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## Multi-CBDC arrangements and the future of cross- border payments

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# Multi-CBDC arrangements and the future of cross-border payments

Raphael Auer, Philipp Haene and Henry Holden<sup>1</sup>

## Abstract

Cross-border payments are inefficient, and technology could play a role in making them better. One means could be through interoperating central bank digital currencies (CBDCs), forming multi-CBDC (mCBDC) arrangements. This paper explores dimensions of payment system interoperability, how they could feature in mCBDC arrangements and where potential benefits lie. These benefits are especially relevant for emerging market economies poorly served by the existing correspondent banking arrangements. Yet competing priorities and history show that these benefits will be difficult to achieve unless central banks incorporate cross-border considerations in their CBDC development from the start and coordinate internationally to avoid the mistakes of the past.

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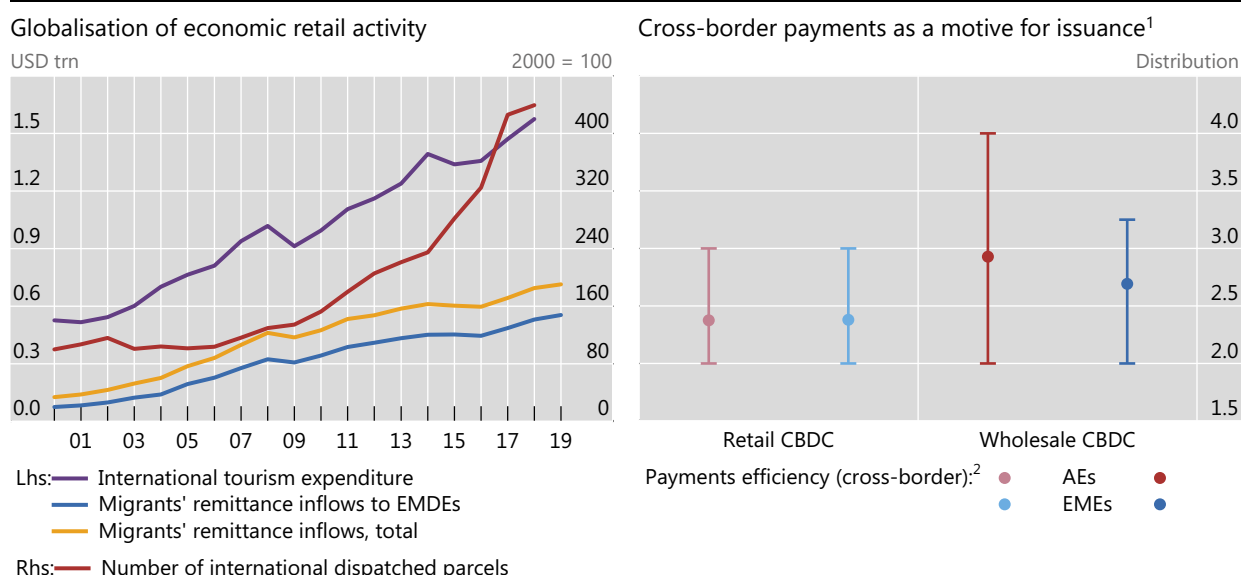
## Introduction

Cross-border payments are ever more vital for economies, especially transactions underpinning tourism, e-commerce and remittances, which have grown substantially over the last decade (Cœuré (2019) and Graph 1, left-hand panel). Yet such payments are often slow, opaque and expensive.<sup>2</sup> Improvement is a priority for globally coordinated policy efforts, and a multi-year G20 “roadmap” is coordinating efforts (G20 FMCBG (2020) and CPMI (2020)).

As well as driving improvements to current systems, central banks are exploring the opportunities central bank digital currencies (CBDCs) might bring to cross-border payments (Carstens (2020 (a, b), 2021), Group of central banks (2020) and Graph 1, right-hand panel). CBDCs are a widely researched new form of digital central bank money, which are just starting to be issued and piloted in some jurisdictions.<sup>3</sup> Improving cross-border payments efficiency is an important motivation for research (right-hand panel).

Cross-border payments efficiency as a motivation for CBDC issuance

Graph 1



<sup>1</sup> Importance of enhancing cross-border payments efficiency as a motive for CBDC issuance in a survey of 66 central banks. The distribution ranges from 1 (not so important) to 4 (very important). <sup>2</sup> The dots indicate the average. The range indicates the interquartile range.

Sources: C Boar, H Holden and A Wadsworth (2020): “Impending arrival – a sequel to the survey on central bank digital currency”, *BIS Papers*, no 107, January; Universal Postal Union; World Bank, Remittance Prices Worldwide; authors' calculations.

This paper models the “multi-CBDC arrangements” in which future cross-border, cross-currency CBDC payments could flow. It considers the potential benefits and the

<sup>2</sup> Remittances to low- and middle-income countries stood at \$551 billion in 2019 (IMF (2020b)). Fees from these payments averaged 6.8% (World Bank (2020), ie 35 billion USD).

