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The coming central bank digital currency revolution and the e-CNY

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THE COMING CENTRAL BANK DIGITAL CURRENCY REVOLUTION AND THE E-CNY

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The only central bank money individuals and businesses have today is cash. Everything else they use as money is commercial bank promises. Central bank digital currencies ("CBDC") will likely change all this by putting central bank money into everyone's hands. China is a front runner in this revolution, and its CBDC, the e-CNY, may well in time profoundly affect the international economic order. This article analyses the major considerations around the e-CNY, its ramifications, in particular for trade, and its possible challenges.

Keywords: Central bank digital currency, cryptoassets, stablecoins, e-CNY, digital yuan, Digital Currency/Electronic Payment ("DC/EP"), e-Renminbi, sovereign digital currencies.

I. Introduction

Most of us think money is created by our nation's central bank. If asked, most English people would say the money they use is created by the Bank of England. But this is not so. The Bank of England mints the currency English people use, and at times intervenes to influence its value. But most money in everyday usage in England is promises by British banks. In virtually all economies, central banks name the currency, shape its value, and issue the cash. But people are paid and make payments in digital commercial bank promises which function as money. This is normal. As many of these transactions occur electronically, usage of physical cash is in steep decline in most developed economies.

Current developments in China involving central bank digital currency ("CBDC") are showing us the future. In time, CBDCs will change the nature of money and

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effect a paradigm shift in the monetary, payments and financial architecture of our economies.

A CBDC is a digital fiat currency issued by a central bank. It is a novel version of money[1] in which central banks are exhibiting extraordinary levels of interest. A Bank for International Settlements ("BIS") survey indicates that around 90% of the world's central banks are actively engaging in various CBDC work.[2] At the time of writing, Nigeria has issued its e-Naira; Ecuador, Ukraine and Uruguay have completed retail CBDC pilots; and a further six retail pilots are ongoing (The Bahamas, Cambodia, China, Eastern Caribbean Currency Union, Korea, and Sweden).[3] In 2021, the European Central Bank ("ECB") started the investigation phase of the digital euro[4] and research efforts are underway into a digital US dollar.[5]

The Managing Director of the International Monetary Fund believes "[t]he history of money is entering a new chapter".[6] CBDCs will create new ecosystems, inevitably requiring new infrastructure and technical standards. They will raise issues ranging from seigniorage to capital flight to loss of monetary sovereignty. In their wake, they will introduce many benefits including efficiency gains, reduced costs, the opportunity to enhance financial inclusion, and many challenges especially around privacy and cybersecurity.[7]

CBDCs and private digital currencies such as stablecoins will likely interact. Indeed, it was the threat of a proposed privately-issued stablecoin, Facebook's Libra/Diem, that moved many central banks to increase their research into CBDCs.[8]

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1 Tommaso Mancini-Griffoli *et al*, "Casting Light on Central Bank Digital Currencies", *International Monetary Fund* (12 November 2018) at 7.

2 Anneke Kosse & Ilaria Mattei, "Gaining Momentum – Results of the 2021 BIS Survey on Central Bank Digital Currencies", *Bank of International Settlements*, 6 May 2022 <www.bis.org/publ/bppdf/bispap125.pdf> at 1.

3 Raphael Auer, Giulio Cornelli & Jon Frost, "Rise of the Central Bank Digital Currencies: Drivers, Approaches and Technologies", *Bank for International Settlements*, 24 August 2020 <https://www.bis.org/publ/work880.pdf> at 7–8 [Auer *et al*, "Rise of the CBDCs"]. The Marshall Islands' digital currency project is not proceeding (for very good reasons) and Venezuela's has failed. For the flaws in the Marshall Islands' project, see AN Didenko & RP Buckley, "Central Bank Digital Currencies as a Potential Response to Some Particularly Pacific Problems" (2022) 30(1) Asia Pac L Rev 44.

4 Fabio Panetta, "More than an Intellectual Game: Exploring the Monetary Policy and Financial Stability Implications of Central Bank Digital Currencies", opening speech at the IESE Business School Banking Initiative Conference on Technology and Finance (8 April 2022) <www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220408~980e39957b.en.html>. See Marc Labonte & Rebecca M Nelson, "Central Bank Digital Currencies: Policy Issues", *Congressional Research Service*, 7 February 2022 <https://sgp.fas.org/crs/misc/R46850.pdf> at 10.

5 "Money and Payments: The U.S. Dollar in the Age of Digital Transformation", *Board of Governors of the Federal Reserve System*, January 2022 <www.federalreserve.gov/publications/files/money-and-payments-20220120.pdf>.

6 Kristalina Georgieva, "The Future of Money: Gearing up for Central Bank Digital Currency", speech (9 February 2022), <www.imf.org/en/News/Articles/2022/02/09/sp020922-the-future-of-money-gearing-up-for-central-bank-digital-currency>.

7 Labonte & Nelson, *supra* note 4, at 9.

8 DA Zetzsche, RP Buckley & DW Arner, "Regulating Libra" (2021) 41(1) Oxford J Legal Stud 80; RP Buckley *et al*, "Sovereign Digital Currencies: Reshaping the Future of Payments and Money" (2021) 15(1) J Payments Strategy & Sys 7.

This trend has of late been reinforced by continuing falls in cash usage and the pandemic-inspired rise in digital payments.[9]

This article next analyses the nature of CBDCs. It then explores China's four possible major considerations behind the e-CNY in Part III, and what China is doing with its digital currency in Part IV. We then discuss the possible and potentially transformative use of e-CNY in trade in Part V and the major challenges ahead in Part VI. Part VII concludes.

II. Nature of Central Bank Digital Currencies

A. *The Design of Central Bank Digital Currency*

Building a CBDC involves a plethora of design choices. A CBDC may be for retail or wholesale use. It may be token based or account based. Its usage may be anonymous, like cash, or traceable, like bank payments. It may pay interest or not. Some CBDCs will be solely for domestic use (such as the Bahamas' Sand dollar), or only for use within a currency union (such as DCash within the Eastern Caribbean Currency Union ("ECCU")). Others will be useable across borders.[10]

Wholesale CBDCs are generally used between financial institutions such as banks, while retail CBDCs are for businesses and the public.[11] Australia, the United Arab Emirates ("UAE") and Saudi Arabia are all working towards developing CBDCs for wholesale use.[12] Various states are also exploring cross-border use of wholesale CBDCs for large flows between institutions.[13] Retail CBDCs complement or substitute for cash, and arguably bring more profound changes than wholesale CBDCs.[14] Many states are researching consumer-facing retail CBDCs.[15]

Account-based CBDCs are "booked in the accounts of the third parties holding accounts with the issuing central bank and the process of its transfer (including, in particular, the legal finality) … conducted on the books of the issuing central bank".[16] A token-based CBDC exists in the form of digital tokens that are stored in a digital wallet. They may be transferred in various ways such as by decentralised

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9 DW Arner *et al*, "COVID-19, Digital Finance and Existential Sustainability Crises: Opportunities and Challenges for Law and Regulation in the 2020s" (2021) 33(2) Nat'l L Sch India Rev 385.

10 Labonte & Nelson, *supra* note 4 at 11–13.

11 Elijah Journey Fullerton & Peter J. Morgan, "The People's Republic of China's Digital Yuan: Its Environment, Design, and Implications", *Asian Development Bank Institute*, February 2022 <https://www.adb.org/sites/default/files/publication/772316/adb-wp1306.pdf> at 9.

12 Labonte & Nelson, *supra* note 4 at 11.

13 Martin Chorzempa, "China, the United States, and Central Bank Digital Currencies: How Important Is It to Be First?" (2021) 14(1) China Econ J 1 at 11.

14 Eswar S Prasad, *The Future of Money: How the Digital Revolution Is Transforming Currencies and Finance* (United States: Belknap Press, 2021) at 12.

15 Labonte & Nelson, *supra* note 4 at 10.

16 Hossein Nabilou & André Prüm, "Central Banks and Regulation of Cryptocurrencies" Rev Banking & Fin L (forthcoming) at 39–40; Christian Barontini & Henry Holden, "Proceeding with Caution: A Survey on Central Bank Digital Currency", *Bank for International Settlements*, 8 January 2019 <https://www.bis.org/publ/bppdf/bispap101.pdf> at 2.

or peer-to-peer networks, and may offer user anonymity.[17] Recordkeeping of an account-based CBDC is managed through transferor and transferee deposit accounts held with a central bank or its agent banks (*eg*, commercial banks), while record-keeping for a token-based CBDC is managed by other means devised by the central bank, such as digital signatures.[18]

CBDCs may be arranged in single-tier or two-tier forms. With one tier, central banks directly issue the CBDC and administer their operation through sophisticated technologies. In two-tier (hybrid) forms, central banks rely on intermediaries such as commercial banks to provide the customer interface for operating the CBDC.[19] Few central banks have the appetite (or current resources) for single-tier CBDCs and most are considering a hybrid form, with the CBDC a direct claim on the central bank and the customer interface handled by commercial banks.[20]

CBDCs are creatures of technology.[21] They can be built upon distributed ledger technology ("DLT") or not but either way will use highly sophisticated cryptography.[22] Many central banks are considering using DLT for token-based CBDCs.[23]

Different CBDC design choices carry profound implications.[24] Token-based and account-based CBDCs are legally different concepts and forms of money. Likewise, any CBDC is legally very different from a balance in a current account.[25] Remunerated CBDCs also bring monetary policy implications.[26]

B. *The Functions and Implications of Central Bank Digital Currency*

CBDCs serve many functions. At their core, CBDCs are payment instruments[27] within the monetary system.[28] CBDCs may "help stimulate the digitization of

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17 *Ibid*.

18 Steven L Schwarcz, "Regulating Digital Currencies: Towards an Analytical Framework" (2022) 102 BU L Rev 1037 at 1047.

19 Wouter Bossu *et al*, "Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations", *International Monetary Fund* (20 November 2020) at 10.

20 Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 1, 28. On why blockchain technology will likely require intermediaries, see Karen Yeung & David Galindo Chacon, "Why Do Public Blockchains Need Formal and Effective Internal Governance Mechanisms" (2019) 10(2) Eur J Risk Reg 359.

21 See, *eg*, "Central Banks and Distributed Ledger Technology: How are Central Banks Exploring Blockchain Today?", *World Economic Forum*, March 2019 <www3.weforum.org/docs/WEF_Central_Bank_Activity_in_Blockchain_DLT.pdf>.

22 "Exploring Central Bank Digital Currencies: How They Could Work for International Payments", *SWIFT & Accenture*, May 2021 <www.swift.com/news-events/news/exploring-central-bank-digital-currencies-swift-and-accenture-publish-joint-paper>.

23 Bossu *et al, supra* note 19 at 12.

24 Ashton de Silva *et al*, "Central Bank Digital Currencies (CBDCs): A Comparative Review", *CPA Australia* (2021) at 26.

