<sup>36</sup> Ghymers, C. “Towards a Global Liquidity Problem: Is there a Pilot in the plane?”, IRELAC Policy Working Paper, September 2019

<sup>37</sup> Ghymers, C., “The systemic nature of the global crisis and some principles for tackling it”, in Guilherme, B. Ghymers C., Griffith-Jones, S., Ribeiro, A. *Financial Crisis and Democracy: Lessons from Europe and Latin America*, (under press) by Springer, New York/Switzerland, 2020

<sup>38</sup> For empirical proofs, see Shin Hyun Song, “Global Banking Glut and Loan Risk Premium”, *IMF Economic Review*, Vol. 60, No. 2, 2012; Rey, H. “International Channels of Transmission of Monetary Policy and the Mundellian Trilemma”, Mundell Fleming Lecture 2014, *IMF Economic Review* 2015; Carney M., The Growing Challenges for Monetary Policy in the current International Monetary and Financial System, speech at Jackson Hole Symposium, August 2019

<sup>39</sup> Ghymers, C., “Overcoming the Triffin dilemma today: A plan for a stable international financial architecture,” in *10 Years After: The End of the Familiar... Reflections on the Great Financial Economic Crisis*, ed. The Reinventing Bretton Woods Committee & e The Astana International Financial Center, Paris & Astana, 2018

<sup>40</sup> RTI working party on SDR, “Using the Special Drawing Rights as a lever to reform the international monetary system, *International Monetary Issues* n°2, ed. Versant Sud, Brussels 2015

<sup>41</sup> e-SDR is the digital version of the Special Drawing Right, which is a multilateral auxiliary reserve asset, created in 1969 by IMF decision and incorporated into the 1d and 2d Amendments of the IMF statutes as the

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currencies) against official multilateral bonds (World Bank or UN green bonds for example) and other national eligible official assets (sovereign bonds), making operational a technical regulation of global monetary base without need for resting national policy autonomy or imposing international coordination of monetary policies.

## 9. The new payment technologies open the way to organize a virtual clearing union with an e-SDR.

The main thesis of this paper is that this first best solution for solving the Triffin dilemma and the built-in destabilizer of the dollar system, could become an operational reality much faster than authorities think, thanks to the revolution of payment digitalization and its geopolitical and monetary policy consequences upon central banks and the Forex. Indeed, the trend and the growing need to issue national CBDC almost everywhere, open an exceptional opportunity for national central banks, which anyway are condemned to cooperate closely for harmonizing technical and legal aspects for fulfilling their core missions, to take a simple a joint-initiative under IMF technical coordination. They will be in a position which allows them to take the lead for introducing a simplification of the Forex by using a new global vehicle, as proposed by Governor Mark Carney at the 2019 Jackson Hole forum: a Synthetic Hegemonic Currency (SHC) would be provided by a network of CBDC<sup>42</sup>. Unfortunately, the Governor of the Bank of England did not mention that the best candidate would be to issue a e-SDR. This is our proposal: to start from the existing SDR in a digital form and to extend progressively its composition for reflecting better the world economy.

This multilateral digital reserve currency, the e-SDR, is the missing tool for transforming the global interbank market into a (virtual) global “Clearing Union” on which all the current exchange-rate transactions (existing system like the “Continuous Linked Settlement” – CLS which processes 40 % of Forex) could opt for being automatically converted (at no-cost) at each moment into e-SDR, making them compatible for being tackled together with the harmonized national CBDC using ad-hoc DLT for cross-border payments (tokenization). Such a new extended platform for storing and allowing for “tokens settlements” would assume the role of a trusted intermediary since DLT allows for some centralized permissioned networks. The technical aspects of such a settlement platform are about to be soon operational and could be organized on continuous, global 24-hour settlement. Presently, international multi-currency clearing system like CLS is

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unit of account of the IMF and for becoming later the principal international currency reserve. However, it has remained a mere currency basket, presently compounded by the five major reserve currencies: 41,73 % for the U.S. dollars, 30,93 % for Euro, 10,92% for Chinese yuan, 8,33 % for the yen and 8,09 % for the Pound, and its value is calculated daily from a weighted sum of its components. Formally, it is nor a genuine currency neither a liability of the IMF but a mere right to get its counterpart value in “freely usable currencies of IMF members”.

<sup>42</sup> “The Growing Challenges for Monetary Policy in the current International Monetary and Financial System”, speech given by Mark Carney as Governor of the Bank of England at Jackson Hole Symposium 2019.

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limited (and costlier) due to the fact that transactions can only occur in specific time windows<sup>43</sup>, such as when two countries' central bank are running concurrently: the operational time of Continuous Linked Settlement (CLS) is limited to a maximum of five-hour window when all real-time gross settlement (RTGS) systems in the CLS settlement currency jurisdictions are open and able to make and receive payments. This means that time zones and geography affect the speed of settlement. The longer a foreign exchange transaction takes (typically there is a two-day settlement period but it could be more), the greater the "Herstatt risk" (settlement failure).

