The Political Economy of Central Bank Digital Currencies:

What Factors Influence Their Design?

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An Honours Thesis in Partial Fulfillment for the

Bachelor of Social Science (Honours) Degree

Presented to

The Department of Political Science

Global Studies Programme

National University of Singapore

Academic Year 2022/2023

ACKNOWLEDGEMENTS

I am grateful to the people who have supported me in making this endeavor possible:

To Dr. Kim Soo Yeon, thank you for your advice that pushed me to think deeply about the issues my paper discusses.

To my parents, I could not have undertaken this journey without your love and provision.

And to Jeremy, Jacyline, Bena, and Chermaine, who live and breathe aspiration and thoughtfulness, thank you for all your encouragements.

ABSTRACT

In recent years, central banks around the world have embarked on projects to develop Central Bank Digital Currencies (CBDC). Even though CBDC issuance seems like global phenomenon, the design of individual CBDCs vary according to national context and the interests of central banks. My paper investigates the factors in a country's political economy that influences the design of CBDCs. Conducting a multiple case study research of 7 countries who have fully issued or are in the late pilot stage of CBDC issuance, I discover two significant trends. Firstly, central banks choose cross-border interoperability to improve remittance costs and currency stability, and to strengthen enforcement of foreign exchange and capital controls. And secondly, a central bank's decision to allow partial user anonymity in CBDC transactions stems from the lack of political will to strengthen the domestic AML/CTF regime. Implications of these findings on the public, the domestic financial sector, domestic governance, and international financial governance are further discussed.

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ABBREVIATIONS

AML/CTF	Anti-Money Laundering and Counter Terrorism Financing
BOG	Bank of Ghana
BOJ	Bank of Jamaica
CBB	Central Bank of Bahamas
CBC	Central Bank of Cambodia
CBDC	Central Bank Digital Currency
CBN	Central Bank of Nigeria
ECCB	Eastern Caribbean Central Bank
FX	Foreign Exchange
KYC	Know-Your-Customer
ML/TF	Money Laundering and Terrorism Financing
PBOC	People's Bank of China

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CHAPTER 1: INTRODUCTION

Central banks around the world are embarking on projects to issue digital versions of their notes and coins, known as Central Bank Digital Currencies (CBDCs). Global CBDC issuance is still in its infancy – till date, of the 79 countries who are researching CBDC development, there are only five fully launched CBDCs. Despite being a recent emergence, Central Bank Digital Currencies (CBDCs) draw its roots from its older cousin – cryptocurrency. Not only are CBDCs inspired from blockchain[1] (which is the same technology that cryptocurrency popularized), CBDCs are also thought to be developed in response to the threat that cryptocurrency poses to governments. Before diving into CBDCs, it is first useful to understand how cryptocurrency came to be popular.

From a macro-perspective, widespread cryptocurrency adoption is a by-product of economic globalization. Greater global interconnectivity drives the diffusion of technological innovations and fuel demand worldwide for mediums to facilitate cross-border transactions and capital investments. The first cryptocurrency, Bitcoin, originated in Japan in 2009 and rose to meet global demand for cheaper, quicker, and more transparent methods of making payment and investments[2]. Other cryptocurrencies emerged following the success of bitcoin, contributing to

[1] Blockchain is also commonly known as Decentralized Ledger Technology (DLT).

[2] Cryptocurrency offer several advantages over fiat currency or digital payments offered by commercial banks. Firstly, cryptocurrency may offer lower transaction fees and faster transaction speed as compared to transactions mediated by financial intermediaries, making them more efficient as a means of payment. Secondly, the protocol of cryptocurrency is typically available on open-source platforms and are available for inspection by third-parties. So as a decentralized cryptocurrency, they are perceived to be more resilient against political manipulation and other third-party interference. Lastly, cryptocurrency offers anonymity, enabling stronger personal data protection.

the global marketplace and worldwide adoption of cryptocurrencies[3]. Global adoption of cryptocurrency is not consistent, however, and differs by country. National cryptocurrency adoption rates are affected by local factors such as confidence in the official fiat currency[4] and social attitudes towards cryptocurrency[5].

As cryptocurrency permeate into the economies of nation-states, it threatens the traditional dominance of fiat currency, and governments face legislative challenges in handling cryptocurrency's disruption to economic stability and facilitation of crime. Widespread substitution of official fiat currency by cryptocurrency (and stablecoins[6]) threatens the efficacy of monetary policy[7]. For instance, cryptocurrency offers an avenue of capital flight upon the raising of interest rates[8]. Also, the user anonymity that cryptocurrency usage confers encourage its use in illegal activity like scams, money laundering and tax evasion[9]. In fact, it is estimated

[3] Like how there exists numerous fiat currencies that are backed by different governments, there are many cryptocurrencies too, each running on different protocols. The term 'cryptocurrency' can take both singular and plural form. Use of the term 'cryptocurrency' shall henceforth refer to the plural form.

[4] Hendrickson, Hogan, and Luther. "Political Economy of Bitcoin", *Economic Inquiry* 54 no. 2 (2015): 937, https://doi.org/10.1111/ecin.12291.

[5] Schaupp and Festa. "Cryptocurrency adoption and the road to regulation". In *Proceedings of the 19th Annual International Conference on Digital Government Research*: Governance in the Data Age (2018): 7, doi:10.1145/3209281.3209336

[6] While cryptocurrencies are conventionally decentralized and volatile in price, Stablecoins are a type of cryptocurrency that are issued and backed by a private entity (i.e., firms), who pegs the price of the stablecoin to the backing asset, making it more stable in value and appealing as a mode of payment and store of value.

[7] Claeys, Demertzis, and Efstathiou. "Cryptocurrencies and Monetary Policy", *Bruegel Policy Contribution*, no. 2018/10 (2018): 8-10, Bruegel, Brussels, http://hdl.handle.net/10419/208013.

[8] Nguyen et al. "Asymmetric Monetary Policy Effects on Cryptocurrency Markets". *International Business and Finance* 48 (2019): 335-339, ISSN 0275-5319

[9] Selimovic et al. "Cryptocurrency – Advantages, Disadvantages, Determinants: Case of Bitcoin". *Sarajevo business and economics review* 39 (2021): 132, http://libproxy1.nus.edu.sg/login?url=https://www.proquest.com/scholarly-journals/cryptocurrency-advantages-disadvantages/docview/2669640064/se-2.

that ¼ of bitcoin users are involved in illegal activity, which makes up 46% of all bitcoin transactions[10].

Given the risks and criminality associated with cryptocurrency, central banks globally look to regulate its use[11], but face a dilemma in doing so. A blanket ban discourages innovations in blockchain technology[12], dampening the development of the domestic fintech industry. Furthermore, if regulations are too strict, investors may flight from centralized exchanges to risky, decentralized, and anonymous peer-to-peer trading venues to escape from regulation[13]. On the other hand, a light regulatory regime risk granting legitimacy to cryptocurrency, potentially fueling its use[14]. It is against this backdrop – the advent of blockchain technology, the demand for more efficient means of payments, the decline in the use of fiat currency, and the dilemma in regulating cryptocurrency usage – that CBDCs are being developed.

Even though CBDC issuance is seemingly global, the design of individual CBDCs will be subjected to central banks' interests and jurisdictional contexts. My paper hence seeks to ask: what are the factors, in a country's political economy, that influence the design of CBDCs? This investigation is significant owing to the potential worldwide reach of CBDCs. Nuances in its design alters the way people around the world perform financial transactions. On the policy

[10] Foley, Karlsen, and Tālis. (2019). "Sex, drugs, and bitcoin: How much illegal activity is financed through cryptocurrencies?", *The Review of Financial Studies* 32, no. 5 (2019): 1798-1853, https://doi.org/10.1093/rfs/hhz015

[11] Krivoruchko, Ponamorenko and Nebera. "Central Bank Policy and Cryptocurrencies", *Journal of Reviews on Global Economics* 7 (2018): 549-561, ISSN: 1929-7092/18.

[12] Nabilou, Hossein. "How to regulate bitcoin? Decentralized regulation for a decentralized cryptocurrency", *International Journal of Law and Information Technology* 27 (2019): 29, doi: 10.1093/ijlit/eaz008

[13] Sauce. "The unintended consequences of the regulation of cryptocurrencies". *Cambridge Journal of Economics* 46, no. 1 (2022): 57-71, https://doi.org/10.1093/cje/beab053

[14] Sauce, 68

front, my paper also provide insight on how central banks may design CBDCs to be effective instruments for furthering policy goals. My paper also urges central banks to look beyond its domestic contexts; to access the implications of bilateral cooperation and international financial governance on the success of their CBDC issuance.

CHAPTER 2: LITERATURE REVIEW

The following literature review discusses scholarship on CBDCs – its definitions, benefits, risks, design elements, and empirical gaps.

2.1 Definitions

CBDCs are generally understood to be electronic money issued and backed by central banks. However, nuances in its definition appear to change quickly overtime according to the pace of technological developments. Earlier studies define CBDCs as state-issued cryptocurrency that run on blockchain[15]. When stablecoins[16] became prominent in the cryptocurrency landscape, it became more suitable to specify that CBDCs are stablecoins, given that the values of CBDCs are pegged to fiat currency[17]. As central banks began to publish reports that outline the design of their CBDCs, it became evident that several central banks were deviating from the use of blockchain. The definition of CBDCs then took a broader turn; defined more broadly as a digital means of payment through transactions recorded by the central bank[18], or more simply, an electronic version of fiat money[19].

[15] Bech and Garratt. "Central Bank Cryptocurrencies". *BIS Quarterly Review*, September (2017): 56, https://ssrn.com/abstract=3041906.

[16] Refer to footnote 6 for a description of stablecoins.

[17] Dell'Erba. "Stablecoins in Cryptoeconomics from Initial Coin Offerings to Central Bank Digital Currencies" *New York University Journal of Legislation and Public Policy* 22, no. 1 (2019): 38-39, https://ssrn.com/abstract=3385840.

[18] Fatas and Weder. "Cryptocurrencies' challenge to central banks", *Vox CEPR Policy Portal* (2018). https://voxeu.org/article/cryptocurrencies-challenge-central-banks.

[19] Solberg and Benhayoun. "Household acceptance of central bank digital currency: the role of institutional trust", *International Journal of Bank Marketing* 40, no. 1 (2022): 172, https://doi.org/10.1108/IJBM-04-2021-0156.

There are two types of CBDCs - wholesale and retail. The use of wholesale CBDCs is restricted to financial institutions who hold reserve deposits in the central bank and is intended to facilitate inter-bank transactions. Retail CBDCs, on the other hand, are intended for the public to use and would be the digital equivalent of today's notes and coins. Retail CBDCs are more disruptive to the financial landscape - while wholesale CBDCs are an improvement over existing inter-bank digital payment systems, retail CBDCs represent the first-ever attempt by central banks globally to digitalize fiat currency, and its widespread use by the public implicates more risks and benefits. This paper focuses on retail CBDCs, and use of the term 'CBDCs' shall henceforth refer solely to the retail type.