25 Bossu *et al*, *supra* note 19 at 12, 41.

26 UK, HL, *Central Bank Digital Currencies: A Solution in Search of a Problem?* (3rd Report of Session 2021–22, 13 January 2022) at 25–26 (Chair: Lord Forsyth of Drumlean).

27 "The Bank of Japan's Approach to Central Bank Digital Currency", *Bank of Japan*, 9 October 2020 <www.boj.or.jp/en/announcements/release_2020/data/rel201009e1.pdf>.

28 Margaret E Tahyar *et al*, "Digital Currencies" in Howell E Jackson & Margaret E Tahyar, eds, *Fintech Law: The Case Studies* (United States: President and Fellows of Harvard University, 2020) at 214.

entire payments value chains, maximizing broad adoption by users and retailers".[29] CBDCs can also improve monetary policy tools by, *inter alia*, facilitating negative interest rate policies.[30] CBDCs can assist in the fight against illicit financial activities[31] through the implementation of anti-money laundering ("AML"), know-your-customer ("KYC"), and counter-terrorism financing requirements. CBDCs may also serve other functions by facilitating fiscal transfers to citizens, allowing programmable money in the context of social security payments.[32]

CBDCs will exist in a new digital landscape.[33] In the view of the then director of the Digital Currency Institute ("DCI") of the People's Bank of China ("PBOC" or "PBC"), China's CBDC "is a credit-based currency from a value perspective, a crypto-currency from a technical perspective, an algorithm-based currency in terms of its implementation and a smart currency when it comes to application scenario".[34] A CBDC may "potentially substitute for cash, cryptocurrency, and digital payments"[35] and needs to be integrated with pre-existing payment instruments.[36]

As a new digital currency, CBDCs will affect numerous aspects of the economy and society.[37] CBDCs will have profound implications for monetary and fiscal policy, international governance, and trade,[38] and many questions remain as to how CBDCs will impact the structure of financial markets and institutions.[39]

Trans-border CBDC transactions may also occur in the near future,[40] although they will face challenges ranging from privacy protection to system reliability and interoperability. Although most central banks have not come to a firm conclusion on non-resident access to their proposed CBDCs, slightly over a quarter indicate an intention to allow it and nearly 20% may consider it later.[41] Some central banks are willing for their CBDCs to be used internationally, such as the Bank of Japan which

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29 Jared Wright, Henry Fingerhut & Lauren Packard, "Central Bank Digital Currencies Can Increase Financial Inclusion", *Tony Blair Institute for Global Change*, 10 March 2022, <www.institute.global/policy/central-bank-digital-currencies-can-increase-financial-inclusion>.

30 Ansgar Belke & Edoardo Beretta, "From cash to central bank digital currencies and cryptocurrencies: a balancing act between modernity and monetary stability" (2020) 47(4) J Econ Stud 911 at 919, 922.

31 "Digital Currencies and Stablecoins: Risks, Opportunities, and Challenges Ahead", *Group of Thirty*, July 2020 <www.group30.org/images/uploads/publications/G30_Digital_Currencies.pdf>.

32 "Central Bank Digital Currencies: Foundational Principles and Core Features", *Bank for International Settlements* (9 October 2020) at 9; Silva *et al*, *supra* note 24 at 12.

33 Cheng-Yun Tsang & Ping-Kuei Chen, "Policy Responses to Cross-border Central Bank Digital Currencies – Assessing the Transborder Effects of Digital Yuan" (2022) 17(2) Capital Markets LJ 237 at 244.

34 Qian Yao, "A systematic framework to understand central bank digital currency" (2018) 61(3) Sci China Info Sci.

35 Labonte & Nelson, *supra* note 4 at 23.

36 Raphael Auer *et al*, "Central Bank Digital Currencies: A New Tool in the Financial Inclusion Toolkit?", *Bank for International Settlements* (12 April 2022) at 23 [Auer *et al*, "Central Bank Digital Currencies"].

37 Yang Ji & Yan Shen, "Introduction to the Special Issue on Digital Currency" (2021) 14(1) China Econ J 1.

38 Silva *et al, supra* note 24 at 4. See Karen P Y Lai & Michael Samers, "Towards an Economic Geography of FinTech" (2021) 45(4) Progress in Hum Geography 720 at 722.

39 Prasad, *supra* note 14 at 14.

40 Raphael Auer *et al*, "CBDCs beyond Borders: Results from a Survey of Central Banks", *Bank for International Settlements Papers No. 116* (11 June 2021), at 15 <https://www.bis.org/publ/bppdf/bispap116.pdf>.

41 *Ibid* at 6.

indicates that it is "desirable to ensure that CBDC could be used for cross-border payments".[42] A digital euro, according to the ECB, may also be made available for international use.[43] Various economies are testing international CBDC transactions (such as the trial of cross-border wholesale CBDC payments by the central banks of France and Switzerland).[44]

CBDCs also face technical and regulatory challenges (discussed in Part VI) and may lead to financial disintermediation. Due to the risk of customers switching to CBDCs in a flight to safety,[45] a run from bank deposits into CBDCs could impact banks' capacity to lend.[46] Given the wide-ranging implications of CBDCs, effective regulation will be essential.

III. China's Possible Considerations – Why China Is Developing the E-Cny

China is the global leader among major economies in developing a CBDC.[47] Initially termed Digital Currency/Electronic Payment ("DC/EP"), China's CBDC is now called the e-CNY or digital yuan.[48] China's lead is built upon it having commenced research into its CBDC in 2014[49] and its general expertise in mobile payments and FinTech.[50] In 2021, the PBOC issued a white paper on e-CNY development ("White Paper").[51]

The development of e-CNY is occurring within the broader context of digital currency and the digital economy. For example, the PBOC identifies "safe, inclusive and adaptive" retail payment infrastructures, declining cash usage and the costs

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42 Bank of Japan, *supra* note 27 at 3.

43 Francesco Canepa, "Digital Euro Could Boost Single Currency's International Use, ECB Says", *Reuters*, 2 June 2021 <www.reuters.com/business/digital-euro-could-boost-single-currencys-international-use-ecb-says-2021-06-02/>.

44 Labonte & Nelson, *supra* note 4 at 11, 12.

45 Megan Greene, "Central Banks Need to Go Slow on Digital Currencies", *Financial Times*, 26 August 2021 <www.ft.com/content/21e3affe-8c57-4bac-b9c5-21b645e93d7c>.

46 Michael Kumhof & Clare Noone, "Central Bank Digital Currencies — Design Principles and Balance Sheet Implications", *Bank of England* (May 2018) at 26.

47 Prasad, *supra* note 14 at 15.

48 For the analysis of China's approach to CBDC, see, *eg*, Heng Wang, "China's Approach to Central Bank Digital Currency" (2022) 18(1) U Pennsylvania Asian L Rev <https://scholarship.law.upenn.edu/alr/vol18/iss1/4> at 77–134; Heng Wang, "How to Understand China's Approach to Central Bank Digital Currency?" (26 April 2022) (unpublished) at 1–24, <www. papers.ssrn.com/sol3/papers.cfm?abstract_id=4036466>.

49 "China Says New Digital Currency Will Be Similar to Facebook's Libra", *Reuters*, 6 September 2019 <www.reuters.com/article/us-china-cryptocurrency-cenbank/china-says-new-digital-currency-will-be-similar-to-facebooks-libra-idUSKCN1VR0NM>.

50 Weishan Chen, "E-CNY Application Will Test the Water Again, and the Existing Payment Channels Will Be 'Disarmed and Surrendered'?", 7 February 2022 <www.inewsweek.cn/finance/2022-02-07/15001.shtml>; Sundeep Gantori *et al*, "Information Technology: Understanding China's Digital Currency and Blockchain Initiatives", *UBS*, 23 April 2020 <www.ubs.com/global/en/wealth-management/chief-investment-office/market-insights/regional-outlook/2020/dcep-chinas-digital-currency/>.

51 "Progress of Research & Development of E-CNY in China", *People's Bank of China*, July 2021 <www.pbc.gov.cn/en/3688110/3688172/4157443/4293696/2021071614584691871.pdf>.

associated with cash, cryptocurrencies (particularly stablecoins), and other states' CBDC exploration as motivations for CBDC development.[52]

China is exploring the CBDC design that "suits China", based on many considerations from costs and benefits to technological capacity.[53] According to the director-general of the DCI, e-CNY's objectives include enhanced efficiency of central bank payment systems, provision of access to central bank money, maintaining monetary sovereignty, and lowering cash issuance and management costs.[54] CBDCs may address potential concerns regarding possible credit shortages and effects on banks' liquidity and the financial system in case of a shift away from bank deposits to third-party payment platform wallets.[55] CBDCs may also help address fragmentation in closed-loop domestic payment systems developed by payment service providers ("PSPs").[56] E-CNY infrastructure may offer valuable redundancy in payments infrastructure if existing digital payment systems experience problems or disruption.[57] By enabling smart contracts, and facilitating accurate tracking of money flows, the e-CNY may also thwart the embezzlement of government subsidies and transfers.[58] There are many possible considerations for the e-CNY, including offering the digital version of traditional currency and reducing money printing and minting costs.[59] We explore four principal ones.

A. *Promoting Financial Inclusion Regulation*

Financial inclusion is a major consideration for, and policy goal of, China's CBDC.[60] In the view of senior PBOC officials, e-CNY will make electronic payments more accessible to unbanked people and therefore boost financial inclusion.[61] E-CNY is a payment instrument that could be token based or quasi-account based.[62] The World Bank defines financial inclusion as individuals and firms having "access to useful and affordable financial products and services that meet their needs – transactions,

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52 *Ibid* at 1–3.

53 *Ibid* at 6–7.

54 Hong Kong Monetary Authority *et al*, "Inthanon-LionRock to mBridge: Building a Multi CBDC Platform for International Payments", *Bank for International Settlements*, 28 September 2021 <www.bis.org/publ/othp40.pdf> at 13 [Hong Kong Monetary Authority *et al*, "Inthanon-LionRock to mBridge"].

55 Fullerton & Morgan, *supra* note 11 at 3.

56 Bank of Canada *et al*, "Central Bank Digital Currencies: Foundational Principles and Core Features", *Bank for International Settlements*, 9 October 2020 <https://www.bis.org/publ/othp33.pdf> at 5–6.

57 Rajesh Bansal & Somya Singh, "China's Digital Yuan: An Alternative to the Dollar-Dominated Financial System", *Carnegie Endowment for International Peace* (August 2021) at 10; Fullerton & Morgan, *supra* note 11 at 3.

58 Fullerton & Morgan, *supra* note 11 at 16.

59 Darrell Duffie & Elizabeth Economy, *Digital Currencies: The US, China, and the World at a Crossroads* (United States: Hoover Institution Press, 2022) at 33.

60 Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 13; Gabriel Soderberg *et al*, "Behind the Scenes of Central Bank Digital Currency", *International Monetary Fund* (9 February 2022) at 7.

