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Regulating Central Bank Digital Currencies: Towards a Conceptual Framework

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Abstract

Due to technological change and the rise of private digital currencies, more and more central banks are investigating the possibility of issuing their own Central Bank Digital Currency (CBDC). This paper develops a conceptual framework that illustrates how the issuance of CBDC and access to it can be regulated with various access models. To this end, it considers access models found in literature, existing legislations, lawsuits, and initiatives from around the world. The framework highlights that the regulation of CBDC encompasses two components: first, the regulation of the legal form of the CBDC; and second, the level of obligation, which indicates how legally binding the issuance and provision of access are for the central bank and any potentially involved third parties. In addition, the paper discusses the various regulatory options to determine how retail CBDC should be regulated. It argues that for a universally accessible retail CBDC, its issuance and provision of access to it must be obligatory for all parties involved.

Keywords Central bank digital currency · Banking regulation · Electronic money · Narrow banking · Distributed ledger technology

Jel Classification E42 · E58 · G21 · G23 · G28 · K22 · K23

Introduction

Initiatives for retail Central Bank Digital Currency (CBDC) have sprung up all over the world within the last decade, and interest in the topic continues to grow. The main goal of these initiatives is to provide citizens with a digital version of central bank money. Typically, citizens only have access to the physical form of central bank money—cash. The potential benefits of CBDCs are manifold: they provide a risk-free digital means of payment, preserve monetary sovereignty, increase competition for bank deposits, strengthen the transmission of monetary policy, and protect privacy in digital payments [1–4]. Despite the growing interest, only a few central banks are seriously considering the issuance of

CBDC.¹ Notable examples include the Swedish Riksbank, which has taken a pioneering role with its e-krona project, and the People's Bank of China (PBOC), which aims to be the first central bank to issue a CBDC. It is less widely known that in some countries, the public already has indirect access to CBDC through third parties—this is referred to as “Synthetic CBDC” [5] or “Indirect CBDC” [6]. In El Salvador, for instance, electronic money (e-money) providers have been offering e-money fully backed by central bank money since 2015.² China follows a similar model: since January 2019, local e-money providers have been required to back their e-money with central bank reserves. In Lithuania, holding customer funds at the central bank is optional for e-money providers, yet the option is actively used. In other countries, indirect CBDC via e-money providers is legally implemented, but information about its practical application is scarce. Countries such as Colombia,

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¹ The current active retail CBDCs at the Bahamas, the Eastern Caribbean, Jamaica and Nigeria (see Kosse and Mattei [62]) were out of scope of this research since only pre-2020 projects were considered.

² See Section “Examples of access models and legal forms” for details on the mentioned examples.



Brazil, the United Kingdom, and Switzerland fall into this category. Banks were also involved in CBDC-related activities. In Norway, the Safe Deposit Bank of Norway offered safe deposits fully backed by central bank money between 2016 and 2023. Euro Pacific Bank, an offshore bank based in Puerto Rico, provided similar services globally till its liquidation in 2023. In the U.S. mainland, The Narrow Bank, a private bank, aimed to offer safe deposits backed by central bank reserves. However, the Federal Reserve Bank of New York denied its request for a central bank account. CBDC discussions have also reached national parliaments. In the Netherlands, for example, parliament supported the citizen initiative “Ons Geld” and, in 2017, resolved to implement a safe deposit bank to protect citizens’ money. However, the initiative has faced legal hurdles that have delayed implementation.

All these initiatives show the various ways how CBDC can be implemented and even is implemented in some countries. Despite this, there has been no comprehensive comparative analysis of different CBDC access models and their respective regulatory frameworks, even though such analysis is urgently needed. A survey by the Bank for International Settlements (BIS) involving 66 central banks found that 40 percent were unsure whether they had the legal authority to issue a CBDC [7]. Previous research was limited in this regard. The Sveriges Riksbank [8, 9] discussed the legal aspects of their e-krona project in two reports. Nabilou [10] and Pfister [11] examined whether the European Central Bank (ECB) could theoretically issue direct CBDC. The Bank of Japan investigated the same question applied to the legislation of Japan [12]. Bossu et al. [13] also focused on the direct access model and conducted a survey among all 146 IMF member central banks, finding that 85 percent of central banks do not have the power to open accounts for the broad public.

This paper takes a broader approach and does not focus on any single country or access model. Instead, it develops a general conceptual framework for various access models based on various real-world examples and theoretical concepts. In this process the following research questions are addressed:

RQ1 How can the issuance of CBDC and access to it be regulated?

RQ2 How should the issuance of CBDC and access to it be regulated?

To answer the first question, the study relates existing legal forms of money to different CBDC access models found in literature. This analysis reveals potential legal forms for CBDC, which constitute one part of the conceptual

framework. After that, various examples from jurisdictions all over the world to different legal forms and access models are examined. Out of this, the levels of obligation are derived, which completes the conceptual framework. To answer the second question, the regulatory options identified in the framework—including the different access models, legal types and levels of obligation—are assessed in terms of their suitability for retail CBDC.

