CBDC, Fintech and cryptocurrency for financial Inclusion and financial stability

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CBDC, Fintech and cryptocurrency for financial Inclusion and financial stability

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Abstract

This article presents a discussion of the role of central bank digital currency (CBDC), Fintech and cryptocurrency for financial inclusion and financial stability. We show that Fintech, CBDC and cryptocurrency can increase financial inclusion by providing an alternative channel through which unbanked adults can access formal financial services. CBDC and Fintech services have the potential to preserve financial stability while cryptocurrency presents financial stability risks that can be mitigated through effective regulation. The paper also identified some problems of CBDC, Fintech and cryptocurrency for financial inclusion and financial stability. The paper offered some insight about the future of financial inclusion and the future of financial stability. Although CBDC, Fintech or cryptocurrency can extend financial services to unbanked adults and offer cost-efficient advantages, there are risk considerations that need to be taken into account when using CBDC, Fintech and cryptocurrency to increase financial inclusion and to preserve financial stability.

Keywords: CBDC, Fintech, cryptocurrency, financial inclusion, financial stability, blockchain, central bank digital currency.

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1. Introduction

Scholars disagree about the role of Fintech, CBDC and cryptocurrency for financial inclusion and financial stability. Cryptocurrency is not even considered to be a positive contributor to financial inclusion and financial stability. In fact, Cumming et al (2019), Taher and Tsuji (2022) and Bateman (2020) dismiss Fintech, CBDC and cryptocurrency as 'over-stretched' determinants of financial inclusion and financial stability because they can be manipulated and used to achieve goals that serve private interest rather than public good. From this perspective, Fintech, cryptocurrency and CBDC do not promote financial inclusion and financial stability if they serve private interests. They only promote financial inclusion and financial stability when they serve public interest. Fredman and Phillips (2022), Buckley et al (2019), FSB (2022a), Deng et al. (2021) and Petrou (2018) reject the idea that digital financial innovation naturally improves financial inclusion and financial stability. They reject the idea because they believe that it underestimates the hidden risks inherent in digital financial innovation that can hinder financial stability and financial inclusion.

A major reason for the disagreement in the literature is because research that clarifies our understanding of the role of digital financial innovation for financial inclusion and financial stability are shallow and are not abundant in the literature. Existing research do not demonstrate a clear-cut channel through which Fintech, cryptocurrency and CBDC promote financial inclusion and financial stability. In fact, the few studies that examine the role of Fintech, cryptocurrency and CBDC for financial inclusion and financial stability often downplay inherent risks in digital financial innovation (Philippon, 2016; Kim and Kwon, 2019; Sotiropoulou and Guégan, 2017). This observation in the literature give rise

to the need for research that clarifies our understanding of the role of Fintech, cryptocurrency and CBDC for financial inclusion and financial stability. Such research will have policy implications and shape the future of financial inclusion and financial stability. Research about the role of these digital financial innovations for financial inclusion and financial stability is important because it will influence the priority that policy makers attach to digital financial innovation for financial inclusion and financial stability reform. There is need for research that provides a convincing framework that demonstrate the channel(s) through which digital financial innovation, such as CBDC, Fintech and cryptocurrency, promotes financial inclusion and financial stability, and the implication for the future of financial inclusion and financial stability. Having identified this gap in the literature, this paper fills this gap in the literature.

Therefore, the purpose of this paper is to present a discussion about the role of central bank digital currency (CBDC), Fintech and cryptocurrency for financial inclusion and financial stability. In terms of definition, financial technology (or Fintech) is defined as the use of technology and software to improve the processes of financial institutions and to improve the delivery of financial services to end users (Vives, 2017; Ozili, 2018). CBDC is commonly defined as money available in digital or electronic form (Tronnier, 2020). Cryptocurrency is commonly defined as a digital currency in which encryption techniques are used to regulate the generation of units of currency and to verify the transfer of funds without needing a financial intermediary or central bank (Lexico, 2020). These three digital financial innovation (CBDC, Fintech and cryptocurrency) have disrupted traditional finance by providing an alternative way to deliver financial services, and they also have risk implications.

The focus on CBDC, Fintech and cryptocurrency in this study is because CBDC, Fintech and cryptocurrency have become very popular among regulators, financial institutions, citizens and among those who do not want to be regulated. CBDC is popular among central banks, Fintech is popular among financial institutions while cryptocurrency is popular among ordinary people and those who want the democratization of financial services. The recent COVID-19 pandemic reinforced the benefits of Fintech and cryptocurrency as they allowed people to engage with financial services remotely without needing intermediaries during the pandemic, and it helped to reduce frictions in the payment system during the pandemic. Fintech, cryptocurrency and CBDC present an opportunity for the global financial system to transform itself to facilitate efficient payments, improve financial inclusion and reduce systemic risk when appropriate regulations are in place. In this paper, I discuss some recent financial innovation particularly Fintech, cryptocurrency and CBDC and the implications for financial inclusion and financial stability. The paper reviews the development of financial innovation with particular focus on CBDC, Fintech and cryptocurrency, and it identifies implications for financial inclusion and financial stability. It also points out some problems that arise from using CBDC, Fintech or cryptocurrency-based financial services. It further identifies how CBDC, Fintech and cryptocurrency might change the future of financial inclusion and the future of financial stability. The discussion in this paper build on the theory of finance and growth which argues that financial sector agents use diverse financial instruments (including financial innovations) to ease financing constraints which enables financial institutions to increase credit supply to support production and investment activities that contribute to economic growth (Levine, 2005). And since meaningful economic growth

cannot be achieved without financial stability and high levels of financial inclusion (Kim et al, 2018; Carbó-Valverde and Sánchez, 2013), it makes sense to draw a connection between financial innovation, financial stability, financial inclusion and economic growth. In other words, financial (digital) innovation can affect financial stability and financial inclusion which in turn affects economic growth. Although this theoretical dimension is relevant for this study, this paper did not focus on economic growth. Rather, it focused on how financial innovation affects financial stability and financial inclusion.

The discussion in this paper contributes to the literature in four ways. First, the study contributes to the financial innovation literature by examining the role of digital financial innovation in promoting financial stability and financial inclusion in society. Second, this study contributes to the financial stability literature by showing that Fintech, CBDC and cryptocurrency are instruments that can increase or decrease financial stability risks under specific conditions. Third, the study contributes to the financial inclusion literature by showing that Fintech, CBDC and cryptocurrency can be used as instruments to extend basic financial services to unbanked and financially excluded adults. Finally, the study contributes to the central bank digital currency literature by showing that CBDC can be an instrument for promoting financial inclusion or financial stability under certain conditions.

