CAPCO JOURNAL

The Capco Institute Journal of Financial Transformation

Value dynamics

Disruptive forces reshaping financial services

Technological transformations

Riding the digital tides: Analyzing the digital yuan's present and possible future

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The Capco Institute Journal of Financial Transformation

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Table of contents

Technological transformations

Secular shifts

Structural challenges

2025, Edition 61
JOURNAL

Value dynamics

Welcome to the 61st edition of the Journal of Financial Transformation.

I am delighted to announce our new partnership with King's College London, a world-renowned leader in education and research, marking a new chapter in the Journal's long and distinguished history.

In this edition focusing on Value Dynamics, we explore a critical – and ever more pressing – challenge: how institutions across financial services create, distribute and sustain value.

As Professor Crawford Spence, our editor from King's College highlights in his own introduction, the forces shaping value dynamics across financial services are myriad, encompassing technological transformations, secular shifts, political and social structures.

As a firm that has been at the cutting edge of innovation for over 25 years, these value drivers intersect directly with the work Capco does every day, helping our clients around the globe transform their businesses for sustained growth.

The integration of innovative new technologies including generative and agentic AI models, the digitalization of currencies and payments infrastructures, the reimagining of customer experiences, the relentless evolution of market ecosystems, the vital role of culture as a value driver: these imperatives are where we see – first-hand – clear opportunities for our clients' future growth, competitive differentiation and success.

We are excited to share the perspectives and insights of many distinguished contributors drawn from across academia and the financial services industry, in addition to showcasing the practical experiences from Capco's industry, consulting, and technology SMEs.

It is an immense source of pride that Capco continues to champion a creative and entrepreneurial culture, one that draws on the deep domain and capability expertise of thousands of talented individuals around the world.

We do not take our hard-earned status as a trusted advisor lightly, nor our responsibility to make a genuine difference for our clients and customers every single day – placing excellence and integrity at the forefront of everything we do.

I hope the articles in this edition help guide your own organization's journey as you navigate the many complexities and opportunities ahead.

As ever, my greatest thanks and appreciation to our contributors, readers, clients, and teams.

Annie Rowland, Capco CEO

2025, Edition 61

Editor's note

KING'S College LONDON

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This 61st edition of the Journal of Financial Transformation is the first with a new editorial team in place, and is the product of a formalized collaboration between Capco and King's College London. This collaboration – a leading financial services consultancy and a prestigious academic institution – embodies the Journal's ethos: a balance between academic rigor and practical accessibility.

Traditional academic journals often deal with more prosaic conceptual matters. Even when they focus on more practical concerns, the timelines and mechanics of double-blind peer review processes can mean that the insights that they offer risk being out of date by the time they are published. Conversely, traditional op-ed articles in the financial press are all too often heavy on opinion and pre-conceived ideas and can lack the heft that comes with thoroughly researched pieces of work.

The Journal we've published strikes a vital balance between these two approaches.

This edition has an overarching focus of Value Dynamics. Specifically, the various articles look at how value is created, distributed and sustained across financial services. In turn, the submissions are grouped into three broad themes.

Technological transformations are explored in terms of how these can bolster or hinder value dynamics if not managed effectively. A number of secular shifts are also discussed – these being long-term changes that are impacting value dynamics in the sector. Finally, structural challenges are highlighted that emphasize the importance of sticky, tricky social and behavioral issues that surround the execution of financial services.

Overall, these themes highlight challenges and opportunities in the sector and encourage us to think differently.

It has been a pleasure working on this issue with such a fantastic and diverse array of different contributors.

Professor Crawford Spence
King's College London

Riding the digital tides:

Analyzing the digital yuan's present and possible future*

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Abstract

Central bank digital currencies (CBDCs) are being considered in many countries – as a novel form of digital public money issued and backed by the state. One of the most extensive and advanced of these schemes is China's e-CNY or "digital yuan" pilot. It is also one of the most discussed. And yet it is perhaps one of the most mysterious, owing to the reticence of Chinese officials, the complexity of the pilot, and the wide variety of options available to Chinese authorities for future development of the e-CNY and the broader digital asset ecosystem within China. This note takes stock of the current status of the e-CNY, emphasizing its core infrastructure, existing use cases, and the "managed anonymity" model. Looking forward, how the e-CNY may fit into a digital financial system, how it may underpin non-financial and government activities, and how it may promote the internationalization of the renminbi are also discussed. We argue that external observers may be somewhat exaggerating the individual importance of the e-CNY scheme to the Chinese government. Ultimately, the e-CNY should be regarded as only one piece of a broader, coordinated drive to modernize the Chinese economy and how the government interacts with it.