According to 2020 OMFIF/CCCU report:

*"In 2019, significant technological advances in the security tokenization industry improved speed, security, transparency and the immutability of records... "using DLT would allow for continuous payment versus payment and delivery-versus-payment settlement globally" ... DLT "could expedite the clearing and settlement of assets where large and complex multiparty transactions occur regularly" .... In 2017, Goldman Sachs was granted a patent for SETLcoin, a transaction settlement system based on blockchain. The Nasdaq stock exchange successfully completed the first blockchain-based securities transaction platform via Linq in 2015. This application of DLT would massively de-risk payment settlement, although it would probably create pressures in other places, such as liquidity management"<sup>44</sup>.*

Two important conclusions emerge:

1. Technical solutions already exist, as for example the SETL's solution, developed by JP Morgan.

2. Liquidity management of the settlement system will be different but won't disappear and could become a key segment able to trigger a systemic change by making obvious the advantages of involving a multilateral LOLR for making the system symmetrical, as we show below.

SETL is a permissioned DLT specifically shaped for financial sector and payments using Quorum, an enterprise-focused version improving Ethereum. It is well-suited to applications requiring high speed and high- throughput for the processing of private transactions within a permissioned group of known participants. SETL provides a framework for real time trading and settlement of financial instruments (cash as well as securities) eliminating risk and cost by shortening the settlement period to a matter of seconds. Quorum allows participants to perform both private and public smart contracts, and so the ledger is differentiated into a private state and a public state database. If deployed as CBDC, it can process large volumes of small payment with settlement taking place at the time of payment obviating the need for any complex clearing and netting systems, but fulfilling the same settlement function without cost. Clearing systems aggregate and net off payments between banks and then, periodically, settlement transactions are sent to systems known as "Real Time Gross Settlement" (RTGS) at the appropriate central bank. Liquidity saving can be achieved through the use of smart contracts and netting algorithms, in

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<sup>43</sup> In Japan, since October 2018, a new platform called "More Time System" has been separately implemented and has been enabling banks to immediately receive funds transferred from other banks 24 hours a day, 365 days a year, supported by the Core Time System and the More Time System, each of which operates in different hours to complement each other. Funds transfers processed by the More Time System is settled on a deferred net settlement basis via the bank's current accounts in the evening (at 4:15 p.m.) on the next business day.

<sup>44</sup> OMFIF-DMI, The role of blockchain in banking, 2020, op. cit.

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connexion with central banks. With SETL's system, Settlement can be done at speed and scale. A single SETL instance can process 30,000 transactions a second across 100m different accounts - with the system fully scalable by extension with the addition of more instances. SETL's technology is thus scalable to billions of transactions a day so is entirely able to deal with the number transactions that might benefit from CBDC<sup>45</sup>. Furthermore, The SETL chain consumes about only 22000 KWh per year i.e. very low CO2 emissions contrary to other technics and to what people believes.

Extending this kind of system to a unified global interbank market would reach immediately a huge volume of transactions with insignificant transaction costs for CBDC and decreasing ones for the traditional operations (competition effect), spurring the extension of CBDC, and calling for a daily liquidity management by central banks. This clearing house would be mainly virtual in the sense that the permissioned DLT while favouring peer-to-peer (microeconomic) transaction would be managed through an intermediary trustee ensuring the clearing of the (macroeconomic) balances to be settled on the interbank market where their respective liquidity would add up. Although the instantaneous peer-to-peer transactions that tokenization makes possible, will reduce liquidity needs, the increased reliance upon dollar liquidity, could worsen global liquidity management. This trend should make more visible the beneficial function of endowing the IMF with an overdraft facility in e-SDR for each national currency. IMF would so intervene this global platform in the same way as national central banks have a role in their national currency clearing, opening the way to a further role for managing global liquidity by issuing or withdrawing e-SDR.

Without the proposed multilateral initiative, the market response to liquidity gaps on the Forex tends to favour and strengthen the dollar vehicle. But the proposed innovation is precisely that the systematic conversion into e-SDR according to harmonized protocols ensuring the interoperability together with a multilateral regulation of (short-term) operational liquidity in e-SDR by the IMF, would shake the status quo of the dollar. DLT would make compatible peer-to-peer transactions with a clearing. The need to process perfectly harmonized transactions for ensuring their interoperability and the automatic "tokenization" of each CBDC in e-SDR, leads to the equivalent of effective centralization in a clearing union with a macroeconomic accumulation of global balances to be settled on the interbank market. In these permanent settlements, there is a standard role for the IMF – like for national central banks in their own currency – which imposes the opening a short-term overdraft facility to any currency for smoothing their operational liquidity and cutting so their transaction costs.

