Framing the Central Bank Digital Currency (CBDC) revolution

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Introduction

Central banks globally race to launch their Central Bank Digital Currency (CBDC). More than 86% of central banks engage in CBDC development while some pilot tests are underway (Auer et al. 2020b; Boar et al. 2020; Boar and Wehrli 2021; OMFIF 2019; Ozturkcan et al. 2019a; Zhao 2020). This paper draws a framework of the CBDC and how it might compare to currently used cash and electronic money in the financial sector. A conceptualisation of the upcoming CBDC revolution is introduced through visiting some related concepts such as money and its primary functions, reserve currency status of the USD, and the post-Bretton Woods era and neoliberalism by also considering the impact of COVID-19 on monetary and fiscal policies and the potential role of CBDC in a troubled economy. To further complement the provided discussion with insights from the perspective of tech-savvy individuals who are likely to represent the early adopters of CBDCs, a brief analysis of tweets on the topic of CBDC from a brief cross-sectional data collection is presented. The paper is concluded with limitations, suggested future research, and an outlook to discuss and elaborate on the opportunities and challenges involved with the CBDCs.

Money and its main functions

Money is defined as anything generally accepted in payment for goods and services or repayment of debts (Mishkin 2011). It has three main functions, which are (1) medium of exchange, (2) store of value, and (3) unit of account.
(1)#Medium of exchange

People use money regularly to purchase and sell goods and services. When it is unavailable, barter takes over with its requirement of the double coincidence of wants, which is extremely difficult to achieve in a modern economy with a large-scale division of labour (OpenStax 2016). Therefore, an essential function of money is to serve as a medium of exchange. Money facilitates the division of labour, a concept popularised by Adam Smith in ‘An Inquiry into the Nature and Causes of the Wealth of Nations (1776)’ (Munger), which enables people to concentrate and become highly skilled in specific jobs. This increased overall efficiency translates into higher economic output and greater wealth – the essentials for modern economies.

There are competing theories against the emergence of money as an alternative to barter. One of the main issues with CBDCs pertaining to functioning as a medium of exchange is the feature of interoperability. A CBDC system should be designed to facilitate convenient flow of funds to and from other payment systems to coexist within a wider payment ecosystem that allows the complex cross-border and cross-currency payments. The challenges involved in interoperability between cross-border CBDC systems will require addressing numerous considerations (BIS 2021c).

(2)#Store of value

It may be difficult or sometimes practically impossible to store some goods and all services for extended periods in a barter economy, e.g. perishable goods may go rancid and fashionable products may go out of fashion. Thus, money may serve as a store of value (OpenStax 2016) that enables individuals to smooth consumption over time. If earning exceeds spending in a certain period, the excess can be saved for spending in subsequent periods. For example, retirement income in the case of voluntary defined contribution (DC) pension systems is an individual’s earlier savings invested in some financial assets.

Complications may arise upon high inflation, at which part of the interest that money pays is due to expected inflation. If the real interest rate becomes negative, then the purchasing power of money declines, resulting in money failing to serve as an adequate store of value compared to other real assets, e.g. stocks, commodities, and real estate.

An important issue regarding CBDCs is their potential impact on bank deposits. It is yet to be decided by major central banks if CBDCs are primarily intended as a means of payment rather than a form of investment. If that is going to be the case, a CBDC could pay an uncompetitive interest rate or be left unremunerated. It could even pay a negative interest rate to avoid undercutting bank deposits in jurisdictions where interest rates are negative. A negative interest rate on CBDC could also be used as an effective monetary policy instrument to boost consumption and investment, especially when and if CBDCs totally replace cash. On the other hand, a remunerated CBDC will be a particularly attractive substitute for cash, which will greatly enhance its adoption (BIS 2021a, 2021b).

(3)#Unit of account

In a barter economy, there is no single numeraire. On the other hand, money serves as a unit of account, nearly like a ruler or scale by which other goods and services’ values are measured. Thus, money acts as a common denominator, which facilitates accounting and thinking about tradeoffs (OpenStax 2016).

As in the case of other functions of money, high inflation can be problematic. Price quotations of high-ticket items in hard currencies are a common practice in high inflation countries. Prices may sometimes be converted into local currency at the time of sale for accounting or legal reasons, but this doesn’t change the fact that soft currencies may fail to serve as a unit of account.
CBDCs issued by central banks of countries with high inflation will naturally be soft CBDCs, and, like their cash counterparts, they may fail to serve as a unit of account, especially for high-ticket items.