61 Hu Yue, Wang Liwei & Luo Meihan, "In Depth: China's Digital Currency Ambitions Lead the World", *Nikkei Asia*, 3 December 2020, <https://asia.nikkei.com/Spotlight/Caixin/In-depth-China-s-digital-currency-ambitions-lead-the-world>.

62 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 3.

payments, savings, credit and insurance – delivered in a responsible and sustainable way".[63] Access to a transaction account is the first step towards greater inclusion.[64] Financial inclusion is particularly important for those who typically experience difficulties accessing financial services including people living in remote areas, senior citizens, and the uneducated.[65] The promotion of financial inclusion is a major reason for the interest of states in CBDCs.[66]

A CBDC can foster financial inclusion by reducing roadblocks to financial access, lowering transaction costs, being highly available and increasing the speed of transactions.[67]

In terms of roadblocks, CBDCs may use wallets with lower limits than bank accounts or that require less rigorous identification given the lower risks of terrorist financing and money laundering.[68] Such a CBDC wallet may only require a phone number in terms of identification but would be subject to very small holding and transaction limits.

Unbanked consumers are unbanked for various reasons including poverty and living remotely.[69] CBDCs could be available in situations beyond the current payment systems of WeChat and Alipay, as e-CNY could be used offline.[70] For China, offline transactions and financial institutions such as the Post Savings Bank are potential ways to promote financial inclusion.[71] To lower transaction costs, individual users will not be charged by authorised operators in China for e-CNY exchange, which means e-CNY will be cheaper than other electronic payment methods.[72] This may well promote greater access to payment services.

CBDCs may also improve financial inclusion by enhancing access to financial services that are difficult to facilitate with cash.[73] E-CNY supports the trend in China away from the use of cash. E-CNY may enable smaller PSPs to provide CBDC-based services, and such opportunity could promote financial inclusion.[74]

Nonetheless, there are challenges concerning offline functions. For e-CNY offline payments, the hardware wallet will presumably need to synchronise with the e-CNY wallet backend (through near-field communication or by mobile phone

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63 "Financial Inclusion", *World Bank*, 29 March 2022 <https://www.worldbank.org/en/topic/financialinclusion/overview>.

64 *Ibid*.

65 Fullerton & Morgan, *supra* note 11 at 5.

66 Group of Thirty, *supra* note 31 at vii; Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 8.

67 Wright, Fingerhut & Packard, *supra* note 29.

68 Georgieva, *supra* note 6.

69 Schwarcz, *supra* note 18 at 50.

70 Karen Yeung & Andrew Mullen, "China Digital Currency: When Will the E-Yuan Be Launched, and What Will It Be Used For?", *South China Morning Post*, 6 June 2021 <www.scmp.com/economy/china-economy/article/3135886/china-digital-currency-when-will-e-yuan-be-launched-and-what>.

71 Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 16.

72 Bansal & Singh, *supra* note 57 at 5.

73 Peterson K Ozili, "Can Central Bank Digital Currency Increase Financial Inclusion? Arguments for and against" in Kiran Sood *et al*, eds, *Big Data Analytics in the Insurance Market* (UK: Emerald Publishing, 2022).

74 Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 16.

connectivity) after a limited number of offline payments.[75] Hardware wallets face limits in storage and processing capacity. Offline payments will also need to address the risks of double spending and payment security. In e-CNY pilots, offline payment services have been "supported by special mobile phones or upgraded point-of-sale terminals" and "a special offline payment app".[76]

CBDC, by supporting the decline in cash usage, may reduce financial inclusion.[77] A report of the Committee on Payments and Market Infrastructures and the World Bank indicates that "CBDCs may crowd out private sector initiatives that could be equally or even better suited to provide individuals with a basic means of payment, such as an industry-wide instant payment scheme".[78] Non-interest-bearing CBDCs arguably also limit financial inclusion as it reduces the incentive for people to save. However, if a CBDC pays interest, it may undermine existing banking services[79] and attract new entrants into the formal financial sector.[80] E-CNY presently does not pay interest. This is an issue the PBOC might revisit over time as it balances the various goals it is striving to achieve with e-CNY.[81]

B. *Strengthening Regulation*

E-CNY enables centralised, top-down governance, led by the central bank. According to a former head of the DCI, the aims of China's CBDC include "more powerful regulation".[82] It is observed that "[t]he most important effect that the e-CNY will have for commerce in the PRC relates to the PBOC's oversight and control of financial transactions".[83] According to senior PBOC officials, e-CNY will help tackle money laundering, illicit finance, and fraud.[84] E-CNY may be being used in law enforcement. The police have reportedly used the state's ability to track e-CNY transactions to tackle money laundering.[85] CBDCs also enable the state to

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75 "数字人民币的双离线支付体验与解析 [Dual Offline Payment Experience and Analysis of E-CNY], *数字中国 [Digital China]*, 30 April 2021 <www.sohu.com/a/463936753_223323>; 人人都是产品经理社区 [Community Where Everyone Is a Product Manager], "数字人民币双离线支付实现原理及应用场景分析 [Implementation Principles and Application Scenarios of E-CNY Dual Offline Payment]", *NetEase Hao*, 7 February 2022 <www.163.com/dy/article/GVJM0VBL0511805E.html>.

76 Chen Jia, "'Offline Payment Services' Added to Digital Currency Trials", *China Daily*, 16 December 2020 <www.chinadaily.com.cn/a/202012/16/WS5fd94b02a31024ad0ba9c08d.html>.

77 Labonte & Nelson, *supra* note 4 at 21.

78 "Payment Aspects of Financial Inclusion in the Fintech Era", *Bank for International Settlements* (14 April 2020) at 31.

79 Labonte & Nelson, *supra* note 4 at 18.

80 Ozili, *supra* note 73.

81 Wright, Fingerhut & Packard, *supra* note 29.

82 Yao, *supra* note 34 at 1.

83 Fullerton & Morgan, *supra* note 11 at 16.

84 Yue, Wang & Luo, *supra* note 61.

85 Yongfei Wang & Xuedong Ran, "Telecom Fraud Criminal Groups Use E-CNY to Launder Money? Walk Right into a Trap", *China Times*, 4 November 2021 <www.chinatimes.net.cn/article/112047.html>.

limit tax evasion given its traceability,[86] and reduce subsidy embezzlement through programmability and traceability.[87]

E-CNY is partially driven by the need to respond to the Libra/Diem proposal and to issues like money laundering and capital flight. Senior PBOC officials have said e-CNY will neuter the threat posed by cryptocurrencies such as Libra.[88]

The PBOC has identified problems with cryptocurrencies such as including no underlying value, sharp fluctuations, trading inefficiencies, energy consumption, money laundering, potential risks to financial and social stability, and the challenges to the financial system, monetary policy and capital flow management.[89] Cryptocurrencies can readily be used to circumvent China's capital control measures, so e-CNY is a response to these issues concerning cryptocurrencies (such as capital flight)[90]. Meanwhile, the White Paper has indicated e-CNY "has intrinsic value" as a liability of the central bank supported by sovereign credit.[91]

Strengthened regulation will most likely flow from the increased centralisation of governance facilitated by the e-CNY.[92] The PBOC is integral to the e-CNY whereas pre-existing mobile payment systems are dominated by private businesses and involve issues like data concentration in private businesses.[93] The PBOC will issue and manage e-CNY and regulate authorised operators.[94] The PBOC will be responsible for e-CNY wallet ecosystem management,[95] such as setting e-CNY wallet rules, and developing wallet standards and "the ground rules for wallet design as well as collecting any data thrown off by transactions".[96] Authorised operators will operate under a quota managed by the PBOC: they will open various kinds of e-CNY wallets for clients depending on "the strength of customer personal information identification", and provide exchange services.[97] An e-CNY account will provide a digital payment channel created by the central bank.[98] E-CNY red packets will also be distributed by the e-CNY application instead of banks' mobile banking

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86 Silva *et al, supra* note 24 at 24.

87 Fullerton & Morgan, *supra* note 11 at 16.

88 Yue, Wang & Luo, *supra* note 61.

89 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 2; Duffie & Economy, *supra* note 59 at 33.

90 Fullerton & Morgan, *supra* note 11 at 16.

91 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 3, 5.

92 Karen Yeung, "What Is China's Sovereign Digital Currency?", *South China Morning Post*, 13 May 2020 <www.scmp.com/economy/china-economy/article/3083952/what-chinas-cryptocurrency-sovereign-digital-currency-and-why> [Yeung, "China's Sovereign Digital Currency"].

93 Karen Yeung, "China's E-Yuan Like 'A Double-Edged Sword', and Mishandling It Carries Considerable Financial Risks", *South China Morning Post*, 18 July 2021 <www.scmp.com/economy/china-economy/article/3141435/chinas-e-yuan-double-edged-sword-and-mishandling-it-carries> [Yeung, "China's E-Yuan"]; Duffie & Economy, *supra* note 59 at 35.

94 Vipin Bharathan, "E-CNY Progress Report Reveals Telling Details About The Chinese Retail CBDC Project", *Forbes*, 19 July 2021 <www.forbes.com/sites/vipinbharathan/2021/07/19/e-cny-progress-report-reveals-telling-details-about-the-chinese-retail-cbdc-project>.

95 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 8, 9.

96 Bharathan, *supra* note 94.

97 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 8.

98 Chen, *supra* note 50.

applications.[99] In the view of a then PBOC deputy governor, the centralised governance of e-CNY requires, *inter alia,* the setting of standards (*eg*, technical, business, security and operation standards), the management of e-CNY information, the management of e-CNY wallets and the development of e-CNY infrastructure (including the connection of different operating institutions).[100]

E-CNY will also likely strengthen centralisation in payment and clearing systems.[101] E-CNY provides "[the] central bank tight centralized control over digital money".[102] In comparison with paper currency, CBDCs provide central banks with more control in monitoring currency use and the e-CNY is "a means to reassert state control over its fintech industry" and digital payments market.[103] Digital yuan will enhance the role of the PBOC in the financial system.[104] The e-CNY may "centralize clearing mechanisms by delegating the PBC as the ultimate entity with the authority to monitor, trace, reverse, and block transactions".[105] CBDCs may strengthen regulation in international transactions. According to a BIS report, issuing central banks may control cross-border use of currency, including limiting the access to the currency by non-residents to selected kinds of transactions.[106]

C. *Improve Macroeconomic Policymaking with Better Data*

E-CNY will allow China to use the big data generated by e-CNY transactions.[107] E-CNY would enhance the regulator's capacity to "scrutinise the nation's payment and financial system" and track how money is used by users.[108] Notably, "the centralized management model and controllable anonymity of digital yuan have great potential to help secure the central bank's capacity to exert control over big data in the financial system".[109] The PBOC will have access to the data as CBDC operating agencies "submit transaction data to the central bank via asynchronous transmission

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99 Yue Hu & Liwei Wang, "Central Bank Digital Currencies Are Growing Globally", *Caixin*, 23 November 2020 <https://weekly.caixin.com/2020-11-21/101630914.html>.