Furthermore, the fact that the full digitalization process and the creation of sufficient national CBDC will take years to become fully operational (and also the fact that not everybody is going to be reachable via DLT), implies that traditional exchange-rate conversions and clearing space will remain necessary but would be improved by connecting the interbank markets to a specific interface working in e-SDR. This kind of complex technological compatibilization could only be implemented through an active involvement and strong leadership of central banks under IMF coordination, with a need for central intervention i.e. a daily liquidity global management.

More precisely, the central banks/IMF initiative would consist – drawing upon the extraordinary efficiency and speed of digital tools using DLT together with the assumption of a generalization of creation of national CBDC – in several components and steps:

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<sup>45</sup> Its main competitors are R3's Corda and IBM's Hyperledger Fabric, see Glossary.

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- the organization with the global banks of a dedicated platform or “harmonized interface” on which each national CBDC would be harmonized and would be “tokenized” (translated) at each moment into the “e-SDR”. Needless to say that the ideal (virtual) place for such a clearing-platform is obviously the IMF which, for example, could dedicate a specific services which would be placed by mandate from the Board under the exclusive authority of the member central banks, and allowed to establish private-public partnerships with global banks and other financial operators necessary for making operational the virtual clearing union, by providing the technology, the monitoring and the customer services linked to it according to specific conditions.

- On this virtual platform, global banks, in cooperation with central banks (according to modalities to bargain according to the mix of roles and services each central bank would define with private firms) would add up in e-SDR (through ad-hoc harmonized algorithms) the individual amounts of national currencies and national CBDC offered for buying other national currencies and CBDC, simulating thus a global multilateral clearing house.

- As mentioned, this virtual platform would be regulated by central banks and IMF for making compatible the respective national roles as well as for smoothing the liquidity gaps. This logically should lead to give a mandate to the IMF to smooth the operations through the creation of a multilateral overdraft facility in e-SDR available for national currency daily clearing.

- In a second step, the demonstration of the beneficial effects of the IMF ability to manage a short-term overdraft facility would lead to move to a more complete systemic tool of e-SDR issuance for managing global liquidity which is not merely the adding-up of national currency liquidity.

- At national level, some rooms for manoeuvre would allow for respective public-private partnerships to fix the conditions for firms to compete for providing services and advantages that the smart devices of the digital wave could bring to customers and payment operators. So, the formula would benefit from cooperative competition and dynamism from private operators while strengthening the role of regulators to the central bank community under coordination by the IMF and its new role as global Lender-of-Last-Resort.

Thus, CBDC provides an historical opportunity for bargaining among central banks, with global banks, and the technical support of IMF, the necessary harmonization of the technological and legal aspects. Such a harmonization corresponds technically to the creation of a virtual clearing union expressed in e-SDR i.e. a neutral, single, multilateral standard, or the missing “(n+1)th” currency above the “n” national currencies of the world. This would realize so simultaneously the initial purpose of making the e-SDR the main reserve vehicle for both official and private agents as well as the Keynes’s plan for a global clearing union and the transformation of the IMF into the missing global LOLR issuing the needed safe-assets in e-SDR according to objective criteria.

In parallel, banks and Fintech firms could easily develop the use of e-SDR for financial assets issuance because the generalized creation of CBDC and their clearing on the multilateral platform, will ensure the competitiveness of the e-SDR in terms of transaction costs, depth, liquidity and range of available financial products. All these elements are presently missing and inhibit the use of the private SDR<sup>46</sup>.

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<sup>46</sup> RTI – Robert Triffin International Association, « Using the SDR as a lever to reform the international monetary system », International Monetary Issues n°2, ed. Versant Sud, Brussels, 2015.

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## 10. Juridical basis founding a central bank multilateral initiative on a new international payment system

From a market power aspect, the central banks enjoy de facto their monopolistic right to regulate and rule the national payment systems and to impose their norms to the banks and Fintech. Furthermore, in the most probable case of central banks taking over the issuance of digital currencies, they will be in a position to impose, for efficiency reasons, their collegial decisions and harmonization to the financial markets, global banks and Fintech, and these firms will have profit interest too in supporting and participating actively to these harmonized digital platforms. Indeed, it would be difficult for them to arrive at the same kind of harmonization and efficiency on their own, without working with the national regulators and the IMF coordination.

From a public opinion point of view, as already mentioned, only central banks enjoy the popular trust necessary for ensuring authority and supervision of digital money<sup>47</sup>.

From an institutional point of view, such an initiative is founded upon the legal respective mandates central banks are endowed with for ensuring the stability and efficiency of each national payment system. Now, the digital waves extend their missions for making more efficient and more socially inclusive any international payments. Indeed, harmonized CBDC will make automatically compatible and convertible the “n” national CBDC, without almost no cost, independently of the amount of the transactions, and allowing to access to the whole range of technological innovation provided by the digital revolution.