**Reserve currency status of the USD**

A reserve currency is held in significant quantities by central banks as part of their foreign exchange reserves. The Bretton Woods agreement in 1944 marks the replacement of Great Britain Pound (GBP) by the US Dollar (USD) that remains as the reserve currency of the world.

The lion’s share in international trade is facilitated in the USD – the unit of account for most of the internationally traded goods. Commodities like oil, copper, grains, gold, and silver are all quoted in USD. The widespread adoption of the USD is due to the Bretton Woods system’s design and the United States’ dominance in global trade and finance in the post-war era.

According to the Bretton Woods agreement, the US government had guaranteed that other central banks could sell their USD reserves at a fixed rate for gold (USD 35/oz). In 1971, the United States started to deflate the value of the USD in gold in response to massive stagflation and, eventually, totally unhooked the value of the dollar from gold by effectively ending the Bretton Woods agreement. In the subsequent era, the USD has remained to serve as the world’s major reserve currency thanks to its dominance in global trade and finance.

While countries like Germany, Japan, and China are net exporters, the United States is a net importer. Yet, the current account deficit has never been an issue for the United States since it is denominated in the USD. This phenomenon has been dubbed as ‘America’s exorbitant privilege’ by Valéry Giscard d’Estaing, then the French minister of finance, in the 1960s. This exorbitant privilege results in an asymmetric financial system where other countries see themselves supporting American living standards and subsidising American multinationals. American economist Barry Eichengreen (2011) summarises exorbitant privilege as follows: ‘It costs only a few cents for the Bureau of Engraving and Printing to produce a $100 bill, but other countries had to pony up $100 of actual goods in order to obtain one’. Nowadays, producing a USD 100 bill demands only a few clicks from FED to buy sums of the US Treasury bonds for creating an equal amount of bank reserves.

Furthermore, the current account surplus of net exporters must be invested in the USD denominated assets since the only financial system large enough to absorb these excesses is that of the US. The situation should be expected to prevail unless the United States decisively starts to take action to change the reserve currency status of the USD.

**The post-Bretton Woods era and neoliberalism**

The post-Bretton Woods era, starting in the 1970s, can be characterised by the globalisation of exchange rate volatility, high inflation, low growth, trade conflicts, and currency crises in emerging economies (Escriva et al. 2008). High inflation coupled with low growth is called stagflation, a severe economic problem that is difficult to cope with.

The underlying reason behind the stagflation of the 1970s was the Arab-Israeli conflict. The conflict reached its climax with the Yom Kippur war in 1973. Infuriated by the US support to Israel, OPEC, which was (and still is) under Arabic countries’ influence, initiated an oil embargo on the US and some other western countries. In addition, they have quadrupled the price of oil to USD 12/bbl. This sent shockwaves to the global economy by increasing inflation and diminishing demand.

Keynesian recipes, which have been quite successful in dealing with other economic problems before, were useless against stagflation. These recipes called for curbing government expenses and increasing taxes to combat high inflation, but they would only exacerbate the stagnation. On the other hand, a Keynesian recipe to combat stagnation would call for increasing government expenses and reducing taxes, which would further increase inflation. In other words, reducing inflation and increasing demand were conflicting goals from the Keynesian stance.
Neoliberalism emerged as a response to this economic crisis. The Neoliberal Theory, which advocates globalisation, has the basic propositions of the Classical Liberal Theory, i.e. there is no need for intervention of the state in the economy, and the economy will balance itself at full employment level in the long term. Neoliberalism aims to increase capital flows from developed countries to developing countries to eliminate the capital insufficiency of developing countries. For this purpose, it proposes to remove the obstacles to international capital flows and trade.

Washington Consensus, a term coined by the prominent British economist, John Williamson, refers to a set of ten neoliberal policy recommendations aimed at developing countries consensually given by the three Washington based institutions, namely the International Monetary Fund (IMF), World Bank, and the United States Department of Treasury (Agarwal 2022). Of these policy recommendations, three of them are particularly important:

(a) Removal of restrictions on foreign trade such as customs duties and quotas,
(b) Removal of restrictions on capital flows,
(c) Privatisation of state economic enterprises.