100 Yifei Fan, "Analysis on the Policy Implications of the M0 Status of E-CNY", *Financial News*, 15 September 2020 <www.web.archive.org/web/20220308171510/financialnews.com.cn/pl/zj/202009/t20200915_200890.html>.

101 Fullerton & Morgan, *supra* note 11 at 1, 4.

102 Narayanan Somasundaram, "Will China's Digital Yuan Vanquish the Dollar?", *Nikkei Asia*, 11 August 2021 <https://asia.nikkei.com/Spotlight/The-Big-Story/Will-China-s-digital-yuan-vanquish-the-dollar>.

103 James Kynge & Sun Yu, "Virtual Control: The Agenda behind China's New Digital Currency", *Financial Times*, 16 February 2021 <www.ft.com/content/7511809e-827e-4526-81ad-ae83f405f623>.

104 Jiaying Jiang & Karman Lucero, "Background and Implications of China's E-CNY" (2021) (unpublished) at 10, <www.papers.ssrn.com/sol3/papers.cfm?abstract_id=3774479>.

105 Fullerton & Morgan, *supra* note 11 at 4.

106 "Annual Economic Report 2021", *Bank for International Settlements*, 29 June 2021 <www.bis.org/publ/arpdf/ar2021e.pdf> at 86–87.

107 David Olsson *et al*, "China's Digital RMB – Is Your Business Ready?", *King & Wood Mallesons*, 27 April 2021 <www.kwm.com/en/au/knowledge/insights/chinas-digital-rmb-is-your-business-ready-20210427>.

108 Yeung, "China's Sovereign Digital Currency", *supra* note 92.

109 Alex He, "Digital RMB: A Possible Way to Reassert Data Control in the Digital Economy", *Centre for International Governance Innovation* (29 November 2021) at 7.

on a timely basis".[110] This data will then be available for various purposes including prudential regulation.[111] The PBOC "is to have access to all of the data" generated through the use of e-CNY.[112] China's CBDC will provide "a better source of data for monitoring the economy and market integrity (especially if it eventually replaces cash) as well as centralization of control of the underlying monetary instrument across all payment systems".[113]

Better access to all of this data should improve macroeconomic policymaking in the furtherance of financial development, inclusion and stability.[114] CBDC provides an "algorithmic hand" to complement the "invisible hand" of the market and the "visible hand" of government.[115] CBDC can promote the implementation of fiscal policy in various ways including direct welfare payments to CBDC end users.[116]

The data from CBDC usage should also improve the responsiveness of monetary policy to changes in complex macroeconomic situations.[117] Compared with paper currency, such data would make it easier for the central bank and other regulators to respond to liquidity needs, address inflation and deflation, and intervene in the economy at short notice.[118] For instance, central banks, through CBDC, may respond to underlying demand by creating liabilities and expanding their balance sheets in a timely fashion.[119] China could experiment by targeting specific regions or groups through monetary policy interventions,[120] and using novel monetary policy tools such as injecting currency that is time limited or "applies only to purchases of certain goods and services".[121] E-CNY provides "more tools to nudge its economy and society in the direction it deems appropriate".[122]

Smart contracts will provide the government with even more control and seem to have been explored in the e-CNY trials.[123] Theoretically, smart contracts operating with e-CNY should permit "governments to embed compliance in payments and enforce government policies".[124]

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[110] Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 23.

[111] *Ibid*.

[112] Yeung, "China's E-Yuan", *supra* note 93.

[113] Anton N Didenko *et al*, "After Libra, Digital Yuan and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems", *European Banking Institute* (11 June 2020) at 38.

[114] Financial Stability Analysis Group of the People's Bank of China, *China Financial Stability Report* (China Financial Publishing House, 2020) at 120.

[115] Paradorn Pasuthip & Steve Yang, "Central Bank Digital Currency: Promises and Risks", *WorldQuant*, 6 February 2020 <www.worldquant.com/ideas/central-bank-digital-currency-promises-and-risks>.

[116] Duffie & Economy, *supra* note 59 at 36–37.

[117] Group of Thirty, *supra* note 31 at vii; Duffie & Economy, *supra* note 59 at 36.

[118] Jiang & Lucero, *supra* note 104 at 16.

[119] Bank of Canada *et al*, *supra* note 56 at 4.

[120] Alun John, "Explainer: How Does China's Digital Yuan Work?", *Reuters*, 19 October 2020 <www.reuters.com/article/us-china-currency-digital-explainer-idUSKBN27411T>.

[121] Fullerton & Morgan, *supra* note 11 at 1.

[122] Pasuthip & Yang, *supra* note 115 at 5.

[123] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 13.

[124] Wright, Fingerhut & Packard, *supra* note 29.

D. *Internationalising the RMB*

For China and many other states, digital currency "is on the cusp of major changes that have the potential to reshape cross-border payments and remittances".[125] China has real strengths in FinTech and e-commerce such as the very wide use of mobile payments,[126] and a large first-mover advantage with CBDCs as demonstrated by CBDC-related patents.[127]

China is seeking to promote international definitions, standards and rules around CBDC that suit China through international standard-setting bodies.[128] China is "pushing hard for common global standards for digital currencies" and trying to forge new competitive advantages.[129] At the 15th G20 Leaders' Summit, China called for the G20 to "discuss developing the standards and principles for central bank digital currencies with an open and accommodating attitude, and properly handle all types of risks and challenges while pushing collectively for the development of the international monetary system".[130] The PBOC indicates that it "actively participated in setting standards for digital fiat currency and building an international standard system under the framework" of international organisations.[131]

China leads in exploring the potential cross-border use of CBDCs, which will promote the international use of RMB. Collaboration under the Multiple CBDC ("mCBDC") Bridge project has been accelerated. This is also called the m-CBDC Bridge or, simply, mBridge.[132] This project explores the use of a CBDC in cross-border foreign currency payments to make payments simpler and less expensive.[133] Much of the economic relationships among the jurisdictions involved in mBridge seems to be large-sum trade in commodities (*eg*, oil and gas) and financial

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[125] Kristalina Georgieva, "Leveraging Digital Money to Facilitate Remittances", opening remarks at iLab Spring Meetings Virtual Workshop (14 April 2021), <www.imf.org/en/News/Articles/2021/04/14/sp041421-leveraging-digital-money-to-facilitate-remittances>.

[126] Gantori *et al*, *supra* note 50 at 9; Bryan Tan, "The BRI's Digital Silk Road" in Basil C Bitas, ed, *ASEAN and the Belt and Road Initiative - Connectivity through Law and Commerce* (Singapore: Academy Publishing, 2021) at 289.

[127] Labonte & Nelson, *supra* note 4 at 12.

[128] See, *eg*, Baizhinan Zhao, "PBOC Wang Xin: Promote the Development of CBDC in the Future", *China Securities Journal*, 8 July 2019 <http://cs.com.cn/xwzx/hg/201907/t20190708_5965953.html>; Chen Jia, "China Promotes Global Digital Fiat Currency Standardization", 8 December 2018 <https://english.www.gov.cn/state_council/ministries/2018/12/08/content_281476424565376.htm> [Jia, "China Promotes Digital Fiat Currency"]; Tom Wilson & Marc Jones, "China Proposes Global Rules for Central Bank Digital Currencies", *Reuters*, 25 March 2021 <www.reuters.com/article/us-cenbanks-digital-china-rules-idUSKBN2BH1TA>.

[129] Yue, Wang & Luo, *supra* note 61.

[130] Xi Jinping, President of the People's Republic of China, "Together, Let Us Fight COVID-19 and Create a Better Future", remarks at 15th G20 Leaders' Summit (21 November 2020) <www.xinhuanet.com/english/2020-11/21/c_139533609.htm>.

[131] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 14.

[132] "Central Banks of China and United Arab Emirates Join Digital Currency Project for Cross-Border Payments", press release (23 February 2021) in *Bank for International Settlements Press Releases*, <www.bis.org/press/p210223.htm>; Hong Kong Monetary Authority *et al*, "Inthanon-LionRock to mBridge", *supra* note 54 at 7.

[133] Yeung & Mullen, *supra* note 70; Somasundaram, *supra* note 102.

assets.[134] Fifteen possible cross-border use cases have been identified in mBridge (*eg*, e-commerce, remittances, and tokenised bond issuance), and trade becomes the first business-use case of mBridge.[135] Commentators suggest that such an mCBDC network "could substantially change the current international payment system and raise the e-CNY to international prominence".[136] China's Xiong'an New Area, a region that trials CBDC, plans the cross-border use of digital yuan.[137] E-CNY was one of the three payment options in the 2022 Winter Olympics held in Beijing.[138] A memorandum has been signed between the PBOC DCI and Hong Kong Monetary Authority ("HKMA"), with e-CNY cross-border payment technical testing having been conducted.[139] It is reported that Hong Kong will conduct "a pilot scheme" of e-CNY.[140] China has also reportedly introduced CBDC-related standards in certain jurisdictions involved in the BRI.[141]

The Legal Entity Identifier ("LEI") may be used in China's CBDC ecosystem, and there is a roadmap for the implementation of the LEI as part of the BRI.[142] Furthermore, the PBOC indicates that it "will actively respond to initiatives of G20 and other international organisations on improving cross-border payments and explore the applicability of CBDC in cross-border scenarios".[143]

Businesses may be involved in promoting the cross-border and international use of e-CNY. Huawei's Mate 40 smartphone with an embedded e-CNY hardware wallet has been launched in major African markets such as South Africa, Nigeria and Kenya.[144] Mastercard is exploring its possible role as a conversion agent to convert e-CNY to other currencies to facilitate the acceptance of CBDCs by merchants and wider cross-border usage of e-CNY.[145] Similar arrangements exist for the Sand Dollar, with travellers to the Bahamas able to convert their fiat currencies

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134 Michelle Lim, "4 Central Banks and BIS Exploring CBDC Bridge for Asia and Middle East", *Forkast*, 25 February 2021 <www.forkast.news/central-banks-bis-cbdc-bridge-asia-middle-east>.

135 Hong Kong Monetary Authority *et al*, "Project mBridge: Connecting Economies Through CBDC", *Bank for International Settlements*, 26 October 2022 <www.bis.org/publ/othp59.pdf>.

136 Fullerton & Morgan, *supra* note 11 at 19.

137 "Chinese Region Plans Digital Yuan Cross Border Use", *Ledger Insights*, 2 September 2020 <www.ledgerinsights.com/chinese-region-plans-digital-yuan-cross-border-use>.

138 Sherry Fei Ju, "At Winter Olympics, Beijing Tries to Sell World on Digital Yuan", *Aljazeera*, 4 February 2022 <www.aljazeera.com/economy/2022/2/4/at-olympics-beijing-sees-chance-to-sell-world-on-digital-yuan>.