2.2 Benefits

The enthusiasm of central banks to issue CBDCs is no wonder given the benefits they confer: increased financial inclusion, strengthening of monetary and fiscal policy, strengthening of currency as a symbol of national pride, and a safeguard against the failure of private currencies.

Financial inclusion is the most popular reason among central banks for CBDC issuance. For countries with a high unbanked population and high cash usage, CBDCs enable central banks to directly provide access to affordable financial services[20]. Additionally, because the central bank serves as a viable alternative to bank deposits, CBDCs may discipline the behavior of oligopolistic banks by compelling them to adjust interest rates and qualifying requirements on

[20] Ulrich. "Central Bank Digital Currency: Financial System Implications and Control", *International Journal of Political Economy* 48, no. 4 (2019): 305, doi:10.1080/08911916.2019.1693160

deposits [21], making financial services offered by commercial banks more attractive and affordable.

CBDCs also act as an additional instrument to conduct monetary and fiscal policy. Unlike cash, CBDCs are not limited to a zero-lower bound interest rate, allowing a central bank to issue interest on CBDC holdings to gain more leverage to dampen inflation[22]. CBDCs also strengthen the efficacy of fiscal policy by enabling quicker monetary relief to be issued directly to the CBDC accounts of specific groups of people[23].

Strengthening the use of a national currency is another benefit of digitalizing fiat currency. A national currency serves as a source of national pride and a symbol of sovereignity; its daily usage an instrument to foster nationalism[24]. A national currency also protects a state's economy and policy autonomy from foreign influences, by ensuring that an issuer of a foreign currency is not able to wield economic coercion because of currency dependency[25]. However, the growing proliferation of digital privately-issued monies (i.e. cryptocurrency) replaces the use of national currencies and poses a threat to the authority of states. By digitalizing fiat money through CBDCs, states retain the relevance of its national currency and promote its circulation.

[21] Jun and Yeo. "Central bank digital currency, loan supply, and bank failure risk: a microeconomic approach", *Financial Innovation* 7, no. 1 (2021): 3-4, https://doi.org/10.1186/s40854-021-00296-4.

[22] Ulrich, 323; Belke and Beretta, "From Cash to Central Bank Digital Currencies and Cryptocurrencies: A Balancing Act Between Modernity and Monetary Stability". *Journal of Economic Studies* 47, no. 4 (2019): 919, https://doi.org/10.1108/JES-07-2019-0311.

[23] Jun and Yeo, 4

[24] Cohen, Benjamin J. *The Future of Money*, (New Jersey: Princeton University Press, 2004): 22-24

[25] Ibid.

CBDCs may also safeguard the financial system against the failure of private currencies. In a financial crisis, business and consumers may lose confidence in private or decentralized payment systems due to the lack of government backing, which may lead to a rolling shutdown of interconnected payment systems[26], worsening financial stress on the economy. Through channeling demand for electronic payments away from private currencies, and into CBDCs, the risk of failure of private currencies decreases.

2.3 Risks

Counteracting the benefits of CBDCs are several risks that go alongside it. Prominent risks to the financial system include the structural disintermediation of banks and the increased risks of banks runs. Central banks face added operational risks as well – in abiding to anti-money laundering and counter-terrorism financing (AML/CTF) principles, efficient credit allocation, and ensuring the security of the CBDC network.

A main concern of CBDC issuance is the structural disintermediation of banks. CBDCs challenge the existing business model of banks; in order to use CBDCs, users are required to shift deposits from commercial banks into the central bank, eroding the deposit base of commercial banks and the profits they make from debt issuance[27]. While commercial banks may offer better conditions on their deposits to protect their deposit base, higher operating costs would still be incurred. As a result, the challenge posed to commercial banks' business model

[26] Prasad. *The Future of Money: How the Digital Revolution Is Transforming Currencies and Finance*, (Cambridge MA: Belknap Press of Harvard University Press, 2021), 12

[27] Ulrich, 312

impedes their role in ensuring the efficient functioning of the financial system. One solution to minimize the structural disintermediation of banks is by preventing the use of CBDCs as a major store of value; through matching CBDC interest rates to commercial bank deposits and prohibiting on-demand convertibility of bank deposits into CBDCs[28].

CBDCs may also increase systemic risks of bank runs in crisis situations. As direct liabilities of the central bank, CBDCs are considered more 'risk-free' by the public. The presence of safe deposits in the central bank make commercial banks vulnerable to bank runs into central banks during a crisis[29]. The risk of bank runs may be mediated, though, through other policies that induce banks to maintain adequate liquidity reserve levels[30].

On the flip side, however, it can also be argued that CBDC issuance may improve financial stability in the long term. If central banks become a rigid, monopolistic depositor, and disintermediates all commercial banks, CBDCs can prevent commercial bank runs completely. Hence, through removing their guarantee on commercial bank deposits, governments eliminate a source of moral hazard from the financial system[31]. And even with just partial disintermediation, the downscaling of commercial banks nevertheless reduces moral hazard in the financial system, improving financial stability.

[28] Ulrich, 322-323

[29] Ulrich, 318

[30] Jun and Yeo, 2

[31] Ulrich, 307

Through accepting deposits from the public, however, central banks become poised to perform functions that were previously performed by commercial banks, increasing the operational risks of central banks. Central banks would be expected to perform know-your-customer (KYC) checks to comply with AML/CTF laws, exposing themselves to higher reputational and operational risks[32]. Additionally, as central banks receive deposits, they may also be obliged to play a role in credit allocation, making credit allocation in the economy less efficient and more vulnerable to political interference than it would be in the private sector[33]. Lastly, the large volume of transactions facilitated by CBDCs networks may make it a target for terrorist and hackers, contributing to greater operational risks[34].

2.4 Design elements of CBDCs

The risk and benefits of CBDC issuance are important considerations for central banks, and the design of CBDCs can minimize risks and maximize benefits according to jurisdictional context. While there are many areas in which CBDC design may differ, this literature review only discusses significant design considerations – the degree of centralization, method of circulation, cross-border interoperability, and method of financing.

2.4.1 Degree of Centralization

The degree of centralization refers to how centralized transaction verification is. In a highly centralized system, only the central bank is responsible for verifying transactions. Such a system

[32] Belke and Beretta, 923

[33] Ulrich, 313

[34] Belke and Beretta, 927

would resemble one where individuals hold electronic accounts with the central bank, who would be the sole entity responsible for recording transactions between accounts[35]. In a highly decentralized system, other actors are involved in verifying transactions. This system may resemble one whereby a central bank develops its own cryptocurrency protocol and make it available to the public, for the public to maintain a decentralized ledger[36]. Alternatively, a cryptocurrency protocol can be made less decentralized if access to the protocol is restricted to only trusted entities.

The benefits of a decentralized system are increased transparency, user trust, and independence from third-parties or government manipulation, which is beneficial for jurisdictions with low trust in government. The drawbacks, however, are captured in the blockchain trilemma, which theorizes that (i) decentralization, (ii) security, and (iii) cost efficiency cannot exist simultaneously[37]. Decentralization comes at the expense of security and cost efficiency, making the network more vulnerable to hacking, expensive to operate, and difficult to scale-up. As of the time of writing, there is consensus among central banks that the optimal arrangement to balance the level of centralization is to disseminate CBDCs through financial intermediaries such as commercial banks and payment service providers. For instance, in blockchain-based systems, this entails that only financial intermediaries are given permission to verify transactions and update the protocol ledger.

[35] Ulrich, 304

[36] Belke and Beretta, 922

[37] Abadi and Brunnermeier. "Blockchain economics", *CEPR Discussion Paper* no. DP13420 (2019): 2, https://ssrn.com/abstract=3310346

2.4.2 Method of circulation

Another design consideration among CBDCs is the form it takes – whether circulated between accounts or circulated as tokens. Scholarship relates the form of CBDCs (token or account-based) to traceability of transactions and the level of user anonymity central banks are willing to tolerate. An account-based CBDC enables transactions to be traced to account holders, making it easier to counter money laundering and terrorism financing (ML/TF). In addition, an account-based CBDC uses existing technology and do not require complex technological solutions[38]. On the other hand, a token-based CBDC exists as digital units that circulate among mobile wallets and allow for direct peer-to-peer payments, bypassing the central bank and emulating the anonymous way cash and cryptocurrency is transacted[39], making it more attractive for privacy-centric jurisdictions. While account-based and token-based design are conceived as binary options, the level of user anonymity lies on a spectrum. Account-based CBDCs can be legislated to collect less user information, while token-based CBDCs can be designed to maintain a ledger of transactions.

2.4.3 Cross-border interoperability

Lastly, cross-border interoperability refers to a CBDC's compatibility with other CBDCs to exchange information and ensure a seamless flow of cross-border funds. Cross-border interoperability demands international cooperation and as a result, requires more resources to

[38] Ulrich, 304

[39] Bech and Garratt, 56

develop. While retail CBDCs are primarily developed with domestic purposes in mind[40], cross-border interoperability offers added advantages; an early issuance of a cross-border interoperable CBDC may allow a country to gain soft power by setting international technical standards for other countries (who intend for cross-border interoperability) to follow. Additionally, it may also help to internationalize a currency, a goal that China's central bank has indicated interest in[41].

2.4.4 Financial model

The last crucial design element is the financing model of the CBDC. The choice of a financing model is complex because while central banks have an interest to recuperate the costs incurred from developing and operating the CBDC, charging users transaction fees contradicts the commitment of a central bank to provide payment systems as a public good[42]. There is also consensus that central banks do not favor commercializing payments data[43]. Furthermore, if private financial intermediaries are involved in the distribution of CBDCs, their involvement hinges upon the profitability of the venture. Currently, there is consensus that the main financing model for intermediaries to disseminate CBDCs is fees made on payments. To ensure that CBDCs continue to appear as a public good, central banks may make exclusions to those subject to fees.

[40] Soderberg et al. "Behind the Scenes of Central Bank Digital Currency". *FinTech Notes* no. 2022/004 (2022): 14, International Monetary Fund. ISBN 9798400201219/2664-5912.

[41] Chorzempa. "China, the United States, and central bank digital currencies: how important is it to be first?", *China Economic Journal* 14, no. 1 (2021): 112, doi: 10.1080/17538963.2020.1870278

[42] Soderberg, 5

[43] Soderberg, 11

2.5 Filling an empirical gap

Given the recency of CBDC issuance, there are few empirical studies that discuss political economy considerations that affect the design of CBDCs. Arauz and Garratt conduct a case study of CBDC issuance in Ecuador and found that the discontinuation of the program in 2018 was due to opposition from private banks[44]. Chorzempa performs a comparative study of CBDC development in the United States and China and argues that political motivations lay behind China's rapid pace of CBDC development. Ahiabenu also wrote a comparative case study of Ghana and Nigeria, arguing that the design of both CBDCs maximize the promotion of financial inclusion[45]. Lastly, using statistical analysis, Soilen and Benhayoun discussed how institutional trust of households and user engagement affects the level of adoption of CBDCs. My paper fills empirical gaps by showing how other design elements, namely, user anonymity and cross-border interoperability, are affected by a country's performance in AML/CTF and high cryptocurrency usage respectively.