1. Introduction

Conceived 2014, and active since 2020, the "digital yuan" or "e-CNY" is arguably the most ambitious central bank digital currency (CBDC) scheme in existence. While still nominally in pilot stage, the scale of the e-CNY project is such that it dwarfs all other active CBDC schemes. Even allowing for extensive schemes currently under development or exploration (notably the digital euro, digital rupee, and digital ruble) it seems likely that the e-CNY will remain a key benchmark for CBDCs in the future. Given China's rapid growth, modernization and global diplomatic goals, it is vital to understand such a large scale policy. And yet, despite the importance of the project, there remains enormous ambiguity surrounding the e-CNY. To some extent this ambiguity is reflected in other countries also, where the pace of change in the digital money domain can be bewildering and confusing. But the goals of the PBOC, and its Digital Currency Research Institute, are also less frequently stated and discussed, relative to the information (arguably an overload of information)

* The views expressed in this document and all errors and omissions should be regarded as those of the authors and not necessarily those of the the Bank of England, the Central Bank of Ireland, Qatar Central Bank, or Chainlink Labs.
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provided by other central banks. As such, taking stock of the e-CNY's current status is relatively difficult, and predicting its future path is even more so. This article attempts to address this, providing insight into features of the digital yuan, explaining the apparent logic behind its design, how it relates to broader Chinese policy, and what one might expect in the future. A key point is that the commonly expressed view that the e-CNY will be pushed to become a domestically and globally dominant money is perhaps questionable. The breadth of the Chinese government's approach to digital money, payments and financial reforms is such that e-CNY is perhaps better regarded as one piece of a broader strategy, and one that may never become the dominant payment medium within the economy. This is not to deny the significant importance of the project, but simply to note that the picture is more nuanced than some depictions of the project.

The development of a CBDC represents an important change in the payment rails of a given country. In China, given the high degree of government or government-backed institutions' interaction with private corporations, it is especially important to be informed about the progress and future of CBDC. Whereas digital money debates have been driven mainly by financial system issues in most countries, China's e-CNY pilot has emphasized non-financial usage, from the disbursement of public funds to contractors, to the use of the e-CNY in transport payments, and in supply chain administration. Foreign banks have begun to offer corporate e-CNY accounts and services and foreign citizens are able to set up e-CNY wallets. Broader projects, such as the belt and road initiative, and wider blockchain/digital asset schemes, show that China could rapidly scale up the e-CNY, not least because it can draw on experimentation currently underway in Hong Kong. The connection of the e-CNY to the wider desire to internationalize the Renminbi, and the possibility that it could (eventually) unlock a more relaxed foreign exchange policy also demands attention from any firm interested in doing business in China.

The structure of the paper is as follows. After a brief discussion of the underling infrastructure of the e-CNY in Section 2, we discuss the privacy challenges surrounding the e-CNY in Section 3 and its relationship to anti-money laundering in Section 4. We then discuss more forward looking topics – asking how the e-CNY might evolve in the future, as one component of the broader strategy of the Chinese government. Section 5 considers the e-CNY in the context of the internationalization of the yuan, while Sections 6 and 7 consider the role the e-CNY may eventually play in a broader digital asset ecosystem and how it may coexist with other forms of digital money and payments reform.

2. Infrastructure

The infrastructure of the e-CNY system seems still to be evolving, in line with the experimental (if advanced) nature of the pilot. As such, it can be difficult to divine what the ultimate approach taken will be. Some high-level characteristics, however, seem to have been finalized. The system will be highly centralized in terms of issuance and distribution of e-CNY, coordination of interbank transactions, and monitoring of the system. With issuance being purely the preserve of the central bank and a set of authorized operators, the system conforms to what presumably will be the approach taken by many – if not all – central banks. Since 2022, the PBOC has been reporting outstanding e-CNY in its monetary accounts [PBOC (2023) and PBOC (2025) for example] and regards the e-CNY as an element of M0, the narrowest form of money. As such, it is akin to cash, but digital and available to the public and businesses.

Currently, the set of authorized operators is small and focused on banks and key payments providers, though one could imagine the set being further expanded in the future. These agents represent "tier 2" institutions, intermediating between the "tier 1" PBOC in a so-called "two tier" structure. This structure was identified early on in the e-CNY development as being most appropriate for the PBOC's aims. First, it allows private sector expertise in on-boarding (wallet creation and management), user interface, and AML/KYC to be exploited. As noted in DCRI (2021), the PBOC sets rules and expectations around what privately provided wallets must offer, in terms of e-CNY functionality. They then defer to private companies for how exactly this is implemented and how their services would function in other dimensions. Arguably, the PBOC has thus implemented a system conforming to the "Model 2" CBDC ecosystem discussed in Liu et al. (2024)'s analysis of possible CBDC ecosystems, described as follows:

"The central bank is responsible for providing the network infrastructure and a basic wallet for end users. Intermediaries provide all other end-user services which would allow central banks to establish a downstream quality standard, foster competition through a central bank digital wallet, enable intervention for market failures and ensure inclusivity for overlooked segments of the population."

This collaborative approach (between PBOC and private sector) is partly in acknowledgment of the greater experience of existing e-money and payment providers in these areas, but also reflects a desire for the e-CNY not to disintermediate the banking system. While even a zero interest-bearing e-CNY might imply some competition with existing payment rails, the inclusion of e-CNY functionality could conceivably crowd in users into a payment provider's app. While this is perhaps unlikely for Alipay and WeChat, who have already almost saturated the mobile payments market, there are suggestions that the inclusion of e-CNY functionality could aid banks in enhancing their mobile payments market share by making their wallets and, indirectly their other services, more attractive.