The rest of the paper is organized as follows. Section 2 presents the literature review. Section 3 and 4 present a discussion of the role of CBDC, Fintech and cryptocurrency for financial inclusion and financial stability. Section 5 highlights the problems of digital financial innovation for financial inclusion and stability. Section 6 presents a discussion

about the future of financial inclusion and the future of financial stability. Section 7 presents the conclusion of the paper.

2. Literature review

2.1. General effects of financial innovation

An extensive literature documents the risks and benefits of financial innovation and suggests options for meaningful regulation of financial innovation. Indraratna (2013) showed that financial innovation has led to new and sophisticated financial products and has led to the creation of new types of institutions as well as expanding the role of existing institutions. Schindler (2017) argued that the technologies that support recent financial innovation (e.g. Fintech innovations) are not new, but financial institutions are only now applying the technologies to financial products and services. Schindler (2017) further argued that Fintech is getting so much more attention than traditional innovation because of the depth of financial innovation. The deeper the financial innovation, the greater the ability of that financial innovation to transform financial services, and the greater the risk to financial stability. Dabrowski (2017) showed that the recent wave of financial innovation poses a serious challenge to the business model of financial institutions and can create new risks to financial stability. But recent financial innovation will not significantly affect monetary policy, and is unlikely to undermine the ability of central banks to perform their price stability mission. Plosser (2009) argued that financial innovation in financial markets has played a positive role in promoting economic growth even though the same financial innovation has contributed to turmoil in financial markets particularly during the 2008

global financial crisis. Similarly, Avgouleas (2015) argued that financial innovation has a welfare enhancing effect and is also a cause of major financial crisis such as the 2008 global financial crisis. Avgouleas (2015) further argued that the financial sector creates financial innovation that is based on perverse incentives because the industry has the capacity to use financial engineering to 'pervert' finance theory and create some infinitely self-referential products whose only purpose is for gambling, profit-making and transmitting high risk to the financial system. As a result, any proposed regulation of financial innovation should focus on altering the incentives of innovators through a properly balanced mix of incentives and sanctions (Avgouleas, 2015). In terms of the risk and benefit of financial innovation and its regulation, Lumpkin (2010) pointed out that financial innovation is neither always helpful nor always threatening. This is because some financial innovation can improve the efficient allocation of resources which contributes to higher level of capital productivity and economic growth while other financial innovation can trigger a financial crisis. Considering these two effects, Lumpkin (2010) argued that innovation should be seen as a natural aspect of the workings of a competitive system, and the ideal policy approach to regulating financial innovation is to find an appropriate balance between preserving the safety and soundness of the financial system and allowing financial institutions and markets to perform their intended functions in a competitive environment without undue regulatory interference (Lumpkin, 2010). And even when such regulations are created, Calomiris (2009) argued that financial innovation will respond to regulation by avoiding regulatory restrictions that would limit the activities people want to engage in.

Despite the risk of financial innovation, empirical financial innovation research has shown that financial innovation offers some benefits to financial institutions and the economy. For example, Lee, Wang and Ho (2020) examined the impact of financial innovation on bank growth. They analyzed 40 OECD and non-OECD countries from 1989 to 2011. The study showed that banks located in countries with a higher level of financial innovation exhibit better growth in assets, loans and profits; however, bank regulations, financial reforms and country governance indicators weakened the relationship between financial innovation and bank growth. Mollaahmetoğlu and Akçalı (2019) investigated the relationship between financial development, financial innovation and economic growth using fifteen countries from 2003 to 2016. Financial development was measured using five variables: financial access, financial depth, financial efficiency, financial stability and number of financial innovation. They find a significant and positive relationship between financial innovation and economic growth. Their result implies that the higher the number of financial innovation, the higher the rate of economic growth. The authors conclude that financial innovation is the main channel through which financial development affects economic growth. Existing research also document the effect of financial innovation on financial stability. Gai et al (2008), in their general equilibrium modeling, showed that financial innovation and greater macroeconomic stability have made financial crises in developed countries less likely than in the past, but when they occur, the effect tend to be more severe than in the past.

Some studies also examine the effect of financial innovation on financial inclusion. Ozili (2021a), in a review of literature, showed that there is a bidirectional association between the level of financial inclusion and the level of financial innovation. Kabir (2022) showed

that financial innovation significantly closes the gaps in financial inclusion. Yuan, Ye and Sun (2021) found that financial innovation affects green innovation by improving financial intermediaries' ability to screen information. They also found that financial innovation promotes green innovation in countries with stricter regulations and lower bank competition. Ozili (2021b) examined whether innovative financial products which are designed for financial inclusion have a significant effect on financial risks. The innovative financial products are debit cards, credit cards and digital finance products. They find that the increase in the use of debit cards, credit cards and digital finance products reduced risk in the financial sector of advanced countries and developed countries but not for transition economies and developing countries. Beck (2020) showed that financial innovation in the form of new delivery channels, products, and providers can increase access to finance and thus increase the size of the banked population. Beck (2020) further showed that examples of these financial innovation are mobile money and crowdfunding platforms. Ozili (2022e) showed that financial innovations that enable the decentralization of finance offers many benefits such as broadening financial inclusion, eliminating the need for intermediaries and making cross-border transactions cheaper; however, the associated risks include data theft risk, interconnectedness risk and external data risk, and greater propensity for illicit activity using DeFi applications. Salampasis and Mention (2018) argued that the emergence of Fintech innovation will help to close the gap between unbanked societies, under-banked societies and developed societies, and it is bringing long-term societal transformational change for the financially excluded or underserved adults while leading to inclusive economic growth.

2.2. A systematic review of the literature

Although researchers have investigated the general effects of financial innovation and the effect of digital financial innovation on financial stability and financial inclusion from a wide range of methodological approach, extant studies are fragmented and disconnected. Therefore, it is important to take inventory of the research that has been done to date through a systematic literature review and identify key research themes. Doing so will help to consolidate extant knowledge and provide the new findings and areas for further research.

The study relied on Google Scholar as the main source of scholarly research on the topic because Google Scholar is the world's largest search engine that indexes the full text or metadata of scholarly research across many disciplines. The period selected for the article search on Google scholar was from 2010 to 2022. The article search began from 2010 because significant research on Fintech and financial inclusion began to emerge from 2010. The article search was conducted using the keywords: "Fintech", "cryptocurrency", "financial inclusion", "financial stability" and "central bank digital currency (CBDC)". The output of the article search on Google scholar resulted in 64 articles that link CBDC, Fintech and cryptocurrency to financial inclusion and financial stability. The type of literature obtained from article search are research articles, academic working papers, policy working papers, practitioner articles and other useful scholar work. The inclusion criterion is that the articles used to conduct the review must be policy articles, academic or policy working papers, published research articles and practitioner articles. The exclusion criterion is that all dissertation papers, theses and opinion materials that were found in the Google Scholar search results are excluded. All

non-English articles were also excluded. After sorting, the final sample of 33 research articles that link CBDC, Fintech and cryptocurrency to financial inclusion and financial stability was found and used to conduct the review. During the article search, I observed that existing research that link Fintech, CBDC and cryptocurrency to financial inclusion were mostly studies focused on developing countries while research that link CBDC, Fintech and cryptocurrency to financial stability was mostly studies focused on developed countries. Also, I observed that most of the single country studies were from India and other Asian countries such as Vietnam while very few single country studies were from African countries. In terms of topics with the highest citations, 'financial inclusion' studies had the highest citations, followed by 'financial stability' studies, followed by 'cryptocurrency' studies, followed by 'Fintech' studies and followed by 'CBDC' studies.

