(IJTBM) 2026, Vol. No. 16, Issue No. I, Jan-Mar **e-ISSN: 2231-6868 p-ISSN: 2454-468X**

The Economics of Central Bank Digital Currency

Mohammed Suhail Mohammed, Hatem Mohammed Hammoud

University of Fallujah, Alanbar, Iraq

DOI:10.37648/ijtbm.v16i01.003

[1]*Received: 19 November 2025; Accepted: 22 December 2025; Published: 18 January 2026*

Abstract

The paper provides a systematic review of central bank digital currency (CBDC) literature that grows at a pace. It defines the economic factors implying the appearance of digital money and analyzes the primary reasons why it is necessary to implement a CBDC. The paper goes further to discuss the possible effects on the financial system and point out some of the policy issues and challenges. Although most of the academic literature captures the concerns of the policymakers about the risks of bank disintermediation and financial instability, it also highlights the circumstances in which these adverse effects can be countered. Lastly, the paper highlights that there are also a few research gaps that need to be addressed, such as the data privacy issues and the influence of the end-user preference in the demand of digital payment instruments.

JEL Codes: E41, E42, E51, E52, E58, G21.

1. Introduction

The economics of money and payments were a topic of discussion over most of history, but were the focus of only a small group of central bankers, scholars, and financial practitioners. This has however changed drastically over the last 15 years. The payments world is changing rapidly like never before due to technological innovation and the impact is becoming more apparent in the daily lives of people. The fast development of e-commerce has not only decreased the use of cash but also contributed to the development of the electronic payment process. Simultaneously, there have been the emergence of technology-driven start-ups (FinTech) and large digital platforms (BigTech), which have ended up in a market traditionally dominated by banks and credit card networks almost solely. Moreover, the development of distributed ledger technology (DLT) has opened the possibility of decentralized settlement of electronic transactions, which has promoted the emergence of cryptocurrencies and stablecoins.

These changes have brought central banks to consider the possibility of introducing a digital version of money: central bank digital currency (CBDC). This debate has taken on new urgency in recent years with the policymakers growing more worried about sudden and potentially irreversible shocks to the financial system compounded by the strong network effects of payments as well as digital services themselves. The change was a turning point when Facebook (since changed to Meta) announced the Libra project, which, however, was never launched, served as a huge wakeup call. Following its inception, the CBDC research increased very fast amongst the central bank fraternity. A survey carried out at the end of 2021 showed that 90 percent of 81 central banks under active investigation of CBDCs (Kosse and Mattei, 2022).

The paper is a systematic review of the emerging literature on the economics of CBDC. We will start with the analyzation of the economic motives of digital money, the most significant one being the general digitalization of the

[1] *How to cite the article:* Mohammed M.S., Hammoud H.M. (January 2026); The Economics of Central Bank Digital Currency; *International Journal of Transformations in Business Management,* Vol 16, Issue 1, 21-39, DOI: http://doi.org/10.37648/ijtbm.v16i01.003

economy and payments. Then we speak about how these developments have brought up concerns about the role of state funds being the backbone of the two-tier monetary system, monetary sovereignty, privacy in payment, and other factors that are compelling the central banks to think about the issuance of a CBDC.

It then focuses on the consequences of CBDCs to the financial system. We examine how the monetary policy could be influenced by such factors as the transmission and implementation of the monetary policy, especially through the role of banks, because of their central role in the process of creating money and providing credit. We also consider the implications of financial stability, distinctions between impacts on the asset and liability sides of the balance sheets of the banks and more general implications on stabilization policies. To ensure stability of the monetary policy and the financial stability, we also emphasize safety measures that have been suggested in the CBDC design to address the potential negative impacts.

The last part deals with policy issues. We inquire as to whether some of the goals behind the issuance of CBDC can be achieved by reforms in the regulatory framework. Then we discuss end user adoption issues such as those of consumers and merchants based on available research on the economics of payment choice. Lastly, we take into account various dimensions of CBDC implementation related to political economy.

In our conclusion we present major findings in the literature. Although the concerns of policymakers regarding the possible negative consequences in the form of decreased bank lending or financial stability are widely accepted by scholars, the opposing forces are also described. As an illustration, CBDCs may spur more competitive deposit markets and thus increase the supply of credit, or may result in more attractive deposit agreements that lessen the risk of bank-runs. We also mention open questions, which need to be investigated with more detailed research, the complicated question of payment privacy and the influence of user preferences on the formation of digital payment instruments demand.

The particular central bank liability on which the current paper is devoted is the economics of retail CBDC central bank liability offered to households and non-financial firms. We do not assume the parallel discussion of wholesale CBDC, aimed at financial intermediaries and would be a much less dramatic change of the present financial system. Although we briefly mention technological solutions like distributed ledger technology, as well as the connections between CBDC and stablecoins, we are not attempting to cover the subjects of cryptocurrencies and decentralized finance at large, i.e. decentralized finance (DeFi).

2. Digitalization in Business and Payments

This part is an overview of the key dynamics behind the discussion of the possible central bank digital currency (CBDC) introduction. We start with an analysis of how the digitalization of the economy is taking place, and then we move on to the emergence of digital money.

2.1 The Economy in the Information Age

The economic digitization is gaining momentum at a very high rate. The companies are spending a lot of money on information and communication technologies (ICT) to seize productivity advantages, and the delivery of goods and services is becoming increasingly dependent on the online channel (see Figure 1).

This continued digitalization is shifting the economy rapidly in terms of structure. There are two developments that are particularly noteworthy: the dominance of digital platforms as a more common business model, and the increased significance of intangible assets, including data and software. Despite the fact that these trends can bring significant levels of efficiency, some of them also generate concern over market concentration and risks of anti-competitive practices.

Digital platforms represented by the example of Google, Amazon, and Facebook have become the icon of the digital economy. They are two sided markets, which entail two unique features (see Rysman 2009). To begin with, they mediate between two separate categories of users. Second, they create great network externalities: the actions of one group have a direct impact on the behavior and participation of the other. As an example, the larger the group of buyers, the more attractive an online marketplace will be to sellers, and the larger the group of sellers, the higher are the chances that buyers will join.

The market power through these network effects is an effective source of power which affects both pricing and competitive market among the platforms. Subsidizing those effects, platforms often create closed communities or walled gardens to lock in one side of the market. This enables them to exert monopoly power on the other party, which is usually by charging a high price, or other limiting practices.

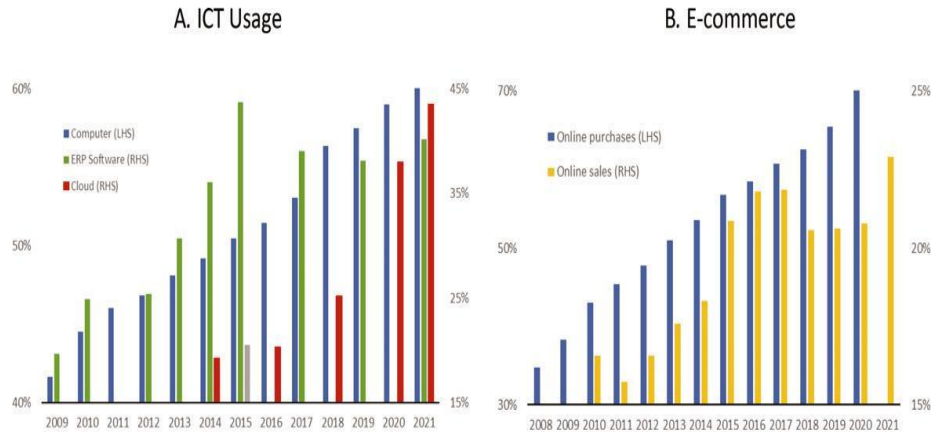

Figure 1. The Evolution of ICT Usage and E-commerce in the Euro Area

The left panel (A) displays different pointers of ICT applications in the euro region with time. Computer is the number of employees that use their own personal computer in the workplace; ERP software refers to the percentage of the companies that use Enterprise Resource Planning systems; and Cloud is the percentage of companies that use cloud computing platforms. The countries covered include DE, FI, FR, GR, IE, IT, LU, NL, PT, and ES. The right panel (B) depicts the growth of e-commerce in the euro area. Online purchases is the number of people who purchased at least one product online in the last 12 months as a percentage and Online sales are the percentage of companies which have been involved in the online selling. The sample covers AT, BE, DE, EE, FI, FR, IE, GR, ES, IT, CY, LV, LT, LU, MT, NL, PT, SI, and SK. All series are aggregated using GDP weights. Sources: OECD (panel A); Eurostat (panel B).