<sup>3</sup> Boar et al (2020) provide an overview of research, motivation and likelihood of issuance from central banks. Auer et al (2020) examine the drivers and take stock of current design approaches. Recently, the Central Bank of Bahamas has issued a CBDC (see Central Bank of The Bahamas (2019) for a description).

international cooperation required to make them happen. The different models are CBDC variants of the “multi-currency cross-border” payment systems and arrangements as defined in the taxonomy developed by Bech et al (2020). The models are conceptual and so the macroeconomic and cross-border legal aspects that would need to be considered as part of any practical development are not covered in this paper.<sup>4</sup>

Multi-CBDC arrangements are preferable to proposals that involve the creation of a global private sector global stablecoin.<sup>5</sup> Instead, they look to foster a diversity of convertible national currencies and strengthen monetary sovereignty in the digital age.<sup>6</sup>

We begin with a primer on the inherent frictions in cross-border and cross-currency payments and the different dimensions of interoperability for payment systems. Through this lens, three different mCBDC arrangements are outlined, together with their likely hurdles and opportunities (based on experience and experimentation to date). We close with thoughts on how mCBDC arrangements relate to monetary sovereignty and how international cooperation on development and experimentation can help realise those opportunities.

## Cross-border payment frictions and interoperability – a primer

Multi-currency, cross-border payments are more complex than their domestic counterparts. Settlement in different currencies adds to risks and costs (CPMI (2018) and Bech and Holden (2019)). Today, most cross-border payments are settled through correspondent banking arrangements. In these, currency conversion typically involves several parties, ie smaller payments will be netted and hedged in wholesale markets by banks.<sup>7</sup> Domestic payment systems naturally prioritise local participants in their design (eg using domestic message standards and having opening hours that correspond to local financial markets), and compliance and regulatory standards can differ, adding frictions and risks.

Although improvements are under way, frictions along particular corridors remain. These frictions add up to more risks and operational complexities to manage (Graph 2).<sup>8</sup>

<sup>4</sup> See International Monetary Fund (2020a) for a review of macroeconomic implications and Ferrari et al (2020) for an examination of international spillovers.

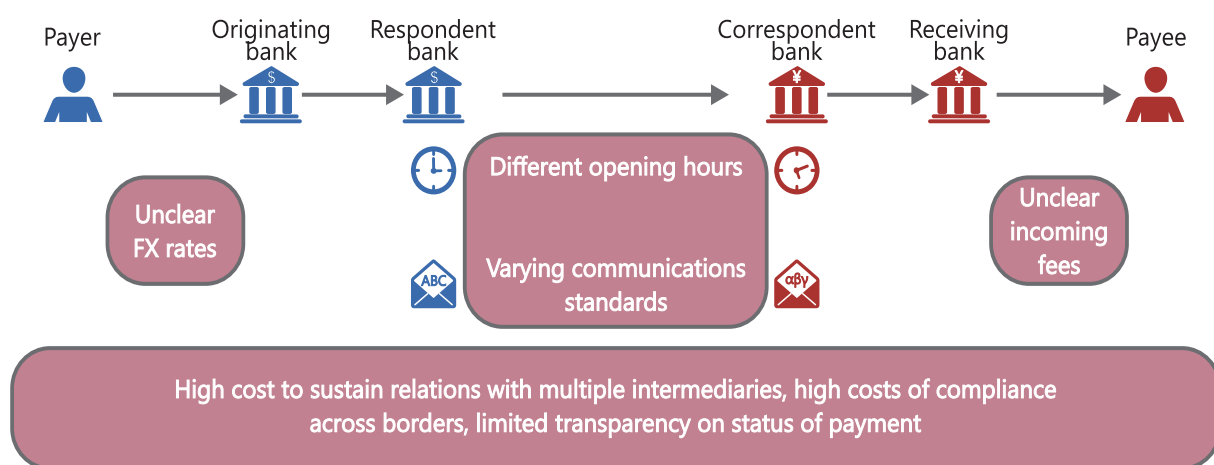
<sup>5</sup> See Libra Association (2019 and 2020) for a proposal and Adrian (2019), Carney (2019), Brunnermeier et al. (2019), and Fatás and Weder di Mauro (2019) for evaluations.

<sup>6</sup> See G7 Working Group on Stablecoins (2019), FSB (2012b), IOSCO (2020), Arner et al. (2020), Adachi et al (2020) for a discussion of regulatory issues, Frost et al (2020) for a discussion of the historical context, and BIS (2018) and ECB (2020) for the technological underpinnings of cryptocurrencies and stablecoins.

<sup>7</sup> There are ways to make conversion more efficient and tailored (eg “matching” customers to reduce the size of net positions). Yet there will always be a net position which will incur exchange rate and settlement risk that needs to be managed.

<sup>8</sup> See also FSB (2020a) and Coelho et al (2020).





Source: Authors' elaboration.

"Interoperability" between payment systems can help reduce frictions. It is a broad term, potentially incorporating any characteristics of systems that could help them exchange information.<sup>9</sup> Today, payment systems achieve cross-border and cross-currency interoperability in three different ways:

1. Compatible standards (eg similar regulatory frameworks, market practices, messaging formats and data requirements).
2. Interlinking systems via technical interfaces, common clearing mechanisms or related schemes.
3. By establishing a single multi-currency payment system.

Payment *systems* and payment *arrangements* are different. Systems feature an operator which maintains a single rulebook and formally controls access to the entire system. Arrangements lack this single unifying agreement. Through use of compatible features and interlinkages, separate payment systems can interoperate to form multi-currency payment arrangements.<sup>10</sup>

The frictions present in today's cross-border, cross-currency payment systems and the ways domestic systems can interoperate are well understood. For cross-border interoperability in CBDC systems, research is in its infancy. Yet there are several studies on the wider challenges facing CBDC-based payment systems, and a broad

<sup>9</sup> The International Organization for Standardization (ISO) defines interoperability as the "capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units" (ISO (2015)).