The capital infusion from developed countries comes in two different flavours. While foreign direct investment generally helps to achieve the intended consequences of neoliberal policies, short-term portfolio inflows may instigate instability in the financial system of a developing country. Excessive portfolio inflows in search of higher returns result in appreciation of the local currency, which, in turn, results in cheaper imports and a temporary increase in perceived wealth, which, in turn, deteriorates the balance of payments, which eventually results in a sudden and violent depreciation of the local currency, namely a currency crisis and an ensuing contraction of the economy accompanied with higher debt levels and higher unemployment.

The impact of COVID-19 and the potential role of CBDC in a troubled economy

The COVID-19, a once-in-a-century pandemic, hit the global economy since 2020. The responding fiscal support has been mainly in the form of stimulus checks in some countries such as the US. Yet reports indicated that some individuals rather preferred to save this income (Fox 2021). CBDCs can provide an alternative stimulus by imposing time limitations to expedite the expenditures, where an expiry date could be fixed.

CBDC may be instrumental in implementing monetary policy via programming to yield negative interest rates, which would increase the propensity to consume. CBDC has the potential to transform all aspects of the monetary system and facilitate the systematic and transparent conduct of monetary policy. It can serve as a practically costless medium of exchange, secure store of value, and a stable unit of account if it is account-based and interest-bearing, and the monetary policy framework fosters true price stability (Bordo and Levin 2017).

The emergence of the Central Bank Digital Currency (CBDC)

CBDC is a digital currency, also known as ‘digital base money’ or ‘digital fiat currency’ (Ozturkcan et al., 2019a). As a counter effect of the widespread digital ledger technologies such as the blockchain and emerging private virtual currencies, also known as stablecoins, the central banks all around the globe started discussing the issuing of their own CBDCs (Bossu et al. 2020).

Several factors necessitate the issuance of CBDCs, with a variety of motivations driving central banks’ research (BIS 2020). In this regard, payment motivations and challenges range from keeping continued access to central bank money as part of an obligation to the public, resilience in distribution and use of available funds, improving diversity among available payment systems, better cross-border payments for international trade, to the facilitation of fiscal transfers during a crisis such as the COVID-19 pandemic. Furthermore, as an additional simultaneous factor, though
not primary, there are also motivations involved with the monetary policy establishments related to the ‘interest-bearing’ features. Lastly, other factors such as the possibility of protecting monetary sovereignty could also be among the motivations.

As one such example, Riksbank of Sweden was the amongst the frontier central banks that promoted a public debate about CBDC, namely the e-Krona, by referring to the declining cash use in the country (Auer and Boehme 2020):

In future, cash may be so marginalized also be that it becomes difficult to use as a means of payment […] If the marginalization of cash continues, a digital krona, an e-krona, could ensure that the general public still has access to a state-guaranteed means of payment. (Riksbank 2018)

The Central Bank of the People’s Republic of China, on the other hand, champions the race with its e-CNY to be launched in 2022 (DeutscheBank 2021) while pilot programmes are ongoing in multiple cities primarily for its ultimate use in retail payments (Li and Huang 2021). Also, there are other similar explorations and trial efforts taking place in Brazil, China, the Eurozone, Japan, Russia, the U.K., and the U.S.A. in their various phases to seek possibilities of launching CBDCs (Kshetri 2021). In this aspect, e-CNY stands out as a different example since it does not rely on blockchain as it is unlike bitcoin (Fulton and Wilson 2021).

Since CBDCs will be issued by central banks, they are to be liabilities of the issuing central banks, too. This backing by the central bank would provide a CBDC with a legal basis to be used in formal transactions such as paying taxes. Also regarded as a key feature of a currency, the legal tender status entitles a debtor to discharge monetary obligations by tendering currency to the creditor (Proctor 2012). Fundamentally, CBDC is to offer the convenience and efficiency that can be possible beyond the existing features of the physical currencies. Holding a CBDC with a legal tender status or just a deposit account could offer two vastly different scenarios in such a situation (GLOBSEC 2020). The latter might lead to effectively losing the money in the deposit account that exceeds the effective deposit insurance cap. On the other hand, the legal tender status of CBDC could ensure the independence of deposit from a bank’s solvency; thus, it may offer further immunisation to an account holder. In turn, the enhanced financial stability could further empower the central bank to exercise its core responsibility in a market. However, various central banks are exploring different scenarios ranging from the account-based CBDC to connect the account holder directly to the central bank with an account to the digital-token as an alternative for no connection between the central bank and the account holder (ECB 2019, 2020). In this regard, the role of the commercial banks in a potential CBDC would not only be limited to the mechanism for verifying ownership and control over the assets (the account vs. token) but perhaps also include the management scheme of a potential CBDC (Giaglis et al. 2021).