[44] Arauz and Garratt. "Dinero Electrónico: The rise and fall of Ecuador's central bank digital currency", *Latin American Journal of Central Banking* 2, no. 2 (2021), https://doi.org/10.1016/j.latcb.2021.100030

[45] Ahiabenu. "Comparative Study of the Design Frameworks of the Ghanaian and Nigerian Central Banks' Digital Currencies". *FinTech 2022*, no. 1 (2022): 235–249. http://dx.doi.org/10.2139/ssrn.4195000.

CHAPTER 3: RESEARCH DESIGN

3.1 Research method

This paper conducts a multiple case study research focusing on countries who (i) have issued retail CBDCs to the public or (ii) are in the late pilot stage of CBDC development. These countries would have published reports outlining the main design aspects of their CBDCs. Countries in the former category include Bahamas, Cambodia, Nigeria, and Jamaica, and countries in the latter include China, Ghana, and Sweden.

Country	Name of CBDC	Issuance status
Bahamas	Sand dollar	Issued in October 2020
Cambodia	Bakong	Issued in October 2020
Nigeria	e-Naira	Issued in October 2021
Jamaica	JAM-DEX	Issued in June 2022
China	e-CNY	Pilot began in April 2020
Ghana	e-Cedi	Pilot began in May 2022
Sweden	e-Krona	Pilot began in February 2020

Table 1: Summary of case studies

The Bahamas, Cambodia, Nigeria, and Jamaica have officially launched their CBDCs. The earliest issuers were the Bahamas and Cambodia, who launched the Sand dollar and Bakong respectively in October 2020. This was followed by Nigeria's issuance, who issued the e-Naira in October 2021. The latest issuer is Jamaica, who issued the JAM-DEX on June 2022.

Ghana, Sweden, and China are still in the late pilot stage. Closest to issuance is China, who began the trial of the e-CNY in April 2020. The pilot program has since expanded and is available for use in 23 cities across China. Ghana is currently piloting the e-Cedi in several regions of the country. Lastly, Sweden concluded its second pilot of the e-Krona in April 2022 and is currently in the third pilot, where the design of the e-Krona is still being explored.

To find out details of the design of various CBDCs, I use official reports and announcements published by these central banks and news reports.

3.2 Excluded cases

There are several CBDCs that are already launched or have been piloted but were excluded from this analysis. These CBDCs are issued by the Eastern Caribbean Central Bank (ECCB), Ukraine, Uruguay, and Korea.

The ECCB launched its CBDC in March 2021. The ECCB is the monetary authority of 8 countries in the Caribbean and its CBDC is designed to be implemented in all 8 member states. It would hence be difficult to isolate the impact of an economy of one individual state onto the design of the CBDC issued by the ECCB. Furthermore, the economies of ECCB's member states vary widely in characteristics, which compounds the difficulty in drawing associations between CBDC design and economic factors.

The CBDCs developed by Ukraine, Uruguay, and Korea concluded at least one pilot stage, but were not included in this analysis as details about the design of their CBDCs were not published by the respective central banks.

CHAPTER 4: FINDINGS

The multiple case study reveals two findings. Firstly, high usage of cryptocurrency in an economy contributes to a central bank's desire for cross-border interoperability. And secondly, poor performance in anti-money laundering and counter terrorist financing (AML/CTF) contributes to the allowance of partial user anonymity in CBDC transactions.

4.1 Cross-border interoperability

The first significant finding of my paper is that central banks of countries with higher adoption rates of cryptocurrency are more likely to indicate interest in CBDC cross-border interoperability[46]. The case studies show that cryptocurrency adoption is caused by one or several underlying aspects of an economy – namely high inflation, high remittance fees, or the presence of capital controls and foreign exchange (FX) controls. Through designing a cross-border interoperable CBDC, central banks hope to strengthen their management of factors that incentivized the adoption of cryptocurrency.

High usage of cryptocurrency is observed in Nigeria, Ghana, China, and Cambodia. The central banks of these countries stated interest or have ongoing plans to incorporate cross-border interoperability in their CBDC. Conversely, central banks of countries with low adoption of cryptocurrency – namely Sweden, Bahamas, and Jamaica – did not indicate interest in cross-border interoperability.

[46] An earlier discussion of cross-border interoperability can be found in chapter 2.4.3.

To find out national adoption rates of cryptocurrency, my paper use two indexes. The first is '*2021 Chainalysis Global Crypto Adoption Index*'[47] published by Chainalysis, a US-based blockchain analysis firm. This index has a coverage of 154 countries. Chainalysis extracts the volume of cryptocurrency transactions that occur on blockchains and demarcate them according to national boundaries. The index then weight transaction volume based on purchasing power parity per capita[48]. As a result, the Chainalysis index show national cryptocurrency transaction volume relative to a country's wealth. The second index is '*Finder Cryptocurrency Adoption Index 2022*'[49], which surveyed 272,257 internet users in 26 countries regarding their cryptocurrency usage. Sweden, Ghana, and Nigeria are included among these 26 countries, and I corroborate the adoption rate of these three countries.

As observed in Table 2, countries with high cryptocurrency usage are more likely to indicate interest in cross-border interoperability. I argue that this is because cross-border interoperability help to remedy factors that gave rise cryptocurrency use in the first place, namely high remittance fees, high inflation, and the presence of FX and capital controls. To trace this causal mechanism, I look at the context of individual countries.

[47] Chainalysis. "*The 2021 Geography of Cryptocurrency Report*", (New York: Chainalysis, 2021), https://go.chainalysis.com/2021-geography-of-crypto.html.

[48] Chainalysis, 5-6

[49] Laycock, Richard. "Finder Cryptocurrency Adoption Index", *Finder*, September 22, 2022, https://www.finder.com/finder-cryptocurrency-adoption-index.

Country	2021 Chainalysis Global Crypto Adoption Index		Finder Cryptocurrency Adoption Index 2022 (Cryptocurrency ownership rate)	Interest in cross-border interoperability
	Index value	Worldwide Ranking		
Nigeria	0.26	6th	26%	Yes
China	0.16	13th	NA	Yes
Ghana	0.14	17th	19%	Yes
Cambodia	0.07	42nd	NA	Yes
Sweden	0.04	73rd	7%	No
Jamaica	0.03	81st	NA	No
Bahamas	0.01	128th	NA	No

Table 2: Summary of cryptocurrency adoption rates

4.1.1 Nigeria

The Central Bank of Nigeria (CBN) indicated that the eNaira was designed to accommodate potential interoperability with other CBDCs[50]. The CBN further noted that cross-border interoperability may help to remedy the problem of dollarization that other Sub-Saharan African countries, including Nigeria, face[51]. The CBN also issued an 'eNaira Implementation Roadmap', which outlines 4 phases in which new features would be progressively introduced to the eNaira after its launch[52]. While not tied to specific dates, cross-border interoperability is scheduled to be in Phase 4. As of the time of writing, the CBN is deploying Phase 2, which started in August

[50] Central Bank of Nigeria, "*Design Paper for the eNaira*", (Nigeria: Central Bank of Nigeria, assessed October 19, 2022), https://enaira.gov.ng/about/design.

[51] Central Bank of Nigeria, 12. While the CBN did not specify how cross-border interoperability will remedy dollarization, it can be assumed that by having sub-Saharan African currencies more freely interchangeable with each other via CBDCs, it increases the attractiveness of local currencies in intra-regional trade, promoting their use.

[52] Central Bank of Nigeria, 21

2022[53]. The scheduling of cross-border interoperability shows the CBN's commitment to the feature.

Cryptocurrency is widely adopted in Nigeria. Chainalysis ranked Nigeria 6th globally for the highest rate of cryptocurrency adoption in 2021. The Finder Cryptocurrency Adoption Index 2022 found that 26% of internet users in Nigeria own cryptocurrency.

The drivers behind cryptocurrency adoption in Nigeria is three-fold; to hedge against high inflation, to evade FX controls, and to transfer remittances. Nigeria faces persistently high inflation – from 11.4%, 13.2%, and 17% in 2019, 2020, 2021 respectively[54]. Tether, a stablecoin whose price is pegged to the USD, is reported to be gaining in popularity in Nigeria[55], showing that the Nigerians turn to cryptocurrency for a reliable hedge against the rapidly weakening Naira[56]. The ease of purchase of cryptocurrency also enable Nigerians to evade restrictive FX policies imposed by the CBN in 2021 to support the Naira. Such regulations include the suspension of dollar sales to currency exchange operators, the reduction of dollars allocated to banks for FX, and documentation required for FX purchase[57]. As access to the dollar is

[53] Osae-Brown, Anthony. "Nigeria Seeks to Boost E-Naira Users 10-Fold as Cryptos Grow", *Bloomberg*, August 18, 2022, https://www.bloomberg.com/news/articles/2022-08-18/nigeria-seeks-to-boost-e-naira-users-10-fold-as-cryptos-grow.

[54] The World Bank. "Inflation, consumer prices (annual %) – Nigeria", accessed October 20, 2022, https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=NG.

[55] Smith. "Cryptocurrency usage soars in Nigeria despite bank ban", S*&P Global Market Intelligence*, June 9, 2022, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/cryptocurrency-usage-soars-in-nigeria-despite-bank-ban-70497781.

[56] The Naira uses a floating exchange rate regime.

[57] Mayowa. "Revisiting CBN retail foreign exchange policy". *Punch Newspaper*, March 18, 2022, https://punchng.com/revisiting-cbn-retail-foreign-exchange-policy.

restricted, Nigerians are unable to use the dollar as a hedge against inflation, turning to cryptocurrency instead. The high unbanked population in Nigeria also suggests that many Nigerians are priced outside of the financial system. In 2020, only 45% of adults owned accounts with a financial institution[58]. Remittances contribute to 4% of Nigeria's GDP (as of 2020)[59], and the high unbanked population suggests that remittance fees charged by financial institutions are unaffordable for many receiving remittances. Cryptocurrency is hence an attractive alternative to transfer remittances at much lower cost.

Even though the Nigerian government has taken a stricter stance against cryptocurrency usage, Nigerians continue to purchase cryptocurrency. The CBN in 2021 ordered financial institutions to suspend operations in cryptocurrency, claiming risks posed to investment losses and AML/CTF[60]. However, Nigerians continue to purchase cryptocurrency despite the ban. Peer-to-peer cryptocurrency trading platforms, which have not been censored or banned, such as Paxful and LocalBitcoins, have seen an uptick of users to purchase cryptocurrency and engage in commercial transactions[61].