The dangers of market concentration are also outlined by these trends in digitalization. Extremely, network externalities may result in a winner-takes-all phenomenon, in which one platform controls a market segment.

The second aspect that defines the digital economy is the increased use of intangible inputs, including data and software. The result of these inputs is high levels of economies of scale: the price of fixed costs increases, and the price of marginal costs decreases in favor of large firms (Farboodi et al. 2019; Farboodi and Veldkamp 2021). This change in cost base provides early users of new technologies with a great advantage. Although this kind of dynamics increases short-run productivity, it also deters entry, which may slow the growth in the long-run (De Ridder 2021). Compared to traditional forms of inputs, data is non-rival, they can be utilized at the same time by several parties (Jones and Tonetti 2020). The wide access to consumer data is likely to yield huge social value due to the enhanced matching efficiency as well as quality of goods and services. Nevertheless, companies tend to keep information secret

to gain market dominance and exclude competition. Combination of network effects and access to unique data is particularly effective in the environment of digital platforms.

This trend towards increased concentration and an increase in the market power is confirmed by the empirical evidence. It has been found out that markups have been on the rise (De Loecker, Eeckhout, and Unger 2020), while a small set of "superstar firms" has emerged as dominant players (Autor et al. 2020). This fact is demonstrated by the incredible performance of the stock markets of BigTech in the last ten years.

2.2 The Transformation of Money and Payment Services

Money is a major element in any economic activity and it facilitates easy exchange of goods and services. In the absence of a medium of exchange, which is universally agreed upon, trade would be restricted to barter or credit, and those are weak and dependent on long-term trust or binding promises.

The different kinds of money coexist in the present day monetary system although the creation of money is distinguished. Central bank issues physical cash as the only type of public money which is treated as a direct liability of monetary authority. In comparison the kind of digital cash that households and firms have is largely generated by commercial banks in the shape of deposits and this is one of the private money.

To the general citizen, this line between state and personal money does not exist in everyday life since the deposits are regarded as synonymous to cash. However, this was not true in the past. An example of this is when the U.S. adopted the free-banking system, bank notes issued privately tended to issue a discount based on the creditworthiness of the issuing bank. Banking regulations and supervision are now very strict and deposit insurance guarantees the impression that retail deposits are absolutely safe and replaceable at all with public money.

Digital money is sought in a digital economy due to the effectiveness of payment systems. With further transactions moving over to the internet the usefulness of cash as a payment method is steadily becoming less used. This tendency is presented in Figure 2 in the panel A: in the euro area, the card payment amount has grown by more than four times over the last 20 years, whilst the cash withdrawals at ATMs have decreased by approximately 20 percent, and the decrease rate has been accelerated within the past years. The data of panel B (based on the payment diary data of Germany and the Netherlands) reveal a sudden decline in cash usage (in terms of the percentage of transactions processed in cash) during the last decade. It also draws attention to the significant differences among the countries, whereby the use of cash is still much higher in certain economies compared to others.

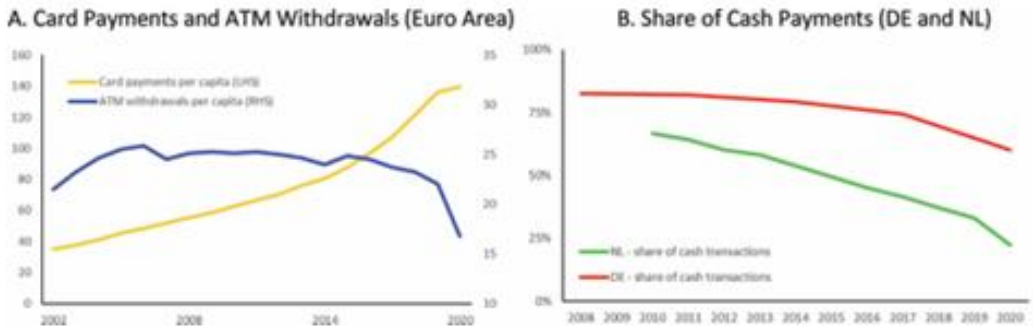

Figure 2. The Shift from Cash to Cashless Payments in the Euro Area

The left panel (A) illustrates the evolution of card payments and ATM withdrawals per capita in the euro area between 2002 and 2021, covering countries AT, BE, CY, DE, EE, ES, FI, FR, GR, IE, LU, LV, NL, PT, SI, and SK. The right

panel (B) presents the share of retail payments settled in cash, based on retail payment diary data from Germany and the Netherlands. Sources: Eurosystem (panel A); Bundesbank and De Nederlandsche Bank/Betaalvereniging (panel B).

Although the digital payments are increasingly replacing the cash, there are still significant obstacles to digital money in the modern context. The current interbank payment systems have not been well adapted to technological advancement. On the part of the consumer, even intra-jurisdictional settlement is usually made slow through bank transfers which take one to two business days to go through. On a larger scale, retail payment systems are very fragmented and advancement in the creation and implementation of instant payment solution has been comparatively low. Although credit cards are highly appropriate in e-commerce transactions especially when it is done across borders, the cards are still expensive to merchants as a result of the existence of a few powerful card networks. In addition, they are still using legacy settlement systems. This has not led to innovativeness among the incumbents which has given new entrants a chance. NBPs have acquired a large market share in online retail payment through the package of payment services with other online services like online marketplaces (PayPal/eBay, Alibaba/Alipay, Amazon), consumer lending (Klarna, Affirm), social networking (WeChat), ride-hailing (Go-Jek), and telecommunications (Apple Pay, Google Pay, M-Pesa). But, still, the retail payment environment relies on the traditional infrastructures. Numerous innovative interfaces, including mobile wallets, typically use a front-end interface and incorporate standard products like credit cards or bank deposits, enhancing the convenience and enabling the providers to seize the customer interface and related information. Notably, the balances that are in the possession of the non-bank payment providers are eventually reflected as deposits in the conventional banking system. Although it can be more efficient when payment flows are internalized in these networks, the absence of interoperability is often compelling consumers and merchants to enter into a multi-homing relationship, which further divides the payment ecosystem.

Distributed ledger technology (DLT) has brought more basic upheaval. Since digital money exists solely as a computer code, it is problematically prone to duplication and the so-called problem of double-spend. In the traditional systems, this is solved through the trusted third parties like banks. DLT, in its turn, allows direct transfer of digital claims (tokens) without having to employ such middlemen. The system has a fixed public registry, which is synchronized throughout a peer-to-peer network by some consensus mechanism. A completely decentralized, permissionless environment will require transactions to be validated by any participant, and the cost of double spending is prohibitively high.

DLT is the foundation of the appearance of cryptocurrencies, which are supposed to be digital payment tools and ensure decentralized payment, even with the help of smart contracts. They have severe restrictions, however. Cryptocurrencies such as Fiat currencies such as Bitcoin have severe price volatility rendering them an untrustworthy method of exchange. Stablecoins cryptocurrencies are proposed as a stablecoin where the reserve assets are the collateral, but recent events, like the failure of the ill-fated stablecoin Terra, show how much confidence can be lost in a short time, with the sector contagion effects. Moreover, the complete decentralization of cryptocurrencies poses the problem of scalability and high consumption of energy resources, particularly in the types of proof-of-work consensus algorithms, which makes them inappropriate to large-scale retail payment systems. These problems may be alleviated with permissioned DLT designs, in which only the nodes selected can update the ledger. The example of such an approach is the facebook Libra project in its modified version (Libra Association 2020).