A similar line of exploration is also present in the audience that the CBDCs will be made available. There is no clear consensus whether it would be available to the public for general purposes or to select public bodies and large entities such as big banks (Auer and Boehme 2020; OMFIF 2019; Richards et al. 2020). Finally, (in)direct debate relates to central banks issuing and administering the circulation of CBDC by themselves or a commercial bank issuing the liability backed by the central bank (Bossu et al. 2020). According to the IMF, central bank law reform is needed to ensure clarity in different approaches involved with CBDCs (Bossu et al. 2020).

CBDCs vs. cryptocurrencies and stablecoins

The concept of CBDC is against the idea of decentralisation that is inherent to the cryptocurrencies – Bitcoin and stablecoins, e.g. Tether. Cryptocurrencies can be traded against each other and fiat currencies, while trading a cryptocurrency against fiat currencies remains difficult.

Stablecoins provide the best of both worlds as they are stable – supposedly pegged to the USD so that they don’t fluctuate in value; and have the technology of a cryptocurrency – can easily be transferred between different cryptocurrency exchanges. Yet, they are not regulated, which could prove
problematic since they may not be backed by cash only to remain prone to depreciation. While stablecoins are not widely used, they possess potential for broader application. For example, Libra/Diem is created by Facebook as a ‘simple global currency’ with potential to undermine sovereign currencies and monetary policies (Massad 2021). Recent efforts concerning cryptocurrency regulation is concentrated on stablecoins such as Tether. It is also evident that one of the main motivations behind creating CBDCs is the existence and proliferation of stablecoins.

CBDC, on the other hand, is a digital payment instrument denominated in the national unit of account, which is a direct liability of the central bank (BIS 2018). Compared to physical cash, CBDC renders more control to the central bank, which makes the financial system even more centralised.

**Methodology**

Twitter, a micro-blogging social media initially adopted for networking and entertainment (Howard 2008), is also used to explore various social phenomena since its millions of active users worldwide produce immense amounts of data to probe temporal behavioural patterns by uncovering meaningful findings often revealing situational phenomena (Metallo and Agrifoglio 2015). To explore the themes that surround the CBDC related posts on Twitter, we retrieved the tweets posted with the hashtag #CBDC between the randomly chosen dates of 17–25 March 2021, by using NCapture. The sample consisted of 2857 tweets and retweets (excluding quoted) posted only in English and only in this period. Social media analytics framework (Cevik et al. 2015; Ozturkcan et al. 2017; Ozturkcan et al. 2019b) is conducted by utilising NVivo. Auto-coding is applied with manual proof, where codes clustered by word similarity indicate reasonable clusters (Figure 1) that are further discussed in the following sections. Though the sampling follows a relatively narrow time frame, the chosen sampling is still based on an objective hashtag represented by #CBDC to prevent possible biases. Still, findings reflect limited generalizability as the focus of the study is not to be a comprehensive illustration of the evolution of the phenomenon in social media but stands as a complementary analysis in its nature where data is not relying on memorial reflections often faced in surveys or unnatural setups in experimental design but comes from real-life posts.

The sentiment analysis’ findings suggested that tweets in the dataset remained mostly neutral. Since CBDC issuance is an ongoing endeavour, the debates, and developments to remain informative could be in line with the expectations. Though it can be argued that the sentiment analysis falls short of leading to interesting and insightful results on public reactions, it still sheds light by reflecting upon the technologically savvy group of individuals. Since the focused technological, financial revolution is yet to take place for everyday use, the layperson can remain uninformed; yet the expected early adopters would likely emerge from the tech-savvy segment represented with the involved sampling in their recent reflections on social media. Moreover, in any new technology case, the early adopters will probably determine the pace and shape of the diffusion of innovation, which could readily transfer to the domain of #CBDC relevant research.

**Word frequency and word cloud**

Word clouds are visual representations of word frequency. The more frequently a word appears in the text being analyzed, the larger the word appears in the image generated (Atenstaedt 2012). The top 20 words, which also had more than 0.5% weighted percentage, are presented in Table 1. The word cloud from the tweets is given in Figure 2.