<sup>10</sup> More formally, a payment *system* is a set of instruments, procedures and rules for the transfer of funds between or among participants, where the system includes the participants and the operating entity (CPMI-IOSCO (2012)). A payment *arrangement* is a broader term including decentralised networks of participants who collaborate to send and receive payments without a multilateral or overarching agreement (eg a correspondent banking arrangement).

outline of what domestic systems could look like is now possible (Group of central banks (2020) and Auer and Böhme (2020a,b and 2021)).

## Cross-border CBDCs: three conceptual approaches

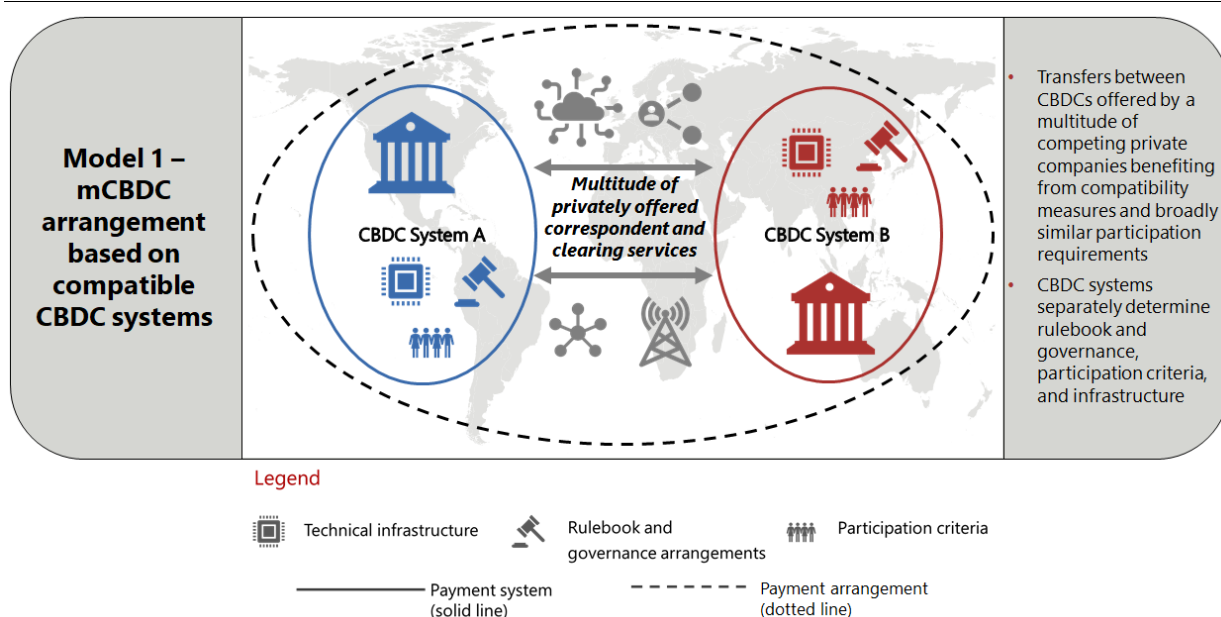
To date, only one central bank has issued a CBDC,<sup>11</sup> and so envisaging multi-CBDC arrangements is necessarily a conceptual undertaking. Conceptually, the three dimensions of payment system interoperability can be stylised in three models: *compatible* CBDC systems (model 1), *interlinked* CBDC systems (model 2) and a *single system* for mCBDC (model 3). The latest CBDC research and historical experience is viewed through this conceptual framing, to provide some practical considerations on the possible benefits and challenges.

### Enhancing compatibility of CBDCs

Through compatible standards, payment systems can reduce frictions and barriers to a diversity of privately offered cross-border and cross-currency services. Diversity, choice and competition make cross-border payments quicker, cheaper and more transparent (CPMI (2018)). The CBDC design stocktake of Auer et al (2020) shows that in many jurisdictions, design efforts concentrate on hybrid CBDC architectures (see Auer and Böhme (2020a,b)), in which the private sector conducts all customer-facing transactions. Given such “tiering” in compatible CBDC systems, a first mCBDC arrangement would probably look very similar to traditional payment systems (Graph 3).

Model 1: mCBDC arrangements based on compatible CBDC systems

Graph 3



Source: Authors' elaboration.

<sup>11</sup> The Central Bank of The Bahamas started issuing its Sand Dollar in October 2020 (Central Bank of the Bahamas (2019)).

In CBDC – just as with any payment means – common technical standards, such as message formats, cryptographic techniques, data requirements and user interfaces can reduce the operational burden of participating in multiple systems. Aligned legal, regulatory and supervisory standards can simplify know-your-customer and transaction monitoring processes.

However, without coordinated policy action, compatibility takes time. Experience has shown it takes years to coordinate participants in complex markets to move to common message standards (eg ISO 20022) or align legal frameworks. Legal and regulatory compatibility are sometimes cited as the greatest source of friction for cross-border payments by banks and payment service providers (CPMI (2018)). Efforts are under way to reduce unintentional barriers (G20 FMCBG (2020)), yet history has shown that legal harmonisation of any kind can take years, even with central bank support and political motivation (eg the Single Euro Payments Area (SEPA)).

