

Policy responses to cross-border central bank digital currencies—assessing the transborder effects of digital yuan

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Key points

- Current literature on central bank digital currencies (CBDCs) generally focuses on regulatory issues in the domestic context. This article discusses the challenges when a CBDC circulates across national borders. It addresses three cross-border spillover effects of the CBDC: the crowding out effect on local currency; challenges to capital control for regulators; and infringement of user privacy.
- The article posits the digital yuan as an example on which spillover effects can be assessed as it is circulated beyond its borders. It is estimated that the major fund receivers of the Belt and Road Initiative (BRI), and China's neighbours, are most likely to be affected by the digital yuan.
- These countries will benefit from convenient, efficient, and secure transactions as the digital yuan circulates. But they may face problems when the digital yuan becomes widely used in local markets. They will find it difficult to control or monitor the flow of the digital yuan, and will have to take measures to protect the privacy of their domestic users. This article therefore proposes unilateral, bilateral and multilateral strategies to cope with the corresponding spillover effects.
- The article's analysis suggests that the adverse effects of the cross-border uses of CBDCs can be addressed and mitigated by adequate institutional design, and by multilateral coordination efforts.

1. Introduction

Central bank digital currencies (CBDCs) have been gaining traction for the past few years, due to innovations in payment methods, the rise of crypto-assets and the COVID-19 pandemic. The issuance of CBDCs has impacts on a sovereign state's monetary environment and financial markets, and calls for the rethinking of the roles of modern states and central banks.

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The current literature focuses mainly on two dimensions of the CBDC: first, the implications of the CBDC issuance for sovereign states' monetary and macroprudential policies;¹ and secondly, on the institutional infrastructure, the legal mandates, and the technical designs through which the CBDC can be issued and distributed.² Yet the launch of CBDCs also introduces some little-discussed spillover effects that range from privacy infringement to impacts on sovereign states' monetary autonomy. Therefore, this article will discuss the cross-border spillover effects of the domestic CBDC, focusing on the foreign sovereign state's monetary stability and capital control measures.

For years, many countries have been exploring the possibilities and implications of using the CBDC.³ This exploration has now become prominent, and has even led countries to consider the use of the CBDC beyond their own jurisdictions, and to try to make CBDCs interoperable through multi-CBDC arrangements (or mCBDCs).⁴ Cross-border use of CBDCs holds the potential to improve current cross-border payment systems but also poses significant challenges to the global financial ecosystem, such as macroeconomic concerns and stability risks. Cross-border use of CBDCs subjects the receiving jurisdictions and the wider financial ecosystem to the risk of international spillovers.⁵ This is currently understudied. This article, therefore, is an early attempt to fill this void in the existing literature. We focus on cross-border spillover effects by the domestic CBDC on other countries.

We use the term 'spillover effects' for two reasons. First, spillover effects are widely understood as impacts experienced by certain groups due to events triggered by an unrelated party or independent event. The concept of 'spillover effects' is related to the concept of 'externality'. Both highlight the unintended impacts on non-issuing countries of a CBDC issued by another country. Second, the spillover effect suggests a chain reaction triggered by a certain event or action. A spillover can create a ripple effect that is unexpected, and may have tremendous consequences for actors not associated with it. The cross-border effects of CBDCs fit these definitions.

1 Eg see W Engart and BSC Fung, 'Central Bank Digital Currency: Motivations and Implications', Bank of Canada, Bank of Canada Staff Discussion Paper N° 16/2017, November 2017; N Yanagawa and H Yamaoka, 'Digital Innovation, Data Revolution and Central Bank Digital Currency', Bank of Japan, Bank of Japan Working Paper Series, N° 19-E-2/2019, February 2019; M Chorzempa, 'China, the United States, and Central Bank Digital Currencies: How Important is it to be First?' (2021) 14 China Econ Rev 102.

2 Eg see B Dyson and G Hodgson, 'Why Central Banks Should Start Issuing Electronic Money' (*Positive Money*, January 2016) <http://positivemoney.org/wp-content/uploads/2016/01/Digital_Cash_WebPrintReady_20160113.pdf> accessed 12 August 2021; R Auer and R Bohme, 'The Technology of Retail Central Bank Digital Currency' (BIS Quarterly Review March 2020, 2020), 85–100; S Allen and others, 'Design Choices for Central Bank Digital Currency' (2020) Global Economy & Development Working Paper 140; R Sunak and A Bailey, 'Public Policy Principles for Retail Central Bank Digital Currencies' (July 2021) <https://www.mof.go.jp/english/policy/international_policy/convention/g7/g7_20211013_2.pdf> accessed 31 October 2021.

3 According to a Bank for International Settlements (BIS) survey published in January 2020, central banks' engagement with CBDCs started roughly in 2017, and in early 2020, 80% of the central banks surveyed are engaging in some sort of work related to CBDCs. Around 40% of central banks surveyed have progressed from conceptual study to proofs of concept. C Boar, H Holden and A Wadsworth, 'Impending Arrival—A Sequel to the Survey on Central Bank Digital Currency', BIS Papers N° 107, January 2020, 3 <<https://www.bis.org/publ/bppdf/bispap107.pdf>> accessed 12 August 2021.

4 R Auer and others, 'CBDCs Beyond Borders: Results from a Survey of Central Banks', BIS Papers N° 116, June 2021, at Abstract.

5 Ibid 15.

For central banks, the issuing of CBDCs primarily aims to innovate the finance and payment systems of their own markets. A CBDC is likely to stimulate financial activity, create new forms of finance, and improve financial inclusion. However, a CBDC is likely to affect the global financial system. Even if a country prohibits the circulation of its CBDC in foreign markets, the unique characteristics of the CBDC make cross-border flow very difficult to stop. The country that catalyses the spillover effect may not intend to change markets beyond its borders. As such, tackling cross-border impacts necessitates intergovernmental cooperation.

To summarize: this article identifies challenges arising from the ‘externality-generating aspect’ of spillover effects, and proposes possible bilateral and multilateral solutions of problems that result from the ‘integration-facilitating aspect’ of spillover effects.

CBDCs generally take two forms: general purpose (retail) CBDCs, and wholesale CBDCs.⁶ Unlike the general purposes CBDC, a wholesale CBDC does not give access to retail users; it is used only for wholesale settlements such as securities settlements and inter-bank payments.⁷ Therefore, central banks’ motivations to develop wholesale CBDCs ‘are generally weaker than those for general purpose CBDCs’.⁸ A 2020 survey conducted by researchers from the Bank for International Settlements (BIS) also shows that emerging market economies (EME) generally have stronger motivations to develop CBDCs, regardless of general purpose or wholesale purpose CBDC.⁹ Some EME central banks have issued general purpose CBDCs, such as Bahamas’ Sand Dollar and Nigerian’s e-Naira, while others have developed advanced pilots. However, all advanced economy central banks are unlikely, or are very unlikely, to issue wholesale CBDCs over the short to medium term.¹⁰ Given the likelihood of future popularity, and the wider impact on the economy, we focus our discussion on general purpose CBDCs.¹¹

Another widely discussed dimension of retail CBDC lies in the architecture for CBDCs.¹² This generally takes three forms: ‘direct model, indirect model and hybrid model’. The key defining factors that differentiate the three models are whether the CBDC is a direct claim on the central bank and whether the central bank handles the payments interface itself, such as onboarding customers and knowing your customer (KYC) procedures.¹³ We do not base our discussion on the differences in the architecture design as they are very unlikely to hold significant implications for this article’s focus on retail cross-border CBDCs.¹⁴

6 Boar and others (n 3) 1.

7 Ibid.

8 Ibid 5.

9 Ibid 5–7.

10 Ibid 8.

11 For discussions which have similar focus, see eg, CJ Waller, ‘CBDC—A Solution in Search of a Problem?’ (Speech at the American Enterprise Institute, Washington, DC, 5 August 2021) <<https://www.bis.org/review/r210806a.pdf>> accessed 12 August 2021.

12 Auer and Bohme (n 2) 87–91.

13 Ibid 88–9.

14 For other possible design parameters which may help highlight challenges and implications introduced by retail general purpose CBDCs, see R Buckley and others, ‘Sovereign Digital Currencies: Reshaping the Design of Money and Payments Systems’, University of Hong Kong Faculty of Law Research Paper N° 2020/053, October 2020, 15.

Nevertheless, what might hold implications for this article's discussion is the accessibility mechanism given to the users of a CBDC.¹⁵ A general purpose CBDC can be designed to give access to users through accounts or tokens.¹⁶ The key difference between the two is their verification designs. An account-based CBDC means the users will be given an account that keeps a record of their CBDC transactions and must tie their ownership of the CBDC holdings to an identity given by the central bank or the relevant issuing authority.¹⁷ A token-based CBDC, on the contrary, means the users can exercise their CBDC holdings and honour claims as long as they can demonstrate knowledge of certain encrypted values tied to the CBDC.¹⁸ A token-based CBDC functions more like digital cash, meaning users can transact it like people use cash—anononymously and universally. Each type presents different implications for privacy protection and regulatory compliance. For example, a token-based CBDC can ensure privacy by default but will pose challenges to Anti-Money Laundering (AML) efforts.¹⁹ For the later discussion in this article, we may differentiate scenarios between token-based CBDCs and account-based CBDCs.

