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## E- krona project report 2

Author: Jonas Weisbrodt, Jonas GrossCentral bank digital currencies (CBDC) is currently a hot topic. A study by the Bank for International Settlements (BIS) from January 2020 shows that 80% of worldwide central banks are engaged in CBDC-related research (Boar et al., 2020, p. 3). The percentage of central banks running experiments or proofs-of-concept is also growing, reaching nearly 50%. 10% of central banks surveyed plan to introduce a publicly available (retail) CBDC over the next three years and 20% over the next six years (ibid., p. 7). Therefore, CBDC efforts are very dynamic and are also expected to increase in momentum within the next few years. This article discusses current CBDC initiatives and explains the rationale and progress of these projects. Our analysis shows that China, Sweden, the Bahamas, the Eastern Caribbean Currency Union and the Marshall Islands can currently be seen as pioneers in CBDC space. Note that this article does not focus on the definition and design principles of a CBDC. If you are interested in details about these aspects, see Klein, Gross, and Sandner (2020). Cbdc retail projects in practiceThe Central Bank of China (PBoC) was one of the first central banks to focus on the development of a CBDC, which is already forming a special working group in 2014. In April 2020, the project gained traction as testing of a CBDC prototype was announced. Currently, the prototype of the Chinese CBDC, called DC/EP (digital currency/electronic payment), is being tested by the private and also by the public sector. 50% of mobility subsidies for public sector employees are paid directly to the DC/EP digital wallet. Further tests were announced to take place during the Winter Olympics in 2022. The role of cash in China is diminishing. In 2016, only 40% of all cash payments (Statista 2019) were made — 2018, only 20% (Bundesbank 2019). In the euro area, this share is 79% (Esselink, Hernández, 2017, p. 4). China is therefore one of the few countries in the world where the currency in circulation (CIC) as a share of gross domestic product (GDP) decreased (see Figure 1). Figure 1: Development of cash use in China; Source: van der Knaap, de Vries 2018, p. 145. Lower use of cash may pose risks, as pointed out by Mu Changchun of the PBoC. Changchun points to the high dependence on private sector companies at risk of bankruptcy of private platforms offering comprehensive digital payment methods (Goh, Shen 2019). A CBDC that replaces cash could support the development of a smaller cash-dependent society without the fallout risk associated with private platforms such as a CBDC issued and backed by the public sector. In addition, the PBoC aims to protect its monetary sovereignty by curbing demand for private cryptocurrencies (Wilmoth 2018) and preventing Libra, the Facebook-initiated digital currency project, taking root in China. Broad acceptance of The Wave of Chinese would threaten sovereignty because Libra will not be backed by Renminbi (RMB) (Bartz 2019). A Chinese CBDC is also justified by driving the internationalization of RMB. Although efforts to internationalize RMB are already taking place, the US dollar remains dominant (Wood 2019). By improving the ability and convenience of cross-border RMB payments and RMB payments abroad, a CBDC could strengthen the international use of RMB and thereby help internationalize yuan (Bloomberg 2020). If the digital Yuan falls under capital controls, the restrictions may limit the successful internationalization of the RMB. At this point, it is unclear whether the PBoC will focus on internationalization of yuan or capital controls. The non-interest-bearing digital yuan will allow immediate transactions, offline usability, and will not require a bank account (Jinze 2019). It is likely to be interoperable with WeChat Pay and Alipay (Goh, Shen 2019). Jinze (2019) reports that the PBoC wants to implement a two-pronged operational structure with the central bank that issues and redeems the digital yuan exclusively to selected companies. This includes banks as well as other large companies such as Alibaba and Tencent. PBoC can trade with these companies through distributed accounting technology (DLT). As companies must be able to meet the target of 300,000 processed transactions per second, it is unlikely that they will also use a DLT infrastructure to conduct end-user transactions (Jinze 2019). Sweden: e-kronan March 2017, the Swedish Riksbank started its CBDC project, the e-krona (Riksbank 2017). A pilot is planned from 2020 to February 2021. Afterwards, the Riksbank decides whether to proceed with issuing a CBDC. The pilot's initial focus will be on a non-interest-bearing CBDC (Riksbank 2018, p. 38). The project aims to ensure direct payments at any time, and offline usability is also investigated in the project (Riksbank 2020, p. 3). When it comes to anonymity, the Riksbank emphasizes that anonymous payments would only be in line with the regulation if e-krona transactions take place peer-to-peer (The Riksbank 2018, p. 16). For its pilot project, the Riksbank is planning a two-level operational structure (see Figure 2). Figure 2: Planned operating structure of the e-crown pilot; Source: Riksbank 2020, p. 4. A network consisting of the Riksbank and selected banks is implemented on a licensed DLT. In addition, a notary node helps prevent double expenses. After activation, end users would manage their e-crown in digital wallets (ibid., p. 5). In addition to China, Sweden also experiences low cash use. In a survey including 50 countries, a majority of both industrialized and emerging countries show increasing CIC relative to GDP, which amounts to 9% on average (Bech et al. 2018, p. 71). In 2018, Swedish CIC accounted for only 9% of GDP (see Figure 3), which is the lowest ratio in the world (van der Knaap, de Vries 2018, p. 134). In addition, only 20% of all payments in implemented with cash (Statista 2019), and a growing number of traders are expected to stop receiving cash in the future. Swedish companies are not obliged to accept cash and Sweden will be cashless by 2023, according to forecasts from Deputy Governor Cecilia Skingsley (Jones 2018). Figure 3: Development of cash use in Sweden; Source: van der Knaap, de Vries 2018, p. 169. In the face of a declining use of cash, the e-krona can counteract the negative effects of an unhindered marginalization of central bank money by offering continued access to (digital) central bank money (Söderberg 2019, p. 3). If cash is less and less accepted, an alternative to digital payments disappears. Network effects could easily lead to oligopolies that lack competition. As regards its marginalization, cash could not compete as a means of payment, resulting in higher fees for the dominant suppliers (ibid.). As an alternative, e-krona could indirectly limit the maximum fee that private providers can charge. The Riksbank also sees threats to financial stability in the form of less robust payment systems that profit-oriented private companies do not take as sophisticated measures to ensure the functionality of payment systems in crises such as public institutions, such as the Central Bank (ibid.). A CBDC would offer a robust alternative in the event of crises or turbulence at private payment service providers, which would ensure the stability of the Swedish payment system. Although Swedes spend less money than any other nation, there are sections of the population that struggle with technological innovations and rely on cash (ibid.). If cash acceptance decreases further, these people will become increasingly excluded. The e-krona could target people who usually renounce digital payments, which counteracts their financial exclusion. Rather, such an initiative can be expected from the public sector and not from the (profit-oriented) private sector. Bahamas: Sand DollarThe Bahamian CBDC project is called Sand Dollar and its prototype had already begun in the district of Exuma in December 2019 and two months later also in the Abaco Islands. The Central Bank of the Bahamas (CBoB) plans to expand the project to all islands in the second half of 2020. Currently, about 380 000 people live scattered on the 700 islands that make up the Bahamas. The national currency, the Bahamian dollar, held at a 1:1 peg with the U.S. dollar. Although 80% of Bahamian adults have a bank account — compared to a global average of 69% (Demirgüç-Kunt et al. 2018, p. 2) — there are significant gaps in access to financial services (CBoB 2018a, p. 6). Opening bank branches on remote islands is often not cost-effective for banks. In addition, stricter anti-money laundering (AML) and counter-terrorist (CFT) standards made banking services more expensive and led to a further in bank branches (Iceland Crypto 2019). Surprisingly, this decline in bank branches did not lead to adoption of electronic payments but a higher cash use (ibid., Figure 4). Therefore, a target of the Sand Dollar is to make digital payment services more attractive by increasing the efficiency of the payment system (CBoB 2019, p. 4). A replacement of cash for sand dollars would lead to cost savings, such as a cost reduction. Figure 4: Currency in circulation in the Bahamas; Source: CBoB 2018b, p. 7. Stricter AML and CFT standards also excluded certain groups from banking services and led to the self-exclusion of persons driven by new due diligence requirements (CBoB 2019, p. 3, 6). Therefore, financial integration is the primary goal of Sand Dollar (ibid.). In order to achieve this objective, unjustified exclusion and self-exclusion from banking services must be prevented. Finally, economic surveillance could be strengthened by the implementation of a CBDC (CBoB 2019, p. 17). Like