139 Hong Kong Monetary Authority *et al*, "Inthanon-LionRock to mBridge", *supra* note 54.

140 Enoch Yiu, "Hong Kong Sets Stage for E-CNY Use, to Launch Pilot 'Soon after Spring Festival'", *South China Morning Post*, 7 February 2022 <www.scmp.com/print/business/banking-finance/article/3166109/hong-kong-sets-stage-e-cny-use-launch-pilot-soon-after>.

141 Jia, "China Promotes Digital Fiat Currency, *supra* note 128.

142 Manesh Samtani, "PBOC Publishes Roadmap for Full LEI Adoption in China", *Regulation Asia*, 18 December 2020 <www.regulationasia.com/pboc-publishes-roadmap-for-full-lei-adoption-in-china>.

143 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 5.

144 Nir Kshetri, "China's Digital Yuan: Motivations of the Chinese Government and Potential Global Effects" (2022) J Contemporary China 1; Eric Olander, "China's Cryptocurrency Now Has a Foothold in Places Like Africa With the Introduction of Huawei's Latest Phone", *China Global South Project*, 2 November 2020 <www.chinaafricaproject.com/2020/11/02/chinas-cryptocurrency-now-has-a-foothold-in-places-like-africa-with-the-introduction-of-huaweis-latest-phone>.

145 Georgina Lee, "Mastercard Seeks Role as Bridge to Facilitate Cross-Border Use of China's Digital Yuan", *South China Morning Post*, 3 May 2021 <www.scmp.com/print/business/banking-finance/article/3131961/mastercard-seeks-role-bridge-facilitate-cross-border-use>.

through a prepaid card on Mastercard's network.[146] It is argued that China may "[perceive] a commercial advantage for Chinese firms that could provide payment technology services abroad".[147]

It seems that a consideration behind e-CNY is "to increase the role of the renminbi in cross-border transactions and international trade pricing, and to promote its acceptance as a reserve currency".[148] RMB internationalisation would benefit China by reducing borrowing costs in international markets and exchange rate risks.[149] Given its far higher speed and lower costs in international payments, the e-CNY could increase the RMB's internationalisation if everything goes well.[150] The international use of China's CBDC may be boosted through, *inter alia*, remittances,[151] cross-border retail payments,[152] international payments via mobile wallets, development aid and concessional loans, and the funding of the BRI.[153] The BRI may promote RMB internationalisation through use of the e-CNY.[154]

E-CNY should accordingly reduce China's reliance on the US dollar and related financial systems.[155] China's CBDC may enable the direct exchange of currencies and may mean "China is setting the stage for fuller yuan convertibility, which would accelerate the use of the currency in foreign exchange settlements".[156] The e-CNY is observed to "[fit] within a greater context of the country's efforts to create an independent payments system based on its Cross-Border Inter-Bank Payments System ['CIPS']".[157] For China, RMB internationalisation will "reduce its dependence on the dollar-dominated global banking system, just as its Belt and Road Initiative is building an alternative network of international trade".[158]

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[146] *Ibid*.

[147] Duffie & Economy, *supra* note 59.

[148] Biswajit Banerjee, "Digital Currencies and Cross-Border Policy Cooperation and Coordination", (2020) 2 G20 Digest 23 at 31.

[149] Fullerton & Morgan, *supra* note 11 at 18.

[150] Jinze & Etienne, "First Look: China's Central Bank Digital Currency", *Binance Research*, 28 August 2019 <www.research.binance.com/en/analysis/china-cbdc>.

[151] Bansal & Singh, *supra* note 57 at 15.

[152] "CICC: The Potential Impact of the Full Promotion of the Digital Renminbi on the Payment System", *CICC Perspective*, 29 July 2021 <https://finance.sina.com.cn/money/forex/forexinfo/2021-07-29/doc-ikqcfnca9634052.shtml>.

[153] Zennon Kapron, "China's Central Bank Digital Currency Will Strengthen Alipay And WeChat Pay, Not Replace Them", *Forbes*, 24 May 2020 <www.forbes.com/sites/zennonkapron/2020/05/24/chinas-central-bank-digital-currency-will-strengthen-alipay-and-wechat-pay-not-replace-them>.

[154] Michael A. Peters *et al*, "Cryptocurrencies, China's Sovereign Digital Currency (DCEP) and the US Dollar System" (2022) 54(11) Educational Philosophy and Theory 1713 at 1717; Bansal & Singh, *supra* note 57 at 1.

[155] Anthony Chan, "Implications of China's Sovereign Digital Currency", *Union Bancaire Privée*, 15 June 2020 <www.ubp.com/files/live/sites/ubp/files/content/Newsroom/Insight/Asia_Macro_Strategy_Chinas_Sovereign_Digital_Currency.pdf?pdf=Asia_Macro_Strategy_Chinas_Sovereign_Digital_Currency> at 2.

[156] Somasundaram, *supra* note 102.

[157] Nikhil Raghuveera & David Bray, "Design Choices of Central Bank Digital Currencies Will Transform Digital Payments and Geopolitics", *Atlantic Council*, 23 April 2020 <www.atlanticcouncil.org/blogs/geotech-cues/design-choices-of-central-bank-digital-currencies-will-transform-digital-payments-and-geopolitics>.

[158] Martin Farrer, "Currency and Control: Why China Wants To Undermine Bitcoin", *The Guardian*, 9 July 2021 <www.theguardian.com/world/2021/jul/09/currency-and-control-why-china-wants-to-undermine-bitcoin>.

If everything goes smoothly, China's CBDC might incrementally "serve as a potential dollar alternative outside the reach of the US but fully under the oversight of China".[159] Such a reshaping of the global financial system may "deny the US some of the 'exorbitant privilege' it currently receives from minting the world's principal global reserve currency and deny the US the capacity to impose financial sanctions on foreign countries".[160] CBDC could be a hedge against potential sanctions.[161]

There are also challenges for international use of e-CNY. If properly managed, e-CNY can reduce the cost and increase the convenience of international payments. That said, mBridge faces challenges. They include the categorisation of CBDC (as currency or debt or otherwise), the foreign exchange price discovery arrangement, and the limited time for banks to off-load foreign CBDCs given the requirements of some central banks to clear balances at the end of a day.[162] The cross-border use of CBDCs also needs to address issues such as monetary sovereignty, different foreign exchange systems, and capital controls.[163] More broadly speaking, "[h]istory shows that the rise of a reserve currency is founded on its usefulness as a medium of exchange, by reducing the cost and increasing the convenience of international payments".[164] However, it remains to be seen whether e-CNY will be widely used by the parties as an international medium of exchange. The key issue will be the level of trust reposed in the PBOC and China itself.[165] "[F]oreign parties will need sufficient assurance that the e-CNY which they receive would be a stable store of value and means of exchange."[166]

IV. What China Is Doing with E-Cny

The PBOC "has built a relatively complete standard system, covering general requirements, business operation, interoperability, wallet, security and regulation" for the digital yuan.[167] E-CNY has different payment methods, including barcode payments, tap-and-go transactions, facial recognition authentication, double offline

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[159] Dirk A Zetzsche *et al*, "Sovereign Digital Currencies: The Future of Money and Payments?" (2020) University of Hong Kong Faculty of Law Research Paper No 2020/053 1 at 6.

[160] *Ibid*.

[161] Duffie & Economy, *supra* note 59.

[162] Bank for International Settlements, *supra* note 132 at 22, 34.

[163] Yicai, "Zhou Xiaochuan: If the U.S. Keeps Using the U.S. Dollar for Sanctions, the Renminbi Will Also Rise", 22 April 2021 <https://finance.sina.com.cn/money/bank/bank_hydt/2021-04-25/doc-ikmyaawc1633176.shtml>.

[164] Mark Carney, Goveror of the Bank of England, "The Growing Challenges for Monetary Policy in the Current International Monetary and Financial System", speech at Jackson Hole Symposium 2019 (23 August 2019) at 15, <www.bis.org/review/r190827b.pdf>.

[165] Debopama Bhattacharya, "Digital Yuan (e-CNY): China's Official Digital Currency" (2022) 46(1) Strategic Analysis 93 at 96. For a discussion on the importance of trust in the digital economy, see Karen Yeung, "Blockchain, Transnational Security and the Promise of Automated Law Enforcement: The Withering of Freedom under Law" (2017) King's College London Law School Research Paper No 2017-20.

[166] Fullerton & Morgan, *supra* note 11 at 19.

[167] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 13.

payments, and remittances.[168] E-CNY applications on smart devices enable users to open and manage e-CNY wallets.[169] The PBOC and participating institutions (large banks, telecommunication companies, and internet firms) have developed e-CNY applications based on three phases ("development and testing, internal verification, and managed external pilot").[170] At the time of writing, e-CNY wallets have been installed by about one-fifth of China's people.[171]

China's CBDC trials are well ahead of the efforts of other major economies which remain at the research or pilot stage.[172] The aim of the e-CNY trials include establishing viability, systemic stability, convenience, risk management, and potential applications in different contexts.[173] China's CBDC is piloted in an increasing number of cities (including the Greater Bay Area) and use cases such as subways,[174] salary payments,[175] government payments,[176] and offline functions.[177] Programmable money features have been adopted, "where the CBDC, distributed through 'red envelopes', would expire in a few days if not used by the recipient".[178] As early as 2020, it was reported that over RMB 2bn had been spent using China's CBDC in four million transactions in China, and that Chinese residents adopted various means of payment (*eg*, bar code, tap-to-go payment, and facial recognition).[179] By the end of 2021, the number of e-CNY users had reached 261 million.[180] China's CBDC has attracted the attention of the G7 and much of the world.[181]

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[168] Bansal & Singh, *supra* note 57 at 5; "China's Central Bank Digital Currency Wallet Is Revealed", *Ledger Insights*, 15 April 2020 <www.ledgerinsights.com/china-digital-currency-wallet-dcep-cbdc> [Ledger Insights, "China CBDC Revealed"].

[169] Yu Wu, "People's Finance Talk | Let's Have a Look! What Is the Use of the Digital RMB App?" (2021) <www.news.cn/fortune/2022-01/07/c_1128242451.htm>.

[170] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 13.

[171] Labonte & Nelson, *supra* note 4 at 12.

[172] Bansal & Singh, *supra* note 57 at 5.

[173] Xinhua, "Factbox: China's Progress on Digital Yuan", *Invest In China*, 17 July 2021 <https://investinchina.chinadaily.com.cn/s/202107/17/WS61ea260a498e6a12c121db15/factbox-chinas-progress-on-digital-yuan.html>.

[174] "Beijing, Suzhou Subway Accept Digital Yuan", *Global Times*, 30 June 2021 <www.globaltimes.cn/page/202106/1227460.shtml>.

[175] Tanzeel Akhtar, "China's Xiong'an New Area Begins Using Digital Yuan for Salary Payments", *CoinDesk*, 14 June 2021 <www.coindesk.com/china-cbdc-wage-pilot>.