Yet an mCBDC arrangement based on compatible domestic systems could benefit from a clean slate. Systems could be designed with international standards in mind and encourage a diversity of private participants. There could be choice and competition within the arrangement and, together with private card networks, correspondent banking and closed loop networks, there could be choice and competition in the wider cross-border payment ecosystem as well. However, given that they resemble traditional cross-border payment arrangements, some of the same issues might apply. Specifically, even with potential for additional diversity, incumbent banks with large networks and foreign exchange operations may have an advantage, leading to the concentration seen in correspondent banking networks (Rice et al (2020)).

Beyond encouraging compatibility, central banks have more tools to influence payment arrangements and potentially avoid some of these outcomes. As an operator of the domestic CBDC system, they can interlink their system with others and provide more formality to an arrangement as well as safety features (eg payment versus payment (PvP)) or efficiency (eg a common clearing mechanism), discussed in the next section.

## Linking multiple CBDC systems

Linking payment systems is a complex task, often requiring compatibility measures. Payments have been compared to the “plumbing” of the financial system (Cunliffe (2020)); an analogy for linking systems is connecting water pipes with different pressures or flow rates. Simply joining them together will not work. Valves and controls are required: contractual and operational arrangements are the equivalent for payment systems. In practice, this can take two forms: (i) a shared technical interface; or (ii) a common clearing mechanism (which, in the case of CBDCs, could be through decentralised, reciprocal accounts or a more centralised common settlement agent or system).

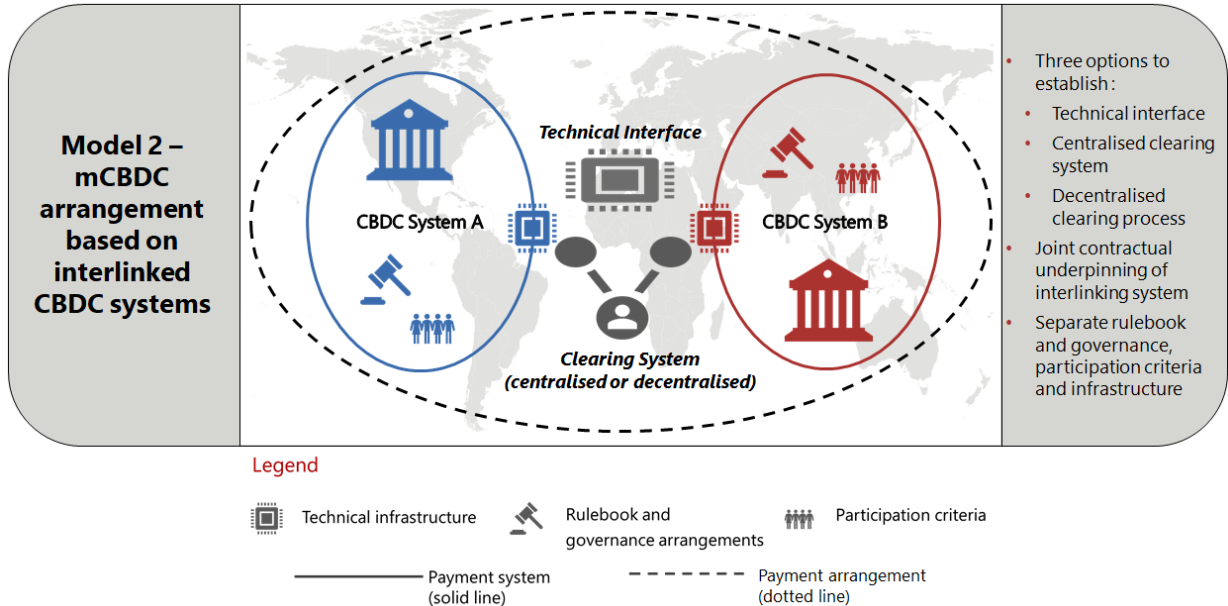
A shared technical interface, supported by contractual agreements between the systems, allows participants in one to make payments to those in another.<sup>12</sup> CBDC experiments have trialled this approach (eg ECB and Bank of Japan (2019)). A common

<sup>12</sup> An example of a technical interface is the link between Hong Kong SAR’s USD CHATS system and the Malaysian high-value payment system RENTAS. It allows payments in each system to be synchronised and avoid settlement risk (ie PvP), supported by a contractual agreement ensuring settlement finality.

clearing mechanism takes a different approach, instead linking systems through designated settlement accounts. Accounts can be distributed (eg the East African Payment System (EAPS), where participating central banks hold accounts with one another to make and receive payments) or centralised (eg TARGET, the European predecessor to TARGET2, where a common Interlinking System debited and credited participating national central bank accounts). For CBDCs, arrangements could incorporate foreign exchange, offered by the central banks or by private institutions. Central banks could also allow other central banks to hold their CBDC and vice versa, acting as correspondents for their domestic distributors or end users (eg the “super correspondents” described in Bank of Canada, Bank of England and Monetary Authority of Singapore (2018)). A more centralised approach could use a trusted intermediary to act as a clearing mechanism for participating central banks.<sup>13</sup>

Model 2: mCBDC arrangements based on linking multiple CBDC systems

Graph 4



Source: Authors' elaboration.