The fact that BigTech companies can combine payments with other services provides them with a significantly privileged status in the payments market. Digital platforms and payment services have strong network externalities, which enhance the threat of market concentration among a few of the issuers of private digital money. These trends have added to the policy discussion of the possible benefits of establishing public digital money as central bank digital currency (CBDC).

3. Motives for the Introduction of Central Bank Digital Currency

This part summarizes the key reasons why the issue of the possible issue of digital cash should be issued. We start with the discussion of the role of the public money as a monetary anchor in a more and more cashless economy. Next we look at the question of monetary sovereignty that has taken on a new sense of urgency after the publication of the first white paper of Libra by Facebook in 2019. Then the topic of privacy in payments is presented, and lastly is how CBDCs can help with frictions in payment systems and financial intermediation among other benefits.

3.1 Public Money as a Monetary Anchor in a Digital World

The existing system of money is premised on the coexistence between the public money (cash) and the private money issued by commercial banks. By quantity, the private money is in the lead: in the euro zone, the number of overnight bank deposits constitutes over 85 percent of the narrow money supply M1. However, the two-tier system relies on the role of public money. It plays the role of an anchor to the system as it is the safest type of money as a central bank liability (Panetta 2021; Brunnermeier and Landau 2022).

To the consumers, commercial bank money is viewed as being the same as that of the public. This equivalence is assured by having a public safety net, which consists of banking regulation and supervision, deposit insurance, and the role of the central bank as a lender of last resort. A combination of these mechanisms ensures that conversion is made at par, which makes deposits a stable medium of exchange.

Nevertheless, this balance is increasingly being broken through the digitalization of the economy. Because cash usage becomes less and less, the principle of one-to-one convertibility becomes in practice no longer significant. To keep on serving the purpose of the monetary anchor, the public money needs to be highly available and in effective use. Digital version of cash CBDC may thus be fundamental in ensuring the coexistence of the public and private money in future.

3.2 Retaining Monetary Sovereignty

Monetary sovereignty means that the domestic currency has the primacy to perform the three essential functions of money, namely unit of account, medium of exchange and store of value. The sovereignty is undermined whenever foreign currency plays an important role in any of these functions. This is called currency substitution or dollarization/euroization and is the case of Montenegro where the euro is used as the legal tender even though the country is not a member of the Eurosystem.

Brunnermeier, James, and Landau (2019) warns that the emergence of digital money may undermine monetary sovereignty. Major platform operators, following the original Libra plan, would incorporate payment services in their digital ecosystems and, through the large customer base allowed, become dominant issuers of personal digital currencies. When adopted as a means of exchange, these currencies might as well take on the functions of unit of account in and possibly outside these ecosystems. This dynamic reflects the model of Doepke and Schneider (2017), where the prevailing unit of account is the result of the activity of the biggest and the most powerful economic actors. Traditionally, this role has been taken by government-issued money supported by state debt in developed nations. A CBDC would aid in maintaining this position in that public money is still practiced.

Monetary sovereignty is a very expensive thing to lose. First, it interferes with the monetary policy. Monetary policy is based on price stickiness in domestic unit of account: the stickiness allows monetary expansions to work to stimulate output and not just promote inflation. (Gali 2015). If contracts and prices are denominated in another currency, policy transmission is impaired. Furthermore, Benigno, Schilling, and Uhlig (2022) claim that monetary policy is limited by the existence of alternative mechanisms of exchange, including cryptocurrencies and personal digital currencies, who restrict the ability of the central bank to charge interest rates above the rate of return on these alternatives, even in cases where higher interest rates are necessary to curb inflation.

Second, weak sovereignty increases financial stability risks. In theory, a central bank can help maintain liquidity in times of crisis by issuing an unlimited supply of its local currency (Skeie 2008; Allen, Carletti, and Gale 2014). In case the liabilities are expressed in foreign or other domestic digital currencies, though, this ability is harshly constrained, making the bank runs even in the solvent institutions even more hazardous. This mechanism is backed up by empirical evidence: Levy-Yeyati (2006) shows that dollarized economies face heightened vulnerability to financial crises.

These concerns are compounded by the international nature of the digital platforms. The digital currencies introduced by the BigTech companies would probably go beyond the national borders, similar to the initial Libra plan (Libra Association 2019). This poses a dire threat of digital dollarization with open economies which are highly dependent on foreign digital platforms (Brunnermeier, James, and Landau 2019). It is especially difficult to face such competition at the expense of social funds as it can curtail the usefulness of domestic regulations a conflict clearly demonstrated by current intercontinental arguments regarding the regulation of giant U.S. online corporations.

3.3 Preserving Privacy

Privacy is a multifaceted concept, but economists typically focus on its informational dimension (Acquisti, Taylor, and Wagman 2016). Another handy reference is a definition by Westin (1967), who views the notion of privacy as the right of individuals, groups, or even institutions to decide about how, when and the extent to which the information about them is disclosed.

Privacy has become an issue due to the ubiquitous gathering of personal information the fuel of the digital economy. Although at the beginning of Internet adoption, most people were not aware of how much data were being harvested, the current moods have changed dramatically. The outcome of a digital euro as indicated by the public consultation carried out by the Eurosystem indicates that consumers are becoming more conscious of the use of data relating to digital payment.

That brings two main questions: what degree of privacy is the electronic payment supposed to provide, and would the market take proper care to ensure the privacy is sufficient, or should the policy be intervened?

In order to provide the answer to the first question, it should be taken into account why people consider privacy in payments to be important. One group of motives refers to illegal actions, such as tax avoidance, drug trafficking and gun trading. Commercial banks are subject to stringent anti-money laundering (AML) and know-your-customer (KYC) laws in order to fight this abuse. Any other new digital mode of payment should be in line with these security measures. In addition to committing crimes, though, there are other valid reasons why people should cherish their privacy. For instance, Kahn, McAndrews, and Roberds (2005) argue that the anonymity afforded by cash helps mitigate moral hazard risks, such as exposure to theft.

3.4 CBDC as a Tool to Address Market Imperfections

Literature indicates that a retail CBDC would lead to better economic results by eliminating current market failures, which are especially in payment services and financial intermediation. It has a potential though that goes much further. Improving payment efficiency. The retail CBDC may reduce the expenses of payment. Williamson (2022b) and Keister and Sanches (2023) study models where payment instruments are not perfect substitutes and operate here with cash and deposits. Another tool that can be introduced to boost welfare is the introduction of CBDC which will decrease the liquidity premium on deposits. The other significant dimension is related to cross-border payments that have increased tremendously with remittances and international travel but are still expensive, in many cases, due to the lack of competition (BIS 2021a). However, although most CBDC initiatives are nationally or currency union level, initiatives like multi-CBDC arrangements at the G20 level have been established. (Auer, Haene, and Holden 2021) seek to interlink them. These schemes would reduce the expense of cross-border and cross-currency payment by increasing consumer choice and competition among middlemen. Solving frictions in financial intermediation.

CBDCs may also reduce distortions in deposit markets, alleviate moral hazard, improve liquidity provision, and enhance information flows to policymakers. Andolfatto (2020) and Chiu et al. (2022) demonstrate that CBDCs restrain the market power of the banks in the deposit markets since they provide depositors with an alternative deposit option, compelling banks to increase deposit rates. Furthermore, as the bank risk-taking moral hazard risk is reduced by redirecting the funds held in deposits to remunerated CBDC, and welfare gains are achieved (Williamson 2022a). Keister and Monnet (2022) continue to claim that CBDCs enhance the information accessible to policy makers e.g. central banks as lender of last resort. As withdrawals in a bank run are converted to CBDC, the central bank can have real-time information on the economy and will be able to intervene faster, minimizing inefficient liquidations and misallocation of resources. In the expectation of this mechanism, investors will find it less likely to preempt exit, and this will increase financial stability.