[176] Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 20.

[177] *Ibid*.

[178] *Ibid*.

[179] Zoey Zhang, "China's Digital Yuan: Development Status and Possible Impact for Businesses", *China Briefing*, 7 December 2020 <www.china-briefing.com/news/chinas-digital-yuan-status-roll-out-impact-businesses>.

[180] Coco Feng, "China Digital Currency: Leading Mobile Payment Apps Alipay, Wechat Pay Install New Features to Help Widen E-CNY Roll-Out", *South China Morning Post*, 6 May 2022 <www.scmp.com/print/tech/big-tech/article/3176812/china-digital-currency-leading-mobile-payment-apps-alipay-wechat-pay> [Feng, "China Digital Literacy"].

[181] Kosuke Takami, "China's Bid for Digital-Yuan Sphere Raises Red Flags at G-7", *Nikkei Asia*, 5 June 2021 <https://asia.nikkei.com/Spotlight/Cryptocurrencies/China-s-bid-for-digital-yuan-sphere-raises-red-flags-at-G-7>.

A. *The Evolving E-CNY*

The e-CNY continues to evolve, with practicality and efficiency as two of the key design principles.[182] Whether and how blockchain technology and DLT will be utilised in the final design is to be seen.[183] DLT may be considered in, *inter alia*, the digital ID system,[184] and the checks for digital counterfeiting of currency.[185] Cryptocurrencies such as Bitcoin tend to be based on blockchain and DLT, but this need not be so for a CBDC. Blockchain and DLT provide technological solutions to the trust problem – which is not an issue for most central banks. The PBOC has chosen a pathway of "long-term evolution" to explore the technology for CBDCs that meets its various needs such as large transaction volumes.[186]

China is exploring the possible cross-border use of e-CNY in the future. Among other initiatives, the DCI is working with the HKMA, Bank of Thailand, BIS Innovation Hub, and the Central Bank of the UAE to explore mCBDC systems that involve "developing a proof of concept (PoC) prototype to support real-time cross-border foreign exchange PvP [payment versus payment] transactions in multiple jurisdictions, operating 24/7".[187]

E-CNY is currently a pilot retail CBDC. Presently, it can be used by the Chinese public and foreign visitors to China.[188] The e-CNY may, in time, be expanded to wholesale transactions, and future fiscal and taxation payments might not need to go through the bank account system.[189] According to a former president of the Bank of China, e-CNY may also be expanded to a wholesale CBDC for use internationally.[190]

It is yet to be seen whether e-CNY, a digital form of cash,[191] will fully replace tangible cash. Observations range from it being "a replacement for cash [that] will be centrally controlled by the PBOC"[192] to the major objective of the e-CNY probably not being to fully replace cash.[193]

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[182] Guohui Li & Meiruo Ma, "Positive Progress Has Been Made in the E-CNY Research & Development Pilot: Central Bank Held a Media Briefing on the White Paper on Progress of Research & Development of E-CNY in China" (2021) <www.financialnews.com.cn/jg/dt/202107/t20210719_223623.html>.

[183] Jack Martin, "Alipay Patents Reveal More Details About China's Forthcoming CBDC". *Cointelegraph*, 24 March 2020 <www.cointelegraph.com/news/alipay-patents-reveal-more-details-about-chinas-forthcoming-cbdc>.

[184] Chen Jia, "Sneaking a Peek at Coming Digital Currency Era", *China Daily*, 13 September 2021 <www.chinadaily.com.cn/a/202109/13/WS613e9401a310efa1bd66ee8e.html>.

[185] Shi Cheng & Xinhong Gao, "Changes and Unchanged Aspects of Central Bank Digital Currency", 28 April 2021 <www.ftchinese.com/story/001092326>.

[186] Robin Hui Huang, *Fintech Regulation in China: Principles, Policies and Practices* (Cambridge: Cambridge University Press, 2021) at 273.

[187] Raphael Auer, Philipp Haene & Henry Holden, "Multi-CBDC Arrangements and the Future of Cross-Border Payments" *Bank for International Settlements* (19 March 2021) at 8.

[188] Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 6.

[189] Chen, *supra* note 50.

[190] Chen Jia, "2022 May Be E-CNY's Breakout", *China Daily*, 23 June 2021 <https://global.chinadaily.com.cn/a/202106/23/WS60d27945a31024ad0bacacaf.html> [Jia, "2022 E-CNY's Breakout"].

[191] Fullerton & Morgan, *supra* note 11 at 10.

[192] Yue, Wang & Luo, *supra* note 61.

[193] Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 22. Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 17.

B. *The Design and Practice of E-CNY*

1. *Two-layer System*

E-CNY is currently a two-tiered, retail CBDC.[194] The director-general of the DCI has described such a two-layer system of e-CNY as such:

> The e-CNY adopts a two-tier system under which the PBC issues e-CNY to second-tier commercial institutions, which then circulate the e-CNY to the public. The second-tier commercial institutions include six commercial banks, three telecom operators, and two PSPs (in the name of their commercial bank entity). These commercial institutions take on responsibilities such as performing anti-money laundering controls, providing privacy protection, and investing in technology.[195]

E-CNY system includes (i) tier 2 institutions (currently six state-owned banks, one joint-stock bank, two banks affiliated with PSPs, and major telecommunication operators), which are also called authorised operators or operating agencies, and (ii) tier 2.5 institutions, which are other actors involved in the e-CNY ecosystem such as other banks and PSPs.[196] Authorised operators "jointly develop and share apps on mobile devices" and "manage wallets, authenticate e-CNY, and develop wallet ecological platforms to enable operator-specific visual system[s] and special features as well as online and offline applications in all scenarios".[197] Authorised operators "design their own wallets, segregating the data set into portions of transaction information collected by each of the nine wallets".[198] For China's CBDC, authorised operators provide onboarding and real-time payment services[199] and play "a much bigger role in transaction messaging".[200]

Tier 2 and tier 2.5 institutions are actors other than the central bank, and largely serve the role of intermediaries. In e-CNY's intermediated architecture, non-central-bank actors take care of customer-facing engagement.[201] For e-CNY, the division of labour between the central bank and the private sector includes: (i) CBDC issuance by the central bank; (ii) validation and updating of the ledger by the central bank and private sector; and (iii) KYC-AML-CFT, user interface and customer service by the private sector.[202]

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194 Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 4–5.

195 Hong Kong Monetary Authority *et al*, "Inthanon-LionRock to mBridge", *supra* note 54 at 13.

196 "Digital Yuan: What Is It and How Does It Work?", *Deutsche Bank*, 14 July 2021 <www.db.com/news/detail/20210714-digital-yuan-what-is-it-and-how-does-it-work>.

197 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 9.

198 Yeung, "China's E-Yuan", *supra* note 93.

199 Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 22.

200 Group of Thirty, *supra* note 31 at 3.

201 Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 4–5.

202 Soderberg *et al*, *supra* note 60 at 11.

2. *E-CNY Wallets*

E-CNY wallets (also called digital wallets or e-wallets) are crucial for e-CNY. These wallets serve as the way through which e-CNY interacts with end users.[203] The PBOC set the rules of e-CNY wallets, and manages the wallet ecosystem.[204] Authorised operators provide the e-CNY wallet services.[205] E-CNY wallets may "become the primary method for Chinese consumers to manage their personal finances and a new channel for delivering digital financial services".[206] As of 2021, over 20 million personal, and 3.5 million corporate, wallets had been opened.[207]

E-CNY wallets include software (*eg*, mobile payment applications) and hardware wallets (*eg*, IC cards using chips).[208] Depending on the strength of user identity verification, per-transaction and daily limits and balance caps will likely be imposed on wallets.[209]

Software wallets deserve special attention given their wide use in the pilot. End users often download a PBOC-authorised digital wallet application.[210] After the e-CNY wallet is opened, the user can access various services provided by both tier 2 and tier 2.5 institutions.[211] E-CNY can be "distributed directly to the e-wallets of users" by authorised operators "setting up payments channels" without necessarily relying on Alipay and WeChat Pay.[212] That said, e-CNY is strongly supported by Alipay and WeChat Pay through e-CNY wallet functions in their applications.[213] The services provided by e-CNY wallets enable end users to conduct electronic transactions, store their payment data,[214] store and manage their funds,[215] link other accounts with the wallet, and review transaction records.[216] For instance, wallets may generate QR codes usable for payments in shops.[217]

Several aspects deserve attention. There is an e-CNY digital wallet ecosystem,[218] which comprises three layers: (i) the PBOC setting the rules; (ii) authorised operators offering "basic functions"; and (iii) authorised operators working with "relevant market players to further develop various payment and financial products".[219] E-CNY wallets differ from bank deposit accounts: "the balance in a bank deposit account represents a liability of the bank, whereas [e-CNY] in a digital wallet …

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[203] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 8.
[204] *Ibid* at 8, 9.
[205] Changchun Mu, "E-CNY: Balancing Privacy and Security" (2022) 9 Mod Bankers 1.
[206] Olsson *et al*, *supra* note 107.
[207] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 12.
[208] *Ibid* at 9, 11.
[209] *Ibid* at 9.
[210] Yeung & Mullen, *supra* note 70.
[211] Deutsche Bank, *supra* note 196.
[212] Kynge & Yu, *supra* note 103.
[213] Feng, "China Digital Literacy", *supra* note 180.
[214] Coco Feng, "Fintech Giant Ant Group's Mybank Joins China's Digital Yuan Platform", *South China Morning Post*, 12 May 2021 <www.scmp.com/tech/big-tech/article/3133227/fintech-giant-ant-groups-mybank-joins-chinas-digital-yuan-platform>.
[215] John, *supra* note 120; Ledger Insights, "China CBDC Revealed", *supra* note 168.
[216] Ledger Insights, "China CBDC Revealed", *supra* note 168.
[217] John, *supra* note 120.
[218] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 6.
[219] *Ibid* at 9–10.

represents a direct liability of the PBOC, and the digital wallet offered by the bank is just an interface to allow users to access their [e-CNY]".[220]

Transactions through e-CNY wallets only transmit the wallet ID – transaction counterparties will not know the user's identity.[221] Here the authentication centre of the PBOC will verify the veracity of e-CNY, and verification requests from the operating agencies will receive a yes or no response in this regard.[222] This is the controlled (or managed) anonymity of e-CNY, under which e-CNY "transaction data is centralized, controlled by and only visible to the PBoC, while all other parties in a transaction cannot trace the underlying [e-CNY] users or their transaction history without the permission of the users".[223] This may affect certain business practices. For instance, managed anonymity may make it difficult for online platforms to collect user information.[224] E-CNY sub-wallets can be opened under their mother wallets, and these sub-wallets are wallet fast payment products.[225] Here payments may be conducted with tokenised sub-wallets available to, for instance, e-commerce platforms, that will not be able to access the personal information.[226]