Research on how digital financial innovation affects financial stability and financial inclusion began in the 2010s just after the 2008 global financial crisis. The first set of studies in this area was country-specific studies that analyzed the concept of digital financial innovation (for example, Zhou et al (2015), McKnight et al (2010), Muthiora (2015)). These studies analyzed the prospects of digital financial innovation and emphasize the need to regulate digital financial innovation to enhance its effect on business performance (Zhou et al, 2015; McKnight et al, 2010; Muthiora, 2015). These studies focused on digital financial innovation such as financial services offered through short message service (SMS) messaging.

Another set of studies focused on Fintech and its positive impact on financial services and the economy (see, for example, Gulamhuseinwala (2015), Dapp et al (2015), Narayan (2014), Arner et al (2017)). These studies show that Fintech is enticing the

younger generation to adopt mobile financial services (Gulamhuseinwala, 2015), Fintech complements the operations of banks that transform to a digital model, Fintech poses a threat to banks that fail to transform to a digital model (Dapp et al, 2015; Ozili, 2022c), and Fintech has a positive effect on economic growth in its latter years but not in its first year (Narayan, 2014). A number of studies have raised concern that Fintech comes with digital risks that are not easy to mitigate in the short term, thereby leading to calls for Fintech regulation (Arner et al, 2017; Cheng and Qu, 2020).

Another set of studies analyse how digital financial innovation, such as central bank digital currency (CBDC) affect banks and other players in the financial sector and the economic system (see, for example, Auer and Böhme (2020), Kiff et al (2020), Khiaonarong and Humphrey (2019) and Ozili (2022d)). These studies analyse the technology of CBDC (Auer and Böhme, 2020), the extent of CBDC adoption (Kiff et al, 2020), how the design of CBDC is crucial for its success (Allen et al, 2020), how the widespread use of CBDC can lead to decline in the use of cash (Khiaonarong and Humphrey, 2019), and how CBDC affects monetary policy (Ozili, 2022a). But these studies pay little attention to how CBDC affects financial inclusion and did not show the channels through which CBDC affects financial inclusion. The studies also did not analyse how CBDC affects systemic risk and financial stability.

A related set of studies assessed how private digital currencies, or cryptocurrencies, affect the financial sector. These studies show that cryptocurrency made financial markets volatile (Liu and Serletis, 2019), they increase the risk of loss (Zhang et al, 2021), they offer privacy benefits (Hassan et al, 2020), and they reduce transaction cost and remittance cost (Rühmann et al, 2020). Some studies propose the regulation of

cryptocurrency in the financial sector while other studies oppose cryptocurrency regulation citing that there should be a free market for cryptocurrencies in order to allow cryptocurrencies to thrive despite been a volatile and risky instrument (Schaupp and Festa, 2018; Feinstein and Werbach, 2021; Shanaev et al, 2020). But the literature has not established a framework that demonstrate how cryptocurrency affects financial inclusion or financial stability.

Taken together, the findings from the above literature review suggest that researchers have not paid much attention to how CBDC and cryptocurrency affect financial inclusion and stability, and they have not paid much attention to the channel through which CBDC affects financial inclusion. Also, the link between Fintech and financial stability has not been well articulated in the literature. Given this identified research gap, there is need for research that clarifies our understanding of the role of CBDC, Fintech and cryptocurrency for financial inclusion and financial stability. There is need for research that demonstrate a clear-cut channel through which Fintech, cryptocurrency and CBDC promote or hinder financial inclusion and financial stability. The next section addresses these issues.

3. CBDC, Fintech and cryptocurrency for financial inclusion

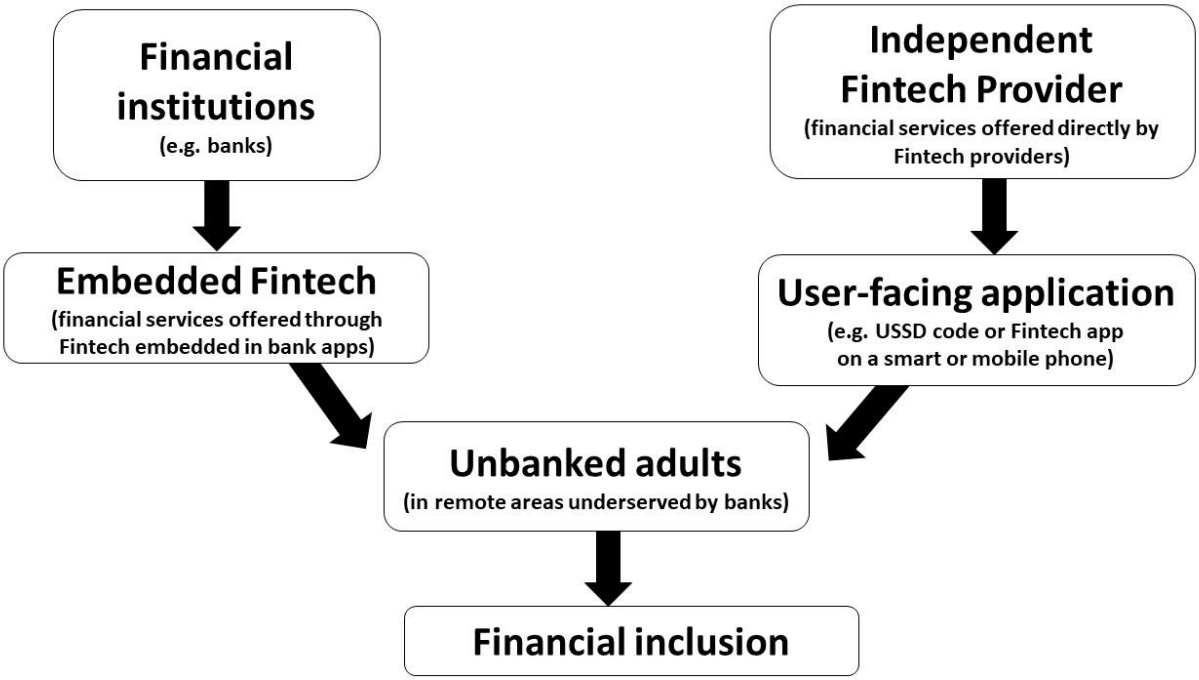
3.1. Fintech and financial inclusion

Fintech providers contribute to financial inclusion by offering basic financial services through digital devices and by delivering digital financial services to unbanked adults living in remote areas that are underserved by banks and non-bank financial institutions (Ozili, 2018). To achieve financial inclusion through Fintech services, unbanked adults must own a mobile device or a digital device (Yermack, 2018). Without having a mobile phone or a digital device, the Fintech model for financial inclusion will not achieve financial inclusion.