CBDCs may also enhance liquidity transformation. Fernández-Villaverde et al. (2021) demonstrate that CBDC is better than deposits in the event of possible bank runs in that (i) the central bank cannot be forcibly liquidated and (ii) it is more likely to make illiquid investments. By doing so, the central bank will be able to replace the commercial banks as an intermediary which would give the consumers greater liquidity than the banks would have afforded to them. Additional benefits. Other than financial system, CBDCs can reduce market dominance in web platforms. Brunner Meier and Payne (2022) create a structure where the token is issued by platforms and rents are collected because of network externalities. The fact that consumers accept tokens nowadays with a hope that they will be accepted in the future makes platforms entrench their market power. An official cryptocurrency of a country would threaten these tokens by making them less popular. In the same manner, CBDCs would enable the governments to gain more control over payment infrastructures an essential benefit in the jurisdictions, including the EU, where the payment system is dominated by foreign providers.

CBDCs also provide governments with an effective way to provide fiscal transfers to citizens, which may increase fiscal policy effectiveness. The functionality that can be programmed such as expiration date transfers would incline consumption propensities during times of crisis.

Lastly, CBDCs are mentioned as a source of financial inclusion. However, survey data show that not more than 5 percent of households in the euro area are unbanked (Ampudia and Ehrmann 2017) so the benefits in developed economies must be lower than the potential (but still considerable) benefits in developing countries (Boar and Wehrli 2021).

4. Implications for Monetary Policy

In this section, the author looks at the impact of CBDC on monetary policy. We start by its impact on policy transmission via the credit channel. Then we consider the position of a remunerated CBDC as a policy instrument and address the difficulties that it can introduce in policy implementation.

4.1 The Credit Channel

Credit channel is the one that puts banks at the center of transmission of money. As CBDCs are a close alternative to deposits, they first of all impact the liability side of bank balance sheets, and have credit supply implications. This effect is determined by three factors, which include variation of the cost of funds, variation of the capital of the bank and the loss of synergies between banking activities. Financing expenditures and rivalry.
In models with perfectly competitive deposit markets, CBDCs crowd out deposits, increase banks' funding costs, and reduce lending (Keister and Sanches 2023; Agur, Ari, and Dell'Ariccia 2022). Policymakers worry this could trigger "disintermediation" (Bindseil 2020). Brunnermeier and Niepelt (2019) show that, under certain conditions, central bank lending can offset this funding gap, achieving CBDC neutrality.

In contrast, in imperfect competition models, banks impose market power through limiting the supply of deposits and reducing the rates. Within this context, a paid CBDC will provide depositors with a favorable external option,

compelling banks to increase the deposit rates (Andolfatto 2021; Chiu et al. 2022). The deposits and lending volumes increase as long as the remuneration is low hence facilitating credit growth. It is empirically established that banks do increase the deposit rates by a great deal in response to increased competition (Drechsler, Savov, and Schnabl 2017). However, Garratt and Zhu (2021) note that smaller banks, offering fewer conveniences (e.g., limited branch networks), are more vulnerable, which could increase concentration in the sector. Bank capital. Capital is critical for bank lending, both for regulatory compliance (Van den Heuvel 2008) and for aligning managerial incentives (Gertler and Kiyotaki 2010). The impact of CBDCs is not clear since banks amass capital to a significant extent via retained earnings (Cohen 2013). On the one hand, the demand on the deposit margins minimizes the profits which can be retained. Conversely, the creditors capacity to transfer the money into secure CBDC enhances market discipline, which compels banks to hold more profits. This is more pronounced when the CB can change the funding mix of banks to include a higher share of uninsured debt which in the past exerts more discipline (Calomiris and Kahn 1991; Diamond and Rajan 2001). Activity synergies.

Deposits and lending have synergies that are beneficial to the banks. Indicatively, deposits and credit-line drawdowns are non-perfectly correlated, and so banks can save on liquid reserves. (Kashyap, Rajan, and Stein 2002). Piazzesi and Schneider (2020) demonstrate that deposits deteriorate as a result of CBDC injections and diminish the synergy in credit provision. Similarly, deposits' stickiness (Neumark and Sharpe 1992; Driscoll and Judson 2013) eliminates interest rate risk on banks enabling them to lend out long term loans in fixed rates. This stability may be threatened by increased competition on the part of CBDCs, exposing banks to risk of interest rate (Whited, Wu, and Xiao 2022).

4.2 CBDC Remuneration as a Monetary Policy Tool

The point that is stressed by most of the key central banks is that the main goal of studying CBDC is not developing a new tool of monetary policy, but instead supplementing cash, not substituting it (Group of Central Banks 2020). This stand is commonly understood as that CBDC is supposed to be elastic in nature and not remunerated like banknote supply. Such a design is not, however, unavoidable.

A zero lower bound on interest rates would essentially be introduced by an unremunerated CBDC of elastic supply. In comparison, the remunerated CBDC may enable the effectiveness of the lower bound (ELB) on interest rates to be overcome (Bordo and Levin 2017; Lilley and Rogoff 2021). Within that framework, the CBDC remuneration would be varied according to the policy rates during the business cycle and even be negative, thus removing the liquidity traps. But to achieve this, cash would have to be phased out so as to avoid hoarding under circumstances where digital money has negative rates something big centrals banks have committed not to do (Group of Central Banks 2020).

Bindseil (2020) points out that, when in a negative interest rate regime, the unremunerated CBDC would have unlimited demand in case it is provided at zero rate. On the other hand, IP-paying CBDC might be unable to be widely adopted, since money would continue to be cheaper. To control the demand, Bindseil suggests a remuneration system at a tiers: the first tier of CBDC holdings will have a non-negative rate, and balances exceeding the first tier will have a penalty rate, which will adjust synchronously with policy rates. Such a design can however be hard to explain to the population, which might discourage its adoption and compromise usability, especially when we have already, at hand, more appealing offerings in the private sector.

In addition, the CBDC holdings might be even more vulnerable to policy rate alterations than cash and maybe even more than deposits, which usually change only partially and slowly. This sensitivity may reinforce the transmission of the policy rates to the funding rates and lending rates of banks (Whited, Wu, and Xiao 2022).

Other than its reinforcing effect on transmission, a remunerated CBDC might offer a policy tool to central banks. It would be able to aim at targets like the exchange rate or the deposit liquidity premium. CBDC would create new avenues of monetary policy to affect output and inflation because it can serve as a means of exchange and as a store of value. Assenmacher, Bitter, and Ristiniemi (2022), connecting a New Monetarism approach with a New Keynesian approach with financial frictions, demonstrate that central banks might separately affect the means-of-exchange and

store-of-value properties of money by directing CBDC supply. This would enable the policy makers to trade-off the payment efficiency, the bank funding conditions and the opportunity cost of holding money which would in turn increase the macroeconomic stabilization.

4.3 CBDC and Implications for Monetary Policy Implementation

CBDC would bring significant implications to the activities of monetary policy and the volume and structure of central bank balance sheets. These effects both vary with the quantity of CBDC in circulation and they are influenced by the policy of the central bank to respond to variation in demand.

Brunner meier and Niepelt (2019) and Niepelt (2020a, 2020b) argue that CBDC issuance could be neutral for bank funding if the central bank offsets deposit outflows by extending additional lending to banks. Figure 5 illustrates this adjustment. When households shift deposits into CBDC, two scenarios emerge:

- When the banks have adequate reserves, their balance sheet balances and those in the balance sheet of central bank are substituted with CBDC (illustrated by the hatched red arrows in Figure 5).
- The lack of enough reserves by the banks will force them to borrow at the central bank leading to an increase in central bank balance sheet (hatched green arrows at Figure 5).

In order to prevent the distortion of capital distribution and relative prices, the central bank would have to lend money to banks in an amount that would equal the deposit money being lost. In particular, they would have to be unsecured. Nonetheless, as the central banks usually impose collateral requirements, it is not possible to ensure that CBDC and bank deposits remain equivalent.