3. *Loosely-Coupled Bank Account Links*

E-CNY is flexible and allows a combination of designs regarding CBDC access. E-CNY is "a value-based, semi-account-based and account-based hybrid payment instrument",[227] which "could be categorized as property, and is bound by property law".[228] Accounts linked to the e-CNY may include "broad" accounts linked to identifying information (*eg*, ID cards, phone numbers, and email addresses), and "narrow" bank accounts (*ie*, traditional checking accounts with commercial banks).[229]

When end users download a PBOC-authorised digital wallet application, it is either linked or unlinked with a bank account.[230] E-CNY wallets can be opened by a phone number (verified with a one-time password[231]) without any bank account, although such wallets would have low holding and daily transaction limits and can only be used for small-amount transactions.[232]

E-CNY wallets can be separate from bank accounts, with implications for important issues like data.[233] Salaries can be paid directly by businesses to e-CNY

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220 Olsson *et al*, *supra* note 107.
221 *Ibid*.
222 Duffie & Economy, *supra* note 59 at 32.
223 Gantori *et al*, *supra* note 50 at 6.
224 Deutsche Bank, *supra* note 196.
225 Mu, *supra* note 205.
226 Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 28–29.
227 Group of Thirty, *supra* note 31 at 18; Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 23.
228 Group of Thirty, *supra* note 31 at 18.
229 Duffie & Economy, *supra* note 59 at 29.
230 Yeung & Mullen, *supra* note 70.
231 Auer *et al*, "Central Bank Digital Currencies", *supra* note 36 at 21.
232 Chen, *supra* note 50.
233 *Ibid*.

accounts without going through bank accounts.[234] Under loosely-coupled bank account links,[235] users can use e-CNY anonymously while operating agencies "submit transaction data to the central bank".[236]

This apparent level of flexibility is exceptional. China's CBDC can be account based or tokenised[237] although in some contexts, like a recent pilot of CBDCs in subway systems, it has been expected that users have a bank account.[238]

C. *Summary*

As a legal tender,[239] e-CNY is evolving relatively rapidly. This offers China a genuine first-mover advantage. To this end, the PBOC considers e-CNY's regulatory measures "need to be tailor-made".[240]

A major consideration of e-CNY design is the avoidance of financial disintermediation. To do so, the PBOC uses categories of e-CNY wallets with tiered ceilings on transactions and balances to, *inter alia*, "ease the crowding-out of bank deposits, and prevent arbitrage", and "system frictions" to prevent bank runs.[241] The e-CNY does not offer interest (*ie*, it is unremunerated). The major reasons for the e-CNY being non-interest bearing and the two-tier operating system are to prevent disintermediation of banks.[242] The PBOC's aim is for e-CNY to replace or supplement cash, not bank deposits.[243] The current domestic pilot of e-CNY is limited to small transactions to avoid financial disintermediation.[244] It is yet to be seen whether a shift from savings accounts to CBDC wallets will occur in China.[245]

Other considerations behind e-CNY's design include the prevention of over-issuance and the management of the burden on the central bank. Banks are expected to hold digital yuan at a 100% reserve ratio, which may help to prevent over-issuance.[246] The two-tier system helps reduce the burden on the central bank. For instance, there is no need for the central bank to develop consumer accounts and related services (such as a call centre for CBDC users).

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234 *Ibid*.

235 Auer *et al*, "Rise of the CBDCs", *supra* note 3 at 23; "Progress of Research & Development of E-CNY in China", *supra* note 51 at 3.

236 *Ibid*.

237 Herbert Poenisch, "CBDC With Chinese Characteristics", *Official Monetary and Financial Institutes Forum*, 18 September 2020 <www.omfif.org/2020/09/cbdc-with-chinese-characteristics>.

238 Global Times, *supra* note 174.

239 "Progress of Research & Development of E-CNY in China", *supra* note 51 at 3.

240 *Ibid* at 11.

241 *Ibid* at 12.

242 Deutsche Bank, *supra* note 196; Jan Knoerich, "China's New Digital Currency: Implications for Renminbi Internationalization and the US Dollar", in Nicola Bilotta & Fabrizio Botti, eds, *The (Near) Future of Central Bank Digital Currencies: Risks and Opportunities for the Global Economy and Society* (Switzerland: Peter Lang, 2021) at 152.

243 Deutsche Bank, *supra* note 196.

244 Group of Thirty, *supra* note 31 at 18.

245 Shiyun Li & Yiping Huang, "The Genesis, Design and Implications of China's Central Bank Digital Currency" (2021) 14(1) China Econ J 1 at 1.

246 Fullerton & Morgan, *supra* note 11 at 10.

V. The Paradigm Change – Digital Yuan in International Trade?

China is the principal bilateral trading partner of most countries, and thus in a position to strongly promote the use of the e-CNY in international trade.[247] It may be able to invoice in Yuan and insist on payment by e-CNY once the digital currency is available for use in trade. This has been dubbed by Charles Gave as possibly underpinning "Asia's new monetary order".[248] E-CNY is likely to be used in commodity trade following China's efforts in promoting the use of RMB in oil trading with some countries.[249]

Through direct exchange of currencies, CBDCs should reduce the need for intermediaries in international trade and the costs of executing transactions through correspondent banks.[250] As a programmable currency, the e-CNY should interact particularly well with smart contracts, offering massive potential savings in cost and time in trade payments especially those involving dematerialised trade documents.[251]

China is actively exploring the possible use of e-CNY in trade.[252] Through the DCI,[253] the PBOC is developing a blockchain-based Digital Trade Finance Platform to "digitize all the cumbersome paperwork in cross-border trades and engage digital currencies in cross-border trade".[254] As discussed above, the PBOC is working with other regulators and the BIS on the m-CBDC Bridge to "make multicurrency cross-border payments simpler and cheaper".[255] If all goes well, the m-CBDC Bridge may be used for international fund transfers, trade settlement and capital market transactions.[256] "In the current open market, each country needs to buy other local currencies from intermediaries and pay a premium."[257] China may "negotiate with the central bank of each of its trading partners to establish exchange rates and develop legal frameworks between two currencies", and m-CBDC will likely provide "a more competitive foreign exchange rate than the open market to attract more central banks to the network" given the reduction in intermediaries.[258] This seems to echo China's recent efforts to promote "direct exchange-rate quotations and interbank trading" between local currencies.[259] Moreover, China is reportedly

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247 "WEF: China Says Digital Yuan Doesn't Aim to Challenge Dollar", *Ledger Insights*, 28 January 2021 <www.ledgerinsights.com/wef-china-says-digital-yuan-does-not-aim-to-challenge-dollar>.

248 Somasundaram, *supra* note 102.

249 Tsang & Chen, *supra* note 33.

250 Silva *et al*, *supra* note 24 at 24.

251 SWIFT & Accenture, *supra* note 22 at 5; Didenko *et al*, *supra* note 113 at 42.

252 "Do Digital Yuan Trial Figures Signal More Business Usage?", *Ledger Insights*, 2 November 2020 <www.ledgerinsights.com/digital-yuan-trial-figures-business-usage-ecny-cbdc>.

253 "PBOC Digital Currency Research Institute on Blockchain: Technical Decentralization Does Not Mean Decentralization of Management", *21 世纪经济报道 [21st Century Business Herald]*, 13 September 2021 <https://finance.sina.com.cn/blockchain/roll/2021-09-13/doc-iktzscyx3969921.shtml>.

254 Ningwei Qin, "PBOC Has Established an E-CNY Distributed Ledger", *Forkast*, 7 December 2021 <www.forkast.news/headlines/pboc-built-ecny-distributed-ledger>.

255 Diana Choyleva, "China Advances in Challenge to Dollar Hegemony", *Financial Times* (2021) <www.ft.com/content/efa3ec2b-5be8-413f-b23c-cc9b9bff1261>.

256 Bank for International Settlements, *supra* note 132.

257 Kshetri, *supra* note 144 at 12–13.

258 *Ibid* at 13.

259 "China, Indonesia Sign MoU to Boost Use of Local Currencies", *Xinhua*, 30 September 2020 <www.xinhuanet.com/english/2020-09/30/c_139410036.htm>.

working with SWIFT, through a joint venture, to explore the international use of China's CBDC.[260]

E-CNY will likely offer cost advantages in RMB settlement and clearance and infrastructure funding.[261] E-CNY may eventually be available for both retail and wholesale use. According to a former PBOC governor, "the application of digital currencies should focus on retail transactions, in particular payment related to current account items such as cross-border travel".[262] The possibility of Chinese tourists using China's CBDC abroad is reportedly being explored by China and Singapore.[263] In the wholesale context, China's CBDC may be used in BRI funding.[264]

E-CNY could be one of a group of regional CBDCs used in trade. With regional economic integration, there could be regional CBDCs.[265] China's early push into CBDCs may enable it to shape the evolution of the infrastructure for international remittances and trade.[266] Some suggest that cross-border payment is where the e-CNY could have the greatest impact, promoting a diversified international settlement system that breaks the dollar's monopoly and promotes RMB internationalisation.[267]

However, the international use of e-CNY remains uncertain. It remains to be seen whether e-CNY will be selected by parties and used on a large scale particularly as the RMB is not fully convertible and China maintains capital controls and other measures that affect currency internationalisation.[268] To date, in the BRI, "international project participants have not been eager to assume risks arising from renminbi availability or exchange rates".[269]

The cross-border use of e-CNY will require coordination of regulatory and technological issues.[270] Although interoperable CBDCs should certainly make international payments faster and cheaper, "corridors with agreed architecture and

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[260] "SWIFT Sets up JV with China's Central Bank", *Reuters*, 4 February 2021 <www.reuters.com/article/china-swift-pboc-idUSL1N2KA0AK>.

[261] Yanyan Zhou, "PBOC Institute of Finance Zhou Chengjun: Limitations of Digital Currency in Cross-Border Economy", *21世纪经济报道*, 22 June 2020 <https://m.21jingji.com/article/20200622/herald/60de089424fbc25ee556066543b9f063_ths.html>.

[262] Xiaochuan Zhou, "Understanding China's Central Bank Digital Currency", *China Finance 40 Forum*, 13 December 2020 <www.cf40.com/en/news_detail/11481.html>.

[263] Hu Yue & Denise Jia, "China's Didi Teams with Central Bank on Digital Currency Trial", *Nikkei Asia*, 9 July 2020 <https://asia.nikkei.com/Spotlight/Caixin/China-s-Didi-teams-with-central-bank-on-digital-currency-trial>.

[264] Takami, *supra* note 181; Min Zhu, "Former IMF Deputy Managing Director: Chinese Government May Take the Initiative to Develop Digital Currency (Token) System Along the BRI" (2020).

[265] Chen, *supra* note 50; Heng Wang & Simin Gao, "The Future of the International Financial System: The Emerging CBDC Network and Its Impact on Regulation" (2021) (unpublished) at 21–24, <www.papers.ssrn.com/sol3/papers.cfm?abstract_id=3766654>.