From a multilateral aspect, the involvement of IMF and the use of SDR basket rely upon the Articles of Agreement VIII, section 7 “*Each member undertakes to collaborate with the Fund and with other members in order to ensure... making the special drawing right the principal reserve asset in the international monetary system.* The IMF role in cooperating with central banks to the setting and organization of the multilateral clearing union could be based upon Art. VIII, Sec. 5, point C): *The Fund may arrange to obtain further information by agreement with members. It shall act as a centre for the collection and exchange of information on monetary and financial problems, thus facilitating the preparation of studies designed to assist members in developing policies which further the purposes of the Fund.*

From a geopolitical point of view, it is important to prevent further hegemonic divisions and a duopolistic conflict between the US and China while cooperative formula ensures a better outcome for both and for the all nations.

It is obvious that IMF which is the only legitimate actor owning the global overview and the necessary technical information by country, should play most of the coordinating role in the general interest. Furthermore, its neutral role is also to ensure an adequate balance between possible divergent interests among members, and being in position to voice interests of minorities.

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<sup>47</sup> OMFIF, “Digital Currencies: A question of trust, An OMFIF report on global public confidence in monetary, financial and payment institutions”, 2020, op. cit.

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## 11. Converging initiatives towards using digital currencies for improving the IMS

Three significant initiatives linked to the debates about the emerging digital currencies have recently appeared and deserve to be related among them and with the above proposal of a systemic improvement in the IMS.

The first one is the e-SDR proposed in a speech by Christine Lagarde, Managing Director of the International Monetary Fund, delivered on September 2017 at the Bank of England, in which she said, “...the Fund will also have to be open to change....to considering a role for a digital version of the SDR...”. Although this proposal seems separated from the question of the national CBDC, it is closely linked since, as explained, national CBDC suppose necessarily an international agreement or arrangement between national central banks, and therefore with the international monetary system and the issue of the reserve currency. Digitalization eases considerably the treatment and management of SDR.

The second one is the initial version of Libra proposal by Facebook, on 18 June 2019, whose aim was to “enable a simple global currency and financial infrastructure that empowers billions of people” by backing it to reserves assets in the five reserve currencies composing the SDR of the IMF, and anchoring the value of the Libra to the SDR basket (weighted average of dollar, euro, yen, renmimbi and pound). This first ambitious version pretended to issue a global reserve currency which would serve as the foundation of a new kind of financial system. The reactions from central banks and regulators made clear, after exchanges of views, that Facebook could not pretend to play the role of a global central bank and in April 2020, the project was reshuffled and downgraded in a series of national digital currencies tied to local currencies but maintaining the idea of a global version backed by several reserve currencies.

The third initiative is the provocative presentation made at the Jackson Hole economic symposium in August 2019, by the governor of the Bank of England, Mark Carney, who challenged the dollar’s position as the world’s reserve currency, arguing that a digital alternative among central banks could replace it: a “*new Synthetic Hegemonic Currency (SHC) would be best provided by the public sector, perhaps through a network of central bank digital currencies*”, concluding by claiming “*Let’s end the malign neglect of the IMFS and build a system worthy of the diverse, multipolar global economy that is emerging*”.

These three converging proposals came out of the discussions about digital currencies and expressed the need to complete them by an organized clearing-platform using a harmonized international standard which cannot be a national currency, but a new reserve which is neutral and could allow for playing the role of the universal standard currency.

The necessarily more stable value of this e-SDR basket would allow to become easily an ideal store of value and an efficient unit of account and billing tool. Due to the efficiency of a joined platform between central banks, all CBDC could become instantaneously the adequate means of international payments by being convertible or converted almost costless into e-SDR and from it into one of the main reserve currencies composing the SDR or any other currency. The critical mass necessary for would be instantaneously reached by the official and coordinated support

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central banks and IMF would give to the new payment system, ensuring the liquidity and economies of scale necessary for establishing successfully the e-SDR as the main vehicle for international payment system.

## 12. Conclusions

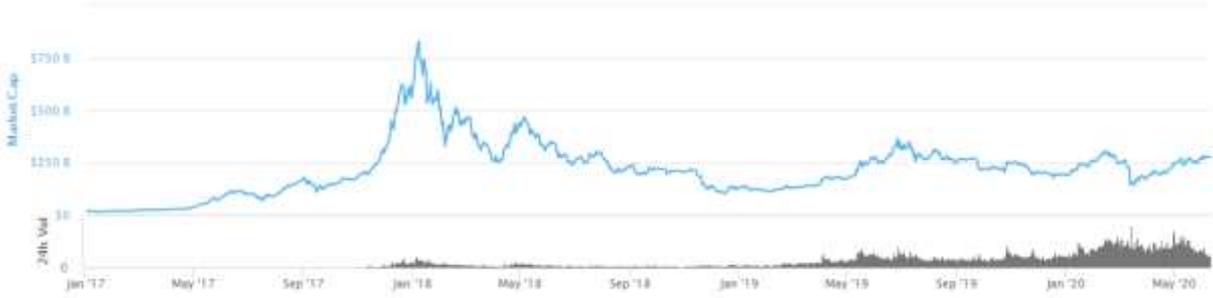
The inertia of the present dollar system is about to be seriously questioned by the central bank necessity to respond to the dynamic emergence of private digital currencies which could offer attractive services to users but would affect dangerously the monetary policy tools and transmission.