A CBDC has similar attributes to cash, which is part of the M0 supply of currency. The circulation of CBDC will have significant impacts on the daily use of currency, including transactions between individuals, and transactions between individuals and banks. Major change rests not only on the medium of exchange but also on the retail payments system. Thus, we will also touch upon the relevant issues that carry implications for the retail payments system.

The article then explores viable policy responses likely to be adopted by the affected foreign sovereign states. Possible spillover effects include bypassing a sovereign state's capital control measures by a token-based CBDC issued and used via a mobile device. That accelerates the process of 'dollarization' (or currency substitution), which potentially jeopardizes the dollarizing country's monetary autonomy, and challenges its current practice and norms of exchange rate policy. The spillover effects discussed pose significant challenges, if not risks, to all foreign countries with access to a domestic CBDC. These issues require unilateral, bilateral, or multilateral efforts by sovereign states. To analyse these effects, and advance possible policy solutions, this article conducts a case study of the world's forerunner in CBDC developments, namely, China's Digital Yuan (or the e-CNY),²⁰ and explores possible policy responses that can be adopted by foreign sovereign states. Implications, and lessons learned from the case, can serve as policy recommendations for regulators in those states.

15 Ibid 93–5.

16 Boar and others (n 3) 2.

17 Auer and Bohme (n 2) 93.

18 Ibid 93–4.

19 Ibid 94.

20 For ease of discussion, we use the terms 'Digital Yuan' and 'e-CNY' interchangeably to refer to China's Digital Renminbi. People's Bank of China recently released a progress report of the Digital Yuan, which also abbreviates the Digital Yuan as e-CNY. Working Group on E-CNY Research and Development of the People's Bank of China, 'Progress of Research & Development of E-CNY in China' 1 (July 2021) <<http://www.pbc.gov.cn/en/3688110/3688172/4157443/4293696/2021071614584691871.pdf>> accessed 12 August 2021.

Section 2 analyses the main cross-border spillover effects of CBDCs, and conducts a thorough review of China's Digital Yuan aspiration. Section 3 explores possible legal/regulatory strategies and institutional designs that may help countries respond to these spillover effects. Section 4 concludes and suggests prospects for future research on the CBDC.

2. The cross-border spillover effects of CBDC and digital yuan as an example

The issuing of a general purpose CBDC in one jurisdiction inevitably introduces potential externalities to other jurisdictions, due to the mobility of the CBDC and its users, which are difficult to trace. The existing monetary system largely builds on two foundations: central banks issuing central bank money in the form of cash, and commercial banks issuing commercial bank money in the form of deposits. The cross-border circulation of both forms of money would require either physical travel or facilitation by commercial banks' cross-border remittance networks. Nevertheless, the cross-border circulation of CBDCs can theoretically be achieved via internet transactions or by double offline payment transactions on mobile phones (in which the CBDC wallet is embedded) by two holders in the same foreign location. CBDCs, therefore, hold cross-border implications that require novel solutions. Among all the possible cross-border spillover effects, we will identify the three most important effects and will provide a brief analysis of each.

The cross-border effects of CBDC

Crowding out effect on local currency

Although the CBDC can exist in the account-based or token-based form, the current mainstream solution seems to prefer the account-based CBDC. Some central banks consider a mix of account-based and token-based CBDC, as this design maintains the level of anonymity and is more likely to be widely accepted.²¹ Be it an account or token-based CBDC, both require a wallet, or tangible interface for users to store and pay with the CBDC. The most perceivable obvious candidate for tangible wallets would be mobile phones. People generally travel to other jurisdictions with their mobile phones. For instance, in a local market X where Currency A is the legal tender, residents in that market can only use currency A for transactions. However, if Currency B is in the form of a CBDC, which can be stored in a mobile phone (or its chip) and can be transferred through the mobile network, the carriers of the mobile phone wallet can freely use Currency B even

21 For the mix of account and token-based CBDC, see R Garratt and others, 'Token- or Account-Based? A Digital Currency Can Be Both', Federal Reserve Bank of New York *Liberty Street Economics* (12 August 2020) <<https://tinyurl.com/yeg37eyj>> accessed 31 October 2021; R Auer, G Cornelli and J Frost, 'Rise of the Central Bank Digital Currencies: Drivers, Approaches and Technologies', (24 August 2020), <<https://www.bis.org/publ/work880.htm>> accessed 31 October 2021. For a relevant discussion on the cross-border use of retail CBDC, please see Auer and others (n 4) 5 (Noting that 'A CBDC, being digital, could be designed so that it faces no constraints on where and by whom it is used. If a CBDC design allows for anonymous digital tokens, it would by default be accessible to foreign residents. Also, there would be no sure way of restricting its use abroad . . . If the national access framework is account-based, i.e. linked to some form of identification of users, use by non-residents becomes a policy choice, and the international circulation could be limited by design.')

if they are located in market X, as long as their counterparty also has a mobile wallet for Currency B. In other words, if the technological design allows it, people can use foreign CBDC domestically with other holders of the CBDC, therefore replacing the local currency if the number of foreign CBDC users increases dramatically. This phenomenon can be understood as ‘dollarization’, the gradual process of a popular foreign currency replacing the less popular local currency in the local market.²² This effect will run afoul of the local government’s monetary policies, and introduce system-wide economic issues. This crowding out effect on the local currency is likely to be very significant in developing countries, where people sometimes suffer from severe inflation or lack of trust on local currencies.²³ Such a crowding out effect is almost inevitable when the CBDC is a strong currency, or if the users of that CBDC enjoy a large population in the local market. In fact, a recent survey published by the BIS also shows that ‘central banks take concerns about currency substitution by a foreign CBDC very seriously; they consider risks from facilitation of tax avoidance and loss of oversight by domestic authorities due to the use of foreign CBDCs to be especially relevant’.²⁴

Evasion of local capital control regime

The second spillover effect is similar to the aforementioned effect, as it also reveals the local market government’s inability to tackle the foreign CBDC’s impact with its monetary control measures. Some countries remain insistent on enforcing a capital control regime to maintain stable exchange rate and price stability. However, people can carry CBDC with mobile phone wallets and travel to foreign locations, and thus bypass banks’ money transmission channels. This would cast a heavy burden on the local government, as detecting and monitoring the inflow and outflow of the CBDC becomes very difficult. Such an evasion of a local capital control regime, is, of course, not very serious theoretically, because it is only when a large amount of CBDC crosses a country’s borders that the capital control regime really becomes ineffective. We anticipate that in the future, a special border control measure may be applied when travellers pass through customs. The customs officials might ask travellers to declare if they are carrying more than a certain amount of CBDCs or even spot check travellers’ mobile phone and its CBDC wallet when they have a reason to do so. One can imagine that this is a labour-intensive activity, and customs officials might not have the required expertise and training to perform it. This border control measure will also slow down customs clearance.

22 In the CBDC context, this can be called ‘digital dollarization’, which is ‘the risk that use of a foreign currency CBDC may become widespread in a recipient economy, displacing the domestic currency in payments and financial transactions’, in Auer and others (n 4) 7.

23 The typical examples are Venezuela and Zimbabwe, which suffer from hyperinflation. Of course, dollarization could be a result of various reasons, such as local people’s choice over different assets in different currencies or the financial market’s imperfections and failure. For a detailed discussion on dollarization, see E Levy-Yeyati, ‘Financial Dollarization and De-Dollarization in the New Millennium’, FLAR (9 February 2021) <<https://flar.com/en/news/research-financial-dollarization-and-de-dollarization-new-millennium>> accessed 31 October 2021.

24 Auer and others (n 4) 3.

Potential privacy infringements of foreign users of the CBDC

One of the main criticisms of the CBDC is that its design can potentially allow the issuing government to oversee the details of users' daily transactions. Although some literature has proposed designs of the CBDC that can limit or avoid this privacy issue, its threat to privacy remains to be real, especially in countries where surveillance of citizens is a common practice.²⁵ If the design of a CBDC allows its issuing government to ensure the surveillance of its nationals, then it is basically a political and sovereign decision that makes the discussion of privacy issues irrelevant. However, one has to keep in mind that foreigners can also possess a local CBDC, and thus be subject to the issuing government's surveillance. Such a privacy infringement of the foreign users of the CBDC is likely to give the foreigners certain legal claims under the existing privacy protection laws, such as the General Data Protection Regulation (GDPR). This situation will cause tension among the issuing states, foreign users and the users' government. This spillover effect requires multilateral solutions.