‘currency’, ‘banks’, ‘central’, ‘cbdc’, ‘digitization’, and ‘payments’ are the most commonly used words in tweets. The first five words are directly related to the CBDC concept. The sixth word, ‘payments’, refers to the ‘medium of exchange’ function of money. As mentioned before, Riksbank of Sweden is the pioneer of CBDC among central banks. The rationale put forth by Riksbank is the need for a safe and efficient public payment system. This coincides with the public perception of CBDC, as manifested by the word cloud analysis of tweets.
Word frequency query results give the frequencies of the words used in tweets. The list consists of a total of 150 words. Of these, the total weighted percentage of the six most frequently cited words (the words mentioned in the above section) is 15.78%.

Figure 1. Codes clustered by word similarity.
Positive vs. negative sentiment

The built-in scoring system available through NVivo (v12) for auto-coding is utilised for positive vs. negative sentiment analysis (QSRInternational 2020) of the dataset. Positive vs. negative sentiment from the tweets on CBDCs is depicted in Figure 3.

Neutral sentiment is prevalent in most of the tweets; when excluded, the dataset becomes rather small to further analyze. This is a positive sign for Central Banks as the CBDC concept can easily be

<table>
<thead>
<tr>
<th>Word</th>
<th>Length</th>
<th>Count</th>
<th>Weighted percentage (%)</th>
<th>Similar words</th>
</tr>
</thead>
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<td>4</td>
<td>3232</td>
<td>5.21</td>
<td>#cbdc, cbdc</td>
</tr>
<tr>
<td>banks</td>
<td>5</td>
<td>1672</td>
<td>2.70</td>
<td>#bank, #banking, #banks, bank, bank’, banking, banks, banks’, banks#dlt#eth#interoperability, banks’</td>
</tr>
<tr>
<td>digitisation</td>
<td>12</td>
<td>1668</td>
<td>2.69</td>
<td>#digital, digital, digitally, digitisation, digits</td>
</tr>
<tr>
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<td>1401</td>
<td>2.26</td>
<td>#central, #centralised, central, centralised</td>
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<td>currency</td>
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<td>1096</td>
<td>1.77</td>
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<td>payments</td>
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<td>715</td>
<td>1.15</td>
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<td>momentum</td>
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<td>behind</td>
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<td>download</td>
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<td>335</td>
<td>0.54</td>
<td>difference, different</td>
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<tr>
<td>bis</td>
<td>3</td>
<td>333</td>
<td>0.54</td>
<td>#bis, @bis, bis</td>
</tr>
<tr>
<td>agustín</td>
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<td>0.50</td>
<td>agustín</td>
</tr>
<tr>
<td>ripples</td>
<td>7</td>
<td>307</td>
<td>0.50</td>
<td>#ripple, @ripple, ripple, ripples</td>
</tr>
</tbody>
</table>

Table 1. Word frequency query results.
associated with increased government control and violation of privacy, i.e. a negative public perception. Nevertheless, we are still in the very early stages of the introduction of CBDCs, and the central banks should consider the possibility that the neutral stance toward CBDCs may very well tilt toward a negative sentiment in the near future. This necessitates a carefully designed communication strategy that focuses on the merits of this new technology.

**Number of references by username**

The number of references by username on CBDCs is given in Figure 4. ‘bis_org’ and ‘ripple’ surpass the other usernames by a large margin.

The Bank for International Settlements, the BIS, can be considered as the central bank of central banks, and it is currently the major hub for most of the studies on CBDCs. Interoperability will be critically important for CBDCs as well as the legislative structure and regulations. When considered together with the prominence of #mcbdc (Figure 5), a joint coordinated effort across the globe is crucial to address the involved issues, among other things. This is not only a technical or a technological challenge but also builds on the will to cooperate.

Ripple Inc. is a payment solutions company that also manages the RippleNet cross-border payment network (Harper 2020). Ripple aims to be a technology provider for central banks. It has recently piloted a private version of its open-source XRP Ledger with a solution for CBDCs (LedgerInsights 2021).

Interestingly, there is no central bank or any other public institution on the list (Figure 3) other than the BIS and the Bundesbank. Yet, there are survey reports of the BIS on central banks’ intentions and active involvements in issuing CBDCs, where it is shown that a large portion of the central banks continues to work towards issuing CBDCs. However, central banks might not be revealing what they have accomplished with the public as they keep their communication confidential with the other relevant public authorities. Thus, it remains uncertain if there is a lack of communication effort about CBDC by public authorities as reflected in the dataset or not; perhaps future research can
focus on this aspect. Furthermore, analysis indicates that ‘#mCBDC’ is the third most widely existing hashtag in the dataset to suggest a need to understand more on the coordination efforts.