A mobile device (e.g., a smart phone) in the hands of unbanked adults will grant them access to basic financial services (Salampasis and Mention, 2018). It will enable unbanked adults to open a bank account remotely using their mobile phone and other digital devices. It will also enable unbanked adults to make payment, receive money and save money to improve their welfare. Fintech providers tend to charge a low fee for financial transactions performed on their digital applications and digital platforms. The transaction fee charged by Fintech providers are relatively lower than the transaction fee charged by banks. For this reason, Fintech services are considered to be an attractive way to bring unbanked adults into the formal financial sector for greater financial inclusion. There are two Fintech models for achieving financial inclusion as shown in figure 1. The first model (on the left in figure 1) involves embedding Fintech into the mobile application of formal financial institutions and then delivering basic financial services to unbanked adults living in remote areas. This model is commonly used in: (i) developing countries,

(ii) countries that are technologically underdeveloped, and (iii) countries where Fintech providers are not permitted to offer independent financial services. The second Fintech model (on the right in figure 2) involves an independent Fintech provider that use its own digital applications to deliver basic financial services directly to unbanked adults living in remote areas.

Figure 1: Linking Fintech to financial inclusion

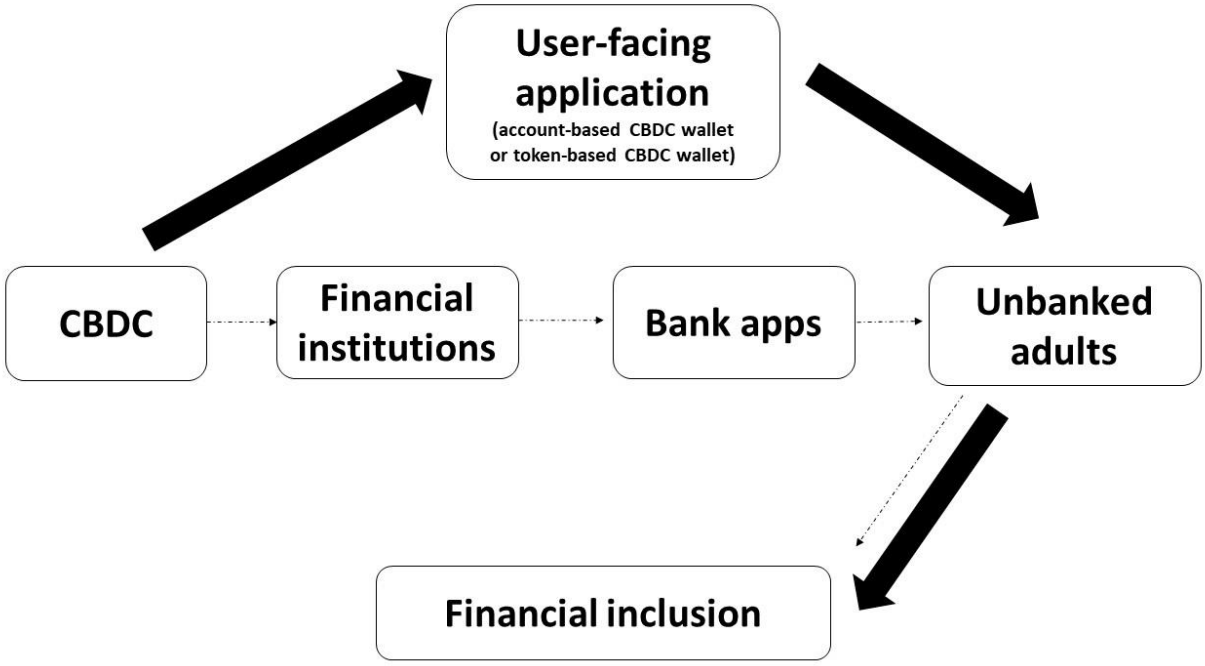


Source: Author's experience in the industry

3.2. Central bank digital currency and financial inclusion

A central bank digital currency can promote financial inclusion only if the central bank digital currency is designed to have features that allow users to purchase CBDC, borrow CBDC or use CBDC without the strict requirement to own a bank account or a formal account (Ozili, 2022b). Unbanked adults will need a unique digital identification (ID) to be able to use CBDC. The unique digital ID can be easily created. The unique digital ID will become the gateway through which unbanked adults are brought into the formal financial sector. Unbanked adults do not need to provide any cumbersome documentation to create a unique digital ID on the CBDC wallet. This will make it easy to formally identify unbanked adults and ensure that unbanked adults (individuals who do not have a traditional bank account) can easily purchase CBDC units, borrow CBDC or use CBDC for payments that improve their welfare. Figure 2 below provides an easy-to-understand illustration of how CBDC promotes financial inclusion. The thick lines in figure 2 show that CBDC can be offered on a CBDC wallet and delivered directly from the central bank to unbanked adults without involving a financial intermediary. In contrast, the dotted lines in figure 2 describe a situation where the CBDC is first delivered to financial institutions by the central bank so that financial institutions can deliver CBDC to banked adults and unbanked adults using their existing banking applications.

Figure 2: Linking central bank digital currency to financial inclusion



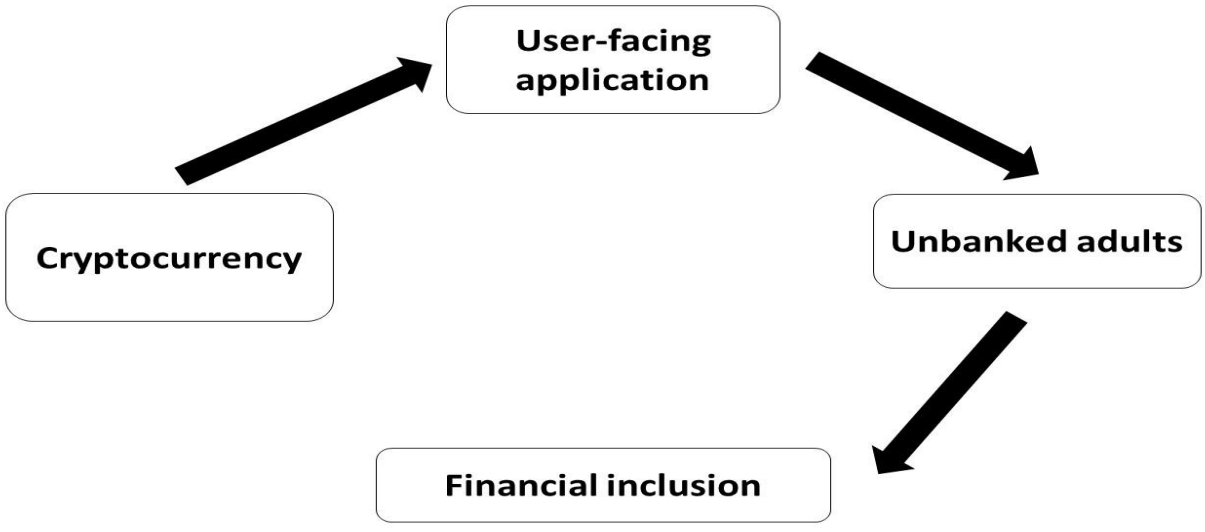
Source: Author's experience in the industry