Putting the digital yuan into the context of spillover-effect discussion

The development of the digital yuan

It is commonly agreed that China is a leading jurisdiction in CBDC development. Its interest dates back to 2014, when the People's Bank of China (PBC) set up a research group within its organization. In 2017, the PBC established the Digital Currency Research Institute.²⁶ China is the first country to conduct field trials of its CBDC, the e-CNY. In the first half of 2020, the PBC issued 10 million e-CNY (US\$1.4 million) as 'red envelopes' to residents in Shenzhen, Suzhou, Chengdu and Xiongan. Another six cities joined the test in late 2020. The latest trial in Beijing might have intended to prepare for the launch of the e-CNY in the 2022 Winter Olympics.²⁷ The total amount of e-CNY issued has reached 34.5 billion (5.3 billion USD).²⁸

The e-CNY follows a standard double-layered design. The PBC distributes the e-CNY to commercial banks. Then, commercial banks will circulate the e-CNY via various payment platforms. Electronic payment in China is split mainly between two giants: AliPay and WeChat Pay. Each platform is supported by its own banking vehicles: MyBank and

25 For example, Bank of Canada published a research note addressing privacy concerns of CBDC. See S Darbha and R Arora, 'Privacy in CBDC Technology' (*Bank of Canada Staff Analytical Note*, June 2020) <www.bankofcanada.ca/2020/06/staff-analytical-note-2020-9/> accessed 12 August 2021. More recently, the UK chief of electronic intelligence Sir Jeremy Fleming also warned of a 'data trap' created by e-CNY and urged coordination on regulations of CBDC. See R Khalaf and H Warrell, 'UK Spy Chief Raises Fears over China's Digital Renminbi' *Financial Times* (11 December 2021) <<https://www.ft.com/content/128d7139-15d6-4f4d-a247-fc9228a53ebd>> accessed 12 December 2021.

26 Wu Meina (吴美娜), 'Zhongguo Yanfa Yanghang Shuzi Huobi Zhe Wu Nian (中国研发央行数字货币这五年) [Those Five Years of Research and Development of Digital Currency by the Central Bank of China]' *Huan Qiu* (环球) [*Global Times*] (25 July 2019) <<https://tinyurl.com/y4dh7oha>> accessed 12 August 2021.

27 A Kharpal, 'China to Hand out \$6.2 Million in Digital Currency to Beijing Residents as Part of Trial' *CNBC* (2 June 2021) <<https://www.cnbc.com/2021/06/02/china-digital-currency-beijing-to-hand-out-6point2-million-in-trial.html>> accessed 12 August 2021.

28 'China's Digital Yuan Trial Reaches \$5.3 Billion in Transactions' *Bloomberg.Com*, 16 July 2021. <<https://www.bloomberg.com/news/articles/2021-07-16/china-s-digital-yuan-trial-reaches-5-3-billion-in-transactions>> accessed 12 August 2021.

WeBank. Online banking is well-established in China. Commercial banks and state-owned banks have online banking apps. The PBC distributes the e-CNY through end-user interfaces provided by financial intermediaries and electronic payment platforms. As a double-layered structure is established here, the concern about central bank intervention in daily transactions decreases, and the impact of the e-CNY on banks, businesses and ordinary people becomes more important.

As emphasized above, the major change that the CBDC brings is the digitalized payment infrastructure. Nevertheless, the PBC does not provide a payment platform of its own, nor does it design a user interface.²⁹ The PBC leaves the electronic payment platform to private institutions. Commercial firms or banks are free to develop platforms, user interface and relevant services. Financial institutions and electronic payment platforms will compete for customer loyalty in the market. In the meantime, they must abide by PBC standards to accommodate the e-CNY in their applications. Although the PBC has displayed no intention to compete with the commercial platforms, the e-CNY may still pose a challenge to existing platforms. The e-CNY can be transferred to savings accounts without fees, while Alipay and Wechat Pay both charge a fee.³⁰

The exact implementation was unveiled gradually, and many details can change in the near future. In May 2021, the Industrial and Commercial Bank of China (ICBC) tested the e-CNY wallet in its banking app, where users store e-CNY, and conduct transactions. It also supports currency conversion.³¹ Alipay is testing a similar function.³² The e-CNY wallet supports offline transactions. The ICBC's and Alipay's e-CNY wallets allow users to create a completely anonymous wallet. Users can conduct transactions under anonymity, but greater KYC safeguards are needed during peer-to-peer (P2P) transactions. The PBC will not offer interest to the holders of e-CNY, a measure that prevents competition with the CNY savings in commercial banks.³³

The latest development shows that the e-CNY is likely to be stored in a different wallet, but existing wallets on commercial platforms will remain effective. Although these two are both e-money to consumers, CNY stored in electronic form, and e-CNY means different things to financial institutions, and have different KYC requirements. Commercial

29 The PBC released a stand-alone app called 'Digital Renminbi'. It is not publicly available. Users need to install the app via an invitation link during the test period. The app is released by six state-owned banks. Therefore, the PBC has no operating platform available to the public yet.

30 Chen Yanqiao (陳言喬), 'Shuwei Renminbi Shidian Shangjia: Haoyong Dan Zan Buneng Qudai Zhifubao Weixin (數位人民幣試點商家: 好用但暫不能取代支付寶微信) [Digital RMB Pilot Merchants: It's Easy to Use, but Cannot Replace Alipay and WeChat in Short Term]' *Lianhe Xinwenwang* (聯合新聞網) [*United Daily News*] (15 December 2020) <[https:// tinyurl. com/ ybb2odwr](https://tinyurl.com/ybb2odwr)> accessed 28 June 2021.

31 K Le, 'China's Banks Unveil ATM for Foreigners to Use Digital Yuan' (*Forkast*, 4 May 2021) <[https:// forkast. news/ chinas-banks-unveil-atm-for-foreigners-to-use-digital-yuan/](https://forkast.news/chinas-banks-unveil-atm-for-foreigners-to-use-digital-yuan/)> accessed 12 August 2021.

32 Diyi Caijing (第一财经), Shuzi Renminbi Ceshi Shengji: Zhifubao Ruju Weizhong Yinhang Zai Lu Shang (数字人民币测试升级: 支付宝入局 微众银行在路上) [Digital RMB Test Upgrades: Alipay is in the Game and WeBank is on the Way] *Diyi Caijing* (第一财经) [*China Business Network*] (28 June 2021) <[https:// tinyurl. com/ y2255szw](https://tinyurl.com/y2255szw)> accessed 12 August 2021.

33 Recent research shows that interest payments are a primary incentive for people to hold CBDC. M Bijlsma, <[https:// doi. org/ 10. 21 39/ ssm. 3836440](https://doi.org/10.2139/ssrn.3836440)> accessed 12 August 2021. Also see U Bindseil, 'Tiered CBDC and the Financial System' (2021) European Central Bank Working Paper Series N° 2351, Ch 5 <[https:// www. ecb. europa. eu/ pub/ pdf/ scpwps/ ecb. wp2351~c8c18bbd60. en. pdf](https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2351~c8c18bbd60.en.pdf)> accessed 12 August 2021.

platforms used to have more freedom to set their e-money policies. It is still unclear whether the PBC will force commercial platforms to convert all digital money to e-CNY. However, the more stringent regulatory measures of Chinese authorities in recent years indicate that this possibility may not be remote.

In terms of privacy concerns, the policy of the PBC on anonymity became clearer recently. The head of the PBC's Digital Currency Research Institute, Changchun Mu, said that the DCEP would institute a 'controllable anonymity' in China Development Forum 2021.³⁴ The White Paper published by the PBC in July further confirmed this 'controllable anonymity' design.³⁵ 'Controllable anonymity' suggests that user identification is required during e-CNY transactions, but the PBC will not manage the onboarding of users and the KYC process. Mu rejected the idea of a completely anonymous e-CNY, as this would increase the risk of money laundering, financing terrorism and tax evasion. Private intermediaries (eg telecommunications companies) are responsible for collecting and processing the users' ID information. The PBC will only collect phone numbers of the transacting parties, but cannot access their identity.³⁶

The e-CNY allows users to establish different levels of the digital wallet. It enables users to create an anonymous wallet to conduct transactions, but the number and quantity of the transactions are limited. There are, however, more KYC safeguards for conducting larger or more frequent transactions. Users can establish different wallets according to their needs.

The central bank-controlled transaction data still triggers privacy concerns. During the trials, the PBC had full control of the e-CNY issued. This allowed the PBC to analyse big data gathered from daily transactions via e-CNY while user ID remained unknown. Despite the PBC taking measures to ensure user privacy, it remains noteworthy to observe how the PBC will preserve, manage and use the data it collects. So far, the PBC has been dedicated to effective supervision on e-CNY, and claims that the data will help make policies that respond to changes in financial markets, or to general trends in international trade. On the flip side, it suggests that the PBC will retain the data on users' transactions. It increases the risk that the PBC may monitor, or intervene in, transactions.³⁷ This creates concerns for national security and economic espionage.

34 Sun Lulu (孙璐璐), 'Shuzi Renminbi "Qinfan Yonghu Yinsi" Shi Wujie? Sheji "Kekong Niming" Shi Weihe? Lai Kan Yanghang Mu Zhangchun Zuixin Huiying (数字人民币“侵犯用户隐私”是误解? 设计“可控匿名”是为何? 来看央行穆长春最新回应) [Is the Digital Renminbi "Infringing User Privacy" a Misunderstanding? What is the Design of "Controllable Anonymity"? Look at the Latest Response from the Central Bank Mu Changchun]' *Zhengquan Shibaowang* (证券时报网) [Securities Times] (21 March 2021) <[https:// tinyurl. com/ yxqq96af](https://tinyurl.com/yxqq96af)> accessed 12 August 2021; W Zhao, 'PBC Official Says "Completely Anonymous CBDC Is Not an Option"' *The Block* (22 March 2021) <[https:// tinyurl. com/ y2t4rneq](https://tinyurl.com/y2t4rneq)> accessed 12 August 2021.

35 The People's Bank of China, 'Progress of Research & Development of E-CNY in China' (July 2021) <[http:// www. pbc. gov. cn/ en/ 3688110/ 3688172/ 4157443/ 4293696/ 2021071614584691871. pdf](http://www.pbc.gov.cn/en/3688110/3688172/4157443/4293696/2021071614584691871.pdf)> accessed 12 August 2021.