Williamson (2022b) also maintains that, in case CBDC replaces a significant portion of money provided privately, the central banks will have to place back on their balance sheets some form of assets privately supplied. This may be a serious break with practice and what it would mean concerning risk management and the role of central bank in the financial intermediation.

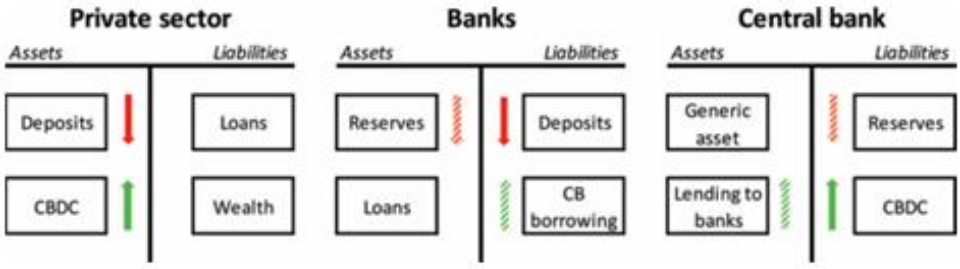

Figure 5. The Balance Sheet Effects of CBDC

The figure shows the balance sheet effect of implementing a CBDC in households, banks and central bank. Fernandez-Villaverde et al. (2021) state that the analogy between CBDC and deposits is weak and collapses in the crisis-prone economies in which the central banks are seen as more stable than commercial banks. In expectancy of this, depositors would completely replace deposits by CBDC. Fraschini, Somoza, and Terracciano (2021) highlight that, if CBDC can be provided more efficiently than deposits, the central bank's balance sheet would expand and seigniorage revenues would rise potentially allowing for tax reductions if the effect is large enough. Similarly, Kahn, Singh, and Alwazir (2022) argue that a CBDC would supplement the central bank money supply, divert demand off of privately issued monetary assets and thus augment monetary control and raise seignior age.

The impact of CBDC on the implementation of the monetary policy will be dependent upon the magnitude of the demand and the wider policy environment during introduction. The issue of volatility in CBDC demand may make it difficult to control interest rates in a corridor system, but in floor systems where excess reserves are high; it would be

easier to address these issues (Malloy et al. 2022). When the environment is highly liquid, banks would be able to fulfill CBDC demand by lowering excess reserves. Provided that the negative rates apply to such reserves, such conversion may even increase the profitability of the banks, but this distribution among banks is extremely uneven (Fegatelli 2021; Adalid et al. 2022).

CBDC can also necessitate reconsideration of the counterparty structure of the central bank. In case the non-bank institutions are allowed to distribute CBDR, they may need to have the central bank balance sheet to enable efficient distribution. In addition, the issuers of private stablecoins may store the CBDC as their reserve portfolios (Libra Association 2019). Overall, the adoption of CBDC would require re-thinking the operational model of monetary policy, which includes the integration of remuneration in the main policy rate framework, the adoption of either corridor or floor models, and the combination of instruments (refinancing operations or direct purchases).

5. Implications for Financial Stability

Policy debates on CBDC revolve around financial stability (BIS 2021b). The fears revolve around the relative safety and compensation of CBDC claims over deposits with the resultant implications on the resilience of banks. The effects on financial stability of CBDC will manifest themselves in various ways, including: the liability aspect of the balance sheets of the banks (funding costs, liquidity, and depositor withdrawals) and the asset aspect (risk-taking incentives). Besides, CBDC can provoke the possibility of the authorities to step in and stabilize the financial system.

5.1 The Liability Side: Fragility and Digital Bank Runs

On the liability side, bank fragility arises from their function as liquidity providers (Diamond and Dybvig 1983; Goldstein and Pauzner 2005). The banks convert the demandable deposits into illiquid risky assets offering liquidity guarantees but putting themselves at risk of maturity mismatch. This exposes them to the dangers of bank runs, which can happen in either of the following forms: (i) self-fulfilling panic, where depositors run their money away (because they believe that other bank depositors will run their money as well) (Diamond and Dybvig 1983), or (ii) deteriorating economic fundamentals (Gorton 1988; Allen and Gale 1998, 2004). In both cases, early withdrawal is rational if it offers higher expected payoffs.

Withdrawal incentives, and consequently run probability, therefore depend on the attractiveness of outside sources of investment. Policymakers fear the effect of introducing a less risky and possibly interest bearing alternative, CBDC, which can increase the instability (Broadbent 2016; Callesen 2017). Relative to the system where the single possible alternative is cash, CBDC increases incentives to move out of the system in stress periods, as transforming deposits into CBDC protects the depositors against the risks of bank failure. Central banks may always pay liabilities though issue of currency; hence, CBDC is considered to be riskless and resistant to the run. In line with this view, a flight-to-safety, Williamson (2022a) demonstrates that CBDC increases the parameter space within which deposit runs may take place in multiple-equilibrium models.

Finally, the stability of banks is a product of depositor/bank behavior and the prudential system at large and the plausibility of lender-of-last-resort guarantee. The separation of the impact of CBDC on the liability and the asset side of banks is therefore most important in recognizing the systemic effect of the latter.

5.2 The Asset Side: Profit Margins and Risk-Taking Incentives

Risk taking decision on the asset side of bank balance sheet is an important factor in determining fragility. Historically, the incentives of risk-taking are strongly associated with the level of profit: the screening and monitoring process of asset risk are expensive, and the banks will not accept these expenses without the returns of adequate magnitude. This is why, increased risk-taking has been traditionally linked with more competitive banking climate (Keeley 1990) or with accommodative monetary policy (Dell'Ariccia, Laeven, and Marquez 2014; Martinez-Miera and Repullo 2017; Heider and Leonello 2021).

It is against this background that the implementation of a CBDC may give banks an incentive to take even more risks, as profitability will narrow and interest rates will become smaller. This can be encouraged in a number of channels. To start with, as mentioned above in this paper, banks may retaliate against CBDC competition by increasing the deposit rates. Unless they are capable of completely covering increased cost of funding by increased lending rates, margins will narrow and may stimulate too much excessive risk-taking and destabilize. Second, there is the possibility of reduced loan volumes by banks even when it is viable to increase the lending rates.

However, not all models confirm this destabilizing view. Monnet, Riva, and Ungaro (2021) indicate that an increase of CBDC remuneration to increase the central bank liability returns is akin to a reduction of the real cost of capital. This helps the banks to increase lending and enhance profitability despite increased cost of funding, so as to decrease incentives to risk taking.

The CBDCs can also affect the risk-taking by affecting market discipline. This process is directly associated with the incentives of the depositors to withdraw funds, as the threat of the runs influences the expected profits of the banks as well as the discipline which the depositors will have (Calomiris and Kahn 1991). Two opposite effects ensue. On the one hand, the increased risk of runs increases discipline: in the case of banks which expect depositors to respond to riskier behaviour, the pressure to behave prudently is greater. Conversely, when the probability of running is already high, the profits expected would be low and this could decrease the incentives of banks to invest in sound risk management. Finally, the question of whether CBDC stimulates or inhibits risk-taking can be determined by the effect that these changes have on the equilibrium probability of runs and the profitability of the banks.

5.3 Impact on Financial Stabilization Policies

Thus far, the analysis has mostly ignored the value of prudential instruments and crisis response including bailouts, deposit guarantees, or lender-of-last-resort guarantees in inhibiting distortions and advancing stability. The design of those policies is vital, especially regarding the timeliness of the intervention, the quality of information that authorities may have concerning the health and fundamental elements of the economy of the banks, and whether they can commit credibly to a certain kind and amount of support (Gale and Vives 2002; Keister 2016; Allen et al. 2018).