digital money, Sand Dollar would allow tracking. With the information obtained, the CBoB could gain a better understanding of the distribution of money that would allow for better tax collection and political decision-making (ibid.). To reach unbanked sections of the population, the private use of Sand Dollar will not require a bank account (ibid., p. 12). In addition, a card-based version that can be updated via POS devices will allow the use of Sand Dollar without a mobile device (ibid., p. 14). Sand Dollar will not bear interest, and limits will be imposed on the held amount (ibid., p. 12). Transactions with Sand Dollar are intended to be low priced, almost instantaneous, and do not require an internet connection (ibid., pp. 10, 17). This is especially important in a region prone to hurricanes. Furthermore, the payment system for Sand Dollar will be interoperable with other payment systems of classic financial intermediaries (ibid., p. 10). Sand Dollar transactions will not be anonymous, but the CBoB emphasizes strict attention to confidentiality (ibid., p. 9). The Bahamian Central Bank is planning a two-pronged operational structure for Sand Dollar (ibid., p. 12). Transactions will be limited to domestic use (CBoB 2019, p. 10). Since the Sand Dollar represents an additional digital variant of the Bahamian dollar, i.e. belonging to the same currency, capital controls may apply to The Sand Dollar as well. This is necessary in order to maintain a fixed exchange rate and also engage in independent monetary policy. As can be seen from Fleming (1962), it is impossible to allow free capital flow, moreover. Since it is impossible to reconcile all three elements, namely fixed exchange rates, sovereign monetary policy, and free capital flow, this concept is known as the impossible trinity. Eastern Caribbean Currency Union (ECCU); DXCDI in March 2019, the Eastern Caribbean Central Bank (ECCB) launched its CBDC project called DXCD. Since March 2020, CBDC has been tested in selected pilot countries for six months. The ECCB issues the Eastern Caribbean Dollar (ECD), which is the legal tender in eight of the eleven States of the Organization of Eastern Caribbean States (OECs), together form the Eastern Caribbean Monetary Union (ECMU). The islands that make up the OECs are located in the Caribbean Sea and are inhabited by more than 14 million people. Since 1976, the ECD is pegged to the U.S. dollar. The economy of the OECs is mainly paper based; 90% of payments are made with cash or cheques, both of which are deemed ineffective (St. Lucia Times 2019). Current digital payment services are costly (ibid.). Furthermore, they usually request a minimum amount of expenditure, excluding transactions of lesser value from being carried out digitally (ECCB n.d.). According to the ECCB (n.d.), established payment services do not meet the needs of certain population groups. As a long-term objective of DXCD, the ECCB mentions financial integration, growth, competitiveness and resilience (ibid.). In order to reach economically excluded sections of the population, transactions in the CBDC will not require a bank account. Furthermore, there will be neither a minimum balance of CBDC to maintain an account nor a minimum amount of expenditure (ibid.). Transactions with digital ECD will be free and processed in real time (ibid.). However, maximum thresholds in the form of limits on transactions and the holding of digital ECD will be implemented (ibid.). While the ECCB promises the integrity and confidentiality of all transaction information (ibid.), it remains unclear how high the degree of data privacy will be in the end. Internet access will be required to fully use the digital ECD. Since CBDC is just another form of cash (ibid.), it would not bear interest. As an operating structure, a two-level system that relies on a DLT network on the first layer (ibid.) is tested. Since the digital ECD acts as a digital equivalent of cash, it is likely to be subject to the same capital controls (O'Neal 2020). Marshall Islands: SOVI February 2018 revealed the Republic of the Marshall Islands (RMI) plans for the issuance of a digital currency, Sovereign (SOVI). With a population of only 58,000 inhabitants, the cost of a physical national currency is currently exceeding its benefits. That is why the US dollar currently acts as the legal tender in RMI. With SOVI, RMI plans to introduce a second, exclusively digital, legal tender. This is motivated by expensive and inefficient payment methods prevailing in RMI. For example, the cost of remittances amounts to 10% of the total funds transferred (SOVI Foundation 2019, p. 7). Furthermore, only very few people have bank accounts or debit cards (ibid., p. 7). Consequently, the country's payment system is dominated by cash. With SOVI, RMI wants to offer an attractive digital payment service to the unbanked (ibid.). RMI accounts for about 20% of