36 C Mu, 'A Conversation With Mu Changchun', <[https:// youtu. be/ 8tmp_ dy- Ba8?t= 1077](https://youtu.be/8tmp_dy-Ba8?t=1077)>, accessed 20 October 2021. Mu emphasizes that phone numbers are collected by telecommunication companies. They cannot provide ID information to PBC or intermediate banks without a warrant from law enforcement.

37 Similar concern was also raised by US regulators. See Waller (n 11). Observing that '[t]he introduction of a CBDC in China, for example, likely will allow the Chinese government to more closely monitor the economic activity of its citizens'.

Digital yuan and transnational monetary flow

The fact that the e-CNY can be converted into other major currencies is a leap forward to its cross-national application. The current development suggests that people can conduct transactions outside China. Mu also said that using e-CNY overseas is no different than domestic transactions.³⁸ But it is still too early to assess its impact on cross-national transactions.³⁹ Even though foreigners can register an e-CNY digital wallet, its use is currently restricted to domestic transactions. There are no corresponding banks overseas that take e-CNY, and e-CNY cannot be converted to Offshore Chinese Yuan (CNH) yet. Therefore, e-CNY is yet to be used in international transactions.

The e-CNY has much potential in the international monetary flow. Some argue that the digital yuan would be a hyper-centralized currency that allows the Chinese government to exert more control over both domestic and international financial transactions.⁴⁰ Some raise the concern that the digital yuan would erode, or directly challenge, the position of the US dollar in trade.⁴¹ Others argue that CBDCs (including e-CNY) simply fulfil central banks' domestic mandates; they are not a tool for geopolitical competition.⁴²

The most prominent scenario is the use of the e-CNY in the commodity trade, including strategic resources. China has already settled the use of the Renminbi (RMB) in its oil trade with Russia and with other countries.⁴³ Many concession loans and development aids are settled in RMB. It is reasonable to believe that e-CNY would flow internationally and become one of the important currencies in many countries.

As China becomes a most important trade partner for most countries, business-to-business (B2B) transactions can be settled using the e-CNY. More Chinese enterprises may prefer their business partners to use the e-CNY. Many argue that the development of the e-CNY will pose a threat to the Society for Worldwide Interbank Financial Telecommunications (SWIFT) system, as it obviates the need for the international transactions of its member banks to verify cross-national transactions.⁴⁴

38 Mu (n 36).

39 Scholars also see that Digital Yuan is likely to be the first major-currency CBDC and its launch will have major international impacts, such as triggering the acceleration and development of similar sovereign projects around the world. A Didenko and others, 'After Libra, Digital Yuan and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems' (2020) European Banking Institute Working Paper Series 65/2020, University of Hong Kong Faculty of Law Research Paper N° 2020/036, UNSW Law Research Paper N° 20–59, 38, <<https://ssrn.com/abstract=3622311>> accessed 12 August 2021.

40 A Kumar and E Rosenbach, 'Could China's Digital Currency Unseat the Dollar?' *Foreign Affairs* (27 October 2020), <<https://www.foreignaffairs.com/articles/china/2020-05-20/could-chinas-digital-currency-unseat-dollar>> accessed 12 August 2021.

41 J Jiang and K Lucero, 'Background and Implications of China's E-CNY', 12–13 <<https://ssrn.com/abstract=3774479>> accessed 12 August 2021.

42 A Carstens, 'Central Bank Digital Currencies: Putting a Big Idea into Practice', 14, 31 March 2021, <<https://www.bis.org/speeches/sp210331.htm>> accessed 12 October 2021.

43 SC Meng, 'Exclusive: China Taking First Steps to Pay for Oil in Yuan This Year—Sources' *Reuters* (29 March 2018) <<https://www.reuters.com/article/us-china-oil-yuan-exclusive-idUSKBN1H51FA>> accessed 12 August 2021; BBC News, 'China Buying Oil from Iran with Yuan' *BBC News* (8 May 2012) <<https://tinyurl.com/y4dqknnf>> accessed 12 August 2021.

44 M Hui, 'The World's Money Transfer System Is China's Achilles Heel in Its Sanctions Battle against the US' *Yahoo Finance* (19 August 2020) <<https://tinyurl.com/y4wz8amu>> accessed 12 August 2021.

The most notable impact would be on the global payment system. The e-CNY provides a simple, efficient, state-backed, interoperable cross-border payment service. It would strengthen the use of QR codes in the payment system, and thus contribute to a global standard for the QR code system.⁴⁵

However, there is a long way to go before the e-CNY can challenge the USD or threaten the SWIFT messaging service. Due to capital controls, foreign banks do not have easy access to or hold RMB. According to the PBC, the amount of global payment denominated in the RMB is 2.42%.⁴⁶ Although more than 70 states include the RMB in their reserve, the amount of RMB as a reserve asset comprises less than 2% of global currency reserves. This suggests that the RMB is not widely circulated, even though China has acquired a significant position in global trade. The PBC has taken more cautious measures on capital control in recent years, pushing the value of the RMB to a relatively low level. The internationalization of the RMB will result in its outflow and more international transactions will create a demand for offshore RMB. The PBC will face pressure to allow the RMB to appreciate—a result it will not necessarily prefer.

The e-CNY will certainly give the RMB a competitive edge due to its convenience, but the expectation that using the e-CNY would facilitate the internationalization of the RMB is unlikely. The scale of the e-CNY's cross-border flow largely depends on the RMB internationalization policy.

Therefore, at least in the short run, the primary objective of the e-CNY in cross-border usage should be to enhance global payments with RMB, not for investments or reserves.⁴⁷ In other words, the spillover effect will be more prominent in transactions among residents and businesses, and among residents and their counterparts in China.

In this case, the e-CNY will not cast immediate challenges to major currencies and offshore financial centres, but it would have direct impacts on the countries that conduct RMB-denominated transactions with China. Of all the RMB cross-border transactions, Hong Kong takes 45%, Singapore takes 10.3%, the countries along the Belt and Road Initiative (BRI) take 14% or 2.73 trillion yuan.⁴⁸ Hong Kong and Singapore are financial centres. RMB digitalization does not bring significant change to daily operations there. The RMB flow with BRI countries, on the other hand, may generate spillover effects. These countries receive loans from China, host Chinese consultants and engineers, and many of them have designated clearing banks to settle their bilateral transactions in RMB. Some studies have confirmed that BRI countries prefer RMB settlement more than the non-BRI

45 J Ekberg and M Ho, *A New Dawn For Digital Currency* (Oliver Wyman 2021) 4 <<https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2021/may/a-new-dawn-for-digital-currency.pdf>> accessed 12 August 2021.

46 SWIFT, 'RMB Tracker: Monthly Reporting and Statistics on Renminbi (RMB) Progress towards Becoming an International Currency' *SWIFT* (February 2021) <<https://www.swift.com/swift-resource/250281/download>> accessed 12 August 2021.

47 N Bilotta and F Botti (eds), *The (Near) Future of Central Bank Digital Currencies*, vol 7 (1st edn, Peter Lang 2021) 159 <<https://doi.org/10.3726/b18087>> accessed 12 August 2021.

48 People's Bank of China (中国人民银行), '2020 Nian Ren Min Bi Guo Ji Hua Bao Gao (2020年人民幣國際化報告) [2020 RMB Internationalization Report]' 59–60 (2020).

countries do.⁴⁹ BRI projects, and their economic relations with China, are the main promoters of RMB settlement. But many BRI countries have another incentive: using the RMB can ease pressure on their foreign reserves, allowing them to cope with debt or currency shock.⁵⁰

To be sure, BRI participants include 140 countries with various economic relations with China. The impact of spillover effects will vary. The e-CNY will most likely have an impact on countries that are located in the vicinity of China, or on countries with close economic/political ties with China. This tentative list includes Pakistan, Myanmar, Laos, Cambodia, Vietnam, Sri Lanka, Kyrgyzstan and Kazakhstan. And even though BRI countries are more likely to accept and circulate the e-CNY in their economies, this does not suggest that they are trying to break away from the dollar system. This is because they are tied to the dollar system; they need USD reserves to maintain economic relations. Pakistan, for example, has struggled to pay off debts denominated in dollars. Its currency swap agreement and RMB clearing with China have helped it ease its shortage of foreign reserves.⁵¹

Challenges arising from the digital yuan: currency substitution

The BRI builds economic relationships between China and loan-receiving countries. The flow of RMB has increased as a result. In addition to concession loans made by Chinese banks, Chinese workers and businesses facilitate the RMB flow to BRI countries. If the e-CNY begins to circulate, Chinese workers are likely to bring e-CNY to local markets. They either convert the e-CNY to local currency, or use the e-CNY directly in the market with other e-CNY holders. Either way, it increases the presence of RMB in these markets. The USD-based cross-national trade is unlikely to be impacted, but local merchants would be more willing to accept the e-CNY. They may expand their business with China to avoid exchange rate risk. The lower exchange rate risk further strengthens trade settled in RMB.⁵² The spread of RMB popularity would be a bottom-up process. China and BRI countries may establish a convenient, efficient CBDC exchange and payment in local markets. As the e-CNY gains popularity, more merchants would use the RMB in their cross-border trade.