**Number of references by hashtag**

The number of references by hashtag on CBDCs is given in Figure 5.

![Number of references by Username](image1)

**Figure 4.** Number of references by Username.

![Number of references by Hashtag](image2)

**Figure 5.** Number of references by Hashtag.
The third hashtag, ‘mcbdc’, deserves special attention. mCBDC is the acronym for Multiple CBDC bridge, which is a wholesale central bank digital currency co-creation project, first initiated by the Hong Kong Monetary Authority and the Bank of Thailand. Later, Innovation Hub, the Digital Currency Institute of the People’s Bank of China, and the Central Bank of the United Arab Emirates joined mCBDC. The project focuses on the interoperability of CBDCs by exploring the capabilities of distributed ledger technology and studying the application of CBDCs in enhancing financial infrastructure to support multi-currency cross-border payments (BIS 2021d).

Among the first ten items of the list, there are two ripple related hashtags, namely ‘xrp’ and ‘ripple’, which have both surpassed ‘bitcoin’. Hence, as the discussions on CBDCs gain steam, we expect the comparisons between CBDCs and decentralised cryptocurrencies such as Bitcoin will become more commonplace.

**Number of references by @mention**

The number of references by @mention on CBDCs is given in Figure 6.

As expected, among the first five @mentions are BIS and three central banks, i.e. the Fed, the Bundesbank, and the Riksbank. This demonstrates that people naturally associate the concept of CBDC with central banks. Yet, other than the BIS and the Bundesbank, this association seems to be unidirectional in the Twitter environment, as discussed above.

Although it ranks second on the list, the Fed seems to be not as enthusiastic as other central banks and takes things a little bit slow on issuing a digital dollar because of the physical dollar’s status as the global reserve currency, as emphasised by the Fed Chair a number of times in recent months (DiCamillo 2021).

Although it has a number of serious competitors such as Corda, Ethereum, Stellar, and Hedera (LedgerInsights 2021), Ripple ranks third on the list, and it seems to have gotten the fruits of its marketing endeavour to become a technology provider for central banks, at least in terms of visibility on Twitter.

The Bundesbank – a member of the European System of Central Banks – ranked fourth, whereas the ECB ranks 31st on the list of mentions. Observing that the ECB was not on the list of usernames, it was
evident that the ECB was not an active participant in CBDC discussions on Twitter until its release of the digital euro. This further strengthens the conclusion that the sharing of information with the public may remain limited during the ongoing coordination activities between the public authorities. However, keeping the public informed on the level of progress towards a major technological revolution could benefit the expected diffusion of innovation that is to follow once the launch is complete.

**Map**

*Figure 7* depicts the origin of tweets on CBDC. As a bit of caution, the data of origin may be prone to inaccuracy due to the use of VPNs.

Europe and North America (the eastern states in particular) are the most active regions in terms of tweets on CBDCs. However, it should be noted that the number of tweets on any random topic is expected to be relatively higher in developed countries, due to widespread social media use.

**Twitter sociogram**

*Figure 8* depicts the Twitter Sociogram on CBDC related tweets. In the sociogram analysis, options included edges of retweets and mentions. The output display included size and vertices by degree, filter vertices by minimum degree, and scale edge weight by the number of retweets and mentions (Table 2).

The two usernames with the highest betweenness score, thus the accounts that have the highest mention and retweeting, are ‘Ripple’ (betweenness = 1534163.088) and ‘BIS_org’ (betweenness = 1456582.585); however, ‘BIS_org’ is the one that has the larger retweeting among the two (degree out = 13) since ‘Ripple’ is mostly talked about but not retweeted for its content (degree out = 0). Thus, ‘BIS_org’ is presumably the opinion leader that sets social media dialogue according to the sociogram of Tweets.

The picture generated by social network analysis resembles a fish with a huge head (in the upper left corner), a relatively long but slim body (extending toward the lower right corner), and a tail (in the lower right corner).

*Figure 7*. Map.
**Figure 8.** Twitter sociogram.