Central banks, drawing upon a significant capital of public opinion trust, are condemned to take a leading part to this innovation in payment systems for fulfilling their core missions. This will force them rather soon than later to issuing themselves national digital currencies – the CBDC, which in turn obliges them to a global coordination for harmonizing the characters of these different national CBDC and therefore, to tackle also the issue of the public good character of part of exchange-rate operations, ultimate barriers to monetary efficiency.

The most rational and natural solution is to organize virtually with global banks a global clearing platform, integrating both the traditional Forex with the peer-to-peer transactions based upon DLT through a systematic conversion of all CBDC into e-SDR as unit of account and of balance settlements. This e-SDR merging the official SDR with the private one, will become the main vehicle for competitive international payments and will ensure all the technical conditions for a fast development of the private use of this new e-SDR. The operational daily liquidity of each national CBDC would be managed on this platform by a limited short-term overdraft each national central bank may access to for smoothing the working of the Forex. This useful innovation should rapidly lead to consider necessary the use of the e-SDR emission/destruction as the main tool for managing global liquidity as a public good for improving financial and macroeconomic stability.

Thus, the inner dynamism and technological innovations in payment systems should put in place all the necessary elements for pushing monetary authorities out of the present rigid status quo of the current non-system based upon the dollar. The multiplication of national CBDC will make national authorities more aware of the urgent need for a global arrangement and from there to a rational multilateral lever upon global liquidity as the coronation of the digitalization of the retail and wholesale means of payments. The official creation of a genuine multilateral reserve currency – the official e-SDR – is the missing component of a symmetrical efficient international monetary system, and it will probably come as a necessity for meeting the challenges innovation payments faced by monetary authorities.

**Chart 3.** Total Market capitalization of crypto-assets (Bitcoins, Ethereum, and others) in \$ billions



Source: coinmarketcap <https://coinmarketcap.com/charts/>

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## Annex: Glossary

**Blockchain:** a distributed electronic ledger that records all the transactions that happen on a network of related computers through internet, similar to a relational database which keeps an unchangeable record of all transactions (“blocks”) i.e. a true and verifiable record of each and every transaction ever made in the network, no need for an administrator. It is a digital database containing information, such as records of financial transactions, that can be simultaneously used and shared within a large decentralised, publicly accessible network. It is a decentralized store of information, or a database that is updated in real-time and distributed across its user-base for validated record-keeping, it can be a trustless means to exchange value, both informational and asset-based. On this shared database the entries must be confirmed and encrypted. Each document entry dependent on a logical relationship to all its predecessors. The name blockchain refers to the “blocks” that get added to the chain of transaction records. To facilitate this, the technology uses cryptographic signatures called a “hash”

**Bitcoin:** A world crypto-asset based upon the blockchain technology for codifying the transfer of ownership and making its de-codification secure by the link to all the previous transactions. It is administered not by a central bank but by private Developers, whose software determines how the currency is created and used Miners, whose computers mint the currency. The total potential supply of Bitcoin is mathematically determined to 21 million units to be reached asymptotically around 2140. Under a nickname, Satoshi Nakamoto (Oct 2008) launched the Bitcoin with a mathematical paper titled “Bitcoin: A Peer-to-Peer Electronic Cash System”. A system capable of creating copies that cannot be copied by being peer-to-peer; Bitcoin's distributed blockchain mechanism makes central authorities of trust obsolete and is virtually invulnerable to hacking since it is impossible to change all the past encrypted transactions validated by millions of computers. Bitcoin is exposed to two major problems: first, the low processing and the energy costs for running the whole system at each operation. However, some improvements have been made since 2015 (Pieter Wuille’s SegWit optimization) and 2017 (Jeff Garzik’s Segwit2x fork); second almost half of all (yearly) transactions in Bitcoin can be linked to illegal activity, although transactions could be traceable, but not without international cooperation.