If the e-CNY is circulated in foreign markets, perhaps against the PBC's wishes, the BRI countries would have more transactions made in RMB. Many BRI countries have already

49 YC Wang, JJ Tsai and W Chen, 'Factors Affecting Cross-Border RMB Settlement under the Belt and Road Initiative: An Empirical Study Based on Panel Data of 19 Countries (Regions)' (2020) 1629 J Phys Conf Ser <<https://doi.org/10.1088/1742-6596/1629/1/012058>> accessed 12 August 2021.

50 Kanu and others explain the case of Nigeria. See generally Clementina Kanu and others, 'Nigeria and China Bilateral Currency Swap: Perceived Economic Implications and Prospects' (2020) 8 Int J Recent Technol Eng 1880.

51 Eg see DS Randhawa, 'China's Central Bank Digital Currency: Implications for ASEAN' (2020) S. Rajaratnam School of International Studies, 7–8 <<http://hdl.handle.net/11540/13024>> accessed 28 June 2021; BL Louie and M Wang, 'China's Forthcoming Digital Currency: Implications for Foreign Companies and Financial Institutions in China' (forthcoming 2021) J Invest Compliance <<https://doi.org/10.1108/JOIC-04-2021-0017>> accessed 12 August 2021; Bilotta and others (n 47) 159. Observing that 'the launch of DCEP can have significant ramifications on a global scale, as it could reduce China's reliance on the SWIFT system for international banking and offers the first glimpse of the internationalization of the renminbi (RMB).'

52 S Donnenfeld and A Haug, 'Currency Invoicing in International Trade: An Empirical Investigation' (2003) 11 Rev Int Econ 332 <<https://doi.org/10.1111/1467-9396.00386>> accessed 12 August 2021.

received RMB denominated foreign investment. They have a certain amount of RMB reserves under currency swap agreements. These have built an environment for RMB circulation in BRI countries.⁵³ In addition, the BRI projects introduce Chinese workers and the e-CNY they carry. If the e-CNY allows offshore transactions, especially small-scale transactions, local cities and villages are likely to accept the e-CNY. It would then gain significant circulation in the domestic economy. Vendors, blue-collar workers and even white-collar workers may accept e-CNY payment, and use the e-CNY in consumption transactions. This phenomenon would be more salient in areas where Chinese workers carry out construction projects. It can form a dual currency economy where transactions can be denominated in both the fiat currency and the e-CNY.

The e-CNY has two advantages in offshore markets. The first advantage is its payment platform. The e-CNY is a convenient, efficient, and secure payment solution compared to many electronic payment systems developed in BRI countries.⁵⁴ BRI countries would also consider modelling the e-CNY to create their CBDC. This makes their system likely to be compatible with the e-CNY and makes currency exchange more efficient. People in BRI countries may also have more confidence in the e-CNY, given their support for the PBC. Secondly, the RMB is a fairly stable currency. BRI countries usually do not have stable exchange rates. When external economic shock occurs, or the economic prospect looks grim, their currencies fluctuate sharply and hyperinflation may ensue. As currency value falls and inflation ramps up, the purchasing power of ordinary people declines sharply, so local citizens are likely to adopt the e-CNY.

The advantages the RMB enjoys in BRI countries is likely to result in a crowding out effect, or currency substitution, where the fiat currency becomes the less preferred. This effect would be more significant when an external economic shock hits. Currency substitution would also be common in the border cities of China's neighbours or infrastructure project sites in BRI countries.

Challenges arising from digital yuan: weakened capital control

The use of the e-CNY would likely diminish the effectiveness of capital control measures in BRI countries. It becomes easier to move large amounts of e-CNY across borders. The CBDC is easy to carry, and border control finds it difficult to discover the amount of e-CNY in an e-wallet. Foreign direct investment is likely to be unaffected, since investors would need to exchange for local currency. But the underground economy, which is prevalent in border trade, would be hard to detect. Illegal funds can travel quickly in and out of a country, bypassing domestic financial institutions. Since the e-CNY can make transactions offline, it is difficult to restrict transactions made overseas, especially along Chinese borders. It is still unknown how the PBC would limit the use of e-CNY overseas, but it is

53 G Kim, 'Why Is China Going to Issue CBDC (Central Bank Digital Currency)?' (2020) 20(4) J Internet Electronic Comm Res 161 <<https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE09875186>> accessed 12 August 2021.

54 K Foster and others, 'Digital Currencies and CBDC Impacts on Least Developed Countries (LDCs)' (2021) The Dialogue on Global Digital Finance Governance Paper Series, 19 <<https://ssrn.com/abstract=3871301>> accessed 12 August 2021.

foreseeable that foreign countries do not necessarily have the capacity to track the presence of e-CNY and transactions made within their borders.

Challenges arising from the digital yuan: modelling the e-CNY experience and privacy concerns

Modelling behaviour would help the e-CNY to gain popularity across the world. This may be particularly true for developing countries which lack the resources and technology to issue CBDCs. BRI countries, for instance, are likely to adopt the design of the e-CNY due to their close economic partnership with China. The e-CNY is supported by the state-owned banks which provide mature electronic payment systems, ensuring secure and efficient transactions. BRI countries usually lack such a financial infrastructure. They are likely to cooperate with Chinese financial institutions or the PBC to establish their own CBDC and electronic payment systems. Chinese tech giants like Alibaba or Tencent are likely to bring their experience to local financial and telecom companies, creating end-user interfaces for CBDC-receiving countries. The e-CNY would no doubt become more competitive in BRI countries. The potential risk for this development is that no public or private financial institutions (including regulators) in the receiving countries understand or have effective control over the electronic payment system. The receiving countries may still lack the ability to maintain or innovate their payment systems. Their banks may not have sufficient technological readiness and resourceful staff. They may need technology and policy supports from their Chinese counterparts.

The privacy and KYC standards of the e-CNY may apply directly to BRI countries. Although the PBC does not process user ID, the data it possesses could assist the Chinese government to track down transactions it does not welcome. The Chinese law and foreign service could cooperate with their counterparts in BRI countries to track suspicious activities. On the one hand, it increases China's capability to combat global terrorism and corruption. On the other hand, it also gives China the leverage to safeguard its political interests and to attain foreign policy goals. For example, the Chinese government could target transactions that flow into overseas Chinese communities. Hypothetically, it could restrict money flows to targets outside the Chinese borders. If Chinese citizens would send e-CNY overseas to exiled opposition groups, the Chinese law enforcement, with the help of PBC and telecom companies, could mark such transactions as illegal and demand that foreign countries cooperate. Even if the foreign country does not help the Chinese government crackdown on these dissidents, it would be able to cut their financial support related to the e-CNY.

3. Possible policy responses

Policy responses to the cross-border spillover effects can be broadly categorized into three strategies: unilateral, bilateral and multilateral. We rely on both the perspectives of the issuing jurisdiction and the receiving jurisdiction(s) to propose such a categorization. Our

Table 1. Strategies for tackling the spillover effects of cross-border use of CBDC

	Unilateral	Bilateral	Multilateral
Crowding out effect	<ul style="list-style-type: none"> • access control • use-ban • favouring local currency • foreign offline transaction prohibition • border control and wallet monitoring 	<ul style="list-style-type: none"> • foreign offline transaction prohibition • border control and wallet monitoring 	<ul style="list-style-type: none"> • regulatory coordination
Capital control evasion	<ul style="list-style-type: none"> • border control and wallet monitoring 		<ul style="list-style-type: none"> • single clearing institution • multilateral capital control monitoring
Privacy infringement	<ul style="list-style-type: none"> • privacy-by-design* 	<ul style="list-style-type: none"> • coordinated digital ID scheme** 	<ul style="list-style-type: none"> • coordinated digital ID scheme

*Only the issuing jurisdiction could exercise this strategy.

**Bilateral effort might work, but multilateral cooperation would be more effective.

Source: compiled by authors.

proposals and analyses are summarized in [Table 1](#). The following paragraphs will give more detailed elaboration.

Unilateral strategies

Both the issuing jurisdiction and the receiving jurisdiction could adopt unilateral strategies. These strategies do not require the cooperative action of other jurisdictions in the form of technological design or legal requirements. To tackle challenges, various unilateral strategies could be applied.

Preventing currency substitution

Without proper design and management, currency substitution would be a real risk for the receiving jurisdiction as its currency would be displaced by foreign CBDCs. The domestic use of a foreign CBDC in daily transactions could take two nuanced forms: one is domestic use by the domestic citizen, and the other is domestic use by the foreign citizen (ie, the issuing jurisdiction's citizens). The risk could be largely eliminated if the issuing jurisdiction makes its CBDC account-based and requires digital ID.⁵⁵ We call such a

55 BIS, 'CBDCs: An Opportunity for the Monetary System' 85–6 (BIS Annual Report 2021, June 2021) <<https://www.bis.org/publ/arpdf/ar2021e3.pdf>> accessed 12 August 2021.

unilateral strategy by the issuing jurisdiction the ‘access control strategy’. This strategy needs to bundle the issuance of a CBDC with digital ID and build the CBDC on an account-based system.⁵⁶

Of course, the access control strategy would only work if the issuing jurisdiction is willing to adopt it to help prevent currency substitution in the receiving jurisdiction. If the issuing jurisdiction does not actively implement this strategy, then the unilateral strategy the receiving jurisdiction could adopt would be twofold. First, the receiving jurisdiction could prohibit its own citizens’ use of foreign CBDCs domestically. We call this strategy of the receiving jurisdiction the ‘use-ban strategy’. Of course, such a strategy may well be too draconian. Therefore, if with identity-based CBDCs, the issuing central bank can aggregate data to monitor foreign use of its CBDCs and take measures on a gradual basis before imposing a full ban. Second, ‘ensure robust legal tender provisions’ that make the use of the legal tender favoured in domestic transactions.⁵⁷ We refer to this policy action as the ‘local currency favouring strategy’. In addition, a host central bank may also issue its own CBDC or improve its domestic payment system to increase the popularity of its own currency.