Although a wide choice of interlinking options exists, none are easy to implement. History shows that many projects do not deliver their anticipated benefits or even fail to reach an operational stage despite significant investments (World Bank (2014)). Experiments have demonstrated the technical feasibility of building links between CBDC systems. Yet setting up a real link not only involves ensuring a more scalable, secure and resilient operating infrastructure but also coordinating the many stakeholders and participants involved (which, just as in conventional systems, would multiply with each CBDC added). Developing a sound ecosystem with the right mix of incentives for participants to use the system safely and efficiently is a significant

<sup>13</sup> If CBDC is provided domestically through a hybrid CBDC architecture that allows the private sector to connect to the central bank's server in a flexible way, this would favour shared technical interfaces and a centralised common clearing mechanism. CBDC provided directly would probably be more conducive to a decentralised model, where central banks offer users FX or access to other currencies through bilateral agreements with other central banks.

undertaking with substantial risk.<sup>14</sup> Just interlinking systems, without investment in broader coordination to introduce compatibility, has been insufficient in the past to achieve efficient cross-border payments.

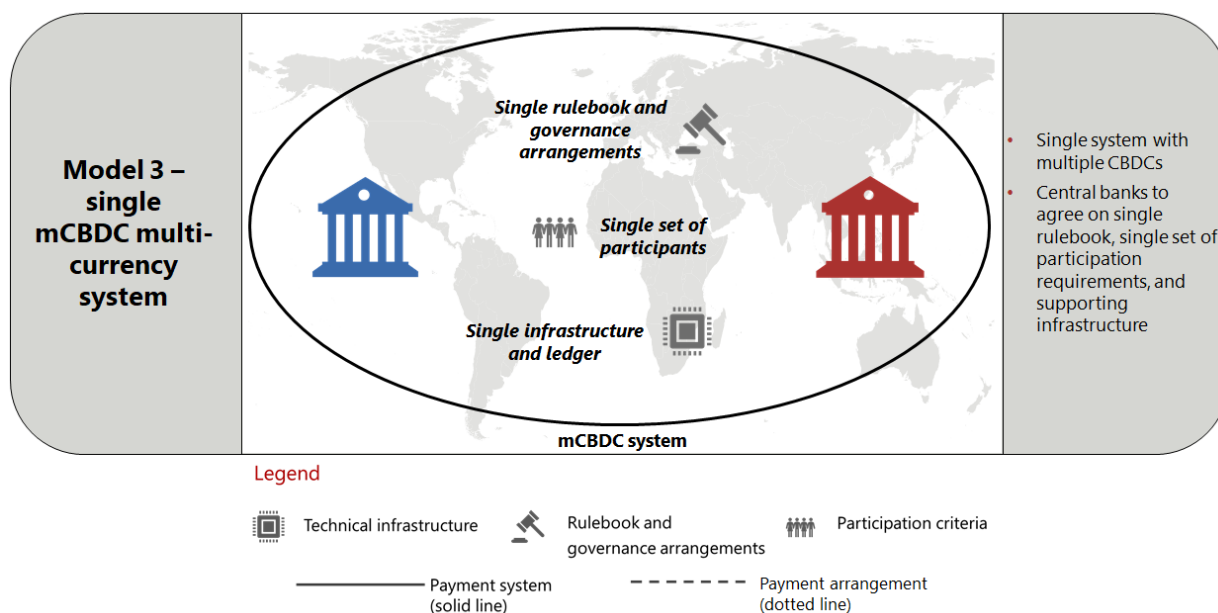
Nonetheless, if systems have strong compatibility then safety and efficiency benefits are possible. Interlinking systems allows for some functionality that is not possible with a purely informal arrangement (eg PVP maintained through a technical interface).

### Integrating multiple CBDCs in a single mCBDC system

Beyond interlinking domestic systems, multi-currency cross-border payment systems are possible involving CBDCs (Graph 5). Multi-currency systems using traditional money types have a single independent rulebook and access criteria, very different to interlinking, where participants directly connect to their “home” system (Bech et al (2020)). This deeper integration allows for potentially more operational functionality and efficiency but increases the governance and control hurdles (eg wider access might allow more efficient settlement but increases other risks).

Model 3: mCBDC arrangements based on single multi-currency system

Graph 5



Source: Authors' elaboration.

Multi-currency CBDC systems could vary significantly in their designs from traditional payment systems and one another. Multiple systems for different use cases could exist (eg more “retail” focused mCBDC systems could focus on higher volume, lower-value cross-border payments, allowing wider participant access than a more “wholesale” focused system that prioritised higher value, real-time payments). New

<sup>14</sup> Where CBDC is distributed by the private sector, there could be additional challenges, from disruption to incumbents' business models (eg a new link may require too much investment by participants or compete against their existing profitable services). A lack of broader compatibility could also result in costs and risks, making use of the link unappealing.

technologies could be used, eg CBDCs could be issued onto a common distributed ledger, potentially exploiting economies of scale in development and maintenance, while being more technically simple than interlinking distinct systems. Other configurations are also possible, eg the Inthanon-LionRock project of Bank of Thailand and Hong Kong Monetary Authority (2020). In this project, participants from two systems directly engage in a shared “corridor” network with a jointly controlled operator, allowing participants to make cross-border payments through depository receipts tied to CBDCs held in the domestic systems. Yet a single mCBDC system raises a raft of policy issues for central banks. The (shared) management of the rulebook and governance arrangements for the shared system will be just one aspect. The wider implications of issuing a CBDC for monetary policy, financial stability and payments policy will need to be worked through for each central bank, potentially requiring trade-offs in the final design. For example, central banks will need to evaluate whether they are willing to relinquish some system control and monitoring functions to an operator, for which the governance arrangements would need to be (jointly) agreed. Negotiating these trade-offs across multiple central banks will be a challenge.