**Table 2.** Sociogram list – Top 30.

<table>
<thead>
<tr>
<th>Username</th>
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<th>Degree In</th>
<th>Degree Out</th>
<th>Betweenness</th>
</tr>
</thead>
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Following this analogy, the head corresponds to the BIS related tweets. As mentioned before, the BIS is the centre of most CBDC related studies. In other words, the BIS is analogous to the brain of this whole CBDC phenomenon. Being the central bank of central banks, the BIS is going to guide central banks on how to build the legislative structure and impose regulations regarding the CBDCs. Interoperability issues will also be solved under the guidance of the BIS.

Again, following the analogy, the tail corresponds to Ripple related tweets. The tail enables the fish to swim. Analogously, CBDCs can only become operational by an appropriate technological infrastructure. Ripple represents the technological aspects of CBDC discussions.

Finally, the body connecting the head and the tail is relatively long but slim. Central banks will eventually decide which technology they are going to implement when they have the necessary legal structure and the regulations ready. More important than these considerations, rather difficult political decisions need to be made to initiate the transformation from physical currencies to CBDCs. Therefore, currently, discussions around the BIS and discussions around Ripple and other potential technology providers are only remotely related, hence a relatively long but slim body.

**Discussion of results**

BIS acts as the central bank of the central banks worldwide. Thus, it is expected that the regulations that involve an emerging revolution that is to affect the global financial system to be led by the BIS as reflected in the dataset. BIS had been the primary source of other standardisation and integration efforts in the past for the known currencies to facilitate the international financial system. Hence, the most notable institution that is expected to host the initiative that leads the CBDC efforts remains the BIS. This is in line with the high level of reflections captured in our dataset.

Ripple, on the other hand, is a U.S.-based money transfer platform targeting financial institutions where it aims to become a viable alternative to the existing money transfer system known as SWIFT. In this regard, the findings of the analysis are consistent with the Ripple emerging as another hub of discussion concerning the CBDC reflections on social media. From a philosophical perspective, both CBDC and Ripple are of similar nature in terms of involved centralisation aspects. Thus, it is not surprising that Ripple emerged as part of the findings from the dataset.

Central banks historically have established a unique communication – in style, tone, channel – to preserve their trustworthiness. Their practice mostly relies on engaging in communication channels that are traditional. However, the upcoming CBDC revolution led by central banks is of a different nature in its essence that has the potential to affect crowds that have not been normally amongst the audience of such communication channels. For example, monetary policy announcements could have been traditionally shared by official channels and press releases. Yet, nowadays, there are other emerging online channels available to the masses that can be reached. In this regard, the efforts towards CBDC issuance could also be shared through such alternative channels with wider audiences to inform and raise awareness. Social media could be amongst such novel communications channels if it can be utilised in a consistent way to preserve the established communication efforts of the central banks.

**Future outlook**

The question is not if but when and which digital currencies will be offered by various central banks (Citi, 2020). A collaboration between major central banks and BIS seeks to set out common foundational principles and core features involved with the CBDCs. They established a consensus on certain criteria that need to be fulfilled. Accordingly, no compromises to monetary or financial stability, complementing existing forms of money, and promoting innovation and efficiency are declared as core principles (BIS 2020).

The introduction of CBDC is expected to involve some opportunities and challenges. The current structure of the financial services is a linear one with the central bank at one end and customers at
the other end, while it is impossible for individuals to have accounts at the central bank to deposit their physical money. The introduction of CBDC may interrupt the linear structure of financial services by making it possible for individuals to have CBDC accounts at the central bank (Figure 9). Retail banks’ deposit account liability could be reduced or eliminated, allowing them to focus solely on innovative financial services.

Physical money comes with personal freedom on choosing to keep and store cash without sharing information on these choices. CBDC, on the other hand, hinders such freedom on disclosure of options. As a fully traceable digital commodity, details on how it is kept, how long it is held, where it is stored or spent, and to whom it is transferred would be available to third parties. While this would enable better measures for identifying illicit economies, such as in money laundering and improved taxation towards the unregistered economy, there are still some downsides concerning privacy.

Lastly, CBDC offers means to implement various economic stimulation policies, such as the ones launched in the context of the COVID-19 pandemic. For example, distributed basic income could be subject to negative interest rates if not spent within a specific set time frame. Thus, the propensity to consume can be better boosted by CBDC. Moreover, CBDC might also be preferable due to raised concerns among consumers and merchants that physical cash can transmit pathogens (Auer et al. 2020a; Lilley and Rogoff 2020; Richards, et al. 2020; Riddell et al. 2020).

Disclosure statement
No potential conflict of interest was reported by the author(s).

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References