There are roughly three main categories of blockchains:

1) **A public blockchain network**, like the Bitcoin, is completely open and anyone is free to join and participate in the core activities of the blockchain network. It is said to be non-permissioned. Public chains are especially valuable due to the transparency inherent in the technology, with anyone able to view and verify all the data recorded on each block. Its main disadvantage is its heavy power consumption and CO2 emission that are necessary to maintain the distributed public ledger and the consequent low speed for processing operations (low scalability). The calculations required to establish consensus in non-permissioned chains are very complex and very large, and take a very long time to solve. A direct consequence of the complexity of the calculations and the time taken to undertake them is the amount of electricity that needs to be consumed. The non-permissioned Bitcoin blockchain uses about THREE MILLION times the amount of electricity that

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a working permissioned blockchain uses. The annual electricity consumption of Bitcoin, as of November 2018, to be 45.8 TWh and estimate that annual carbon emissions range from 22.0 to 22.9 MtCO<sub>2</sub> (5,5 % of total CO<sub>2</sub> emission of the UK).

2) A private blockchain or private distributed ledger that restricts who can initiate transactions. This is similar to an account-based system, where users must apply to open an account before they can use the system. It allows a participant to join only through an authentic and verified invitation, and a validation is necessary either by the network operator(s) or by a clearly defined set protocol implemented by the network. It is decentralized, and is a distributed ledger that operates as a closed, secure database based on cryptography concepts. It is overcoming the amount of processing power needed to host blockchains, making less energy consuming and reaching a higher scalability. A private blockchain is not decentralized, and is a distributed ledger that operates as a closed, secure database based on cryptography concepts.

3) The permissioned blockchains, or permissioned DL is a distributed ledger that allows only trusted third parties to be involved in the updating process. Because validators are trusted, less computationally intensive mechanisms can be used to validate transactions. It allow a mixed bag between the public and private blockchains with lots of customization options and possible centralization. The available options include allowing anyone to join the permissioned network after suitable verification of their identity, and allocation of select and designated permissions to perform only certain activities on the network

CBDC, central bank digital currency: a digital asset issued by a central bank for the purpose of payment and settlement, in either retail or wholesale transactions. A 'retail' CBDC would be used like a digital extension of cash by all people and companies, whereas a 'wholesale' CBDC could be used only by permitted institutions as a settlement asset in the interbank market.

Corda: is a distributed ledger technology platform developed by enterprise software company R3. It was initially designed to meet the specific needs of the financial services industry; it has expanded its reach to include support for central banks in their digital currency and DLT endeavours. R3's framework includes more than 300 partners including financial institutions, software companies and systems integrators. R3's successes include a first live securities lending transaction on the Corda platform between Credit Suisse and ING in March 2018. The company continues to partner with a number of banks including Bank of America Merrill Lynch, Credit Suisse. Membership of the network has fluctuated over time – JPMorgan Chase, for instance, joined early but left the network in April 2017 to develop its own blockchain-based technology, Quorum. (Source: OMFIF 2020, The role of blockchain in banking Future prospects for cross-border payments).

Crypto-assets: digital assets in which cryptographic techniques are used to regulate the generation of units of the asset and to verify their transfer between parties via a blockchain without a central party. A digital asset is generally issued by private interests, the price of which is fluctuating in function of demand facing a rigid of fixed mechanism of supply; it is not equivalent to a currency but could be exchanged at fluctuating prices for official currencies. Crypto-assets are easily accessible, transferable, exchangeable and tradable from nearly anywhere in the world, therefore offering a new escape for numerous illegal transactions. These illegal activities include, amongst others, the buying and selling of illegal goods or services online in darknet marketplaces, money laundering, evasion of capital controls, payments in ransomware attacks, and thefts.

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Cryptocurrency: a digital official currency issued by a central bank that uses cryptographic encryption techniques to regulate the issuance of new units, record transactions and attempt to prevent fraud.

Delivery versus payment (DvP): Securities settlement mechanism that links a securities transfer and a funds transfer in such a way as to ensure that delivery occurs if and only if the corresponding payment occurs. There are three models of DvP, one when funds or securities are settled on a gross and obligation-by-obligation basis when corresponding payment is cleared, another one when assets are settled on a gross basis, but funds or securities are settled on a net basis, and the third one when funds or securities are settled on a net basis, with final transfers of both securities and funds occurring at the end of the processing cycle.

Digital cash: a system that permits users to pay, anonymously and electronically, by transmitting a unique digital certificate similar to a banknote number, without the intermediate involvement of a commercial bank. It is a type of currency that can only be used in digital or electronic form, in contrast to physical currency such as banknotes and coins.