Cryptocurrency usage is driven by high inflation, FX controls, and high remittance fees, and the e-Naira's incorporation of cross-border interoperability helps the CBN to strengthen their management over these issues. The e-Naira would be able to facilitate low-cost cross-border

[58] Asli et al. "*The Global Findex Database 2021*" (Washington, DC: The World Bank, 2022), 177, https://www.worldbank.org/en/publication/globalfindex/Report.

[59] The World Bank. "Personal remittances, received (% of GDP) – Nigeria", accessed October 20, 2022, https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS?locations=NG.

[60] Smith.

[61] Ibid.

transfers, making it attractive in facilitating remittances (and other cross-border retail transactions) in place of cryptocurrency. Through increasing the cross-border use-cases of the e-Naira, there would be increased demand for the Naira, strengthening the value of the currency. Lastly, public reliance on the e-Naira for cross-border transfers also enable the CBN to have direct surveillance over capital outflows and FX, strengthening CBN's control of FX.

4.1.2 Ghana

The Bank of Ghana (BOG) indicated that the e-Cedi was designed to accommodate any potential participation of the BOG in international cross-border CBDC projects[62]. It was also noted that a key consideration in the design of the e-Cedi was the goal of increasing Ghana's integration with other African economies, justifying cross-border interoperability[63].

Cryptocurrency is popular in Ghana. Chainalysis ranked Ghana 17th globally in cryptocurrency adoption in 2021. Additionally, Finder reported that as of 2022, 19% of Ghanian internet users owned cryptocurrency, a rise from 17% in 2021[64].

Similar to Nigeria, the drivers of cryptocurrency adoption in Ghana are the high cost of sending remittances, high inflation, and FX controls. In 2020, only 68% of the adult population owned an

[62] Bank of Ghana. "*Design Paper of the Digital Cedi (eCedi)*" (Ghana: Bank of Ghana, 2022), 7, https://www.bog.gov.gh/news/design-paper-of-the-digital-cedi-ecedi/.

[63] Bank of Ghana. "*Design Paper of the Digital Cedi (eCedi)*", 7

[64] News Ghana. "20% of Ghanaians currently own cryptocurrency", *News Ghana*, August 30, 2022, https://newsghana.com.gh/20-of-ghanaians-currently-own-cryptocurrency/.

account with a financial institution[65], suggesting that financial services are unaffordable for many Ghanaians. Remittances contributed to 6.1% of Ghana's GDP in 2020[66] and money transfer operators charge high prices – charging transaction fees as high as 10% of the amount being remitted[67]. Furthermore, irregular migrants, who form part of the Ghanaian diaspora, also lack identification documents required by financial institutions and are excluded from formal remittance channels[68]. As a result, cryptocurrency is an attractive alternative for sending remittances. Cryptocurrency usage is also driven by high inflation; Ghana's inflation target is 6-10%[69] but the annual inflation from 2012-2021 exceeded this target, averaging at 12.02%[70]. As such, adoption of cryptocurrency is likely intended to hedge against inflation and a weakening cedi[71]. FX controls were implemented to support the cedi - in April 2022 the Ghanaian government banned domestic business from transacting in foreign currencies[72]. The anticipation of FX controls being expanded to restrict the public from purchasing foreign fiat currency makes cryptocurrency an appealing alternative to hedge against high inflation.

[65] Asli et al., 176

[66] The World Bank. "Personal remittances, received (% of GDP)", accessed October 20, 2022, https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS.

[67] Teye, Badasu, and Yeboah, "*Assessment of remittances-related services and practices of financial institutions in Ghana*", (Geneva: International Organization of Migration, United Nations, 2017), 17, https://www.iom.int/sites/default/files/country/docs/ghana/IOM-Ghana-Assessment-of-Remittance-Related-Services-and-Practices-of-Financial-Institutions-in-Ghana.pdf.

[68] Ibid., 24

[69] Bank of Ghana. "Monetary Policy Framework", accessed October 20, 2022, https://www.bog.gov.gh/monetary-policy/our-monetary-policy-framework/.

[70] The World Bank. "Inflation, consumer prices (annual %) – Ghana", accessed October 20, 2022, https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=GH.

[71] The cedi uses a floating exchange rate regime.

[72] Erezi, Dennis. "Ghana bans use of foreign currencies in business transactions", *The Guardian*, April 8, 2022, https://guardian.ng/news/ghana-bans-use-of-foreign-currencies-in-business-transactions/.

The discouragement of cryptocurrency use is apparent in several statements issued by the government. In 2019, the Securities and Exchange Commission Ghana (SEC) issued a statement to warn the public of the risks of investing in cryptocurrencies, emphasizing that they are not regulated or recognized as legal tender[73]. And in an interview in May 2021, the deputy director-general of the SEC further labeled cryptocurrencies as illegal[74], even though no legislation has been made to ban cryptocurrencies.

Cryptocurrency adoption in Ghana is driven by high remittance fees, high inflation, and FX controls, and the BOG's management of these issues can be strengthened by issuing a cross-border interoperable e-Cedi. The facilitation of low-cost cross-border transfers makes the eCedi attractive for remittances, particular for irregular Ghanaian migrants as the e-Cedi also allows for partial user anonymity. The increase in use-cases of the e-Cedi for cross-border transfers also strengthens demand for the Cedi. Lastly, reliance on the e-Cedi for cross-border payments will also enable higher surveillance of FX transactions, strengthening the position of the BOG in implementing FX controls in the future.

[73] Securities and Exchange Commission of Ghana (SEC). "*Public Warning on Investment and Trading in Crypto-Currencies and Their Digital Platforms SEC/PN/003/03/2019*" (Ghana: SEC, 2019), https://sec.gov.gh/wp-content/uploads/Public-Notices/Public_Notice_Cryptocurrency_Regulatory_Warning.pdf.

[74] Zimwara. "Ghana Regulator Labels Crypto Transactions Illegal— Urges People to 'Stay Away From Them'", *News Bitcoin*, May 4, 2021, https://news.bitcoin.com/ghana-regulator-labels-crypto-transactions-illegal-urges-people-to-stay-away-from-them/.

4.1.3 China

The People's Bank of China (PBOC) stated that exploring improvements in cross-border payments is the third objective of the e-CNY[75] and indicated that it will actively respond to initiatives of the G20 or other international organizations to explore CBDC cross-border projects and will also cooperate bilaterally with other central banks to set up cooperation mechanisms for cross-border interoperability[76].

Chainalysis ranked China 13th globally in cryptocurrency adoption in 2021. The adoption of cryptocurrency is driven by capital controls in China – where citizens are subjected to an annual limit of US$50,000 for the purchase of foreign currencies or assets, and are subjected to strict operational requirements to make such transactions, such as requiring documentation and high administrative fees[77]. While these capital controls are intended to stabilize the price of the yuan and encourage domestic investments, cryptocurrency offers a way to bypass capital controls. It was estimated that sums as high as $50 billion worth of cryptocurrency left East Asian accounts to accounts outside the region in 2019 and 2020, facilitated largely by Tether, a stable coin pegged to the USD, which became more popular in 2017, despite the PBOC's prohibition on cryptocurrency exchanges in 2017[78].

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[75] People's Bank of China. "*Progress of Research & Development of E-CNY in China*", (China: People's Bank of China, 2021), 3-4, http://www.pbc.gov.cn/.

[76] People's Bank of China, 5

[77] Yueng, Karen. "China 'stuck' as rigid controls on capital outflows becoming harder to peel back", *South China Morning Post*, August 26, 2020, https://www.scmp.com/economy/china-economy/article/3098814/china-stuck-rigid-controls-capital-outflows-becoming-harder.

[78] Shin, Francis. "What's behind China's cryptocurrency ban?", *World Economic Forum*, January 31, 2022, https://www.weforum.org/agenda/2022/01/what-s-behind-china-s-cryptocurrency-ban/.

The issuance of the e-CNY in 2021 coincided with stricter cryptocurrency bans and the easing of capital controls. In September 2021, further bans on cryptocurrency services were announced, including the banning of mining and making payments in cryptocurrency. Capital controls were eased as well; in June 2021, China approved record amounts of retail investment capital to leave the country in response to a rallying RMB and high domestic asset prices[79].

The stricter ban of cryptocurrency and the easing of capital controls is likely to channel demand for cross-border transactions towards the e-CNY. Reliance on the e-CNY for cross-border transactions allows the PBOC to impose higher surveillance on capital outflows, lending the PBOC better enforcement powers for future FX or capital controls.

4.1.4 Cambodia

Above and beyond indicating its interest in cross-border interoperability, Cambodia is the only country to have an existing cross-border initiative for its CBDC. In August 2021, the National Bank of Cambodia (NBC) partnered with Maybank, Malaysia's largest bank, to enable cross-border transfers from Malaysia to Cambodia[80]. Transactions are mediated through the Bakong e-wallet and Maybank's mobile banking application and users are charged a flat service fee of

[79] Hale, Thomas. and Lockett, Hudson. "China approves highest-ever outflows for mainland investors", *Financial Times*, June 15, 2021, https://www.ft.com/content/4170c04c-e98a-4e52-9a44-a085616cc21b.

[80] Khmer Times. "Cambodia explores cross-border transactions of CBDC-like Bakong, now used by 200,00 people", *Khmer Times*, August 9, 2021, https://www.khmertimeskh.com/50911542/cambodia-explores-cross-border-transactions-of-cbdc-like-bakong-now-used-by-20000-people/.

RM10 (approx. $2) for a transaction of up to RM10,000[81]. It was also reported that the partnership aims to benefit Cambodian migrant workers in Malaysia[82].

Cryptocurrency adoption in Cambodia is driven by high remittance fees. Chainalysis ranked Cambodia 42th globally in cryptocurrency adoption in 2021. The high unbanked population, where only 33% of Cambodians hold an account with a financial institution[83], suggests that the majority of Cambodians are priced out of the financial system and are unable to afford high remittance fees. Cambodians rely heavily on remittances as well; 4.9% of Cambodia's GDP was contributed by remittances in 2020[84]. Malaysia, whom Cambodia has an interoperability initiative with, is the fourth top source of remittances, accounting for 1.4%, behind Thailand (73%), South Korea (16%), Japan (6%) in 2020[85]. Hence, in the absence of Bakong's cross-border interoperability with other top remittance sources, cryptocurrency serves as an appealing alternative for sending remittances.

The NBC has taken a stricter stance towards cryptocurrencies. In 2018, the NBC banned financial institutions from trading cryptocurrencies[86]. In the same year, the Securities and

[81] Maybank."Maybank-Bakong Transfer", accessed October 20, 2022, https://www.maybank2u.com.my/maybank2u/malaysia/en/personal/services/funds_transfer/overseas/maybank-bakong_transfer.page.