annual GDP and is highly dependent on US aid (IMF 2018, p. 2). Since RMI plans to retain 50% of the originally issued SOVs, at the beginning, a continued balanced SOVs, which as the annual growth of SOVs, will constitute a new source of income, when financial support from the United States ends in 2023. Only low fees would be charged on SOVI transactions that are processed in real time and do not require a bank account (SOVI Foundation 2019, p. 9). SOVI will be based on the permit-promised DLT, whose protocol will also ensure a monetary supply with a stable growth rate (ibid., p. 12). This follows Friedman's k-percent rule (Friedman, Schwartz 1963). After the first issue of 24 million SOVI units, the money supply will grow at an annual rate of 4%. The additional amount for SOVs is planned to be distributed proportionally to, among other things, holders of SOVI (SOVI Foundation 2019, p. 13), which makes SOVI practically interest bearing. A fixed monetary policy can guarantee confidence, but it also means that RMI cannot counteract an appreciation or depreciation of sov with adjustment of the money supply. Therefore, a high volatility in sov's price seems possible, especially as international access will be allowed. The impending high volatility in sov is one of the reasons why the IMF (2018) expressed concern about the Marshallese project. However, a floating exchange also has its advantages, e.g., making disintermediation of the banking sector less likely. If depositors overly replace their U.S. dollar-denominated deposits for SOVs, sleep appreciate and make continued compensation less attractive. So-called controllers will board users, who will then be able to shop SOVs on the distributed ledger (SOVI Foundation 2019, p. 18). Twenty-one block producers (ibid., p. 11) approved by RMI would initially check transactions, wherein more validators were selected later (ibid.). There are no limits to possession or transacting SOV devices. Even if the transactions do not contain personally identifying information (ibid., p. 10), SOVI users must be verified (ibid., p. 9). While all the CBDC projects presented would be digital variants of an existing currency, which constitutes central bank debt, SOVI would be a new, government-backed digital currency. Albeit legal tender, SOVI would not be a liability for a central bank — even since rmi does not have its own central bank — and thus strictly speaking would not qualify as a CBDC. Summary of current retail CBDC initiativesMore and more central banks are showing interest in CBDCs. Interestingly, an overly dominant role of cash in the payment system, as well as declining cash use, is cited as motivating factors. On the one hand, CBoB and RMI address inefficiencies from high cash use and aim to promote financial integration with a CBDC. China and Sweden, on the other hand, see the importance of declining cash use and stress negative consequences of lower cash use as a motivation for their CBDC. Other reasons are better (CBoB), a relieved internationalisation of the currency (PBoC), and an alternative source of income (RMI). As for their implementation design, cbdc's are quite similar. With the exception of SOVI, all projects would depend on a two-level business structure, and none of them are scheduled to bear interest. However, these initiatives follow different approaches to CBDC boundaries, anonymity, offline usability, international access and technology. Note that the effect of a CBDC on the financial system so far can only theoretically be analysed. It remains to be seen, therefore, how citizens would actually react to the concrete implementation of a new version of central bank money. Given the advanced status of the projects presented, we may soon be able to observe this reaction. Additional materialsJonas Weisbrodt studies Philosophy & Economics (B.A.) at the University of Bayreuth. He became aware of the central bank's digital currencies during a seminar at the University of Bayreuth. In addition to macroeconomic issues, he is interested in game theory. During his bachelor's thesis, he deals with models that examine the stability of authoritarian governments in the face of potential protests. The best way to contact Jonas is by mail (jonas.weisbrodt@gmx.de). Jonas Gross is a research assistant at the University of Bayreuth and project manager at Frankfurt School Blockchain Center. His research and his doctoral thesis focus mainly on central bank digital currencies (CBDC) and stablecoin projects such as Libra. You can contact Jonas by mail (jonas.gross@fs-blockchain.de), LinkedIn ( and Twitter (@Jonas\_Gross). This article was written in conjunction with a seminar on cryptocurrencies and central bank digital currencies (CBDC) at the University of Bayreuth. The seminar was offered by the President of the International Economy and Finance (WV. I. 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