It is, therefore, important to know how CBDC interplays with prudential policies. In particular, is CBDC able to increase the ability of regulators to ensure financial stability? And what design factors are the most topical? Keister and Monnet (2022) optimises a scenario in which local authorities are not entirely committed and slowly get to know the state of the economy. There is a significant trade-off that is emphasized in their analysis. On the one hand, CBDC offers depositors a more enticing appearance of the exterior, increasing the threat of bank runs. CBDC accounts, conversely, allow policymakers to have a real-time view of deposit flows and more precise interventions are possible. CBDC would weaken or strengthen financial stability depending on the dominating force.

These lessons have design implications of CBDCs. Stability-wise, an account-based CBDC would be better, as it will enable the central bank to monitor flows directly something that cannot be done in a pure token-based system. In comparison, having rigorous holding limits would lessen the accuracy of the data presented, and its applicability to intervention.

Lastly, the CBDC would indirectly enhance stability by lowering the moral hazard associated with implicit government guarantees. The primary argument that underpins the argument in favor of the banks is their central nature in the payment systems. An alternative that is safe and publicly available de-escalates the special treatment of banks, diminishing the justification of special treatment, and helps in limiting the distortions linked to expectation of special treatment.

6. Too Much vs. Too Little: Ensuring Adoption of CBDC

The risks of excessive adoption of central bank digital currency (CBDC) and the subsequent implication on monetary policy and financial stability have been the subject of much debate. Concurrently, central banks should also be wary of introducing a product which will not pick up. Although certain theoretical frameworks emphasize the disciplining influence of the CBDC as an outside option to be applied by the parties involved, the low implementation would probably demonstrate the lack of demand and, at the very least, would form the perception of failure among the rest of the population. In addition, a lack of adoption may also jeopardize the capacity of CBDC to offer public mooring to monetary system.

It is important to know the determinants of user behavior in the payments market. The barriers to entry into the market are especially high given the high network externalities that the market enjoys. A new payment instrument needs to appeal to both consumers and merchants in large numbers simultaneously in order to be successful. As predicted by theoretical models, interchange fees are usually relatively high to the merchants. The design of a cost-recovery CBDC might therefore be dedicated to the establishment of a broad merchant acceptance as one of the conditions of success as a medium of exchange. This strategy would equally follow the past regulations in capping interchange fees to increase merchant acceptance (Valverde, Chakravorti, and Fernández 2016).

Yet cost is not the only determinant of merchant adoption. As digital payments are increasingly bundled with complementary services such as data analytics (e.g., PayPal Marketing Solutions) or consumer credit (e.g., Klarna, Affirm) merchants can use wider value propositions as the basis of their decision. An effective CBDC would thus require to be embedded in an infrastructure capable of supporting such a bundling, or it would face the danger imposed by the private solutions.

Consumer adoption is also necessary in order to succeed. A large body of empirical research examines the factors of payment decision-making in retail markets. There have been indications that consumers usually spend little amounts of money using cash but change to electronic payments like debit and credit cards when they make a big purchase (Klee 2008; Chen, Rysman et al. 2021). This behavior is consistent with the Baumol-Tobin model of money demand (Baumol 1952; Tobin 1956; Alvarez and Lippi 2009), where opportunity costs are at the center stage. Likely, the same is also evident in the study carried out by Li (2021), who states that, on average, an increase in CBDC remuneration by 0.1 percentage point would lead to a 8 to 18 percent improvement in demand.

More broadly, consumers appear cost-conscious: they avoid methods that impose fees and prefer those offering rewards such as rebates or loyalty points (Ching and Hayashi 2010; Simon, Smith, and West 2010; Carbó-Valverde and Liñares-Zegarra 2011). The rise in the non-monetary criterion, e.g., convenience and speed of transaction, can also be observed in the secular fall of cash usage. Whereas card payment used to be slow and cumbersome (Klee 2008), the innovations such as contactless payments have changed the preferences with preferences even on low value payments (Brown et al. 2021).

Consumer habits further reinforce these dynamics. Once individuals adopt a preferred payment method, they exhibit strong inertia and reluctance to switch (Van der Cruijsen, Hernandez, and Jonker 2017; Berg et al. 2021). A recent survey commissioned by the ECB establishes that consumers react strongly to seamless one-stop solutions that mitigate the inconvenience of multi-homing including having to manage more than one card or device (Kantar Public 2022).

The issue of privacy is also very much prominent in the debate. Cryptocurrency enthusiasts tend to emphasize anonymity as one of the main aspects. According to survey evidence nonetheless, consumers are conscious of the aspect of privacy in retail payments but that is not the main consideration that they make. (Kantar Public 2022). Li (2021) concludes that the lack of anonymity might reduce the demand of CBDC, but her results were estimated with the help of survey data and are subject to the famous privacy paradox (Chen, Huang et al. 2021). Practically, a small amount of monetary incentives could be sufficient to curb the privacy fears, despite the fact that this will decrease the

demand of the CBDC. This disparity between social and capital value of privacy (Garratt and van Oordt 2021) could result in welfare losses that might only be mitigated through additional regulation of rebate schemes.

Moreover, privacy preferences are context-dependent. Ahnert, Hoffmann, and Monnet (2022) show that preferences vary with the environment, a finding corroborated by recent ECB survey evidence (Kantar Public 2022). This suggests that a fixed privacy regime could hinder adoption.

Lastly, there is very limited information on the extent to which the consumers appreciate the fact that they are being offered with other services through bundling of payments. Although money has always fulfilled both the role of a medium of exchange and a store of value, the present CBDC design proposals tend to divide them into holding limits or tiered remuneration (Bindseil, Panetta, and Terol 2021). Such features can help reduce risks associated with bank lending and financial stability, but they are not well known in their impact on demand. These effects may be significant based on the success of BigTech companies in integrating payments with more extensive digital services (Brunnermeier, James, and Landau 2019). An effective CBDC is likely to require a design that allows integrating the financial and non-financial services smoothly.

In conclusion, it is very essential to hit the correct balance. The overuse can jeopardize credit provision and financial stability and the underuse can bring down the credibility and effectiveness of CBDC. As cash is fast becoming less popular and electronic payment the new dominant mode of payment, additional studies are required to gain a more comprehensive insight into how bundling and the privacy of consumers and merchants influence their decisions and to inform policymakers on how to effectively design CBDC.

6.1 Political Economy Considerations

The central banks also face high operational risks that are associated with the issuance of CBDC and this may affect the credibility of these central banks. This is especially necessary considering that the central bank depends on the confidence of the people on the central bank in order to accomplish its number one mandate which is ensuring that there is price stability. Of these risks, the most important is cybersecurity. Kahn, Rivadeneyra, and Wong (2021) highlight the inherent trade-off between convenience and security in digital currencies, noting that thefts of private digital assets remain widespread.

In a wider sense, when the central bank takes direct responsibility over a wider payment infrastructure, even simply disruptive or failure by any of the intermediate bears may be directly blamed on the central bank, and it could be seen as undermining trust among the public. Such risks could be eliminated by putting intermediaries at the center of customer onboarding and payment processes.

The political economy aspect is also permeated to the monetary policy. At the moment, the policy rates have an indirect influence on households, potentially restricting the interest of the population on monetary policy. A paid CBDC, in its turn, would make policymaking more concrete as interest payments would be directly paid out of household digital balances. Rogoff (1985) wary that once central banks are subjected to political pressure, and act on the preferences of the people, may end up pursuing measures that create excessive inflation one of the pillars supporting central bank independence. Goncharov, Ioannidou, have recently given evidence to the contrary, and Schmalz (2023) supports this concern, showing that greater public influence could weaken the central bank's ability to stabilize the economy.

Besides, as households would be net creditors via their balances in the CBDC, there would be a heightened political pressure, which would be biased, in promoting higher flow rates. This opposition to rate cuts would further limit the monetary policy options and would expose the economy to suboptimal economic results. Fernández-Villaverde et al. (2021) warns that a successful CBDC implementation would put enormous resources under the control of central bank, which then allowed the political party to engage in inefficient or unproductive fiscal policies.