[82] Khmer Times. "Cambodia explores cross-border transactions of CBDC-like Bakong, now used by 200,00 people"

[83] Asli et al.,175

[84] The World Bank. "Personal remittances, received (% of GDP)"

[85] Kunmakara. "Remittances fall 17% to $1.2B in 2020: NBC data", *The Phnom Penh Post*, June 3, 2021, https://www.phnompenhpost.com/business/remittances-fall-17-12b-2020-nbc-data.

[86] Spiess. "Cryptocurrencies continue to operate in a grey area", *Phnom Penh Post*, March 27, 2018, https://www.phnompenhpost.com/special-reports-supplements/cryptocurrencies-continue-operate-grey-area.

Exchange Commission of Cambodia issued a statement warning citizens of the risks associated with cryptocurrency in the absence of regulations[87]. More recently in May 2022, the Ministry of Finance and Economics issued a statement affirming that it is still illegal for firms to create, distribute, or trade cryptocurrency in Cambodia[88]. The government stopped short of banning public usage of cryptocurrency for cross-border transactions. Regardless of whether such a ban is enacted, the Bakong is likely to be more popular for cross-border transactions, given its low service fee, relative safety and technical accessibility compared to cryptocurrency.

Cryptocurrency is driven by high remittance fees, and cross-border interoperability of the Bakong directly lowers remittances fees for countries that it has interoperability cooperation with. There are indirect impacts as well; the anticipation that cross-border interoperability may be expanded to other countries may pressure remittance services to start offering more competitive rates, indirectly lowering remittance fees across the board.

4.1.5 Counterfactual: Sweden

Sweden's CBDC, the e-krona, is still in its third pilot stage and design features have not been finalized. In reports published by the Central Bank of Sweden, known as the Riksbank, the possibility of cross-border interoperability was not discussed, indicating a lack of commitment and interest in cross-border interoperability.

[87] Kimsay. "SECC warns against cryptocurrency trading", *Phnom Penh Post*, January 18, 2018, https://www.phnompenhpost.com/business/secc-warns-against-cryptocurrency-trading.

[88] Khmer Times. "Kingdom says a firm 'no' to unsanctioned crypto-related activities", *Khmer Times*, May 3, 2022, https://www.khmertimeskh.com/501068033/kingdom-says-a-firm-no-to-unsanctioned-crypto-related-activities/.

The lack of interest in cross-border interoperability is likely due to the lack of strong demand for alternative cross-border payment methods. Cryptocurrency adoption in Sweden is weak. Chainalysis ranked Sweden ranked 73th globally in cryptocurrency adoption in 2021. Similarly, Finder finds that only 7% of internet users own cryptocurrencies. The poor rate of cryptocurrency adoption is likely due to high public confidence in the value of the krona and in banking institutions; average inflation in Sweden was 0.73% from 2012 – 2021[89], and 100% of Swedes own bank accounts[90]. There is also an absence of foreign exchange controls[91], creating no demand for cryptocurrency to circumvent regulations. Lastly, Sweden has no laws prohibiting the purchase or trading of cryptocurrencies, ruling out the impact of regulations on low cryptocurrency usage.

Hence, as there is little public demand for alternative cross-border payment methods, there is little incentive for the Riksbank to invest in cross-border interoperability of the e-krona.

4.1.6 Counterfactual: Bahamas

The Central Bank of Bahamas (CBB) specified that its CBDC, called the Sand Dollar, is restricted to domestic use and that non-domestic payees are prohibited from accepting payments

[89] The World Bank. "Inflation, consumer prices (annual %) – Sweden", assessed October 20, 2022, https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=SE.

[90] Asli et al., 178

[91] International Trade Administration. "Sweden - Country Commercial Guide", last modified July 25, 2022, https://www.trade.gov/country-commercial-guides/sweden-trade-financing

with it[92]. The CBB added that if users intend to use Sand Dollar accounts for international transactions, their accounts will have to be linked to a domestic commercial bank to make electronic purchase of foreign exchange, therefore showing that the CBB lack interest in direct cross-border interoperability with other CBDCs[93].

The lack of interest in cross-border interoperability is likely due to fixed exchange rate regime of the Bahamian dollar, which maintains a 1:1 fixed parity with the USD. To maintain the fixed exchange rate, the CBB prevents outflows of the Bahamian dollar. As the Sand dollar CBDC and the Bahamian dollar is freely interchangeable, a cross-border interoperable Sand dollar would contradict the monetary policy of the CBB.

But while capital controls led to high public demand for cryptocurrency in China, capital controls in the Bahamas do not spur demand for cryptocurrency as Bahamians are permitted to purchase foreign securities and are not subject to purchasing limits. For Bahamians to purchase foreign currency-denominated securities, they must first exchange currency at the 'investment currency market' operated by the CBB[94]. While the CBB charges a premium for FX rates[95], there

[92] Central Bank of the Bahamas. "*Project Sand Dollar: A Bahamas Payments System Modernization Initiative*" (Bahamas: Central Bank of Bahamas, 2019), 10, https://www.centralbankbahamas.com/publications/main-publications/project-sanddollar-a-bahamian-payments-system-modernization-initiative.

[93] Ibid.

[94] Central Bank of the Bahamas. "Investment Currency Market", accessed October 21, 2022, https://www.centralbankbahamas.com/investment-currency-market.

[95] Central Bank of the Bahamas. "New Relaxation of Exchange Controls", accessed October 21, 2022, https://www.centralbankbahamas.com/news/press-releases/new-relaxation-of-exchange-controls. Buy and sell rates are B$1.050 =US$1.000 and B$1.025=US$1.000, translating to a premium of 5% and 2.5% respectively.

are no limits placed on the amount of 'investment currencies'[96] that Bahamians may buy. Furthermore, FX controls have been incrementally liberalized since the mid-1990s, with the latest round of relaxation implemented in 2018, significantly easing the access of Bahamians to purchase foreign investments[97]. As Bahamians are able to purchase foreign investments with relative ease, cryptocurrency demand is low – Chainalysis ranked Bahamas 128th globally in cryptocurrency adoption. In fact, a survey revealed that in 2020, cash was the most widely used mode of payment in the Bahamas, while cryptocurrencies and mobile wallets were the least used[98].

While the CBB's decision to forego CBDC cross-border interoperability is intrinsically due to its monetary policy, it is also due to how there is no incentive for CBB to place more surveillance on cross-border transactions as cryptocurrency is not used to evade capital controls.

4.1.7 Counterfactual: Jamaica

The Bank of Ghana (BOJ) specified that their CBDC, the JAM-DEX, is solely for domestic use. Chainalysis ranked Jamaica 101th globally in cryptocurrency adoption in 2021. Low cryptocurrency adoption in Jamaica is likely due to low inflation and affordable remittances fees. Jamaica's average inflation from 2012-2021 is 5.37%[99], which is well within the BOJ's inflation

[96] The CBB uses the term 'investment currencies' as a shortened form of 'foreign-currency for investments'

[97] Central Bank of the Bahamas. "New Relaxation of Exchange Controls"

[98] McKenzie. "CASHLESS TREND: Acceptance and use of electronic payments increased in 2020, Central Bank survey finds", *EW News*, June 17, 2021, https://ewnews.com/cashless-trend-acceptance-and-use-of-electronic-payments-increased-in-2020-central-bank-of-the-bahamas-cbob-survey-finds.

[99] The World Bank. "Inflation, consumer prices (annual %) – Jamaica", accessed October 20, 2022, https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?end=2021&locations=JM&start=2010&view=chart.

target of 4-6%[100], hence causing no demand for cryptocurrency to be used as a hedge against the inflation. Additionally, remittances is a significant source of income for Jamaica – in 2020 remittances contributed to 22.2% of annual GDP[101]. Despite the high volume of remittances, there lacks demand for more affordable channels of remittances. Lower remittance costs are associated with higher GDP of the sending country and a larger volume of remittance transaction, which enables economies of scale and competitive pricing[102]. In 2021, the US accounted for 60% of remittances, the UK and Canada accounted for 9% each, and Cayman Islands accounted for 4%[103]. The volume of remittances sent from these advanced economies promote competition among financial institutions in offering competitive remittance fees, hence creating no demand for cryptocurrency to be used for transferring remittances. As a result, the BOJ has no incentive to issue a cross-border interoperable JAM-DEX.

Having analyzed the context of individual countries, I demonstrate how high cryptocurrency adoption rate is a by-product of various economic ills, namely high inflation, high remittance fees, or the presence of capital controls and foreign exchange controls. These conditions incentivize central banks to use cross-border interoperable CBDCs to strengthen their management over the very conditions that drive demand for cryptocurrency.

[100] Bank of Jamaica. "The Inflation Target", accessed October 20, 2022, https://boj.org.jm/core-functions/monetary-policy/what-is-inflation/the-inflation-target/.

[101] The World Bank. "Personal remittances, received (% of GDP)"

[102] Beck, Janfils, and Kpodar. . "What Explains Remittance Fees? Panel Evidence", *IMF Paper* no. 2022/063 (2022), International Monetary Fund, Washington, D.C., https://www.imf.org/en/Publications/WP/Issues/2022/04/01/What-Explains-Remittance-Fees-Panel-Evidence-515957.

[103] Bank of Jamaica Statistics Department, "Remittances by Corridor Inbound", Bank of Jamaica, date accessed October 20, 2022, https://boj.org.jm/statistics/external-sector/remittances/.

4.2 Partial user anonymity

The second significant finding of my paper is the positive association between poor anti-money laundering and counter terrorism financing (AML/CTF) performance and the allowance for CBDC users to remain partially anonymous. Partial user anonymity refers to an arrangement where only a phone number is required to create an account. On the other hand, countries performing well in AML/CTF are more likely to require all users of the CBDC to undergo know-your-customer (KYC) identification checks. I argue that countries performing poorly in AML/CTF allow user anonymity because they lack the political will to strengthen their AML/CTF regime, and the lack of political will extends to the design of CBDCs – manifesting in a lack of resolution to ensure that CBDCs do not become complicit with illicit transactions.

I will first discuss the details of partial user anonymity (or the lack of) in individual CBDCs, followed by a discussion of the cost and benefits of allowing anonymity. I then divulge the AML/CTF performance of individual central banks and explain why AML/CTF performance is symbiotic with political will to strengthen the AML/CTF regime.

4.2.1 Sweden, Ghana, Jamaica: require identification of all users

The three central banks that require all users to undergo know-your-customer (KYC) checks are Sweden, Ghana, and Jamaica.

The Riksbank (Sweden) is currently in the third pilot stage of the e-krona and has not ruled out partial anonymity. However, based on the design of the first two pilots, the Riksbank appear to

favor KYC for all users. In the report concluding the first pilot stage, the Riksbank specified that anonymity may be permitted to a limited extent, such as limiting wallets to transaction and holding limits[104]. In the second pilot stage, the e-krona was only distributed through commercial banks[105], restricting access to the e-Krona to bank users who have, by default, already underwent KYC checks. While the report of the second pilot stage did not rule-out partial anonymity, the choice of distribution model in the second pilot stage and Sweden's high banked population of 99.7%[106] (as of 2021) suggest that it is likely that the e-Krona, when issued, is likely resemble the distribution model of the second pilot.