The latter type of currency substitution is not a typical dollarization problem, but it could become vivid when the receiving jurisdiction houses a significant population of the issuing jurisdiction’s citizens. Take the e-CNY as an example: If a BRI country such as Kazakhstan has, say, several hundred thousand Chinese residents living and working in it,⁵⁸ and these Chinese residents all have access to the e-CNY, and could use their mobile wallets to conduct offline transactions, those Chinese citizens could create a certain level of crowding out effect on the Kazakh legal tender, the tenge (KZT).

In this scenario, the issuing jurisdiction could employ some technological designs to make offline transactions outside its jurisdiction impossible. We call this the ‘foreign offline transaction prohibition strategy’. The hands of the receiving jurisdiction may be somewhat tied in this situation, but some technology-enabled and regulation-facilitated solutions are possible. First, the receiving jurisdiction could compete with a foreign CBDC by issuing its own CBDC or improving their financial infrastructure. Secondly, the receiving jurisdiction could tackle the issue directly and restrict the use of foreign CBDC within its borders. For example, when foreign citizens cross the receiving country’s border, some border checks or voluntary disclosure requirement could be implemented to record their CBDC wallet IDs and balances. This might sound unusual, but might well be a reality if a country finds good reason to do so, as it is already very common for customs officers to require disclosure of the amount of cash carried by foreign immigrants. In this era of the

⁵⁶ Ibid 86.

⁵⁷ Ibid 87.

⁵⁸ In fact, growing Chinese influence in the country has caused some social unrest and controversy. Eg see RFE/RL’s Kazakh Service, ‘Hundreds Rally in Kazakhstan to Protest Growing Chinese Influence’ (*RadioFree Europe Radio Liberty*, 27 March 2021) <<https://www.rferl.org/a/kazakhstan-almaty-anti-china-rally-arrests/31172559.html>> accessed 12 August 2021.

pandemic, most travellers are tested for COVID-19 at borders. So long as every CBDC wallet is recorded by the receiving country's authorities, it is not technologically difficult for those authorities to work with its telecommunication service providers to implement regular or ad hoc monitoring of noncompliance. We refer to such an institutional solution as the 'border control and wallet monitoring strategy'.

These foregoing five unilateral strategies might work well theoretically, but it is obviously more cost-effective for receiving countries if the issuing country is willing to ensure access control through the design of its CBDC. For example, employing the border control and wallet monitoring strategy could be time consuming and labour-intensive and could be difficult to implement effectively. Therefore, it is expected that strategies requiring bilateral efforts would be more common in the future, when CBDCs become more widely available (Figure 1).

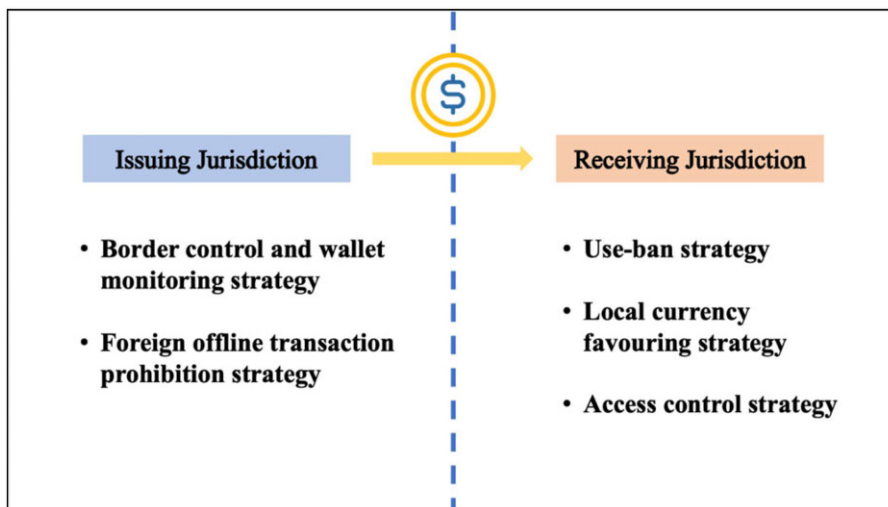


Figure 1. Unilateral strategies for preventing currency substitution. (Source: Created by the authors)

Mitigating weakening effects on capital control measures

As already noted, the receiving country's government may find itself unable to tackle the foreign CBDC's impact on its monetary control measures, especially in the case where a foreign CBDC enters its borders. The unilateral strategy to mitigate such a capital control weakening effect is similar to the abovementioned 'border control and wallet monitoring strategy'. The effectiveness of this strategy is premised on the effective coordination of the receiving country's technological readiness, the professionalism of custom officials and the cooperative efforts of telecommunications companies.

Addressing privacy concerns

Concerns about privacy have been central in discussions of the CBDC.⁵⁹ Most commentators agree that the level of privacy protection largely depends on whether the CBDC adopts a token or account-based access.⁶⁰ Token-based access gives users access to the CBDC 'based on a password-like digital signature using private-public key cryptography, without requiring personal identification'.⁶¹ Such a CBDC would theoretically 'offer good privacy by default',⁶² but subjects the issuing country to money laundering risks which require extra safeguards.⁶³ Account-based access, on the contrary, builds on users' identity verification systems, and generally comes with a digital ID scheme.⁶⁴ That CBDC could potentially allow the surveillance of citizens' transactions by the issuing government, but it also allows effective monitoring of illicit activities.⁶⁵ The account-based CBDC would not necessarily infringe privacy, as the issuing country could design a proper payment authentication process.⁶⁶ In addition, account-based access could be embedded in a double-layered, indirect CBDC architecture under which commercial banks help onboarding users and conduct KYC procedures or even record retail balances and transactions. Under an indirect CBDC architecture, central banks and commercial banks could collaborate to ensure privacy safeguards for every retail user. This also applies to any CBDC design that involves private sector payment service providers.

The foregoing analysis underscored the nature of possible strategies for addressing privacy concerns. Those strategies are technology-enabled and authentication-process dependent. For the issuing jurisdiction, such strategies could protect users' privacy by their adequate architecture and access designs. This approach is unilateral in nature and could be referred to as the 'privacy-by-design strategy' (Figure 2). For the receiving country, privacy concerns typically arise when its citizens use the issuing country's CBDC, and therefore cause personal data and transaction information to be leaked to unauthorized parties. The receiving jurisdiction would find it difficult to resolve this problem on its own. Bilateral efforts are more desirable.

Bilateral strategies

Preventing currency substitution and ensuring capital controls

In 'Unilateral strategies' section, we listed five unilateral strategies for preventing the cross-border spillover effect of currency substitution, and noted that two of these strategies might be implemented more effectively if bilateral coordination exists. They are 'the

59 Eg see T Mancini-Griffoli and others, 'Casting Light on Central Bank Digital Currency', 20, IMF STAFF DISCUSSION NOTE (November 2018), <<https://www.imf.org/-/media/Files/Publications/SDN/2018/SDN1808.ashx>> accessed 28 June 2021; Darbha and Arora (n 25).

60 See Auer and Bohme (n 2) 93–5.

61 BIS (n 55) 72.

62 Auer and Bohme (n 2) 94.

63 Ibid.

64 BIS (n 55) 73.

65 Ibid.

66 Ibid 72.

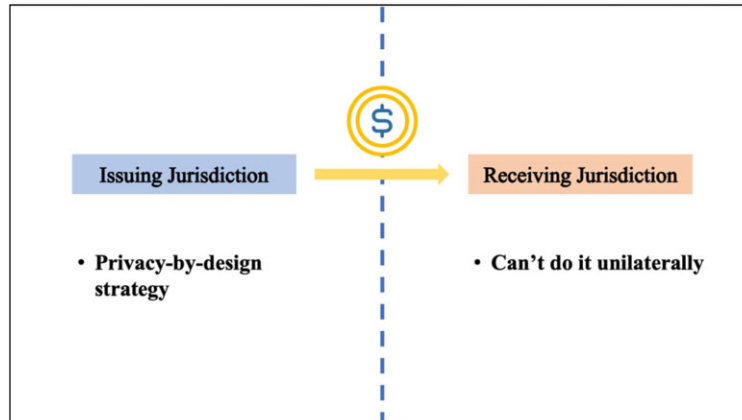


Figure 2. Unilateral strategies for addressing privacy concerns. (Source: Created by the authors)

foreign offline transaction prohibition strategy’ and ‘border control and wallet monitoring strategy’.