7. Conclusion

The discussion of the advantages and disadvantages of central bank digital currencies (CBDCs) is also changing rapidly. Although certain of these dimensions are quite well comprehended, the wider ramifications to monetary policy and financial stability usually rely on the economic context in which it is being operated and the particular design characteristics of CBDC. Additionally, there are a number of unanswered questions that need to be researched upon in order to give the policymakers a clearer structure to make a decision.

From our review of the literature, several key conclusions emerge.

First, as the concept of CBDC is digital by its very nature and the payment data starts to accumulate, the issue of privacy turns out to be a particularly tricky one. The externalities and profit making interests in the private sector indicate that the public sector enjoys comparative advantages in offering privacy in payments. Simultaneously, such a universal approach as providing complete anonymity (excluding the AML/KYC issues) might not be the best choice, as the ability to share data under control can also be a benefit to users.

Second, the fear of a tightening in the supply of credit with the introduction of CBDC can be exaggerated in the situations when banks use market power in the markets of retail deposits. The CBDC in these situations would potentially increase competition, better deposit terms, and total welfare. Besides, HFs central banks might raise the liquidity supply to banks by countering deposit disbursements. Nevertheless, functional tensions including collateralization requirements could limit the degree at which banks can depend on the central bank facilities.

Third, theoretical models indicate that the financial risks of the financial stability of CBDC can be lower than normally presumed. Although the introduction of CBDC as a compelling alternative asset may increase the chances of bank runs, the existence of competition among banks will encourage them to provide more competitive deposit deals that can counter or potentially reverse the undesirable impact on stability.

Finally, The central banks are in a fine line of either excessive adoption or insufficient adoption. Safety measures like holding constraints or tiered pay can aid in avoiding uptake overload and the danger of disintermediation, yet their influence on user demand is not clear. In a broader sense, the booming electronic payment adoption is an indicator of a new taste among the users, but not much is available about the end-users in terms of the importance of certain features of electronic payment like privacy or integrating the electronic payment with other services. These dynamics will be critical in making sure that the designs of CBDC are based on user needs and policy objectives.

References

Adalid, R., Assenmacher, K., Álvarez-Blázquez, Á., Burlon, L., Dimou, C., López-Quiles, C., Martín, N., Muldoon, J., Segura, A., & Vergote, O. (2022). *Central bank digital currency and bank intermediation* (ECB Occasional Paper No. 293). European Central Bank. **https://doi.org/10.2866/773104**

Acquisti, A., Taylor, C., & Wagman, L. (2016). The economics of privacy. *Journal of Economic Literature, 54*(2), 442–492. **https://doi.org/10.1257/jel.54.2.442**

Allen, F., Carletti, E., & Gale, D. (2014). Money, financial stability and efficiency. *Journal of Economic Theory, 149*, 100–127. **https://doi.org/10.1016/j.jet.2013.04.011**

Allen, F., Carletti, E., Goldstein, I., & Leonello, A. (2018). Government guarantees and financial stability. *Journal of Economic Theory, 177*, 518–557. **https://doi.org/10.1016/j.jet.2018.05.006**

Alvarez, F., & Lippi, F. (2009). Financial innovation and the transactions demand for cash. *Econometrica, 77*(2), 363–402. **https://doi.org/10.3982/ECTA5776**

Ampudia, M., & Ehrmann, M. (2017). *Financial inclusion: What's it worth?* (ECB Working Paper No. 1990). European Central Bank. **https://doi.org/10.2866/485899**

Andolfatto, D. (2021). Assessing the impact of central bank digital currency on private banks. *The Economic Journal, 131*(634), 525–540. **https://doi.org/10.1093/ej/ueaa102**

Ahnert, T., Hoffmann, P., Leonello, A., & Porcellacchia, D. (2022). *CBDC and financial stability* [Unpublished working paper]. N/A

Assenmacher, K., Bitter, L., & Ristiniemi, A. (2022). *CBDC and business cycle dynamics in a New Monetarist New Keynesian model* [Manuscript]. N/A

Auer, R., Cornelli, G., & Frost, J. (2020). Taking stock: Ongoing retail CBDC projects. *BIS Quarterly Review, March*, 97–98. N/A (BIS box article)

Auer, R., Haene, P., & Holden, H. (2021). *Multi-CBDC arrangements and the future of cross-border payments*. Bank for International Settlements. N/A

Baumol, W. J. (1952). The transactions demand for cash: An inventory theoretic approach. *Quarterly Journal of Economics, 66*(4), 545–556. **https://doi.org/10.2307/1885454**

Benigno, P., Schilling, L. M., & Uhlig, H. (2022). Cryptocurrencies, currency competition, and the impossible trinity. *Journal of International Economics, 136*, Article 103601. **https://doi.org/10.1016/j.jinteco.2022.103601**

Berg, T., Burg, B., Keil, J., & Puri, M. (2021). *On the rise of payment firms* [Working paper]. N/A

Bindseil, U. (2020). *Tiered CBDC and the financial system* (ECB Working Paper No. 2351). European Central Bank. **https://doi.org/10.2866/936436**

Bindseil, U., Panetta, F., & Terol, I. (2021). *Central bank digital currency: Functional scope, pricing and controls* (ECB Occasional Paper No. 265). European Central Bank. **https://doi.org/10.2866/182051**

Boar, C., & Wehrli, A. (2021). *Ready, steady, go? Results of the third BIS survey on central bank digital currency* (BIS Papers No. 114). Bank for International Settlements. N/A

Brown, M., Hentschel, N., Mettler, H., & Stix, H. (2021). The convenience of electronic payments and consumer cash demand: Causal evidence from the staggered introduction of contactless debit cards. N/A (Journal not specified in original)

Brunnermeier, M. K., James, H., & Landau, J.-P. (2019). *The digitalization of money* (NBER Working Paper No. 26300). National Bureau of Economic Research. **https://doi.org/10.3386/w26300**

Brunnermeier, M. K., & Payne, J. (2022). *Platforms, tokens, and interoperability* [Unpublished working paper]. N/A

Calomiris, C. W., & Kahn, C. M. (1991). The role of demandable debt in structuring optimal banking arrangements. *American Economic Review, 81*(3), 497–513. **https://doi.org/10.1257/aer.81.3.497**

Chen, L., Huang, Y., Ouyang, S., & Xiong, W. (2021). *The data privacy paradox and digital demand* (NBER Working Paper No. 28854). National Bureau of Economic Research. **https://doi.org/10.3386/w28854**

Chiu, J., Davoodalhosseini, S. M., Jiang, J. H., & Zhu, Y. (2022). *Bank market power and central bank digital currency: Theory and quantitative assessment* [Unpublished manuscript]. N/A

Cohen, B. H. (2013). How have banks adjusted to higher capital requirements? *BIS Quarterly Review, September*, 25–42. N/A

De Loecker, J., Eeckhout, J., & Unger, G. (2020). The rise of market power and the macroeconomic implications. *Quarterly Journal of Economics, 135*(2), 561–644. **https://doi.org/10.1093/qje/qjaa001**

Dell'Ariccia, G., Laeven, L., & Marquez, R. (2014). Real interest rates, leverage, and bank risk-taking. *Journal of Economic Theory, 149*, 65–99. **https://doi.org/10.1016/j.jet.2013.03.010**

Diamond, D. W., & Rajan, R. G. (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking. *Journal of Political Economy, 109*(2), 287–327. **https://doi.org/10.1086/319552**

Doepke, M., & Schneider, M. (2017). Money as a unit of account. *Econometrica, 85*(5), 1537–1574. **https://doi.org/10.3982/ECTA14177**

Driscoll, J. C., & Judson, R. (2013). *Sticky deposit rates* [Unpublished manuscript]. N/A

Drechsler, I., Savov, A., & Schnabl, P. (2017). The deposits channel of monetary policy. *Quarterly Journal of Economics, 132*(4), 1819–1876. **https://doi.org/10.1093/qje/qjx023**

Farboodi, M., Mihet, R., Philippon, T., & Veldkamp, L. (2019). Big data and firm dynamics. *American Economic Review: Papers & Proceedings, 109*, 38–42. **https://doi.org/10.1257/aer.p20191038**

Farboodi, M., & Veldkamp, L. (2021). *A growth model of the data economy* (NBER Working Paper No. 28427). National Bureau of Economic Research. **https://doi.org/10.3386/w28427**

Fegatelli, P. (2021). *The one trillion euro digital currency: How to issue a digital euro without threatening monetary policy transmission and financial stability?* (Working Paper No. 155). Banque Centrale du Luxembourg. N/A

Fernández-Villaverde, J., Sanches, D., Schilling, L., & Uhlig, H. (2021). Central bank digital currency: Central banking for all? *Review of Economic Dynamics, 41*, 225–242. **https://doi.org/10.1016/j.red.2021.06.010**

Gali, J. (2015). *Monetary policy, inflation, and the business cycle: An introduction to the New Keynesian framework and its applications*. Princeton University Press.