The BOG (Ghana) similarly emphasized that the CBDC onboarding process is designed to be seamless and easy, with the possibility of remote KYC procedures for users with smartphones[107]. Users without a smartphone are required to undergo physical KYC checks at financial institutions[108]. The design paper of the e-Cedi states that as an instrument for digital payments, onboarding should comply with AML/CTF regulations and requirements[109]. The BOG has not specified the identification documents required for the KYC process of the e-Cedi, and as the e-cedi is still in the pilot stage, no data on onboarding requirements has been published, but it is likely that onboarding requirements would be similar to conventional KYC checks at financial institutions.

[104]Sveriges Riksbank. "*E-krona pilot Phase 1*", 14

[105] Sveriges Riksbank. "*E-krona pilot Phase 2*", 8

[106] Asli et al., 178

[107] Bank of Ghana. "*Design Paper of the Digital Cedi (eCedi)*", 22-27

[108] Ibid, 21

[109] Ibid, 26

The BOJ (Jamaica) stated that JAM-DEX accounts are designed to be "easier and simpler to obtain (than regular bank accounts), with streamlined and simplified KYC requirements"[110]. This simplified KYC procedure requires verification of government ID, a picture of oneself, and a taxpayer registration number[111]. While existing bank account users are automatically given a CBDC account, unbanked customers are required to undergo KYC procedures at payment service providers and other deposit-taking institutions[112].

4.2.2 Bahamas, China, Nigeria, Cambodia: allow partial user anonymity

The four central banks that favor partial anonymity, namely the Bahamas, China, Nigeria, and Cambodia, adopt a tiered system that allows partial anonymity in the lowest tier. Registration of a phone number is the minimum requirement in the lowest tier, which is subject to the strictest transaction and holding limits.

The CBB (Bahamas) specified that the Sand Dollar will have two tiers of wallet limits based on the identification of users[113]. The first tier, where users are only identified by a phone number or email address, is subjected to a balance limit of BSD$500 (approx. USD$500) and a monthly transaction limit of BSD$1500. The second tier, where users are identified by government issued

[110] Haynes.

[111] Douglas Mcintosh, "BOJ Hopeful More Persons Will Join Banks To Get CBDC Accounts", *Jamaica Information Service*, June 16, 2022, https://jis.gov.jm/boj-hopeful-more-persons-will-join-banks-to-get-cbdc-accounts/.

[112] Haynes.

[113] Central Bank of the Bahamas. "*Project Sand Dollar*", 23-26

identification, has higher holding limits of BSD$8000 and a monthly transaction limit of BSD$10,000.

The PBOC (China) indicated that the e-CNY follows the principle of "anonymity for small value and traceable for high value"[114]. There are 4 tiers of e-CNY wallet limits[115] – in the first tier, which allows the most anonymity, only a cellphone number is required to register for an e-CNY account. The wallet is subject to a balance limit of 10,000 yuan (approx. USD$1400), a limit of 2000 yuan in a single transaction, a daily transaction limit of 5000 yuan, and an annual transaction limit of 50,000 yuan. Subsequent tiers require different types of identification documents but allow higher limits. The second tier requires proof of a resident identity card, the third tier requires the e-CNY account to be linked to an existing bank account, and the highest tier requires user to undergo physical KYC at a commercial bank.

The CBN (Nigeria) similarly offers 4 tiers for the e-Naira[116]. In the first tier, only a telephone number is required for registration and the account is subjected to a balance limit of 120,000 NGN (approx. USD$280) and a daily transaction limit of 20,000NGN. The second tier requires declaration of a National Identity Number and the account is subject to a balance limit of 300,000NGN and a daily transaction limit of 50,000NGN. The third and fourth tier both require a Bank Verification Number (that proves a user had gone through KYC checks at a financial institution). Wallet limits in the third and fourth tiers are selected based on the user's

[114] People's Bank of China, 7

[115] Zhang. "China launches digital yuan app in pilot cities nationwide", *Nikkei Asia*, January 6, 2022, https://asia.nikkei.com/Spotlight/Caixin/China-launches-digital-yuan-app-in-pilot-cities-nationwide.

[116] Central Bank of Nigeria, 14

preferences, where tier 3 is subject to a balance limit of 500,000NGN and a daily transaction limit of 200,000NGN, while tier 4 is subject to a balance limit of 500,000,000NGN and a daily transaction limit of 500,000NGN.

The CBC (Cambodia) offers 3 tiers of wallets limits for the Bakong[117]. In the first tier, customers only need to provide their phone number[118] and are subject to a daily transaction limit of KHR 2 million (approx. USD$490). In the second tier, customers are required to provide a selfie picture and a photo of their identification card or passport and are subject to a daily transaction limit to KHR 3 million. In the third tier, customers must be verified by the standard KYC procedure of a financial institution and are allowed to make transactions of up to KHR 40 million a day.

4.2.3 User anonymity: cost and benefits

The decision of countries to allow user anonymity hinges on the benefit and cost of anonymity, which is captured in the tension between AML/CTF regulations and accessibility. While user anonymity improves the public's access to use CBDCs, it comes at the risk of worsening a country's AML/CTF reputation. Conversely, requiring identification checks for all users for the sake of AML/CTF creates additional barriers to access CBDCs.

[117] National Bank of Cambodia, "*Project Bakong Next Generation Payment System*", (Cambodia: Central Bank of Cambodia, 2020), 25, https://soramitsu.co.jp/bakong/whitepaper.

[118] Bakong, "The Next-Generation Mobile Payments And Banking", accessed October 18, 2022, https://bakong.nbc.org.kh/en/.

CBDCs affect AML/CTF efforts as CBDC transactions are more mobile than transactions made in physical fiat currency, increasing opportunities for the layering of illicit funds[119]. If accounts are anonymous, it would encourage CBDCs to be used as an instrument for ML/TF. On the other hand, identification of CBDC users can bolster efforts to strengthen AML/CTF efforts[120]. Besides preventing users from making illicit transactions using CBDCs, widespread public adoption of CBDCs also minimize the circulation of physical fiat currency, placing increased scrutiny on physical fiat that is circulated for illicit purposes.

Requiring identification checks for all users, on the other hand, reduces accessibility. This is because identification checks create compliance costs, which manifest most heavily in investments in transaction monitoring systems and labour costs associated with KYC checks[121]. Increased compliance costs born by financial institutions may lead to costs being passed on to consumers, hence reducing the affordability of CBDCs. Additionally, consumers also face higher compliance costs through being required to produce identification documents and commuting for physical KYC checks, which may be difficult for economies with a weak national identification system and poor banking infrastructure. Furthermore, smaller financial institutions may lack financing to cope with higher compliance costs, which exclude them from being intermediaries to facilitate CBDC distribution. The exclusion of smaller financial institutions further limits

[119] Layering is a stage in the process of money laundering that involves funds being transacted through several financial institutions to distance the funds from its illicit source and, instead, give the appearance that it is from a legitimate source.

[120] Bank of International Settlements (BIS), "*Central bank digital currencies for cross-border payment Report to the G20*", (Switzerland: BIS, 2021), 7, ISBN 978-92-9259-476-3

[121] Rosca. "Banks Wrestle with Anti-Money Laundering Compliance Costs, but must Tread Carefully." *European Financials Daily*, September 17, 2015

consumer's accessibility to CBDCs. Hence, imposing identification of all CBDC users come at the expense of accessibility.

Partial anonymity is the compromise reached by the Bahamas, China, Nigeria, and Cambodia to minimize ML/TF risks and maximize accessibility. As aforementioned, partially anonymous CBDC accounts require only the registration of a phone number and is subjected to transaction and holding limits. The system becomes vulnerable to users obscuring their identities behind phone numbers and using CBDCs to layer illicit funds, albeit in smaller amounts. Partial anonymity is hence potentially insufficient in deterring ML/TF and still poses a risk to AML/CTF efforts.

4.2.4 Breaking down the Basel AML Index

Despite the risk of partial anonymity to AML/CTF efforts, countries still opt for partial anonymity because they lack the political will to ensure that CBDCs are not detrimental to the AML/CTF regime. To advance this argument, I refer to the Basel AML Index 2021[122]. The index is published by the Basel Institute of Governance, an international non-profit organization based in Switzerland. The index has global coverage of countries and is suitable for comparing the relative AML/CTF performance of selected countries.

[122] Basel Institute of Governance, "*Basel AML Index 2021: 10th Public Edition - Ranking money laundering and terrorist financing risks around the world*", (Switzerland: Basel Institute of Governance, 2022), https://index.baselgovernance.org.

Country	Allowance of partial anonymity in CBDC accounts	Basel AML Index 2021 score (in ascending order, from 0-10, where 0 represents lowest risk)
Sweden	No	3.36
Ghana	No	4.88
Jamaica	No	5.77
Bahamas	Yes	6.46
Nigeria	Yes	6.88
China	Yes	6.7
Cambodia	Yes	7.13

Table 3: Summary of partial anonymity and Basel AML Index 2021

As illustrated in Table 3, poor performance on the index is correlated to central banks allowing partial anonymity for CBDC users. By breaking down the Basel Index into its component parts, I explain how poor performance in the Basel Index reflects a lack of political willingness of central banks to strengthen their AML/CTF regime.

The Basel AML Index is composed of 18 indicators[123]; each contributing varying weights to the final index. I will assess only the top 7 indicators, which in total account for 70% of the index.

The most significant indicator, which accounts of 35% of the index, is based on the Financial Action Task Force (FATF) Mutual Evaluation Reports. These reports assess a country's legal compliance to the 40 recommendation and 11 key goals of the FATF standards. The FATF

[123] Basel Institute of Governance, "What's behind the Basel AML Index?", accessed October 19, 2022, https://index.baselgovernance.org/methodology.

reports are not published as an index, so the Basel Governance Institute tabulates a country's compliance to FATF standards into a numerical score. A poor score, by extension, reflects a country's shortcoming in legislating stricter AML/CTF regulations according to the FATF standards, suggesting a lack of political concern for a strong AML/CTF regime.

The next indicator is the Tax Justice Network Financial Secrecy Index, which accounts for 15% of the final index. The Financial Secrecy Index measures the extent to which a country's legal framework legislates transparency in how the banking sector exchange information. The index also incorporates the jurisdiction's share of the global market of offshore banking services, as larger offshore banking sectors offer more opportunities for illicit transactions to be hidden. Poor performance on this index reflects a country's interest to allow financial secrecy in order to benefit from offshore banking services, leading to a lack of political will to legislate stricter transparency standards for the banking sector.