Historically, multi-currency systems have often been developed as a prelude to monetary union. In such cases, the governance and operation of a system is seen as transitional, with complexities being guided by wider considerations. CLS provides a useful example of where this is not the case. When considering the design of a new system for the settlement of foreign exchange transactions, central banks collectively considered: systemic risks, liquidity pressures, monetary policy, international interdependencies, access for participants and currencies, and balancing the role of the private and public sector (CPSS (1996)). Then, even after central bank commitment to a clear and shared strategy, the development of a new system and collaboration with the private sector took many years.

An mCBDC system could theoretically use new technologies to explore possibilities and complexities not previously available (eg through additional monitoring, control and segmentation within a distributed ledger system).<sup>15</sup> For example, CLS settles foreign exchange transactions on its own books, but the final (netted) payments are made through the accounts it holds at each central bank (Galati (2002)). This enables the system to settle in central bank money, making it far safer. Yet operational complexity is arguably added by using the accounts held at each central bank. A CBDC, in a tokenised form, could exist outside the central bank and therefore theoretically enable different and more integrated models where all currencies could be settled on a single distributed ledger. This would also be possible with private tokenised money, although it might not be as safe a system as one using CBDCs to settle transactions.

Building upon the Inthanon-LionRock project, the BIS, through its Innovation Hub, is further exploring mCBDC systems through the mCBDC Bridge initiative, run in partnership with the Hong Kong Monetary Authority, the Bank of Thailand, the Digital Currency Institute of the People’s Bank of China and the Central Bank of the United Arab Emirates. The initiative involves developing a proof of concept (PoC) prototype to support real-time cross-border foreign exchange PvP transactions in multiple jurisdictions, operating 24/7. The mCBDC Bridge initiative aims to foster an

<sup>15</sup> In particular, deploying a system based on distributed ledger technology rather than a centralised ledger may have economic potential wherever it is difficult for the involved jurisdictions to agree on a common governance arrangement (Auer, Monnet and Shin (2021)).

environment in which more central banks in Asia and other regions can jointly study the potential of DLT for enhancing the financial infrastructure for cross-border payments (BIS (2021b)).

## International coordination to harness the potential of mCBDC arrangements

Many central banks are researching CBDC, and there are clear opportunities for CBDCs to improve cross-border payments and protect monetary sovereignty (Group of central banks (2020)). Table 1 highlights how different mCBDC arrangements could help alleviate frictions in cross-border payments.

The BIS is supporting experimentation on mCBDC arrangements through its Innovation Hub. The Innovation Hub's work programme for 2021/22 includes exploring PoCs to link w-CBDC in different currencies to allow for PvP settlement. This could involve the use of bilateral links but also the establishment of settlement platforms for multiple wholesale CBDCs (BIS (2021a)). The mCBDC Bridge initiative outlined above is a concrete example for how the BIS can contribute to central bank experimentation, fostering collaboration among central banks (BIS (2021b)).

Exchange rate conversion (FX) will be a necessary friction for any mCBDC arrangement. Today's FX wholesale markets are vast but also highly complex, fragmented and concentrated among a few large dealers (Schrimpf and Sushko (2019)). At the same time, the underlying settlement risk is significant and increasing (Bech and Holden (2019)). The three mCBDC models outlined in this paper do not prescribe foreign exchange mechanisms. Yet they could, in different ways, allow for improvements on the arrangements in place today.

For example, compatible CBDC systems (model 1) could provide an additional means to settle transactions from existing markets in central bank money. Through developing open, competitive and compatible domestic payment systems, a more diverse group of banks and non-banks could settle payments in central bank money. Through these "back-end" access improvements, a broader variety of "front-end" cross-border and cross-currency payment services could be possible. This might lead to a better balance between fragmentation and concentration in payments than seen today.

Interlinked CBDC systems (model 2) could build on these potential improvements to offer additional safety. Specifically, PvP settlement could be included through a technical interface between domestic systems. New technologies could allow this to be implemented through a novel means (eg Bank of Canada and Monetary Authority of Singapore (2019)). Common clearing mechanisms (either centralised or decentralised) could potentially also add efficiencies, especially when linked with FX trading venues.

Finally, an mCBDC system (model 3) could offer the same improvements as interlinking systems but with additional integration. For example, all FX settlements would be PvP by default, rather than requiring routing or specific settlement instructions through an interface. Trading venues could also be integrated into mCBDC systems, which could (assuming the right designs) further reduce complexity, fragmentation and concentration in currency markets (Bank of Thailand and Hong Kong Monetary Authority (2020)). Such a model is also adopted in Project Aber (see

SAMA and CBUAE (2019, 2020)), which even goes a step further via the joint issuance of a CBDC that is used in the single mCBDC arrangement. Because both the Saudi riyal and UAE dirham are pegged to the US dollar, the newly issued CBDC was effectively guaranteed to have a fixed exchange rate to both local currencies.