3.3. Cryptocurrency and financial inclusion

Cryptocurrency can increase financial inclusion in two ways. One, cryptocurrency can be used to provide tailored financial services that meet the needs of unbanked adults without

needing formal financial institutions (Kim, Chen and Ryu, 2022). By removing financial institutions from the financial intermediation process, cryptocurrency offers minimal or no transaction cost when performing financial transactions (Oh and Nguyen, 2018). This is beneficial for unbanked adults because it saves money for poor unbanked adults who have very little money. The cost savings can encourage more unbanked adults to use crypto-based financial services. Two, using cryptocurrency to access financial services helps to bypass existing barriers that have prevented unbanked people from opening a bank account, particularly, the documentation and regulatory know-your-customer (KYC) barriers. Other benefits of cryptocurrency for financial inclusion include zero-cost or low cost of sending remittances to friends and family. Figure 3 shows that cryptocurrency can be delivered to unbanked adults through user-facing applications or decentralized apps (dApps) for financial inclusion (Ozili, 2022e). Unbanked adults that have access to a relevant dApps can receive remittances and receive payments to improve their welfare.

Figure 3: Linking cryptocurrency to financial inclusion



Source: Author's experience in the industry

3.4. Linking CBDC, cryptocurrency and Fintech services to financial inclusion

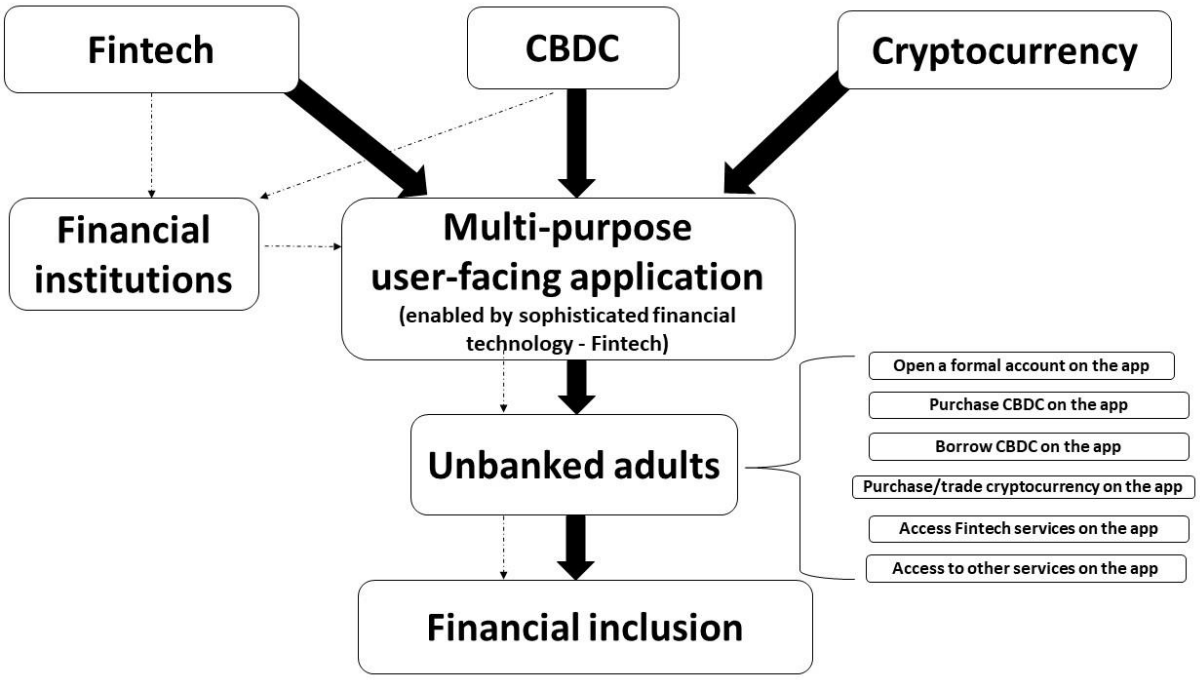
The connection between CBDC, cryptocurrency and Fintech services for financial inclusion is that CBDC and cryptocurrency can be delivered to unbanked adults on a multi-purpose user-facing application that is enabled by sophisticated financial technology (Fintech), and then delivered to unbanked adults to bring them into the formal financial sector. When unbanked adults have access to a multi-purpose user-facing application that offers both CBDC and cryptocurrency, unbanked adults will be able to open an account in the multi-purpose user-facing application, and they will be able to use the CBDC and cryptocurrency offered on the app to receive payment, save money, borrow money and make transfers that improve their welfare, thereby leading to greater financial inclusion.

To illustrate this, take a look at figure 4. Figure 4 describes a situation where CBDC and cryptocurrency are delivered to unbanked adults without involving formal financial institutions. The thick lines show that CBDC and cryptocurrency can be made available to unbanked adults through a multi-purpose user-facing application that is enabled by sophisticated financial technology (Fintech). Unbanked adults that have access to the multi-purpose user-facing application can formally open a bank account on the app. After opening an account on the app, unbanked adults can purchase or borrow specified quantities of CBDC or cryptocurrency that are offered on the multi-purpose user-facing application.

Designing the multi-purpose user-facing application to have features that allow people to borrow CBDC and cryptocurrency in the application is important because it will encourage poor unbanked adults to use the multi-purpose user-facing application to (i) open an

account, (ii) purchase CBDC or cryptocurrency units, (iii) borrow money, and (iv) remain in the formal financial sector. Meanwhile, the dotted lines in figure 4 describe a situation where CBDC and embedded Fintech services are offered through formal financial institutions. In this case, formal financial institutions will deliver CBDC and embedded Fintech services to unbanked adults using their own customized applications. Their applications will be designed to have features that allow unbanked adults to (i) open an account remotely, (ii) purchase CBDC or cryptocurrency units, and (iii) borrow money, thereby, bringing unbanked adults into the formal financial sector.