As discussed in Deutsche Bank (2021) there is, in a sense, a "tier 2.5" set of institutions, comprising other banks and payment service providers who cannot directly exchange deposits and cash for e-CNY with PBOC, but who can interact with the authorized operators to layer services upon their underlying rails. This provision of a unified underlying rail is one of the main benefits cited by other central banks in their communications on CBDC (notably the digital euro and digital pound) in that it should allow innovative services to be created by those with the comparative advantage for doing so, the banking and payments sector.[1]

While there is an official e-CNY wallet app, the PBOC, in collaboration with commercial partners, has ensured that the e-CNY is increasingly available as an option in existing widely-used apps, and can be used in much the same manner as existing payment methods and digital moneys. This was an explicitly stated aim of the PBOC in minimizing switching costs. It was thought important for adoption that merchants and citizens should not have to learn new methods and habits. Similarly, the avoidance of fees for merchants and other users was a priority. The ability to use existing approaches (touch to pay, QR code scanning, and so forth) and existing apps (AliPay, WeChat, and commercial banking apps) ensures that in technical terms, the e-CNY scheme could be rolled out with minimal disruption.

[1] For a useful comparison of some of the main characteristics of the digital yuan and digital euro, see Hogan Lovells (2025)

The e-CNY scheme features a rich variety of wallet options, which has been termed the "wallet matrix" [Mu (2023)]. A set of important wallet characteristics defines the dimensions of this matrix: software or physical, offline or online, and individual or corporate. An interesting further distinction is whether the wallet is the primary wallet, or one of possibly multiple "sub-wallets" that are connected to an overarching primary wallet, but which can be used for particular interactions with external services and counterparties. Users can tune characteristics of their sub-wallet according to use case, such as setting payment limits or limiting the sharing of personal information for a particular type of transaction.

Software-based wallets, be that in the official e-CNY app or via intermediaries' apps, will likely be the dominant method of using the e-CNY, reflecting familiarity with, and the success of, mobile payments (often implemented via QR and barcode scanning) within China. However, as noted in Mu (2024) the expectation is that the variety of wallets will grow. An important theme is that of "loose coupling" with banking rails, such that the e-CNY can be used independently of the rails, thus not requiring bank accounts. Enhanced physical and SIM-based wallets are emerging, and e-CNY functionality is even being embedded in the operating system of new Huawei smart devices [Ledger Insights (2024c)].

Great emphasis is put on the scope for official payments (be they fiscal or to contractors working on government projects) to be executed using e-CNY rails, so as to reduce corruption and fund diversion. In other countries, the ability to make direct fiscal payments has also been cited as a possible benefit of e-CNY [see World Bank (2021)] and in a country so vast and with such different degrees of terrain and development – in some cases subject to natural disasters – the ability to directly credit citizens and firms with government funds is extremely important. The aforementioned physical/visual wallets and off-chain functionality also relate to these issues, such that distant or damaged regions and less technologically savvy citizens are capable of participation.

3. Privacy

In many countries considering the introduction of CBDC, privacy concerns are prominent. Bidder et al. (2023) show a significant relationship between trust in the ECB and projected adoption of the digital euro, and that experience of authoritarian rule in East Germany prior to reunification also is associated with lower demand for the CBDC. In Korea, Choi et al. (2023) find similar results and in the United States, one of the often mentioned reasons for opposition to CBDC has been concern over government oversight (see Ted Cruz's CBDC Anti-Surveillance State Act, for example). Similar concerns have been expressed both within and outside China in relation to the e-CNY. Indeed, PBOC officials have acknowledged the importance of the issue and repeatedly emphasize the various steps that have been taken to ensure data security and to promote user privacy [Gang (2022)].

At the same time, a key aim of e-CNY is to help reduce fraud and money laundering. As in other countries, the ability to use digital cash at a scale that is impractical for physical cash has raised difficult trade-offs between privacy and oversight. Given the additional salience of capital controls and forex restrictions in China, and the greater role of the government within the economy, these trade-offs have especial force. An additional trade-off perhaps applies in China, arising from the more managed nature of its economy, where

the government is more involved in directing activity. In this context, the scope to use the "big data" arising from transactions with e-CNY in enhancing the efficiency of a given amount of government activity is enormous.

Balancing these trade-offs has led the PBOC to a policy commonly translated as "controlled anonymity" or, perhaps more naturally translated, "managed anonymity" [Mu (2022)]. As aforementioned, e-CNY wallets are available in various forms. Wallets with higher spending limits are associated with more rigorous identity checking. A mantra often referred to is that of "anonymity for small amounts, traceability for large amounts." To an extent this is also reflected in mooted designs for the digital euro, where it has been suggested that offline and small value transactions might be allowed to be effectively anonymous outside the counterparties involved [Daman (2024)]. However, it should be noted that the e-CNY, even in the lowest tier of hard wallet, does apparently require a phone number. While this per se is not equivalent to supplying identifying information, it is typically the case that to obtain a SIM card, one must provide identity documents such that the proxy (phone number) can presumably be traced back to an individual if necessary. However, there may be other safeguards in place to prevent this, or at least prevent it from happening without formal oversight and guardrails.