Potential improvements of different mCBDC arrangements to frictions in correspondent bank arrangements for cross-border payments

Table 1

Frictions in existing correspondent bank arrangements for cross-border payments	Potential improvements		
	Model 1–mCBDC arrangement based on compatible CBDC systems	Model 2–mCBDC arrangement based on interlinked CBDC systems	Model 3–single mCBDC multi-currency system
Operational costs to sustain cross-border banking relations & prefunding	Compatible systems allow for efficiency gains in existing banking relations	A common clearing mechanism could reduce the number of relationships and provide economies of scale	A single system does not require such relations (however a single system may add to operational costs)
Mismatch of opening times across time zones	CBDCs can be open 24/7, eliminating any mismatch of opening times		
Mismatch of communication standards	Compatible message standards allow payments to flow without data loss or manual intervention	The message standard (eg ISO 20022) adopted by the interlinkage would act to harmonise standards across systems	Single message standard across the system eliminates mismatches
Unclear FX rates & unclear incoming fees	Compatibility requirements for wallet providers could enable users to calculate fees and rates prior to a payment	Common calculation of rates and fees for transfers using any interlinkage would aid transparency	Unclear FX rates & unclear incoming fees
Limited transparency on status of payment	CBDCs could settle instantly, reducing the need for status updates		
High costs of compliance across borders	Compatible compliance regimes reduce uncertainty and costs	Interlinking systems does not impact multiple or conflicting compliance requirements	Single set of access requirements means compliance could be equivalent across the system

Source: Authors' elaboration

## Compatibility

Compatible CBDC systems could foster open, competitive and innovative markets for services offering convenience and choice to end users. This could mean, at least for larger jurisdictions, providing a CBDC through private operators in some way. At the same time, CBDCs could allow for enhanced monitoring and control by central banks (eg through enforcement of capital controls and accurate data on offshore holdings) that could relieve operational issues that slow down many cross-border and cross-currency payments today. New technologies can help connect diverse participants and systems that rely on different infrastructures.

History has shown that compatibility is a prerequisite for successful implementation of interlinkages and common systems. "Build it and they will come" does not apply (Bech et al (2020)), as cross-border, multi-currency payment arrangements are time-consuming and difficult to set up. Experience has shown that



setting-up cross-border governance, addressing conflict of laws issues and making changes to multiple compliance and regulatory regimes take many years.<sup>16</sup>

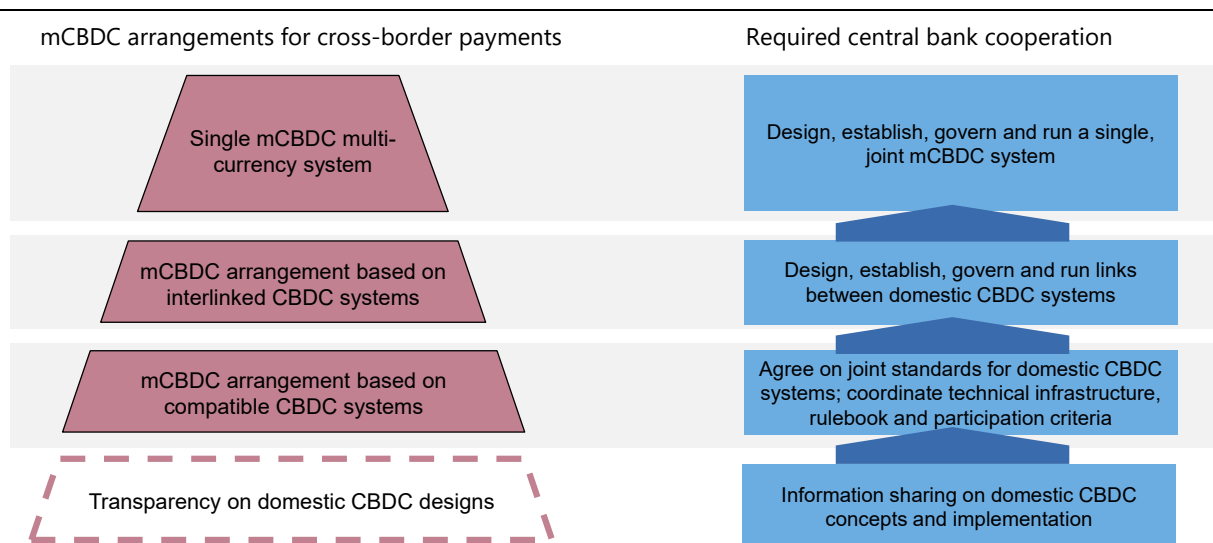
## Coordination

Incorporating cross-currency compatibility into early CBDC development can help avoid the long time frames of post hoc coordination exercises. For central banks developing CBDCs, compatibility with their peers will be a moving target. Technology standards are evolving, and so coordinated development will play an important role in facilitating some degree of future interoperability (Bech and Hancock (2020)). Coordination is impossible without information-sharing and early transparency among central banks on provisional designs for domestic CBDC systems. The CBDC design stocktake of Auer et al (2020) shows that in many jurisdictions, CBDC systems will involve private distribution. Wherever this is the case, cooperation also requires the engagement of key private sector stakeholders.

Early cooperation on exploring how new technologies can enable novel designs for potential multi-currency systems may also play an important part in CBDC development. Time will be required to properly understand the possibilities that new technologies could bring. Possibly even more time might be required to work through the resulting policy implications and how these could be balanced with different system designs.<sup>17</sup>

Central bank cooperation required for different mCBDC arrangement

Graph 6



Source: Authors' elaboration.

In addition to coordination on CBDC development, central bank cooperation to identify and manage any risks arising from an mCBDC arrangement will be necessary.

<sup>16</sup> The original specification for ISO 20022 was originally drafted by SWIFT in 2000. After 20 years of development and increasing adoption, cross-border payments will likely migrate to this (not-so) new standard at the end of 2022 (SWIFT (2020a)).