The nature of these two strategies is basically the same, regardless of whether they are implemented unilaterally or bilaterally. Nevertheless, we argue that a bilateral framework would facilitate information exchange and refine the effectiveness of these strategies with iterations. We argue that both the issuing and receiving jurisdictions should adopt an approach like FinTech MoUs to enhance bilateral collaboration.⁶⁷ Since 2016, many financial regulators around the world have taken to signing FinTech MoUs on a bilateral or even multilateral basis.⁶⁸ The first FinTech MoUs were executed by the Financial Conduct Authority of the United Kingdom and by the Australian Securities and Investment Commission⁶⁹ in March 2016.⁷⁰ In addition to functions such as information sharing and exchange typically provided by MoUs, FinTech MoUs usually contain provisions that set forth referral mechanisms, which allow an issuing jurisdiction to refer industry players it deems qualified to apply for resources provided by the hosting jurisdiction, such as regulatory consultation, or access to government-sponsored innovation hubs and accelerators.⁷¹

FinTech MoUs help facilitate financial innovations that may potentially benefit both jurisdictions and deepen regulatory collaboration beyond the traditional information exchanges. The CBDC is also one form of financial innovation which could potentially bring positive and negative effects on the jurisdictions where it is in circulation. We believe

67 Li Xiaonan, ‘Regulatory Response to Cross-Border Payment Using Blockchain Global Economic Governance’ (2020) 10(2) J WTO China 95, 109–10 <<https://heinonline.org/HOL/LandingPage?handle=hein.journals/jwtoch10&div=15&id=&page=>>> accessed 12 August 2021.

68 According our preliminary survey, there are at least 36 FinTech MoUs around the world (statistics on file with the authors).

69 L Bromberg, A Godwin and I Ramsay, ‘Cross-border Cooperation in Financial Regulation: Crossing the Fintech bridge’ (2018) 13 Cap Markets L J 59, 71. Observing that ‘[f]intech MoUs are a very recent phenomenon—the first one was signed by ASIC and the FCA in March 2016’.

70 Financial Conduct Authority (FCA), ‘Innovation Hubs Co-operation Agreement between FCA and ASIC’ <<https://www.fca.org.uk/publication/mou/fca-asic-cooperation-agreement.pdf>> accessed 12 August 2021.

71 See Bromberg, Godwin and Ramsay (n 69) 72–3.

that a FinTech MoU-like bilateral regime would help central banks and the relevant authorities concerning the CBDC not only to conduct regulatory coordination, but also to learn together how to adapt legally and institutionally as the CBDC evolves.

Addressing privacy concerns

The level and variety of privacy concerns, as noted during our unilateral strategy discussion, largely depend on how the architecture of a CBDC and its access mode are designed. These concerns generally require technological solutions enabled by sensibly designed Digital ID and KYC schemes. Bilateral coordination could help facilitate such a scheme, but may not be the most effective solution. When CBDCs become widely circulated, better ID and KYC schemes lie in multilateral coordination; otherwise, the need for interoperability would become another urgent issue requiring extra policy discussions. We therefore leave strategies to address privacy concerns where multilateral strategies and the mCBDC are analysed.

Multilateral strategies

A multilateral strategy builds on the agreements among states. The governance of the CBDC is not necessarily a global regulatory regime. It could be confined to several countries that have a similar level of development progress and technological infrastructure. Multilateral cooperation should focus on the interoperability of CBDCs, and on information exchange among states. States also need to strike a balance between protecting user privacy and combating illicit activities.⁷² More importantly, they would need to identify and deter CBDC whose design may cause instability in global financial systems.⁷³

Central banks around the world, especially major countries, have worked closely on CBDC.⁷⁴ Several multilateral organizations have paid attention to the CBDC over the past few years, including the BIS (CPMI), the G20 (FSB) and the World Bank. In addition to CBDC's design and domestic impact, they tried to address the cross-border transaction using CBDC. The BIS's 2021 annual report, for example, proposed a multilateral CBDC (mCBDC) to facilitate cross-border interoperability.⁷⁵ Their recommendations include three models.⁷⁶ At minimum, states should enhance CBDC compatibility, establish private correspondence and clearing services, and coordinate identification schemes. The second

72 Similar multilateral efforts in the governance of global finance include International Organization of Securities Commissions (IOSCO)'s efforts in pushing for the MMoU (Multilateral Memorandum of Understanding Concerning Consultation and Cooperation and the Exchange of Information) with the aim to enhance information provision and investigation cooperation regarding securities crimes.* IOSCO, 'Multilateral Memorandum of Understanding Concerning Consultation and Cooperation and the Exchange of Information (MMoU)' <<https://www.iosco.org/about/?subsection=mmou>> accessed 12 August 2021.

73 SL Schwarcz, 'Regulating Digital Currencies: Towards an Analytical Framework' (forthcoming 2021) 102 Boston Univ L Rev 42 <<https://ssrn.com/abstract=3775136>> accessed 12 August 2021. Countries may also adopt peer review such as 'algorithm audit', see Li (n 67) 106.

74 BIS, Central banks and the BIS explore what a retail CBDC might look like, press release <<https://www.bis.org/press/p210930.htm>> accessed 21 November.

75 R Auer, P Haene and H Holden, 'Multi-CBDC Arrangements and the Future of Crossborder Payments' BIS Paper N° 115 <<https://www.bis.org/publ/bppdf/bispap115.pdf>> accessed 12 August 2021; BIS (n 55) 87–90.

76 BIS, *ibid* 90.

model requires states to establish shared CBDC interfaces so they could recognize one another's ID schemes. The most integrated mCBDC uses a single platform and a shared payment system.⁷⁷

The BIS research reveals several key components of cross-national cooperation on the CBDC, including identification schemes, payment system compatibility, technical infrastructure compatibility, clearing mechanisms and domestic regulatory standards.⁷⁸ States may increase their mCBDC cooperation gradually. They would focus primarily on the application of CBDC in their own market, but they need to coordinate with other countries before they issue CBDCs if they want to cope with the problems that emerge in cross-border transactions. Therefore, states should consider multilateral cooperation at an early stage.

International cooperation has emerged in several global standard-setting bodies, but many regulatory issues concerning cross-border CBDC need to be discussed and coordinated. The standard-setters could provide the platform for CBDC governance. Consensus may be reached starting from a few central banks. Their consensus could then be adopted by other countries. It is important to involve the major economies during the formation of a global standard, since their currencies are widely circulated and served as major sources of reserves. Central banks have tested cross-national CBDC models such as the mCBDC, Bridge and Project Dunbar.⁷⁹ These findings no doubt serve as the foundation for multilateral cooperation. If central banks are willing to take preventive measures before they issue CBDCs, they would significantly mitigate the challenges discussed in this article.

Preventing currency substitution

Infrastructure compatibility is the utmost concern in a response to a currency substitution. The problem of currency substitution is in the fact that it does not matter whether a country has the CBDC. It is important that the receiving jurisdiction has the ability to manage the circulation of the foreign CBDC in its economy. The receiving jurisdiction does not necessarily need to have a compatible or interlinked system with foreign countries. It relies greatly on the issuing jurisdiction's system. They could work on common technological restrictions to limit the use of the CBDC in foreign countries. This does not require a full ban on using the CBDC in foreign countries. The issuing jurisdiction could limit the amount and frequency of CBDC transactions in foreign countries. It could introduce further restrictions if the receiving jurisdiction suffers a currency crisis or hyperinflation.

To discourage the formation of an economy that uses the foreign CBDC within a state, governments could reach a consensus on their regulation concerning the overuse of the CBDC beyond borders. A convenient and reliable currency exchange platform would be essential to achieve this. Tourists, short-term workers and business people would need a

77 Ibid 88–9.

78 Ibid 87–90.

79 BIS, 'Project Dunbar: International Settlements Using Multi-CBDCs' <<https://www.bis.org/about/bisih/topics/cbdc/wcbdc.htm>> accessed 12 August 2021.

convenient and secure way to exchange their CBDCs for local currency even if the receiving jurisdiction does not have a CBDC. Multilateral cooperation on CBDC regulation could cope better with the currency substitution problem. A CBDC with few or no restrictions on cross-border transactions would be more likely to circulate in foreign countries than CBDCs with more restrictions.

On the other hand, issuing jurisdictions could help the receiving ones set up domestic regulations to prevent currency substitution. Knowing that they are at risk of dollarization effects, receiving jurisdictions could regulate when and where the foreign CBDC is allowed. The issuing jurisdiction may have a more lenient policy on foreign CBDCs in places where the foreign CBDC is likely to circulate—for instance, tourist spots, major construction sites, harbours, border cities or special economic zones. The receiving jurisdiction could cooperate with local merchants and issuing jurisdictions to track the amount of foreign CBDC circulated in these places. They may also set regulations about foreign CBDC circulation in their own economies. International coordination could tackle this problem more effectively. We call the abovementioned measures the ‘regulation coordination strategy’.

Mitigating weakening effects on capital control measures

In addition to the domestic regulatory measures discussed above, the challenge of capital controls needs a technological solution. States must be able to detect or be informed about CBDC flows in and out of their countries, bypassing traditional check points. Traditional capital control measures of the domestic financial system and its border areas would no longer be effective. Central banks would rely on multilateral cooperation to obtain information about the unregistered flow of capital. States would need to rely on other states to control their CBDC flows as well. However, this multilateral cooperation is inherently difficult, since each state has different capital control measures. They do not necessarily want to help other states to optimize their capital controls. The issue of capital control could therefore be a point at issue for linkage. States may offer help with capital control in exchange for other international cooperation.