A subtlety to the privacy debate is that in some respects the e-CNY could enhance privacy, at least relative to existing digital payment methods. The ability to deploy sub-wallets for interaction with online services and the "loose coupling" of wallets with bank accounts [see PBOC (2022)] can promote privacy for users in relation to their counterparties and traditional payment intermediaries.[2] As in many other countries, Chinese consumers are growing increasingly wary of the use of their private information by payment firms. Indeed, the Bank of England emphasizes that one benefit of an hypothetical digital pound might be that transactions data and personal metadata cannot, or would not, be mined for profit in the way that private companies now do – a point reiterated by officials allaying privacy concerns around the digital euro [MIT DCI and BoE (2024); Daman (2024)].

Combined with sub-wallet features, the offline functionality of physical wallets, such as the visual hard wallets discussed in Zhang (2024) or SIM-based hard wallets associated with smartphones discussed in Ledger Insights (2023), does appear to provide privacy advantages for Chinese users, relative to some private sector payment options (along with other benefits unrelated to privacy, such as functioning in extreme conditions, internet outages and so forth). However, the concern most often raised is in relation to citizen's privacy from the PBOC and the broader government, and the security and use of their transactions data. One of the clearer statements on the approach to privacy is provided in Mu (2022), quoted here:

"The authorised operators collect the personal information necessary for the services and operations. The personal information generated by the wallet is collected and stored by the authorised operators. The PBC only processes inter-institutional transaction information and does not hold personal information. ID anonymisation technology is used between e-CNY wallets and

[2] The loose coupling of e-CNY to the banking system relates to the ability to use the e-CNY separately from traditional banking rails, even though one can (optionally) also use the e-CNY through bank-provided wallets, or exploit e-CNY functionality that relies on a bank account for automated top-ups. The "looseness" reflects functionality such as offline payments and the presence of hard wallets unrelated to banks. It also reflects the fact that the e-CNY allows a bearer instrument or "value-based" settlement model (settlement occurs at the point of the transaction), rather than solely an account-based model (ultimate settlement required interbank settlement). The advantages of loose coupling are not limited to privacy, in that it extends the e-CNY user-base to include the unbanked and those who find modern banking technologies too complex.

the personal information exchanged between all wallets is anonymous to counterparties and other commercial institutions. For legitimate transactions, none of the above entities can obtain complete transaction and consumption behavior information to protect consumers' privacy. Under normal conditions, no other party has the right to obtain the transaction information.

Only when suspicious transactions arise can the authorised operators apply to obtain relevant data for further analysis to ensure the fulfillment of their legal obligations, such as with respect to AML/CFT. In addition, when relevant authorities obtain consumers' personal information with legal warrants, they will strictly confine the scope of knowledge obtained and its use to the authorisation of laws and regulations. Moreover, they will take security protection measures.

The PBC strictly abides by the 'Network Security Law', the 'Personal Information Protection Law' and other laws and regulations. It ensures the security of personal information through advanced technical means and strict management mechanisms. The PBC adopts industry-leading technology, such as access control security and multi-factor authentication to protect data security and prevent data from unauthorised access, public disclosure, use, modification, damage or loss. The PBC has set up a 'firewall' internally and strictly implements information security and privacy protection through institutional arrangements such as specially-assigned responsible persons for maintenance, business isolation, hierarchical authorisation, post checks and balances and internal audit. Information relating to the e-CNY will be sealed and stored and all customer information will be de-identified. Without legal authorisation, neither the PBC's internal personnel nor any external business unit or individual may inquire or use it at will. Unauthorised inquiry or use of personal information will be investigated according to law and those responsible would be held accountable."

> **"It could be that the PBOC and Chinese government decide that a functioning but not dominant e-CNY system is adequate for their needs.**

Notwithstanding this, Lee et al. (2021b) [cited also in Subrahmanyam (2023)] refer to an architecture of "one CBDC, two databases and three centres" where the two databases are the "issuance database" supposedly held by the PBOC and the "digital currency commercial bank database" held (apparently) by authorized operators. The three centers are, apparently the "authentication centre, registration centre and big data analysis centre." Lee et al. (2021a) also state that "the PBOC could still track all trading information in China's efforts to combat corruption, money laundering, tax evasion, and terrorist financing." It is somewhat unclear what (if any) official documentation underpins these claims, but they are perhaps consistent with the above quote from Mu (2022). It is certainly the case that the PBOC and other authorities reserve the right to obtain detailed user data in the case of suspected crimes, as indeed would likely be the case in other countries. Naturally, one must then ask how any government might define and interpret criminal activity, and what evidence and process would need to be provided and followed to demonstrate a justification for obtaining private data. How different countries approach these difficult questions remains to be seen.

The presence of an "issuance database" seems intrinsic to any CBDC, all of which appear likely to be fully centralized for issuance. Similarly,

registration of operators and users would also naturally give rise to an associated "registration database." As Mu (2022) notes, authorized operators are expected to collect personal information and frequently provide wallet services so, it is natural that there should be some form of "commercial bank database."