The next two indicators measure the risk of corruption and bribery, which in total account for 10% of the final index[124]. Taken together, they measure the prevalence of rent-seeking and the presence and enforcement of anti-corruption laws. Rent-seeking behavior flourishes in a climate that lacks political conviction to deter it. Rent-seeking is also facilitated by anonymous transactions, and jurisdictions that lack the conviction to deter rent-seeking are also not likely to be interested in barring anonymous transactions.

[124] The indicators are Corruption Perceptions Index and Bribery Risk Matrix. The former is by Transparency International, and the latter by TRACE International, both international non-governmental organizations.

The last three indicators measure financial transparency and reporting standards, which in total account for 10% of the final index[125]. Taken together, they reflect a country's corporate transparency, reporting standards for the financial sector, and capacity of the financial sector to abide by banking regulations. Poor performance in these indexes reflect a lack of political will to impose stricter transparency in financial reporting standards, showing unwillingness to impose higher AML/CTF compliance costs onto financial institutions.

Each component of the Basel AML Index reveal how poor performance in the index is caused by a lack of political will to strengthen the country's AML/CTF regime. This analysis shows that taking into consideration central banks' interests to maximize the benefits of accessibility and minimize AML compliance costs, the lack of political will to strengthen the domestic AML/CTF regime results in the decision of some central banks to accommodate partial anonymity for CBDC users.

4.2.5 Ruling out a potential confounder: FATF grey list

Lastly, this paper finds that the risk of inclusion in the FATF grey list is not a confounder in influencing whether a central bank chooses to allow partial user anonymity.

The Financial Action Task Force (FATF) is a leading inter-governmental body that set global standards on AML/CTF. To necessitate adherence to the FATF standards, the organization publishes a 'grey list' every quarter that publicly identifies jurisdictions that lack compliance to

[125] These indicators are the Extent of Corporate Transparency Index by World Bank, Global Competitiveness Report by World Economic Forum, and IDA Resource Allocation Index by World Bank.

the FATF standards and, as a result, are subjected to increased monitoring by the FATF. Through public identification, these economies face the cost of reduced foreign investor confidence, pressuring them to improve their AML/CTF regimes according to the FATF guidelines. Inclusion in the FATF grey list is a concern to governments and the cost of being placed on the list is evident; in a press conference in 2021 that addresses the removal of Ghana from the grey list, the minister of finance expressed that the country suffered economic consequences as a result of being included in the list[126]. In another press conference in 2019, the Cambodian government described the inclusion of Cambodia in the grey list in 2019 as 'unfair' and announced their intention to meet FATF standards swiftly[127]. Even though being placed on the grey list is costly to an economy, Table 4 shows that historic and current inclusion in the grey list does not deter a country from allowing user anonymity.

[126] Ministry of Finance, "Ghana is off the Financial Action Taskforce "Gray list"", July 1, 2021, https://mofep.gov.gh/news-and-events/2021-07-01/survey-of-the-ghanaian-tax-system.

[127] Purushotman and Niem, "'Unfair' to include Cambodia in money-laundering 'grey list'", *The Phnem Penh Post*, February 25, 2019, https://www.phnompenhpost.com/national/unfair-include-cambodia-money-laundering-grey-list.

Country	Allowance of partial anonymity	Inclusion in FATF grey list[128]
Sweden	No	NA
Ghana	No	October 2018 - June 2021
Jamaica	No	February 2020 - Present
Bahamas	Yes	July 2017 - November 2020
Nigeria	Yes	February 2010 - October 2013
China	Yes	NA
Cambodia	Yes	February 2019 - Present June 2011 – February 2015

Table 4: Summary of FATF grey list inclusion

The lack of deterrence is due to the methodology that FATF uses to identify 'grey list' jurisdictions[129]. Of the 40 FATF recommendations, anonymity in CBDC transactions concern recommendation number 10 (r10), which specifies that "financial institutions should be prohibited from keeping anonymous accounts or accounts in obviously fictitious names" and are required to undertake customer due diligence measures when establishing business relations[130]. During FATF Mutual Evaluations, countries are rated in 4 tiers: 'non-compliant' (NC), 'partially compliant' (PC), 'largely compliant', and 'compliant' according to their compliance to individual FATF recommendations. To be identified for potential inclusion in the grey list, countries would have to score NC or PC in 20 or more recommendations (out of the 40 listed in

[128] Financial Action Task Force, "High-risk and other monitored jurisdictions", accessed October 19, 2022, https://www.fatf-gafi.org/publications/high-risk-and-other-monitored-jurisdictions/more/more-on-high-risk-and-non-cooperative-jurisdictions.html.

[129] The difference in methodology also accounts for why FATF grey list and Basel AML Index is not correlated. While FATF standards contribute to 35% of the Basel AML Index, the remaining 65% of the Basel AML Index assesses broader macro-economic conditions.

[130] Financial Action Task Force (FATF), "*International Standards on Combating Money Laundering and the Financing of Terrorism & Proliferation – the FATF Recommendations*" (Paris: FATF, 2012-2022), 14, retrieved from www.fatf-gafi.org/recommendations.html.

FATF guidelines). Emphasis is also given to recommendations 3, 5, 6, 10, 11, and 20, where jurisdiction cannot score NC or PC in more than 3 of these highlighted recommendations[131]. Even though user anonymity of CBDCs affects r10, one of the highlighted recommendations, it is still nevertheless only one out of many recommendations.

The current performance of countries in r10 also shows that partial anonymity is unlikely to place them at risk of being grey-listed. All case studies (Jamaica[132], Ghana[133], Sweden[134], China[135], Nigeria[136], Cambodia[137]), with the exception of Bahamas, are found to be 'largely compliant' in r10. The Bahamas scored 'compliant' in r10[138]. Their existing compliance with r10 show that they have leeway to accommodate more risk of non-compliance before being downgraded in their compliance with r10, emboldening the allowance of partially anonymous CBDC transactions.

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[131] Financial Action Task Force, "High-risk and other monitored jurisdictions"

[132] CFATF. CFATF. "*Anti-money laundering and counter-terrorist financing measures – Jamaica, 3rd Enhanced Follow-up Report & Technical Compliance Re-Rating*", (Trinidad and Tobago: CFATF, 2021), 1, https://www.cfatf-gafic.org/documents/4th-round-follow-up-reports/jamaica-2.

[133] GIABA (2021), "*Anti-Money Laundering and Counter-Terrorist Financing Measures – Ghana , Second Round Mutual Evaluation Report*", (Dakar: GIABA, 2021), 1, https://www.fatf-gafi.org/publications/mutualevaluations/documents/fur-ghana-2021.html.

[134] FATF. "*Anti-money laundering and counter-terrorist financing measures – Sweden, 1st Regular Follow-up Report & Technical Compliance Re-Rating*", (Paris: FATF, 2020), 1, http://www.fatf-gafi.org/publications/mutualevaluations/documents/fur-sweden-2020.html.

[135] FATF. "*Anti-money laundering and counter-terrorist financing measures – People's Republic of China, 2nd Enhanced Follow-up Report & Technical Compliance Re-Rating*", (Paris: FATF, 2021), 1, http://www.fatf-gafi.org/publications/mutualevaluations/documents/fur-china-2021.html.

[136] GIABA. "*Anti-Money Laundering and Counter-Terrorist Financing Measures – Federal Republic of Nigeria, Second Round Mutual Evaluation Report*", (Dakar: GIABA, 2021), 17, https://www.fatf-gafi.org/countries/n-r/nigeria/documents/mer-nigeria-2021.html.

[137] APG. " *Mutual Evaluation of Cambodia – 3rd Follow-Up Report*", (Sydney: APG, 2021), 1, https://www.fatf-gafi.org/publications/mutualevaluations/documents/fur-cambodia-2021.html.

[138] CFATF. "*Anti-Money Laundering and Counter Terrorist Financing Measures – The Bahamas, 4th Enhanced Follow Up Report & Technical Compliance Re-Rating*", (Trinidad and Tobago: CFATF, 2021), 3, https://www.cfatf-gafic.org/documents/4th-round-follow-up-reports/the-bahamas-2.

Hence, even though allowing user anonymity for CBDCs may aggravate a country's AML/CTF regime, the way in which FATF standards and mutual evaluations are designed make it unlikely that partial anonymity will significantly influence a country's likelihood of being placed on the FATF grey list. As a result, the low risk of being placed on the FATF grey list does not influence a country's decision to issue a partially anonymous CBDC.

Having ruled out the FATF grey list as a confounder, this section has shown that poor performance in AML/CTF, as measured by the Basel AML Index, shows that a central bank lack political will to ensure that its CBDC is not detrimental to AML/CTF efforts, resulting in the accommodation of partial anonymity.

CHAPTER 5: LIMITATIONS AND FURTHER RESEARCH

5.1 Limitations for cross-border interoperability

This paper found that central banks express interest in cross-border interoperable CBDCs to better manage economic factors that drive cryptocurrency adoption; namely high remittance fees, high inflation, and FX or capital controls. In assessing the usefulness of cross-border interoperability in mitigating the depreciation of a floating currency, further empirical research is needed to ascertain if cross-border CBDC usage truly has meaningful impact in driving demand for a local currency. I also argued that cross-border interoperable CBDCs may strengthen a central bank's use of FX or capital controls if an economy is reliant on CBDCs for cross-border transactions. To substantiate this hypothesis, further research may assess the degree to which people might become reliant on CBDCs for cross-border payments and related switching costs to other modes of cross-border payment to bypass FX/capital controls.

5.2 Limitations for partial anonymity

The second finding of my paper is that central banks accommodate partial user anonymity because they lack political will to strengthen AML/CTF measures. There are two potential confounders that warrant further research: (i) hidden policy goals and (ii) the enforcement of SIM card registration laws.

5.2.1 Key policy goals of CBDCs

It is possible that countries who perform poorly in AML/CTF may harbor intentions to eventually use CBDCs as an instrument to further strengthen the AML/CTF regime. While the

public stance of central banks do not reflect this intention, more research is needed to determine if this is a hidden intention of central banks who perform poorly in AML/CTF.

All central banks publicly stated their key policy goals of CBDC issuance. Among the 7 case studies, only the Bahamas publicly specified that bolstering the AML/CTF regime is a key policy goal of the Sand dollar[139] (the Bahamas, interestingly, allows partial user anonymity). The Central Bank of Jamaica also noted that, while not a key policy goal, the tracking of payments will address AML/CTF risks[140]. Other central banks – Ghana[141], Cambodia[142], China[143], Sweden[144], and Nigeria[145] – took a more conservative stance, having stated that their CBDCs are designed to merely be compliant with AML/CTF regulations.