<sup>17</sup> Central banks are already collaborating on how new technologies can enable novel ways of making cross-border payments (eg Bank of Canada and Monetary Authority of Singapore (2019)).

The specific form of cooperation between central banks will depend on the mCBDC arrangement envisaged. While connections can be established through private service providers benefiting from compatibility achieved through joint standards, more formal interlinkages and a single mCBDC system will require much deeper cooperation by central banks (Graph 6).

Central bank cooperation will also be necessary to oversee any private initiatives in cross-border payments. The models in this paper are not exhaustive, and novel arrangements could develop depending on the CBDC systems. To understand these private arrangements and the risks they pose, central banks and supervisory authorities can profit from experiences establishing successful cooperative oversight arrangements for traditional payment systems and service providers like CLS or SWIFT.

Yet the development of mCBDC arrangements will also need to be considered in the context of private sector proposals that involve the creation of novel private sector global stablecoins (ie Libra Association (2020, 2019), Fatás and Weder di Mauro (2019)). Such attempts to create a novel global unit of account cannot do away with risks underlying the currency conversion in cross-border payments: they just shift the risk elsewhere (specifically, to the recipient of the new unit of account). And this shift can further encourage currency substitution if domestic use of the stablecoin becomes widespread.

The future of the international financial system will rely on fostering the seamless convertibility of one sovereign currency into another. Payment system design is a domestic choice, but it has important international implications (IMF (2020a)). Wherever there are macroeconomic or institutional reasons for dollarisation today, foreign CBDC issuance may aggravate this threat, by making it even easier for users to adopt a foreign (digital) alternative (Carstens (2021)).<sup>18</sup> A CBDC cannot, in itself, make a currency more stable. Yet CBDCs that form well-functioning mCBDC arrangements can then allow cheap and fast conversion to discourage holding of foreign currency (Diez de los Rios and Zhu (2020)).<sup>19</sup>

## Concluding thoughts

Any central bank issuing a CBDC will do so in pursuit of its domestic mandate and public policy objectives (BIS (2020)). Yet as the globalisation of economic activity continues, a broader horizon will be needed. Convenient and inexpensive access to other currencies for remittances, travel and trade could give users more incentives to adopt a CBDC.

CBDCs will not be launched into a domestic or international vacuum. Different kinds of widely available private electronic money already exist for payments.

<sup>18</sup> See Schilling and Uhlig (2019) for a theoretical analysis of the role of transaction costs in currency substitution.

<sup>19</sup> However, the broader international macroeconomic implications of CBDC issuance need to be understood. CBDC issuance will have repercussions on the international monetary and financial system. Further design considerations can also reduce the risk of international spillovers. This is especially important given the much greater international spillovers in the presence of national CBDCs shown in Ferrari et al (2020) and IMF (2020a).

Therefore, CBDC interoperability will need to consider not just other (potential) CBDCs but existing and developing systems too. With payments changing rapidly (eg with the potential introduction of stablecoins), this could be a fast-moving target.

There are many ways a central bank can facilitate the use of CBDC across borders. Depending on circumstances and the designs of the domestic CBDC systems, a variety of options to link CBDCs are possible. It should also be possible, with the benefit of hindsight, to avoid some of the pitfalls of past interlinking projects. At least conceptually, single mCBDC systems and interlinkages can significantly reduce existing frictions in cross-border payments (although they also come with governance, technical and cooperation challenges). Yet a condition for their success is the underlying compatibility. Current international initiatives (eg the G20 roadmap) are already laying the foundations for this.<sup>20</sup>

International initiatives have been driven by the retreat of correspondent banking and its adverse impact on cross-border payments (Rice et al (2020)). This is an issue with an outsized impact on emerging market and developing economies (EMDEs). The risk of currency substitution due to a global stablecoin might also be a particular risk for some EMDEs. Given that reports and surveys show that EMDEs have stronger motivations to issue a CBDC than their advanced economy peers, considering how mCBDC arrangements can best be fostered will be a pressing concern for some central banks (Boar et al (2020)).

The Bank for International Settlements is conducting experiments on mCBDC arrangements with its Innovation Hub, exploring some of the outlined models together with central banks. One example is the mCBDC Bridge initiative, which explores a single multi-currency CBDC system (model 3 outlined above). As central banks progress with their CBDC research and development, there are a significant number of policy considerations. A review of the conceptual options and recent history of interoperability highlights some steps for central banks to encourage efficient cross-border payments if CBDCs are issued. Coordinating early and openly can help central banks in identifying unintended barriers. This will aid efficiency. Yet for those central banks aiming to avoid competition from global stablecoins, it is a question of safety. A positive way to prevent widespread use of private global currencies is by fostering an efficient and convenient way to convert currencies. A CBDC, compatible with others and benefiting from a diverse and competitive market for services, would be a real public good. To achieve this, central banks will need to collaborate.

<sup>20</sup> While this paper has focused on cross-border interoperability between CBDC systems, domestic interoperability will also be a critical success factor for CBDC systems. Such interoperability could link CBDCs with domestic faster payment systems (FPS), as are currently being established in many jurisdictions (Bech and Hancock (2020)). With seamless payments between retail CBDC systems and faster payment systems, cross-border interoperability could also be achieved by linking domestic fast payment systems. For example, the UK's Faster Payments conducted a pilot together with SWIFT demonstrating that cross-border payments can be cleared and settled in a matter of seconds (SWIFT (2020b)).

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