Where there is perhaps greater ambiguity, though not necessarily contradiction, in how Mu (2022) relates to Lee et al. (2021b), is in the presence (if indeed Lee et al. (2021b) is correct) of a "big data centre." It is possible that the PBOC runs a big data center that operates not on e-CNY transactions data (unless, as discussed above they have been flagged as fraudulent and criminal in some way), but on some other data relevant to the e-CNY – perhaps some form of e-CNY metadata or aggregated and anonymized transaction data. If this sort of analysis is undertaken – preserving privacy at individual user or transaction levels, but tracking and analyzing properties of the whole set of transactions data – then it should be no surprise to find such operations coordinated within a "big data analysis" center. One can envisage many dimensions in which big data analysis of payments flows could enhance policy effectiveness in managing payments and monitoring system performance.

As discussed in BoE (2023) there are various methods that complement big data analysis in a way that protects privacy, which could be used by the "big data centre." To the extent that such analysis is being carried out, it would perhaps serve the PBOC's own interests to provide more detail. Since PBOC officials have acknowledged the delicacy of the privacy-security trade-offs in this area, it could promote greater trust and, ultimately, adoption. Specifically, it might be useful to clarify somewhat the nature of the privacy protections and analytical techniques used in the e-CNY big data analysis (if indeed they are analyzing e-CNY data in this way).

4. Privacy and AML trade-offs

An especially important trade-off with privacy is concern over anti-money laundering (AML), as noted in Lu and Zhang (2022) and Huang and Li (2023). In 2021, China introduced its first comprehensive legislation on personal information and data privacy – the Personal Information Protection Law (PIPL) – which is akin to the E.U.'s General Data Protection Regulation (GDPR). PIPL has imposed more stringent regulatory requirements on businesses and authorities dealing with citizens' data [Olcott (2021)]. However, the effective enforcement of AML regulations tends to require financial authorities and institutions to collect, share, and even in some cases disclose sensitive information relating to citizens' daily transactions. This could be hard to achieve under a strict set of data protection laws like PIPL or GDPR, especially when central banks plan to promote the usage of their CBDCs on the international stage.

When piloting the e-CNY, the PBOC is obliged to proactively incorporate the compulsory requirements of AML frameworks into the e-CNY payment and settlement process. Of course, "identity" is a key factor in triggering any AML enforcement cases and – from an international perspective – features prominently in data-gathering standards, such as the FATF "travel rule" [FATF (2024)]. Failures to conduct customer due diligence (CDD) or verify account ownership have been common reasons for substantial fines imposed on financial institutions and other corporations. This indicates that AML investigations initially prioritize verifying clients' identities and accounts as a primitive for transactions processing, thus allowing law enforcement officials to examine the origin and movement of funds, business connections, and potentially suspicious transactions. With the e-CNY intended to mimic cash-like properties (notably, a high degree of anonymity), it is clear

that some of the traditional approaches to AML used in the past may need some adaptation. Again, this points to the utility of techniques such as the combination of big data analytics with privacy enhancing transformations or aggregation of underlying transaction data.

Ultimately, of course, the idiosyncrasies of each country will determine where the line is drawn in trading off privacy against oversight and AML – as part of a the broader boundaries and restrictions placed on governments in relation to personal data. For example, in the European Union, a "proportionality test" requires member states to ensure that the regulatory powers granted to governments under a particular law do not unduly restrict fundamental rights protected by the E.U. Charter. Additionally, the AML transaction monitoring process may be reviewed and evaluated by the Court of Justice of the European Union (CJEU) to determine whether requiring financial institutions and banks to detect and report suspicious activities complies with the GDPR, as interpreted in light of the Charter.

Within Europe, arguably the protection of consumer data is the overriding concern. In mainland China and Hong Kong, regulators seem to prioritize the task of detecting potential money-laundering activities, though with safeguards to prevent inappropriate access to personal information. These differences reflect a major distinction between the Chinese and E.U. approaches in that the financial judicial system in China does not lead or shape regulatory policy as it does in Europe. Instead, court decisions relating to financial disputes usually follow the policies and decisions implemented by regulators. The PBOC and other Chinese regulators have a specific focus on financial stability and AML, and it is thus perhaps unsurprising that the balance between privacy and oversight shades somewhat more to the latter in China.

5. Renminbi internationalization and the e-CNY

The promotion of CBDCs beyond its borders aligns with China's long-term national strategy of Renminbi (RMB) internationalization and the building of a financial superpower. A key strategy of the Chinese government has been to promote the use of the RMB in international payments, competing with major currencies. Despite China having been the world's second largest economy for many years, RMB has been significantly underrepresented in international payments and financial transactions. As of August 2024, the U.S. dollar accounted for 49.1% of SWIFT international payments based on transaction value, the euro for 21.6%, and sterling for 6.5%, while the yuan only accounted for 4.7%. While the yuan has in recent years become the majority denomination in trade involving China, its position clearly lags well behind the dollar in terms of general global trade, where non-U.S. counterparties will typically rely on the dollar, even when trading among themselves [Reuters (2023)].