Figure 4: Linking CBDC, cryptocurrency and Fintech to financial inclusion



Source: Author's experience in the industry

4. CBDC, Fintech and cryptocurrency for financial stability

4.1. Cryptocurrency and financial stability

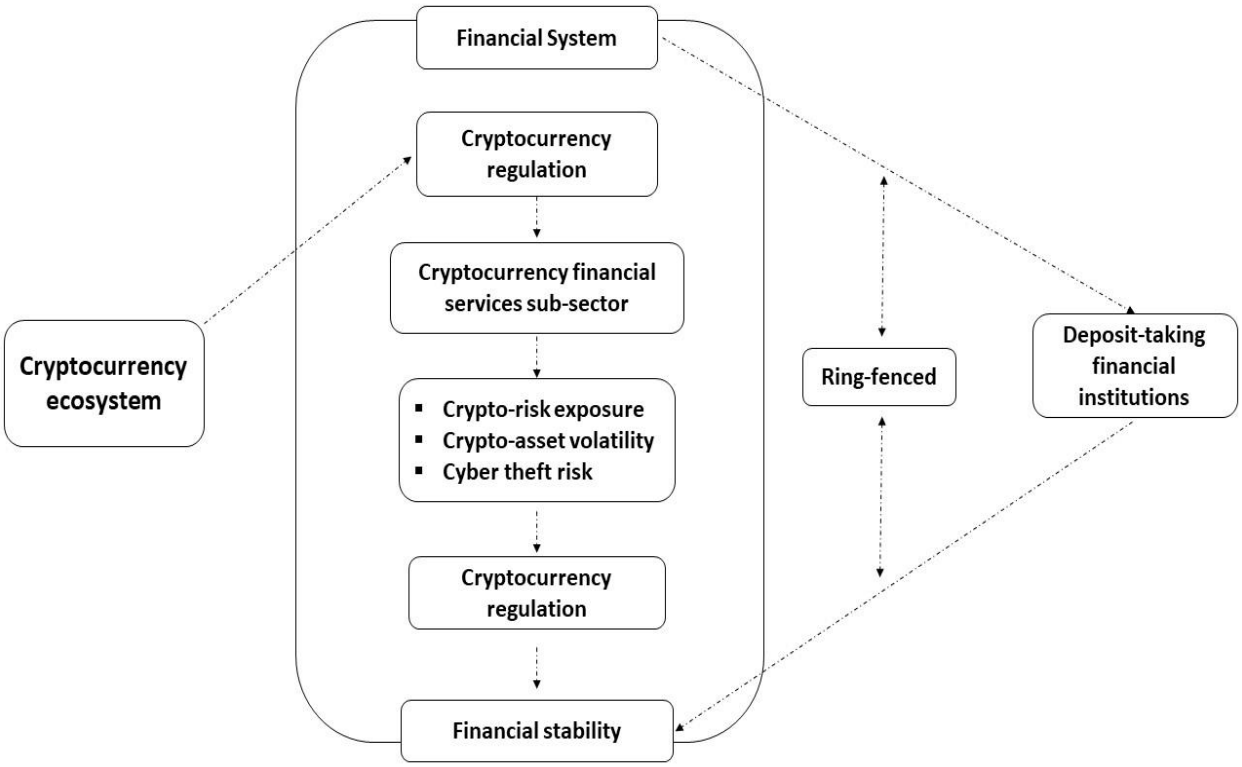
More than 85 percent of the activities in the global cryptocurrency ecosystem are carried out in the global financial system. The global crypto ecosystem is incredibly large in size and has a market capitalization of over US$2 trillion[1] as at 2021. There are direct interconnections between crypto-assets and systemically important financial institutions. These interconnections pose systemic risk to the global financial system (FSB, 2022b). The global crypto ecosystem is also unregulated. For this reason, cryptocurrency activities, the size of crypto-assets, their structural vulnerabilities and their increasing interconnectedness with the financial system pose significant systemic risk to the global financial system. Some of the systemic risk posed by cryptocurrency activity includes concentration risk in terms of the protocol and blockchain technology used, cyber security failures, high volume of thefts through hacking, among others.

Some ideas have emerged on how to promote financial stability in the crypto ecosystem in order to minimize systemic risk to the global financial system. One idea is to develop standards focused on regulating crypto-assets in the financial system. Such standards or regulations should be proportionate to the risks that cryptocurrency activity pose to the financial system (Drakopoulos et al, 2021). The regulation should also be proportionate to the economic functions they serve. Regulation should be focused on minimizing risk and volatility while enhancing transparency in cryptocurrency activities. Another idea is to

[1] According to a 2022 FSB Report titled "Assessment of Risks to Financial Stability from Crypto-assets" https://www.fsb.org/2022/02/fsb-warns-of-emerging-risks-from-crypto-assets-to-global-financial-stability/

ring-fence the banking sector from the cryptocurrency ecosystem (see figure 5). This will require ring-fencing depositors' fund from cryptocurrency risk. Banks should not be allowed to use depositors' money to invest, trade or service cryptocurrency activities or crypto assets. This will help to reduce liquidity risk in the banking system, avoid bank runs and will protect depositors' money from being exposed to risk, fragilities and vulnerabilities in the crypto ecosystem. Another idea is to create a cryptocurrency financial services sub-sector within the financial services industry and significantly reduce the sub-sector's interconnectedness with other sectors of the financial services industry. This can be achieved by using licensing restriction, regulatory segmentation, activity restriction and preventing cryptocurrency businesses from dealing directly or indirectly with deposit-taking financial institutions. This will help to ensure that the risks in the cryptocurrency financial services sub-sector are contained and internalized within the sub-sector itself without spreading to other sectors of the financial services industry, thereby minimizing systemic risk and promoting financial stability.