DLT, distributed ledger technology: a technic to record transactions held across a network of computers (nodes) where each node has a synchronised copy. It usually relies on cryptography to allow nodes to securely propose, validate and record state changes (or updates) to the synchronised ledger either without or with the need for a central authority. The use of cryptography permits a safe method to validate the accuracy of a copy of the ledger, to lock-up funds for a period of time or until a specified event has happened, or to validate the correct owner of specific funds. It is the supporting system of any blockchain, which can be permissioned (centralized) or permissionless (decentralized). This determines if anyone or only approved people can run a node to validate transactions. All blockchains are DLT, but not all DLT are blockchains. The main difference is that while blockchain requires global consensus across all nodes a permissioned DLT achieves consensus without having to validate across the entire blockchain, being so much less costly in energy. DLT and Blockchain are two different concepts. Removing the intermediary party to process, validate or authenticate transactions is what makes the concept of permissioned DLT so appealing and cost-cutting. Unlike blockchain a permissioned distributed ledger does not necessarily need to have a data structure in blocks and is not necessarily decentralized. A DLT is merely a type of database spread across multiple sites, regions, or participants but it could be managed by an intermediary trustee. Enterprises use distributed ledger technology to process, validate or authenticate transactions or other types of data exchanges. Typically, these records are only ever stored in the ledger when the consensus has been reached by the parties involved. All files in the distributed ledger are then timestamped and given a unique cryptographic signature. All of the participants on the distributed ledger can view all of the records in question. An alternative DLT is a hierarchical one, where each node has a full copy of the ledger but some details are hidden using cryptography. Only one or more trusted third parties have a full view of the ledger. The technology provides a verifiable and auditable history of all information stored on that particular dataset. Contrary to Bitcoin, there are no "miners" for validating with their computers, and there are no blocks, users confirm each other's transactions via a process that confirms previous transactions with each new transaction.

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Fast (retail) payment systems (FPSs): is a system in which the transmission of the payment message and the availability of the final funds to the payee occur in real time or near real time on as near to a 24/7 basis as possible.

Hyperledger: is an open source distributed ledger technology platform designed for enterprises. It uses a permissioned distributed ledger and is the first to allow smart contracts to be written in general programming languages like Java, Google go and Node JS. Therefore, no additional training is required for learning domain specific languages. The main difference between this and other platforms is the support of pluggable consensus, which allows it to be more efficient for a particular use case. Started as a Linux Foundation project in 2016, it aims to create an open-source cross industry standard platform for distributed ledgers. Hyperledger Fabric is an implementation of a distributed ledger platform for running smart contracts, leveraging familiar and proven technologies, with a modular architecture allowing pluggable implementations of various functions. (Source: OMFIF 2020, The role of blockchain in banking Future prospects for cross-border payments)

Incumbents alternatives: Although blockchain has rapidly emerged as a solution for the shortcomings in the global payments infrastructure, this has also prompted responses from major incumbents in the payments industry. Rather than compete with technologies that require complete and costly overhauls of front-to-back office infrastructure, organisations could take a middle ground, instead revising their existing technological systems and business processes to keep pace with the disruptive potential of blockchain. For instance, since 2015, Swift has enhanced its traditional messaging system through the global payment innovation programme. This uses alternative technologies and processes to blockchain and DLT to accomplish similar objectives. While receptive to its potential to enrich their efforts, Swift has stated its belief that blockchain and DLT is 'not yet mature enough' for practical, large-scale usage for cross-border payments. Keeping the overall structural features of the nostro-vostro banking model intact, Swift gpi instead uses new technologies and procedures to reduce friction and promote collaboration and transparency among member institutions. The technologies underpinning Swift gpi are cloudbased computing and APIs that enable the real-time tracking of payments, giving end-to-end visibility for transactions to institutions and clients. These services are underpinned by new service level agreements that financial institutions which have signed up to Swift gpi mutually agree upon. One of the requirements in the gpi SLA is that payments are to be processed on the same day, thus leading to radically shorter transaction and settlement times. As of 2019, Swift has stated that more than \$300bn is exchanged daily over Swift gpi with more than 50% of payments credited to end beneficiaries within 30 minutes, 75% within six hours and nearly 100% of payments within 24 hours. Three subsystems facilitate these improvements: an end-to-end payments tracking system (gpi Tracker), a data monitor of banks adherence to the SLA rules (gpi Observer) and a complete list of all gpi members and their details (gpi Directory). (Source: OMFIF 2020, The role of blockchain in banking Future prospects for cross-border payments)

Interoperability: Technical or legal compatibility that enables a system or mechanism to be used in conjunction with other systems or mechanisms. Interoperability allows participants in different systems to conduct, clear and settle payments or financial transactions across systems without participating in multiple systems (source BIS).

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Payment versus payment (PvP): Settlement mechanism that ensures that the final transfer of a payment in one currency occurs if and only if the final transfer of a payment in another currency or currencies takes place. PvP transfers can occur within a jurisdiction or across borders (source BIS).

Peer-to-peer arrangement: Arrangement that cuts out the financial intermediary payment service providers between the payer and payee.