The e-CNY pilot is only part (and at the moment, a small part) of China's push towards internationalizing the RMB. Many of the trade-offs discussed above apply with greater force in the international arena. For example, U.S. and European norms and habits regarding privacy-oversight trade-offs are likely to differ from those of the Chinese. Additionally, foreign exchange restrictions and exchange rate policies constrain how independently influential the RMB can be, relative to the USD. On the other hand, some have suggested that future programmability (via smart contracts) of a digital yuan, along with government oversight, could allow more flexible and sophisticated forex controls than the relatively blunt tools currently used to control capital flows. As such, it could be that the Chinese

government can relax some elements of its capital controls because the e-CNY could allow more targeted restrictions.

As ever, when dealing with China one must take a (very) long-term perspective in assessing the e-CNY. China's role in international trade will continue to grow over time, not least boosted by the so-called "belt and road initiative" (BRI). Launched in 2013, the BRI is designed to enhance connectivity and strengthen economic cooperation across continents. While traditionally focused on infrastructure and trade, the BRI is now being complemented by schemes focusing on digital assets – including the international BSN Spartan network (discussed further below), and many trade credit pilots using the e-CNY have obvious connections to the broader BRI initiative. The PBOC was a prominent participant in the successful BIS mBridge wholesale CBDC pilot, along with the Hong Kong Monetary Authority and the central banks of Thailand and the United Arab Emirates.

6. Blockchain and digital assets in China

While much of the impetus for CBDCs around the world has come from the rapid emergence of cryptocurrencies deployed on blockchain, there is no requirement that a CBDC should itself run entirely, or even mainly, on a blockchain. There is ongoing ambiguity over the role of blockchain in the e-CNY system. There is suggestive evidence that the PBOC is considering it – though whether it would be part of the core implementation, as opposed to making e-CNY somehow interoperable with on-chain applications, is somewhat unclear. Notably, blockchain has been referred to in recent communications from the DCRI [see Mu (2024) for example]. Some e-CNY experiments have explicitly explored blockchain technology, such as "on-chain" payment of wages in Xiongan New Area – a hub for digital innovation [Xiongan (2021)]. In this case, wages were paid via a "blockchain fund payment platform" from a public wallet to subcontractors' private wallets. Furthermore, various official documentation make repeated references to smart contracts [again, see Mu (2024)]. And finally, patent activity linked to the DCRI suggests that expertise in core blockchain and cryptographic primitives has been developed, and that interoperability and automation featured in their research [CDC (2020)]. In many jurisdictions, providing an official "fiat on chain" has been one of the main justifications for introducing a CBDC, especially as stablecoins seem to be growing in popularity, despite continued concerns about their safety. As such, one might wonder if e-CNY issuance "on chain" may occur in the future.

Here we must acknowledge the idiosyncratic nature of China's relationship with blockchain. Crypto is tightly controlled within China. Cryptocurrencies, including stablecoins, have been especially restricted, to the extent that almost any cryptocurrency activity is prohibited, unauthorized stablecoin usage has been punished, and any trading (as opposed to primary market issuance and buying to hold/own) of digital assets is typically banned. And yet, the situation is nuanced – befitting a country that has previously seen widespread activity in this area (before exchange and mining crackdowns in 2017 and 2021) and which even now is home to enormous technical expertise in blockchain. Indeed, the legality of some forms of digital asset ownership has been affirmed [Kaaru (2024)].

On the mainland, blockchain is embraced by the government as a tool for non-speculative, non-financial applications (see Sergeenkov (2024) and Team Exponential (2024) for recent summaries of several projects). Indeed, while commonly associated in other jurisdictions with highly decentralized activities, the Chinese government is exploiting blockchain technology to enhance

the efficiency with which the government, and its various representatives across the vast country, coordinate activity. This is emphasized most obviously in the region of Xiongan [see Lei (2023) and SCMP (2024)], where various blockchain-based projects are explored as part of a broader push towards digital modernity.[3]

There is also an advanced government-controlled blockchain network, BSN, running in China.[4] Designed by Red Date, BSN provides a platform for a rich array of applications. Notably non-fungible tokens (NFTs or "digital collectibles") are extremely popular within China, though secondary trading is essentially prohibited [Shen (2022) and Quin (2022)].

7. Digital moneys in China – possible future paths

The Chinese approach to blockchain has been described as "blockchain without cryptocurrencies" [Hung (2024)], which is in stark contrast to many permissionless blockchains running globally, where the native currencies, such as Bitcoin and Ether, play a core role in the operation of the chains, and where stablecoins are blockchain's first "killer app" in the eyes of many. To the extent that the PBOC regards e-CNY as distinct from cryptocurrencies, an interesting question is how it could be incorporated into a broader blockchain system. One option is to issue a CBDC natively on a blockchain platform, while another is to permit an approved bridging protocol (or standards for such protocols) that allow a synthetic form of the CBDC to circulate on blockchains, while always connected 1:1 with off-chain CBDC. Similar issues have been discussed in the context of (wholesale) CBDC pilots run by the ECB and BoJ (2018) and in Switzerland [SNB et al. (2022)], as discussed in Bidder (2023).