It is not known, however, the extent to which strengthening AML/CTF efforts is a hidden agenda behind partial user anonymity. For instance, central banks may use partial anonymity to entice users to CBDCs, and when adoption rates are high, eventually retrograde partial anonymity when individuals find that the benefits[146] of undergoing KYC checks outweigh the cost of doing so. More research is needed in this area to determine if central banks with poor AML/CTF

[139] Central Bank of the Bahamas. "*Project Sand Dollar*", 4

[140] International Monetary Fund, "*Jamaica*", IMF Country Report no. 2022/043 (2022): 22, ISBN 9798400203374/1934-7685

[141] Bank of Ghana. "*Design Paper of the Digital Cedi (eCedi)*", 26

[142] National Bank of Cambodia, 22

[143] People's Bank of China, 6

[144] Sveriges Riksbank. "*The Riksbank's e-krona project - Report 1*", 37

[145] Central Bank of Nigeria, 15

[146] If adoption rates of a CBDC is high, it becomes more useful as a method of payment.

performance actually possess hidden intentions to use CBDCs as an instrument to strengthen their AML/CTF regime.

5.2.2 SIM card registration laws

SIM card registration laws may be another confounder – the presence and enforcement of SIM card registration laws, where telcos are required to register individuals upon the use or purchase of a SIM card, may make partially anonymous CBDC transactions traceable to an identity, and as such mitigate the risk to AML/CTF efforts. This paper finds that the while the presence of a SIM card registration regime is only weakly associated with a jurisdiction's choice to allow partial user anonymity, the **enforcement** of SIM card registration laws is an area that warrants further research.

Country	Allowance of partial anonymity	SIM Card Registration Laws[147]
Jamaica	No	Legislated
Ghana	No	Legislated
Sweden	No	Not legislated
Bahamas	Yes	Legislated
China	Yes	Require facial biometric scans
Nigeria	Yes	Require facial biometric scans
Cambodia	Yes	Legislated

Table 5: Summary of SIM Card Registration Laws

[147] GSMA, "*Access to Mobile Services and Proof of Identity 2021*", (London: GSMA, 2021), 54-61, https://www.gsma.com/mobilefordevelopment/resources/access-to-mobile-services-and-proof-of-identity-2021/.

As observed in Table 5, in all the case studies, with the exception of Sweden, mandatory SIM card registration is legislated. Additionally, China and Nigeria are considered to have one of the world's strictest SIM Card registration laws, requiring facial biometric scans[148]. The presence of a strict SIM card registration regime may contribute to why the China and Nigeria accommodate partial anonymity, while Sweden does not. This association, however, does not account for why Jamaica and Ghana require KYC for all users despite the presence of a SIM Card registration regime.

Jurisdictions with stronger **enforcement** of SIM card registry laws may be more inclined to allow CBDC accounts to be registered with only a phone number. However, further research is needed to measure the enforcement of SIM card registration laws. In jurisdictions that require SIM card registration, mobile phone owners may not register SIM cards in their own names[149]. Additionally, retailers may not observe SIM card registration laws; in Cambodia, the government issued directives and warnings to reiterate observation of SIM card registration laws several years after the laws were passed[150]. This study suggest that adherence to SIM card registration laws in other jurisdictions may be lacking too, and more research is needed to determine the relationship between the enforcement of SIM card registration laws and the allowance of CBDC user anonymity.

[148] Anna. "China's SIM Card Registration Laws Among the World's Strictest", *The Beijinger*, January 10, 2020, https://www.thebeijinger.com/blog/2020/01/10/chinas-sim-card-registration-laws-among-worlds-strictest.

[149] GSMA, 36-39. For instance, a study conducted in several low-income countries found that women, people with only primary education, the disabled, and the unemployed are less likely to have a SIM card registered in their own name and are more likely to use a SIM that is registered with another family member or a friend.

[150] Long Kimmarita, "Telecoms ministry orders all SIMs registered by 2023", *The Phnom Penh Post*, August 20, 2022, https://www.phnompenhpost.com/national/telecoms-ministry-orders-all-sims-registered-2023.

CHAPTER 6: IMPLICATIONS

My paper analyzed factors that influence the design of CBDCs and presents two findings: firstly, central banks choose cross-border interoperable CBDCs to strengthen their management of factors that drive cryptocurrency usage, namely high remittance costs, high inflation, and the presence of FX or capital controls. And secondly, the accommodation of partial user anonymity in CBDC accounts stems from the lack of political will to strengthen AML/CTF regimes. These hold several implications to stakeholders of the domestic and global financial system.

On a domestic level, this study validates that the design of retail CBDCs weigh in favor of the public. For jurisdictions with poor AML/CTF regimes, partial user anonymity makes CBDCs cheaper and more accessible to the public due to reduced KYC compliance costs. For jurisdictions with high inflation and high remittance fees, cross-border interoperability would improve currency stability and the welfare of those who rely on remittances.

For the financial sector, however, CBDCs that allow partial user anonymity or cross-border interoperability are potentially destabilizing. Mandating that CBDCs allow partial user anonymity places financial intermediaries at higher risk of facilitating illicit transactions, threatening the AML/CTF reputation of the financial sector. Additionally, the usage of CBDCs for cross-border transactions threaten existing business models of financial intermediaries (i.e., payment service providers, remittance transfer providers, and currency exchanges). The increase in competition may potentially encourage smaller and less competitive financial institutions to overlook suspicious illicit transactions in favor of maximizing profits. Seeing as to how countries

who accommodate cross-border interoperability are also likely to perform poorly in AML/CTF (China, Nigeria, and Cambodia in this case), the increase in ML/TF risk-taking further threatens the reputation of the financial sector.

On the level of domestic governance, this study also validates that the design of CBDCs very intentionally serves a central bank's key policy goals. Partial user anonymity and cross-border interoperability improve financial inclusion and currency stability respectively. However, this study also reveals the importance of strengthening other areas of legislation that intersects with CBDC usage. For instance, following the example set by the PBOC, stricter cryptocurrency bans may be needed to complement cross-border interoperable CBDCs, in order to channel demand for cross-border transactions onto CBDC platforms. Stricter enforcement of SIM card registration laws will also be needed to reduce the risk that partially anonymous CBDC accounts may be used to facilitate crime.

On the international domain, countries who express interest in cross-border interoperability may find difficulty in finding central banks to partner with. For CBDCs to be cross-border interoperable, countries must have mutual bilateral interest in interoperability. Given that countries with healthy economies (i.e., high banked population, low inflation) tend not to express interest in cross-border interoperability, central banks who want interoperability will find very limited bilateral partnership options, resulting in a small web of cross-border interoperable CBDCs, which undermines its usefulness in serving broad public demand for cross-border transactions. Central banks who want interoperability may expand the web through partnerships with the private sector overseas and making their CBDC interoperable with standard foreign

exchange processes in financial intermediaries, as seen in the partnership between Cambodia's CBDC and Maybank in Malaysia[151]. CBDC partnerships with the overseas private sector, however, brings drawbacks: not only does it make cross-border transactions subjected to higher transaction fees, the web of cross-border interoperability would be fragmented according to the lines of financial intermediaries' market share. These challenges further undermine the usefulness of cross-border interoperability. Hence, in light of the lack of interest of many central banks for cross-border interoperable retail CBDCs, it is unlikely that retail CBDCs will significantly improve financial cross-border transactions. Such a goal is likely to be fulfilled by wholesale CBDCs instead, which are already seeing several ongoing international partnerships.

Given the scarcity of cross-border interoperability partners, the usefulness of Nigeria's JAM-DEX in de-dollarization and China's e-CNY in internationalizing the yuan is called into question[152]. Looking at the broader international trend of de-dollarization, the reducing of a country's reliance on the dollar, cross-border interoperable retail CBDCs are unlikely to serve as effective instruments for de-dollarization[153]. A central banks' pursuit of de-dollarization is likely to be more effective via cross-border wholesale CBDC systems instead.

[151] Cross-border interoperability of Cambodia's CBDC was earlier discussed in Chapter 4.1.4.

[152] The intentions behind cross-border interoperability for the JAM-DEX and e-CNY was earlier discussed in Chapter 4.1.1 and 4.1.3 respectively.

[153] This issue is particularly germane given recent geopolitical developments in 2022. In the Russia-Ukraine conflict, the United States is accused of weaponizing the dollar through imposing sanctions on Russia and excluding the country from the inter-bank SWIFT system, the primary system that financial institutions use globally to conduct international transactions and that is largely governed by the United States and the European Union. The weaponization of the dollar has reignited debate regarding over-reliance on the USD in international trade (with emphasis on its use as petrodollar), as a reserve currency, and as a preferred settlement mechanism in global currency exchanges, especially for countries non-aligned to the foreign policy of the United States. In a scenario where an expansive web of cross-border retail CBDCs were to exist, direct currency exchange at the retail level would bypass the inter-bank SWIFT system and eliminate the use of the USD as a third-party currency for facilitating international retail transactions.

Regarding global financial governance, anonymous use of CBDCs present a threat to the international AML/CTF regime. The increased mobility of funds puts CBDCs at risk of being used to facilitate the layering[154] of illicit funds. This is especially likely given that partial user anonymity is used in jurisdictions with weak AML/CTF regimes which lack enforcement capacity or political will to strengthen AML/CTF efforts. This study has shown that the decision to accommodate partial user anonymity is a by-product of how the benefits of financial inclusion outweigh the reputational cost of increased ML/TF risks. Given the increased risk posed to the international AML/CTF regime, the anonymous use of retail CBDCs warrants scrutiny from the FATF, who may revise its standards to discourage user anonymity, hence increasing the reputational cost to central banks who issue CBDCs that accommodate partial user anonymity.

[154] As described earlier in footnote 119, layering is a stage in the process of money laundering that involves funds being transacted through several financial institutions to distance the funds from its illicit source and, instead, give the appearance that it is from a legitimate source.

CHAPTER 7: CONCLUSION

The development of retail CBDCs by 79 central banks around the world traces back to the globalization of cryptocurrency. Like how cryptocurrency adoption rates vary across countries, the design of CBDCs is similarly subject to political economical context. This paper finds that firstly, high usage of cryptocurrency incentivizes central banks to express interest in CBDC cross-border interoperability, to use it as an instrument to lower remittance fees, improve currency stability, and better manage FX and capital controls. Secondly, lack of political will to strengthen the domestic AML/CTF regime makes central banks more likely to allow partial user anonymity to maximize the public's access to using CBDCs. These findings demonstrate how CBDCs are designed to serve key policy goals of central banks, to the benefit of the public but at the expense of the financial sector. In ensuring the success of CBDCs as policy instruments, central banks must look at other areas of legislation. Other legal domains that intersect with CBDC usage, such as cryptocurrency bans and enforcement of SIM card registration laws, must complement the intentions behind CBDCs. Outside the domestic context, central banks must also consider the policy stance of other central banks and international bodies. Cross-border interoperability is unlikely to succeed without mutual bilateral interest, and partial anonymity may warrant reconsideration if it draws increasing scrutiny from the FATF. These considerations will shape the contexts in which individual CBDCs are designed, furthering scholarly understanding of the nuances behind the seemingly global phenomenon of CBDC issuance.

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