[266] Banerjee, *supra* note 148 at 30–31.

[267] Yanting Wu, "Why Does the Digital RMB Accelerate?" *Outlook Weekly* (2021).

[268] "Zhou Xiaochuan: A Few Questions and Responses about Digital Currency", *Tsinghua PBCSF*, 16 April 2022 <www.163.com/dy/article/H53QJ8PN05198N6J.html>.

[269] Mark Hu *et al*, "Project Finance and Public-Private Partnerships Along the Belt and Road", in Basil C. Bitas, ed, *ASEAN and the Belt and Road Initiative - Connectivity through Law and Commerce* (Academy Publishing, 2021) at 173.

[270] Gantori *et al*, *supra* note 50 at 9.

governance" are needed and probably will require many bilateral agreements.[271] Regulatory requirements such as for AML may slow the pace of CBDC usage in cross-border payments. CBDC usage in this context will also require strong customer identification and have implications for privacy protection, data storage, data flow, and data security.[272] Without effective international cooperation on the complex technical and regulatory issues, the rise of CBDCs could paradoxically increase the costs of cross-border transactions.[273]

VI. Challenges and Possible Risks

CBDCs bring opportunities and technical, regulatory and geoeconomic uncertainties. We next explore the challenges in domestic regulation and international cooperation.

A. *Changes in Regulation*

In large part, the technical and regulatory issues of CBDCs do not apply to, or are more complex than, those of paper currency. It remains to be seen how CBDC regulation interacts with existing regulation such as that on banking and risk management.[274] Unlike physical cash, a CBDC carries with it data. In many ways CBDCs will fulfil more functions than cash and thus require more regulation.[275]

Specific regulation will be needed given CBDC's implications for the financial system and stakeholders including consumers.[276] Cybersecurity and financial disintermediation will be major issues. The CBDC ledger may become a target for cyberattacks.[277] CBDC design defects may bring cybersecurity risks.[278] Financial disintermediation ranks among the major issues for the PBOC regarding e-CNY.[279] CBDC may pose a similar challenge to stablecoins: bank deposits may fall as depositors shift to digital currencies, and lead to financial disintermediation.[280] The two-tier system for China's CBDC seeks to address issues of financial disintermediation by preserving the role of the commercial banks and payments providers

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[271] Greene, *supra* note 45.

[272] Arthur Kroeber, "Digital Renminbi Will Not Help Russia Evade Sanctions", *Financial Times*, 16 March 2022 <www.ft.com/content/cb13c87c-90d5-4266-8d62-e7e50be14f01>.

[273] Labonte & Nelson, *supra* note 4 at 20.

[274] Panetta, *supra* note 4.

[275] "Central Bank Digital Currency: Opportunities, Challenges and Design", *Bank of England*, March 2020 <www.bankofengland.co.uk/-/media/boe/files/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design.pdf> at 8.

[276] Labonte & Nelson, *supra* note 4 at 25.

[277] UK, HL, *supra* note 26 at 5.

[278] Fullerton & Morgan, *supra* note 11 at 16.

[279] Jia, "2022 E-CNY's Breakout", *supra* note 190.

[280] Lael Brainard, Member of the Board of Governors of the Federal Reserve System, "Digital Currencies, Stablecoins, and the Evolving Payments Landscape", remarks at The Future of Money in the Digital Age (16 October 2019), <www.federalreserve.gov/newsevents/speech/files/brainard20191016a.pdf>.

in supplying customer-facing services.[281] Yet the effects of e-CNY in this regard remain to be seen.

The erosion of the deposit base which banks leverage to provide loans may be remediable as central banks can recycle these funds by making them available to the commercial banks through their discount window.[282] A run from commercial bank deposits into CBDC at times of deep uncertainty will be far more problematic because of the speed with which it may well occur,[283] and it will be interesting to see the protections the PBOC implements to ameliorate this potent risk. The possible expansion of the central bank's balance sheet due to CBDCs also merits consideration as this affects the risk handled by the central bank.[284]

It may be challenging to develop regulations in response to the needs of the technological and structural changes arising from e-CNY.[285] One example is that "to operationalize legal tender status would require the State imposing on its population the acquisition of the technical infrastructure to hold and transfer" CBDCs.[286]

CBDCs bring with them a host of other regulatory issues, including privacy protection, cybersecurity, legal protections for consumers, and the prevention of systemic risks. Issues of counterfeiting, such as the fake CBDC wallets revealed in the e-CNY pilots, are also possible.[287] Regulatory development should cover new activities and new actors (*eg*, BigTechs) in the CBDC ecosystem.[288] Specific issues could also arise from the cross-border use of CBDCs ranging from severe exchange rate fluctuations to capital flight.[289]

B. *Balancing Different Considerations*

A careful balance will need to be struck between stability and security on the one hand, and usability and convenience on the other. Different retail CBDC designs carry different implications for financial stability and monetary policy.[290]

Tensions will arise between the various goals of a CBDC. For instance, maximising financial inclusion in the CBDC design may affect the effectiveness of CBDCs in realising other payments goals.[291] A limit on individual CBDC holdings may reduce major deposit outflows but also constrain the scale and scope of CBDC use and its

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[281] Panetta, *supra* note 4.

[282] Greene, *supra* note 45.

[283] Kumhof & Noone, *supra* note 46 at 1, 26.

[284] Panetta, *supra* note 4.

[285] Fullerton & Morgan, *supra* note 11 at 16.

[286] Bossu *et al*, *supra* note 19 at 38.

[287] "Fake Digital RMB Wallets Have Been Found. What are the Geniune Ones?", *China News*, 27 October 2020 <www.chinanews.com/cj/2020/10-27/9323268.shtml>.

[288] John Kiff *et al*, "A Survey of Research on Retail Central Bank Digital Currency", *International Monetary Fund* (26 June 2020) at 44.

[289] Panetta, *supra* note 4.

[290] "Progress of Research & Development of E-CNY in China", *supra* note 51 at 11.

[291] Jesse Leigh Maniff, "Motives Matter: Examining Potential Tension in Central Bank Digital Currency Designs", *Federal Reserve Bank of Kansas City*, 1 July 2020 <www.kansascityfed.org/Payments%20Systems%20Research%20Briefings/documents/7578/prsb20maniff0701-01.pdf>.

role as a payment instrument.[292] Another example, discussed above, is that paying interest on a CBDC may promote financial inclusion but lead to financial disintermediation. It remains to be seen how a CBDC will navigate the "CBDC trilemma" (the aims of efficiency, financial stability, and price stability).[293] Furthermore, the reduction of capital controls will help promote RMB internationalisation but risk capital flight which has been among China's "greatest financial challenges".[294]

C. *International Collaboration*

CBDCs will have transboundary effects given the interlinkage among economies, and the cross-border use of CBDC in particular will call for international collaboration. Problems with one CBDC may affect other economies. For instance, the technical breakdown of one CBDC may affect other CBDCs with which it is linked. Regulatory arbitrage is also a possible challenge with CBDC.[295] Finally, if account-based CBDCs are to be used across borders, it is likely that central banks will need to validate the identity of foreign users.[296]

The international coordination of CBDC governance will be particularly challenging, since CBDC design and regulation appear set to vary across economies. In these nascent stages of CBDC development, international collaboration in design and standard setting will likely yield major returns in the longer term. Yet it has been noted that "CBDC design considerations are often country- and economy-specific, [where] payments infrastructure efficiency, cash usage and financial inclusion rates differ."[297] These national variations are particularly likely as CBDC concerns the "very fundamental relationship between money, the State, and the law".[298]

There is likely to be substantial divergence between China, the US, UK, and EU on crucial issues like data management and privacy. For example, the Bank of England does not plan to "hold personal data on any user" regarding CBDCs.[299] This differs from China's likely approach.

Without efficient international cooperation, "profound fragmentation of the post-war international monetary system" may arise from CBDCs.[300] "Beyond a handful of bilateral cross-border testing arrangements, there has been relatively little international coordination among countries in their CBDC efforts in comparison to other international financial issues, such as financial regulatory reform after the 2008–2009 global financial crisis."[301] With the rise of CBDCs there may be different

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[292] Panetta, *supra* note 4.

[293] Linda Schilling, Jesús Fernández-Villaverde & Harald Uhlig, "Central Bank Digital Currency: When Price and Bank Stability Collide", *National Bureau of Economic Research* (December 2020) at 1.

[294] Fullerton & Morgan, *supra* note 11 at 19.

[295] "Focusing on Digital Currency and the Reform of the International Financial System, the 4th IMF-CF40-IDF Seminar on Fintech in China Was Held", *China Finance 40 Forum*, 18 July 2021 <https://zhuanlan.zhihu.com/p/390792476>.

[296] Bank for International Settlements, *supra* note 132 at 86.

[297] Silva *et al, supra* note 24 at 26.

[298] Bossu *et al*, *supra* note 19 at 5.

[299] UK, HL, *supra* note 26 at 31.

[300] Didenko *et al*, *supra* note 113 at 39.

[301] Labonte & Nelson, *supra* note 4 at 10.

international payments systems in the future, and whether they are compatible with each other remains to be seen.

VII. Conclusion

China shares with other nations some of its reasons for issuing a CBDC, such as promoting financial inclusion and addressing the decline in the usage of cash. Yet China may also have other considerations such as strengthening the role of the state in the domestic payment market, gathering more information about money flows, and, in the longer term, promoting its currency as a global reserve currency and garnering some of the many economic benefits this brings.

As China's reasons to introduce a CBDC exceed those of other nations, and it has a strong existing technological base in FinTech, it is not surprising that China is far ahead of all other countries in developing and trialling a retail CBDC. China literally leads the world when it comes to CBDC development.

Yet for so long as China's developments remain in the context of a retail CBDC for domestic use, they will not be globally transformative. This will likely change if and when China releases the e-CNY for use offshore in payment and settlement of international trade transactions, *ie*, in international wholesale transactions. Many obstacles remain in the way of the use of e-CNY in international trade, centred mostly on trust in China and its central bank. However, China also enjoys many powerful levers with which to promote the e-CNY. These range from making its use free and more convenient than other alternatives to mandating its use as the payment mechanism for Chinese exports or imports. In the fullness of time, China will likely release the e-CNY for offshore wholesale use not to make money, but to reorder the international financial system to its advantage. If merchants begin to trust and use the e-CNY in international trade, or simply use it because they have to do so, the e-CNY will provide a veritable river of valuable data to China about these transactions in real time. The need to have access to such data will be one of the major reasons other nations launch their own CBDCs.

Some 90% of national central banks are currently researching CBDCs. Putting central bank money into the hands of citizens and businesses in digital form is a transformative change and not one any central bank will undertake lightly.

Yet it behoves central bankers around the world to keep a close eye on developments in CBDCs, to which effort we trust this article makes a contribution, and to keep assiduously researching and developing their own CBDCs. The nature of money and payments is about to change radically. We all need to be ready.