A single clearing agency would help governments to acquire capital movement information and thereby pick up capital flows that may destabilize the local currency. We may refer to this as the ‘single clearing institution strategy’. However, a single clearing institution is not one step ahead. During the initial period, states may rely on multiple clearing agencies to process cross-border transactions. The compatibility and transparency of these institutions would be the main issue in multilateral discussions.

If a central bank wants to discourage currency speculation, it needs to know the activities of major traders in the foreign exchange market or in the retail market. A compatible ID scheme would be particularly important here. Central banks may exchange information on suspected currency speculation activities. They also clarify unreported CBDC movements in a country’s capital market. Information *per se* does not necessarily reveal the identity of the traders, but it reveals the magnitude and frequency of their trades. A bilateral strategy may be more effective, but a multilateral one is still possible if several states

share a common interest in monitoring suspicious capital flows, especially when the flows come from a common source. Such efforts could be referred to as the ‘multilateral capital control monitoring strategy’.

Addressing privacy concerns

CBDCs’ infringement of privacy is perhaps the most controversial issue that needs to be tackled by multilateral solutions. This issue is directly related to the confidence of CBDC users.⁸⁰ A CBDC that could not guarantee user privacy would bring an adverse effect on its cross-border use. Credibility in this matter is hard to establish, because a CBDC is under the full control of the central bank. Any central bank could set weak privacy protection standards or violate the privacy protection commitments of its government, if it so desires. If a central bank follows a multilateral standard on privacy requirements, it could better eliminate concerns about itself among users within and beyond its borders.⁸¹ Multinational discussion among central bankers or high-ranking government officials should start early, so that each state could build up the technology necessary to fulfil the agreed requirements before it officially circulates the CBDC internationally.

Multilateral cooperation may begin by building a common guideline for KYC requirements. Full anonymity in cross-border transactions is likely to be rejected by states, since most agree that the CBDC should prevent illicit activities.⁸² However, states also have to pledge privacy protection in order to make the CBDC the equivalent of cash. A stratified KYC requirement would resolve this problem. This stratified standard applies only to the currency exchange between any two CBDCs. States would require identification information if the transaction is above a certain amount or frequency. The standard could require more scrutiny if the transaction flows to countries under UN sanctions. States would make known to users the information registered during a transaction, and how governments would use such information. Governments should retain the authority to trace the flow of the CBDC, but a transaction should not reveal the individual identity, or the purpose of the transaction, unless either is required for security reasons.

States would need to coordinate on ID systems and currency clearing mechanisms. They would also need to establish a shared correspondent and clearing system, like the ‘model 1 mCBDC’ proposed in the BIS report.⁸³ The system could be a private institution providing global public goods if its neutrality and fairness is endorsed by the participating states. The correspondent and clearing system process is the informant about cross-border CBDC flow. They cooperate with states to conduct investigations of AML or Countering

80 NN Atako, ‘Privacy beyond Possession: Solving the Access Conundrum in Digital Dollars Notes’ (2021) 23(4) *Vanderbilt J Entertainment & Technol Law* 821, 826–7.

81 A similar multilateral standard on privacy rules is the Cross-Border Privacy Rules System of The Asia-Pacific Economic Cooperation (APEC CBPR). For an introduction, see APEC, ‘What is the Cross-Border Privacy Rules System?’ (APEC, 15 April 2019) <<https://www.apec.org/about-us/about-apec/fact-sheets/what-is-the-cross-border-privacy-rules-system>> accessed 15 August 2021.

82 A recent report by Goldman Sachs also shares the similar view. See I Kaminska, ‘Why CBDCs will likely be ID-based’ *Financial Times* (5 May 2021) <<https://www.ft.com/content/88f47c48-97fe-4df3-854e-0d404a3a5f9a>> accessed 15 August 2021.

83 BIS (n 55) 88.

the financing of terrorism (CFT) cases.⁸⁴ States should also consider the punishment suitable for abusers of the system.

A mutually recognizable ID system is the foundation of cross-national cooperation on the illicit use of CBDCs. States would need to work together to set up a common standard to register, preserve and access personal information. This does not suggest a common database for all CBDC users. Rather, each state would manage its own ID system, but the design of such a system would allow for compatibility between the states. We call this the ‘coordinated digital ID scheme strategy’. Cooperation on the ID system could be a gradual process in which states need initially only to achieve compatibility between their systems. Once that is achieved, they could decide whether it is necessary to further integrate their ID systems.

4. Conclusion

The CBDC is not just an idea. Its viability has become real and its popularity is no longer a remote theoretical construct—we have seen many active discussions of it internationally. Nevertheless, the current literature on this subject still concentrates on the implications of the CBDC for the issuance of sovereign states’ monetary and macroprudential policies, institutional infrastructure, legal mandates and technical designs through which the CBDC could be issued and distributed. The cross-border spillover effects arising from the launch of the CBDCs are little discussed. A CBDC, such as the e-CNY, issued by the world’s second-largest economy, undoubtedly deepens cross-border concerns, and requires trenchant scholastic review. Accordingly, this article examined the cross-border spillover effects of the domestic CBDC, concentrating on the Chinese e-CNY, and the foreign sovereign state’s monetary stability, capital control measures and privacy concerns.

We identified three main spillover effects a CBDC may introduce to its receiving jurisdictions: ‘the crowding out effect on local currency; the evasive effect on the receiving country’s capital control regimes; and the potential privacy-infringing effect on foreign users of the CBDC’. In response to the challenges posed by these three effects, we proposed a framework composed of unilateral, bilateral and multilateral considerations through which policymakers and regulators could develop strategies to tackle these spillover effects.

For ‘unilateral efforts’, we proposed six strategies to address the various challenges: the ‘access control strategy’; the ‘use-ban strategy’; the ‘local currency favouring strategy’; the ‘foreign offline transaction prohibition strategy’; the ‘border control and wallet monitoring strategy’; and the ‘privacy-by-design strategy’. To better address the spillover concerns raised, States could engage in ‘bilateral efforts’ to effectuate the foreign offline transaction

84 In such a scenario, AML/CFT guidance and requirements made by the Financial Action Task Force (FATF) are likely to be referred and observed. Such guidance and requirements include but are not limited to FATF, ‘the FATF Recommendations’ (Updated June 2021) <<https://www.fatf-gafi.org/media/fatf/documents/recommendations/pdfs/FATF%20Recommendations%202012.pdf>> accessed 15 August 2021; FATF, ‘Guidance on Proliferation Financing Risk Assessment and Mitigation’ (June 2021) <<http://www.fatf-gafi.org/media/fatf/documents/reports/Guidance-Proliferation-Financing-Risk-Assessment-Mitigation.pdf>> accessed 15 August 2021.

prohibition strategy and the border control and wallet monitoring strategy. For ‘multilateral efforts’, we highlighted the importance of mCBDC models, and proposed four strategies that could complement mCBDC arrangements in the future: the ‘regulation coordination strategy’; the ‘single clearing institution strategy’; the ‘multilateral capital control monitoring strategy’; and the ‘coordinated digital ID scheme strategy’.

As we argued in the Introduction to this article, the spillover effect has an ‘externality-generating aspect’ and an ‘integration-facilitating aspect’. This article identifies the challenges resulting from the externality-generating aspect, but proposes strategies with the potential to manifest the integration-facilitating aspect. All the unilateral, bilateral and multilateral strategies are driven by the externality-generating aspect of cross-border uses of CBDCs; but it can also, surprisingly, lead to collaboration involving governments, experts, interest groups and international organizations. It could even facilitate regional integration.

The discussion also suggests that governments would have to collaborate on multiple issues to cope with the spillover effects. In accordance with neo-functionalism, this could lead to a series of regulatory harmonization. International relations scholars like Ernst B. Haas suggest that certain institutionalized mediators (eg, experts, supranational institutions) may uphold common interests and enable compromises among different nation-states.⁸⁵ In other words, the spillover effect we discuss here could be understood as a catalyst of transnational financial integration, where governments may seek international cooperation to ease negative impacts. The impact of the cross-border effect is encompassing, and this may propagate transnational cooperation from one issue area to another. The spillover effects may lead to coordinated, if not integrated, actions in clearing mechanisms, payment systems, digital privacy and internet security. To coordinate the interests of states, and to build up technological professionalism among financial regulators, we argue that financial intermediaries, experts, academics, regional interest groups and international organizations would play significant roles to facilitate cross-border regulatory harmonization.

It is beyond the scope of this article to thoroughly analyse the pros and cons of each proposed strategy. Nor did we intend to predict the future uses or the possible developments of CBDCs. We aimed to identify spillover concerns that would require cross-border coordination and integration, and to offer this article as an early start of what we hope will become a serial scholastic and policy-making research subject.

85 Neo-functionalism is a widely accepted theoretical framework in analysing regional integration. It argues that cross-national cooperation emerges as states find a common interest to work together. The institutionalized cooperation in one issue area may ‘spillover’ to other areas since states realize the benefit of further integration. To understand more about the spillover effects in the context of international relations, see also D Mitrany, *Functional Theory of Politics* (St Martin’s Press 1975); E Haas, *Beyond the Nation-State—Functionalism and International Organization* (Stanford University Press 1968 reprinted version) 455–8.