Figure 5: Cryptocurrency and financial stability



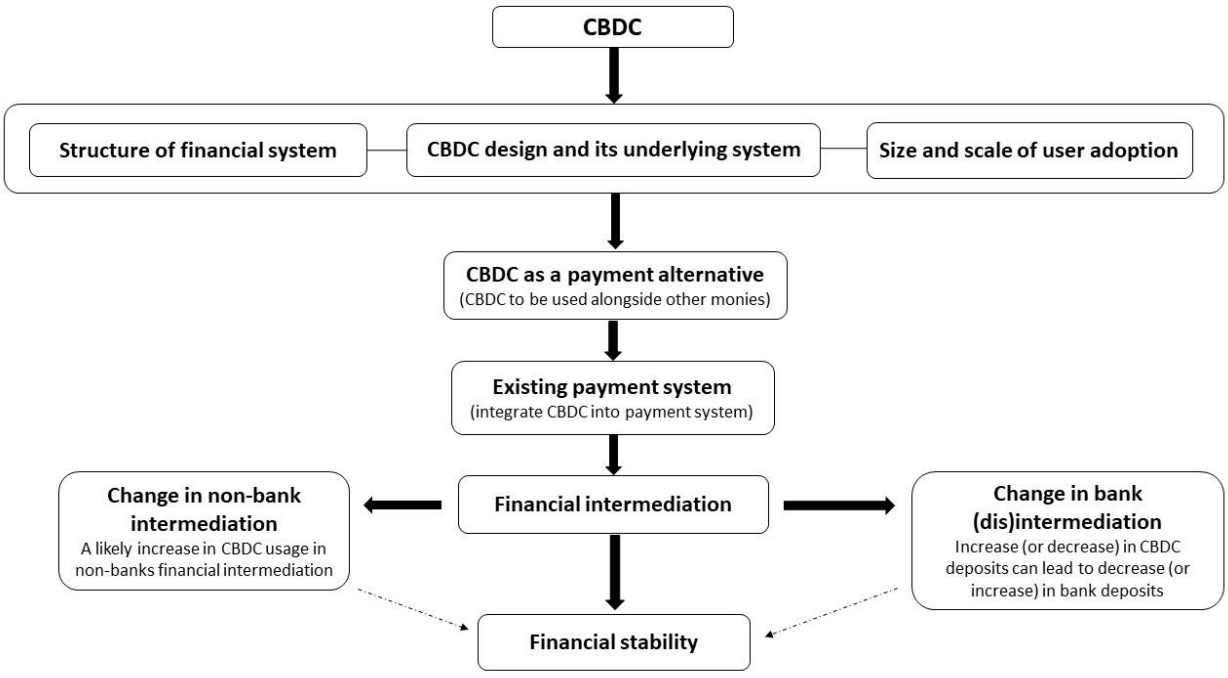
Source: Author's experience in the industry

4.2. CBDC and financial stability

It is important to understand how CBDC can promote financial stability, and how CBDC might present material risks to financial stability. There are two hypotheses in this regard. The first hypothesis or argument can be referred to as the CBDC-stability hypothesis. The CBDC-stability hypothesis argues that a CBDC that is issued by a central bank will support the fulfilment of central bank objectives, and one of such objectives is the stability of the financial system (BIS, 2021). The argument is that central banks will not issue a CBDC if it limits central banks' ability to achieve their core mandate which includes monetary stability, financial stability and price stability; therefore, the CBDC-stability hypothesis assumes that the issuance of a CBDC by a central bank will promote financial stability or, at least, the CBDC will not pose any material risks to financial stability (BIS, 2021). This is because most retail CBDCs are presently being designed to co-exist with private forms of money (Maniff, 2020), they are designed to work well with existing payments system (Bofinger and Haas, 2020), and there is the belief that central banks will give financial institutions and people enough time to adopt CBDC and will allow flexibility in the use of CBDC or other existing payments method (BIS, 2021). These factors can make the transition to CBDCs smooth with no material risks to financial stability, and it can encourage CBDC adoption only on a need basis, thereby mitigating any disruptive effects to financial stability. The second argument or hypothesis is the CBDC-disruption hypothesis. The CBDC-disruption hypothesis argues that the design, issuance and use of CBDC can disrupt existing financial market structures, disrupt the traditional financial intermediation process, and disrupt existing business models of financial institutions, thereby posing risks to financial stability (Allen, Gu and Jagtiani,

2022). The widespread use of CBDC can present deposit substitution risks in the financial system (Bian, Ji and Wang, 2021). It can lead to bank disintermediation when there is a significant shift from bank deposits to CBDC deposits (Ward and Rochemont, 2019). The resulting decrease in bank deposits can lead to liquidity risk and funding risk in the banking sector and can decrease the ability of banks to lend, thereby triggering a credit crunch and a bank run which leads to financial instability (Kumhof and Noone, 2018). And the extent of the disruptive effect of CBDC for financial stability will depend on the size and scale of CBDC adoption by users, the nature of CBDC design and its underlying system, and the structure of the financial system (BIS, 2021). Figure 6 summarizes how CBDC affects financial stability.

Figure 6: CBDC and financial stability



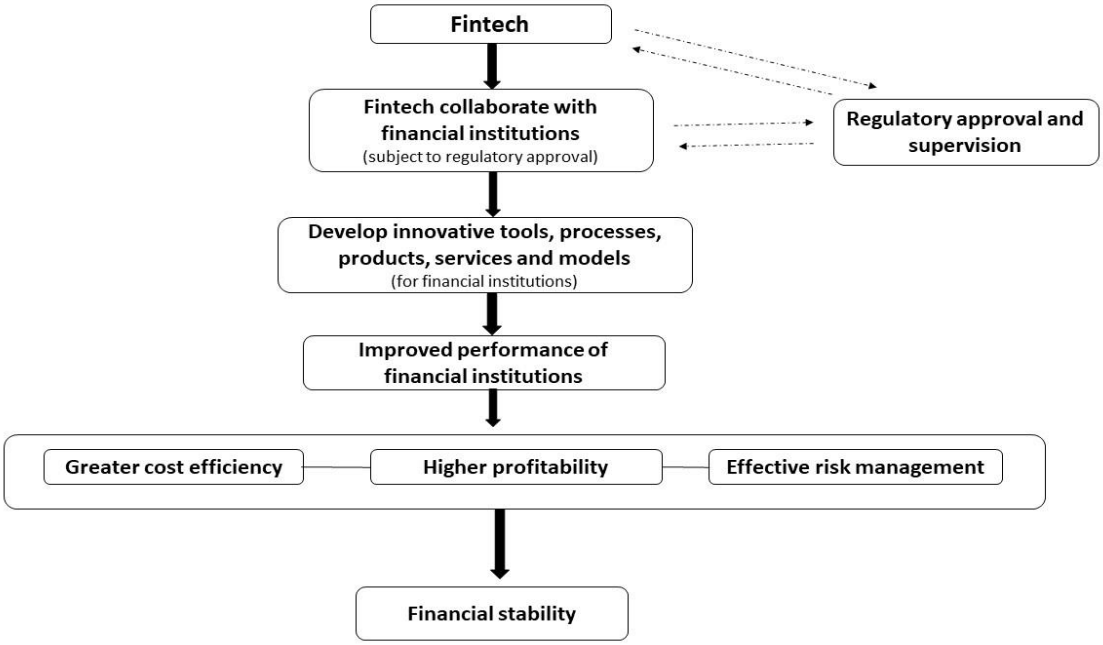
Source: Author's experience in the industry