Garratt, R., & Zhu, H. (2021). *On interest-bearing central bank digital currency with heterogeneous banks* [Unpublished manuscript]. N/A

Garratt, R. J., & van Oordt, M. R. C. (2021). Privacy as a public good: A case for electronic cash. *Journal of Political Economy, 129*(7), 2157–2180. **https://doi.org/10.1086/713317**

Gertler, M., & Kiyotaki, N. (2010). Financial intermediation and credit policy in business cycle analysis. In B. M. Friedman & M. Woodford (Eds.), *Handbook of monetary economics* (Vol. 3, pp. 547–599). Elsevier. **https://doi.org/10.1016/B978-0-444-53454-5.00011-9**

Goldstein, I., & Pauzner, A. (2005). Demand-deposit contracts and the probability of bank runs. *Journal of Finance, 60*(3), 1293–1327. **https://doi.org/10.1111/j.1540-6261.2005.00765.x**

Goncharov, I., Ioannidou, V., & Schmalz, M. C. (2023). (Why) Do central banks care about their profits? *Journal of Finance, 78*(5), 2413–3049. **https://doi.org/10.1111/jofi.13258**

Gorton, G. (1988). Banking panics and business cycles. *Oxford Economic Papers, 40*(4), 751–781. **https://doi.org/10.1093/oxfordjournals.oep.a041881**

Group of Central Banks. (2020). *Central bank digital currencies: Foundational principles and core features* (Report No. 1). N/A

Heider, F., & Leonello, A. (2021). *Monetary policy in a low interest rate environment: Reversal rate and risk-taking* (ECB Working Paper No. 2593). European Central Bank. **https://doi.org/10.2866/390531**

Jones, C. I., & Tonetti, C. (2020). Nonrivalry and the economics of data. *American Economic Review, 110*(9), 2819–2858. **https://doi.org/10.1257/aer.20191330**

Kahn, C. M., McAndrews, J., & Roberds, W. (2005). Money is privacy. *International Economic Review, 46*(2), 377–399. **https://doi.org/10.1111/j.1468-2354.2005.00337.x**

Kantar Public. (2022). *Study on new digital payment methods*. N/A

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking. *Journal of Finance, 57*(1), 33–73. **https://doi.org/10.1111/1540-6261.00415**

Keister, T., & Sanches, D. (2023). Should central banks issue digital currency? *Review of Economic Studies, 90*(1), 404–431. **https://doi.org/10.1093/restud/rdac042**

Klee, E. (2008). How people pay: Evidence from grocery store data. *Journal of Monetary Economics, 55*(3), 526–541. **https://doi.org/10.1016/j.jmoneco.2008.01.004**

Kosse, A., & Mattei, I. (2022). *Gaining momentum: Results of the 2021 BIS survey on central bank digital currencies* (BIS Papers No. 125). Bank for International Settlements. N/A

Levy-Yeyati, E. (2006). Financial dollarization: Evaluating the consequences. *Economic Policy, 21*(45), 62–118. **https://doi.org/10.1111/j.1468-0327.2006.00158.x**

Libra Association. (2019). *An introduction to Libra* [Technical report]. N/A (**https://www.libra.org/en/white-paper/**)

Li, J. (2021). *Predicting the demand for central bank digital currency: A structural analysis with survey data* (Staff Working Paper No. 2021-65). Bank of Canada. **https://doi.org/10.34989/swp-2021-65**

Martinez-Miera, D., & Repullo, R. (2017). Search for yield. *Econometrica, 85*(2), 351–378. **https://doi.org/10.3982/ECTA12747**

Monnet, E., Riva, A., & Ungaro, S. (2021). *The real effects of bank runs: Evidence from the French Great Depression (1930-1931)* (CEPR Discussion Paper No. 16054). Centre for Economic Policy Research. **https://doi.org/10.2139/ssrn.3839065**

Neumark, D., & Sharpe, S. A. (1992). Market structure and the nature of price rigidity: Evidence from the market for consumer deposits. *Quarterly Journal of Economics, 107*(2), 657–680. **https://doi.org/10.2307/2118477**

Niepelt, D. (2020a). *Monetary policy with reserves and CBDC: Optimality, equivalence and politics* (CEPR Discussion Paper No. 15457). Centre for Economic Policy Research. **https://doi.org/10.2139/ssrn.3689040**

Niepelt, D. (2020b). Reserves for all? Central bank digital currency, deposits, and their (non)-equivalence. *International Journal of Central Banking, 16*(3), 211–238. **https://www.ijcb.org/journal/ijcb21q2a7.htm**

Panetta, F. (2021, November 5). *Central bank digital currencies: A monetary anchor for digital innovation* [Speech]. Elcano Royal Institute, Madrid, Spain. N/A (**https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp211105~d3749e6d08.en.html**)

Panetta, F. (2022, June 15). *The digital euro and the evolution of the financial system* [Introductory statement]. Committee on Economic and Monetary Affairs of the European Parliament, Brussels, Belgium. N/A (**https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220615~8cc1f5d9de.en.html**)

Piazzesi, M., & Schneider, M. (2020). *Credit lines, bank deposits or CBDC? Competition and efficiency in modern payment systems* [Unpublished manuscript]. N/A

Rysman, M. (2009). The economics of two-sided markets. *Journal of Economic Perspectives, 23*(3), 125–143. **https://doi.org/10.1257/jep.23.3.125**

Skeie, D. R. (2008). Banking with nominal deposits and inside money. *Journal of Financial Intermediation, 17*(4), 562–584. **https://doi.org/10.1016/j.jfi.2008.02.001**

Skeie, D. R. (2020). *Digital currency runs* [Research paper]. WBS Finance Group. N/A

Valverde, S. C., Chakravorti, S., & Fernández, F. R. (2016). The role of interchange fees in two-sided markets: An empirical investigation on payment cards. *Review of Economics and Statistics, 98*(2), 367–381. **https://doi.org/10.1162/REST_a_00570**

Van der Cruijsen, C., Hernandez, L., & Jonker, N. (2017). In love with the debit card but still married to cash. *Applied Economics, 49*(30), 2989–3004. **https://doi.org/10.1080/00036846.2016.1255075**

Westin, A. (1967). *Privacy and freedom*. Atheneum.

Whited, T. M., Wu, Y., & Xiao, X. (2022). *Central bank digital currency and banks* [Unpublished working paper]. N/A

Williamson, S. (2022a). Central bank digital currency and flight to safety. *Journal of Economic Dynamics and Control, 142*, Article 104146. **https://doi.org/10.1016/j.jedc.2022.104446**

Williamson, S. (2022b). Central bank digital currency: Welfare and policy implications. *Journal of Political Economy, 130*(11), 2928–2961. **https://doi.org/10.1086/720769**

Woodford, M. (2003). *Interest and prices: Foundations of a theory of monetary policy*. Princeton University Press.