It is purely speculative as to whether the e-CNY may play an on-chain role in this way. Rumors abound as to a possible relaxing of the government's stance on digital assets within the mainland – though this may be wishful thinking among blockchain supporters. If this were to occur, then the demand for a reliable on-chain fiat currency would increase dramatically, and it is difficult to envisage the PBOC (indeed this could be said of many central banks) being comfortable with privately provided cryptocurrencies and digital moneys being the only option on chain for a cash leg of settlement or for P2P payments. BSN already entails permissioned access – in contrast to the permissionless (and pseudonymous) access to global blockchains such as Ethereum mainnet and Bitcoin. As such, there is already a sense in which it is consistent with some of the tiers of e-CNY wallets (those with more demanding KYC elements).

The PBOC may also be swayed by the possibility that CBDC could crowd out destabilizing excess private liquidity, akin to the theories discussed in Krishnamurthy and Vissing-Jorgensen (2015), Greenwood et al. (2018) and Bidder et al. (2023). Whether in practice this is a quantitatively important justification for e-CNY expansion is unclear. Relatedly, proponents of CBDC sometimes point to the risk of "walled gardens" [see Cipollone (2023) and Panetta (2023)] from powerful synergies between money issuance and online platforms selling goods and services. These issues hold especial force in China and, indeed, across Asia where digital moneys are often issued by companies with dominant retail platforms and are embedded in super apps. However, in China at least, other tools – more direct than issuing a CBDC – for avoiding walled gardens have been explored. Alibaba and Tencent have been at the heart of this debate and some key platforms have

[3] Fortis (2023) discusses other initiatives in Shanghai.
[4] BSN Spartan is the international version of this network [Shen (2023)].

recently made it easier to use their competitors' moneys within their systems [see Wang (2021) and Hall (2024)].

Together with GFT and other participants, Red Date has been heavily involved in developing the Universal Digital Payments Network (UDPN), which is an interoperability platform for digital moneys – both CBDCs and privately issued (stablecoins and tokenized deposits). In a sense, UDPN is an alternative to SWIFT, though connecting blockchain payment platforms rather than traditional rails. It is a private sector solution somewhat akin to some of the bridging and cross-border protocols developed under various BIS pilots of recent years, such as Projects mBridge and Agora – with PBOC being involved in the former [BIS (2022) and BIS (2024b)]. UDPN is already seeing activity in the domain of stablecoins and tokenized deposits (see experiments discussed in Ledger Insights (2024a) and Ledger Insights (2024b)) and while the e-CNY is not a supported currency on UDPN, there are connections (client-customer and in initial setup) between Red Date and UDPN and Chinese government-connected organizations. It is unclear if the PBOC would ever choose to be involved in UDPN, but it would presumably be a simple avenue to explore, if it so wished.

A picture is thus emerging of various options for the PBOC to consider. It seems well within their technical and policy capability to extend e-CNY, at scale, into various blockchain-related platforms and use cases, both internationally and domestically. But will they choose to do so?

It is commonly assumed that the PBOC will keep pushing e-CNY, ultimately to the maximal scale. One reason why this may not happen – at least in the near term – is that China may wish to observe how other countries proceed and, indeed, how Hong Kong fares as it expands its activities in tokenization, digital money and CBDC. Given the apparent demand for digital money and crypto assets within China, and the PBOC's concern over speculative activity, it is understandable that in the mainland, the PBOC may be especially cautious. While other countries, notably in the Middle East, have created specific "free economic zones" from scratch to provide a "safe" and contained experimental environment [see de Ramos (2023) and Heaver (2024) for example], China effectively possesses one already in Hong Kong, and in the vibrant Greater Bay Area more broadly. The presence of such an "experimental" region somewhat reduces the pressure for the PBOC to experiment on the mainland.

It is also important to note the advanced capability of instant payments within China and the breadth of money and payments options available to the PBOC and government. In the presence of such options, it is far from clear that the e-CNY will be pushed to expand, particularly if organic retail adoption and usage continue to be modest. Indeed, important recent research on CBDCs makes clear that even zero to low adoption of CBDC is consistent with it nevertheless having welfare enhancing effects, through its impact on private sector moneys. The presence of a CBDC – and the option to use it – can be a disciplining effect that induces better service among incumbent payment and money providers [Chiu et al. (2022)]. That is, low take up of a CBDC is not necessarily a sign of failure, if it is accompanied by improvements in private sector solutions that it has helped stimulate.[5]

[5] Of course, low take up, if it is concentrated among previously marginalized or excluded groups could also be regarded as a success, on the basis of equality and access reasons.