4.3. Fintech and financial stability

Fintech is any technology-enabled innovation in financial services that lead to the development of new business models, applications and processes for the efficient delivery of financial services (Omarova, 2020). Fintech providers often collaborate with financial institutions subject to regulatory approval while few Fintech providers provide independent financial services as shown in figure 7. New Fintech entrants are often regulated within a regulatory sandbox to promote a level playing field and to enable the development of Fintech innovations under a supportive regulatory environment (Bromberg, Godwin and Ramsay, 2017). There is still some controversy about whether financial technology (or Fintech) preserves financial stability or causes financial instability. On one hand, Fintech enables financial innovation while preserving financial stability (Arner et al, 2017). It does so by collaborating with financial institutions and developing innovative financial services and products as well as innovative business models, applications and processes that improve financial risk management in the financial system, thereby reducing risk to financial stability. Fintech providers can collaborate with financial institutions and develop low-risk and low-cost financial technology products and services that financial institutions can use to increase their profitability and ultimately contribute in preserving financial stability. Fintech also enables the automation of banking services to reduce cost and increase income (Donald, 2020). Fintech also gives the banking sector sophisticated tools and software that enables effective risk management in the financial intermediation activities of banks, thereby contributing to preserving banking stability and financial stability. On the other hand, Fintech can transmit material risks to the financial system (Fung et al, 2020). Fintech can make the financial system

become vulnerable by exposing the financial system to third-party risk (Ozili, 2018). Fintech exposes the financial system to third-party risk when financial institutions rely heavily on third-party service providers to provide embedded financial technology into their products and services. Also, third-party Fintech products and processes can fail completely and unexpectedly, and can increase systemic risk in the financial system which can lead to financial instability.

Figure 7: Fintech and financial stability



Source: Author's experience in the industry

5. Problems of digital financial innovation for financial inclusion and stability

The first problem of digital financial innovation for financial inclusion is that individual choice will remain paramount despite the rise of new digital financial innovation for financial inclusion. This means that, no matter how novel and beneficial a digital financial innovation is for financial inclusion, individual choice will be a significant factor influencing the adoption and use of the innovation. Another issue is that CBDC, Fintech or cryptocurrency-based financial services removes the human touch almost completely because banked adults who make transactions on Fintech, CBDC and cryptocurrency platforms are unable to talk directly to a physical human agent whenever they have an enquiry or complaint about the transactions they have made or the transaction they intend to make. Another issue is the regulatory loopholes in Fintech and cryptocurrency regulation that negatively affects financial inclusion. Another issue is that CBDC, Fintech or cryptocurrency-based financial inclusion leaves a large segment of the population behind especially those that are digitally illiterate. The problems of digital financial innovation for financial stability include the following. CBDC, Fintech and cryptocurrency create new risks that may pose new threats to financial stability. They have hidden risks that are difficult to detect or risks that are detected too late. These risks may be difficult to measure, and finally, prudential regulation may struggle to keep up with changing financial innovation.

6. The future of financial inclusion and financial stability

6.1. The future of financial inclusion

CBDC, Fintech and cryptocurrency services can help to increase financial inclusion by reducing the burdensome documentation requirements needed to open a formal account and by granting access to finance to people that do not have or own a formal account. These three innovations offer non-bank solutions for financial inclusion, thereby making traditional banks become less relevant for financial inclusion. The implication is that financial inclusion, in the future, will no longer be about people being 'banked' or 'unbanked'. Rather, the future of financial inclusion will be about 'access' and 'more access' to formal financial services wherever it can be found whether in banks, non-bank financial institutions or agents offering formal financial services through CBDC, Fintech or cryptocurrency, and ensuring that people who lack access to formal financial services are granted access – whether basic access, restricted access or full access. In the future, financial inclusion will focus on increasing access to formal financial services for everyone without the strict requirement to own a bank account or a formal account since money can be held in a digital token, digital wallet or stored on the cloud using digital technology, rather than stored in a bank account. As a result, academic and policy discussions about financial inclusion will shift from people becoming 'banked' to people having 'basic access', 'restricted access' and 'full access' to different types of formal financial services. This shift in focus is inevitable because disruptive financial innovation (e.g. CBDC, Fintech, cryptocurrency) are making banks become less relevant for financial inclusion.

6.2. The future of financial stability

Most financial institutions use digital technology systems to (i) improve their business processes, (ii) support business decision making, (iii) deliver better financial services to customers, and (iii) for disclosing information and disseminating financial and non-financial information to a wide range of users of financial information. Consequently, the future of financial stability will witness an inseparably intersection between the financial system and digital technology systems. In the future, financial stability will be achieved through the combined stability of financial institutions and the operational stability (and well-functioning) of digital technology systems which financial institutions rely on. In the future, financial system regulators and supervisors will need to monitor financial risks in the financial system and also monitor digital technology risks and cybersecurity risks. They need to constantly assess how digital technology risks affect the stability of financial institutions that rely on digital technology systems. The monitoring of digital technology risks should also extend to CBDC, Fintech and cryptocurrency technology infrastructure. Regulators need to constantly stress-test the technology infrastructure that delivers CBDC, Fintech and cryptocurrency to ensure that the risks they pose to the financial system are non-systemic and can be managed and controlled using existing risk management systems. Micro-prudential regulation should introduce robust controls that enable individual financial institutions to withstand shocks arising from cybersecurity risks and other digital technology risks. Macro-prudential regulation should have robust risk mitigation controls that increase the resilience of the financial system and improve its capability to withstand shocks arising from system-wide cybersecurity attacks and digital technology failures.

7. Conclusion

This paper discussed the role of CBDC, Fintech and cryptocurrency for financial inclusion and financial stability. It argued that Fintech, CBDC, and cryptocurrency can increase financial inclusion by providing an alternative channel through which unbanked adults can access formal financial services. It also showed that Fintech, CBDC and cryptocurrency have implications for financial stability. CBDC and Fintech services have the potential to preserve financial stability while cryptocurrency presents financial stability risks that can be mitigated through effective regulation. The paper also identified some problems of CBDC, Fintech and cryptocurrency for financial inclusion and financial stability. The paper offered some insight about the future of financial inclusion and the future of financial stability. It argued that the future of financial inclusion will be about 'access' and 'more access' to formal financial services for everyone wherever 'access' can be found whether in banks, non-bank financial institutions or agents offering formal financial services through CBDC, Fintech or cryptocurrency. Meanwhile, the future of financial stability will witness an inseparably intersection between the financial system and digital technology systems, and the stability of the financial system will be achieved through the combined stability of financial institutions and the operational stability (and well-functioning) of the digital technology systems which financial institutions rely on. The implication of the discussion in this paper is that while CBDC, Fintech or cryptocurrency can extend financial services to unbanked adults and offer cost efficiency advantages, there are risk considerations that need to be taken into account when using CBDC, Fintech and cryptocurrency to increase financial inclusion and financial stability. There are many unanswered questions and opportunities for future research. One of such questions is

what will be the exact role of banks in the future of financial inclusion? There will also be concerns about whether regulators will be able to identify bad actors that hack the blockchain technologies that are used to deliver CBDC or cryptocurrency-based financial services.

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