Quorum: Developed by JP Morgan for its SETL system, it is the first step taken towards implementing blockchain in financial sector. This permissioned blockchain, which is specifically designed for financial use cases, is built off Go Ethereum. It aims to provide confidentiality of records, the main concern for financial institutions. Quorum is an enterprise-focused version of Ethereum. Quorum is a private blockchain enterprise-ready distributed ledger and smart contract platform. It is well-suited to applications requiring high speed and high-throughput for the processing of private transactions within a permissioned group of known participants (for example, a group of investment banks). Quorum allows participants to perform both private and public smart contracts, and so the ledger is differentiated into a private state and a public state database. All nodes can view the public states of the ledger; however only participating nodes can view private ledger states. (Source: OMFIF 2020, The role of blockchain in banking Future prospects for cross-border payments).

Real-time gross settlement (RTGS): Real-time settlement of payments, transfer instructions or other obligations individually on a transaction-by-transaction basis (source BIS).

Scalability: capacity of processing a number of transactions per second. Bitcoin technology allows only to process 7 transactions per second. As a comparison, Visa manages 1667 transactions per second, Paypal manages 193 transactions per second. On the contrary, some private blockchains which are not decentralized could reach very high scalability, like permissioned DLT, making them suitable for banking transactions and consuming much lower energy. The scalability Trilemma expresses the fact that only two of three attributes scalability, decentralisation and security, can be attained simultaneously.

Settlement risk: it could stem from the risk of the payer or the payer's Payment service providers (PSP, a bank (or a non-bank firm like Visa, MasterCard, AliPay, WeChat Pay) defaulting prior to final settlement (ie credit risk) or being unable to settle the payment when it falls due, resulting in a delay in the receipt of funds (liquidity risk).

Settlement of payments "is the process of transferring funds to discharge monetary obligations between two or more parties. Payments can be settled either on a gross basis individually or on a net basis as a batch. The former is known as realtime gross settlement (RTGS), since, provided the payer's PSP has sufficient funds, each payment is settled as soon as it enters the system. When the payer's PSP has insufficient funds to settle immediately, the payment is rejected or queued. The alternative is known as deferred net settlement (DNS), since the netting and settlement take place after a specified period. Hybrid systems offer a mix of RTGS and DNS settlement. For example, if a payment is queued because the payer's PSP does not have sufficient funds to settle on an RTGS basis, the system may offer liquidity saving mechanisms that attempt to settle the payment by netting or offsetting it against other payments."<sup>48</sup>

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<sup>48</sup> Taken from BIS

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Stablecoin: a variant of cryptocurrencies typically pegged to the price of another asset (such as the dollar), designed to maintain a stable market value and to improve the cross-border payments efficiency by using DLT. Stablecoins have many of the features of crypto-assets but seek to stabilise the price of the “coin” by linking its value to that of a stable currency or a pool of assets, approaching so the concept of private cryptocurrency and are potential competitors for CBDC.

Swift bank-to-bank transfers: In March 2018, Swift reported a successful pilot with IBM’s hyperledger to help with nostro account reconciliation. The cross-border payments solution test was in conjunction with more than 50 global banks, including BNP Paribas, BNY Mellon, and JPMorgan Chase. PoC results showed that DLT could provide the functions needed for Nostro account reconciliation, including 'real-time event handling, transaction status updates, full audit trails, visibility of expected and available balances, real-time simplified account entries confirmation, the identification of pending entries and potential related issues, and [...] the data required to support regulatory reporting. (Source: OMFIF 2020, The role of blockchain in banking Future prospects for cross-border payments).

Tokenisation: Process of converting assets into digital tokens. It corresponds to the shift from an account-based payment system to a token-based payment system which simulates electronically the physical possession of a ‘bearer instrument’ whose ownership is transferred hand to hand. The term relies upon an analogy with a materialization of a coin or a banknote i.e. instruments where ownership depends upon who is the bearer, it does not need to be recorded against any legal entity like a bank account but is entirely denoted by the ability of a person to produce a digital signature proving he is the owner. So, the value is transferred not between two accounts but from one holder to another one, simulating a bearer transfer of fiat money or other non-nominal assets i.e. like gold but without physical manipulation or cost. However, the difference with cash is that anonymity is not necessarily warranted since the digital process is fully recorded. Every asset is destined to become liquid via the tokenisation on a blockchain, where “tokens” allow owners to transfer ownership without moving the object from its location but making easy to track the provenance of the object. Obviously, the “token” is purely virtual since the owner does not have the token but only the encrypted key to access and transfer it.

Tokenised cash: an alternative to account-based systems as it enables direct access to a digital currency without intermediaries like delivering banknotes against another asset or good. The transfer of a digital currency simulates the transfer of a physical token from one party to another without need for reconciling two “accounts” databases, but is rather the near-immediate transfer of ownership, very much like handing over banknotes from one person to another. However, is not a physical thing. It can, however, have similar characteristics.

Virtual currency: a type of unregulated, digital money, which is issued and is usually controlled by its developers, and is used and accepted among the members of a specific virtual community.

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