While a stated aim of the PBOC was to be minimally disruptive to the existing financial system, there is a sense in which it could provide a disciplining effect on AliPay and WeChat and promote additional competition within the payments ecosystem. Antitrust concerns have been raised in relation to these two dominant providers before [see Ye et al. (2021) for example], and, even setting aside any competitive concerns, there is a worry that such concentration could make the payments system fragile to failure or attack. In this respect, there are interesting parallels to be drawn between motivations for the digital euro and e-CNY. The ECB has been even more explicit in its singling out of specific private companies – Mastercard and Visa – in their justification for the digital euro, citing competitive and "strategic autonomy" concerns [Cipollone (2025)]. There are also significant restrictions put on (non-euro backed) stablecoins under MiCA, which is a softer form of restriction than the outright bans currently in place on mainland China, but far stricter than what is being permitted in Hong Kong. The Bank of England's current stance on systemic stablecoins also appears incompatible with any of the most prominent and globally successful stablecoins. Restrictions on private digital moneys are also observed in Qatar, where there are parallels with the Chinese openness to blockchain and digital assets, yet restrictiveness on cryptocurrencies. In Qatar, as in China, emphasis is put on blockchain applications that relate to "real activity" or tangible underlying assets [see Wyden (2024) and Hofverberg (2025) for example]. Frequently, and understandably, countries with foreign exchange restrictions and concerns over digital dollarization or strategic autonomy are observed to be cautious on permitting the scaling of private digital moneys on global blockchains (see Ledger Insights (2024d) and Tepedino (2025) for related debates in Brazil and Turkey).

A further reason why the PBOC may choose not to push the e-CNY to mass adoption is the general cooling of interest, globally, in launching retail CBDCs. Apart from President Trump's executive order that effectively bans a U.S. CBDC for the foreseeable future, Canada and Australia have also scaled back their schemes, pivoting perhaps more towards wholesale CBDC. Indeed, in Asia, there are interesting experiments, such as Project Nexus, that focus on connecting instant payment rails across countries, rather than relying on CBDC [BIS (2024a)]. Furthermore, unlike in Europe, the U.S. or the U.K., instant payments schemes in Asia are exceptionally efficient and rich in functionality/synergies, reducing the need for a CBDC rail – at least at a retail level. In Europe, one of the most compelling economic arguments (as opposed to geopoliticial "strategic autonomy" arguments) for a CBDC is the fragmentation of payment systems between the Eurosystem countries. AliPay and WeChat dominate payments in China and provide instant settlement thanks to their "closed-loop" paradigm, where transactions can settle within their own balance sheets. While this is perhaps not so suitable for corporate use, there is also the functionality provided by the Internet Banking Payment System (IBPS) that already provides 24/7 real time payment rails. Furthermore, work to integrate Hong Kong FPS with IBPS was completed in June 2025 [FNHK (2025)]. There is also ongoing work to connect the e-CNY to FPS [HKMA (2024)].

It could be that the PBOC and Chinese government decide that a functioning but not dominant e-CNY system is adequate for their needs. In this case, the e-CNY could play an important role in filling the "gaps" in the existing payments system (regional disparities, access for excluded demographics) and/or provide a more efficient way for the government to disburse funds and interact with private sector contractors. It could

also complement other blockchain applications promoted by the government (trade finance and belt and road initiatives), while leaving an innovative private sector to deal with the majority of digital payments.

The PBOC and Chinese government have gradually constructed a broad and deep set of options for China's future monetary and payments system. The e-CNY could, and likely will, be an important component and could ultimately become the main component. But that is not a foregone conclusion, not simply because of reluctant adoption by the citizenry (which many people believe will afflict all CBDCs) but also because the PBOC and government regard it as only part of a broader approach to achieving their policy goals.

8. Conclusions

The e-CNY pilot shares much in common with other CBDC pilots. Anyone who follows CBDC debates globally will recognize many of the issues raised in relation to the digital yuan. Discussions over privacy, oversight, technology and infrastructure challenges are strikingly similar, even if the eventual choices will differ across jurisdictions. The broader and long-running goal of yuan internationalization and the rather idiosyncratic approach to blockchain and digital assets leads to some distinctive elements of the debate in China. These, together with the reticence of the PBOC and DCRI in describing their investigations and goals, leave many in the West (and perhaps also in China) unsure of where the project is heading. But given its sophistication, scale and innovative nature, the e-CNY is sure to become a key element in the Chinese economy and, thus, the global policy debate for many years to come. And yet, attention must be paid to many of the other reforms and digital money developments within China. It is far from obvious that the e-CNY will be promoted to the exclusion of alternative moneys and payment rails, given that many of the government and PBOC's goals can be achieved via other means.

Any firms interested in trading with, and operating in, China should be aware of the program and of broader advances, which could occur quickly, if the government is so minded, in blockchain and digital assets. We have emphasized how the e-CNY has been focused on non-financial use cases so far – in the sense of supporting real activity and modernizing "cash" for citizens. However, for advances in tokenization (where Hong Kong is a current leader) to be sustainable, a cash leg digital asset is likely to be required. It seems implausible that the PBOC will tolerate dominance by private digital moneys that are backed by foreign denominated assets, such as global stablecoins. At the same time, if the rest of the world pushes ahead with tokenized assets and on chain finance, it is also implausible that China will allow itself to be left behind (especially given its digital asset expertize). In addition to the existing use cases emphasized by the PBOC, a big question is how e-CNY usage might expand in the dimensions of wholesale finance and tokenization in the future. Will it become the dominant money in circulation, or will it focus on a subset of use cases, and/or indirectly complement (e.g., as a backing asset for stablecoins) or discipline (as an "outside option" for users) private moneys? The world will be looking on with great interest as the e-CNY develops.

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