The paper focuses specifically on the primary legal questions surrounding CBDC, namely the regulation of issuance and the provision of access, which are fundamental requirements for CBDC to function as a means of payment. Subordinated legal questions—such as those concerning legal tender status or anti-money laundering (AML) and counter-terrorism financing (CTF)—are beyond its scope and would require a separate, detailed analysis. This paper also sets its focus on retail CBDC, which is accessible by the broad public, instead of wholesale CBDC, which is only accessible by financial institutions. Furthermore, Dyson and Hodgson [3] distinguish between “reactive” and “proactive” issuance of CBDC. Reactive issuance means that CBDC is issued in response to demand from non-banks, as with cash today. Existing money would be converted to CBDC, which would not increase the total money supply. This may require commercial banks to borrow central bank money from the central bank before the conversion, which increases the money supply. In contrast, proactive issuance refers to the central bank creating new money on its own initiative and distributing it directly to citizens as a non-repayable grant, (a so-called “helicopter drop”), which would increase the total money supply and include monetary policy operations by default. Unless otherwise stated, this study is only concerned with reactive issuance.

The paper is structured as follows. In Section “Existing legal forms of money”, the existing legal types of money are differentiated. Section “CBDC access models and legal classification” shows possible access models for CBDC and assesses its legal nature. Section “Examples of access models and legal forms” presents examples of the legal forms of CBDC from selected jurisdictions. Section “Levels of obligation” introduces the different levels of obligation, followed by Section “Considerations on the optimal regulation of CBDCs”, which assesses different regulatory options. Finally, Section “Discussion and conclusion” discusses the results and gives concluding remarks.

Existing legal forms of money

To legally assess CBDC, existing legal types of money must first be defined. Overall, six legal types of money can be distinguished: Central bank deposits, cash, bank deposits,



electronic money, money market mutual fund shares, and virtual currency. Most countries regulate these types of money in similar ways. The definitions of electronic money and virtual currencies are discussed here with consideration of their respective regulation in the EU.

Central bank deposits and cash

Today, the central bank issues two legal forms of money: Central bank deposits (also known as reserves) and cash. Both are forms of central bank money—liabilities of the central bank that can be used for settlement purposes [14]. Deposits and cash differ legally in terms of the financial instruments they represent. Central bank deposits are registered instruments, meaning a record is kept—usually by the issuer—of the owner and the amount held. Cash, in the form of banknotes and coins, is a bearer instrument: it represents a claim against the central bank, and the holder of the physical document is considered the owner. No ownership record is maintained for bearer instruments.

Central bank deposits are issued whenever the central bank is granting a loan or purchases assets.³ Theoretically, they can also be issued by a “helicopter drop”. Cash is issued to commercial banks in exchange for central bank deposits. Historically, central bank money was backed by gold, but today it is generally unbacked. Central bank money carries no default risk, as a state cannot go bankrupt in its own currency—unless it operates under a currency board backed by a foreign currency.

Bank deposits

Bank deposits (also called commercial bank money) are liabilities of commercial banks that are redeemable for cash at any time and can be used for settlement purposes [14]. Just as central bank deposits they are registered instruments. Commercial banks can issue deposits in three ways: by granting a loan, by purchasing assets, or by receiving cash from a customer. A fraction of bank deposits must be backed by a minimum reserve held in central bank deposits. Usually, an additional surplus reserve is held to handle cash withdrawals and other liquidity needs. By default, bank deposits bear a default risk which in turn can be taken by government agencies or deposit insurance.

Electronic money

E-money is primarily a liability of non-banks, redeemable for commercial or central bank money, and accepted

as a means of payment by entities other than the issuer.⁴ Depending on the jurisdiction, entities other than non-banks may also issue e-money. In the EU, for example, non-banks, commercial banks, public institutions, and central banks are all permitted to issue e-money.⁵ E-money is typically issued in only one way: upon the receipt of existing funds. Like central bank money, it can take the legal type of either a registered or bearer instrument.

E-money originated with prepaid cards issued by non-banks that were accepted by a broad range of merchants beyond the issuer (open-loop systems) [15]. Later account-based e-money products have been established next to e-money cards. Non-banks began offering payment accounts to the public, entering a market traditionally dominated by commercial banks. The difference between account-based e-money and a bank deposit is the interest-bearing property. While deposits bear an interest, e-money usually does not.⁶ Non-banks must usually obtain a special license to issue e-money. In the EU and most other countries, they must operate as E-Money Institutions (EMIs). In this paper, non-bank e-money issuers are referred to as e-money providers (EMPs). These issuers face a looser regulation than commercial banks since they cannot lend out the funds. Hence, they are basically narrow banks. However, they usually need to fulfill other requirements such as certain capital requirements, safeguarding of customer funds, and fund segregation.

Safeguarding requirements on where the customer funds must be held vary by country.⁷ Some jurisdictions permit safeguarding only at commercial bank accounts; others allow a mix of low-risk assets, such as government bonds. In some countries, funds can optionally or mandatorily be safeguarded in central bank money. The EU also permits safeguarding through an insurance policy covering the value of outstanding e-money.

Additionally, customer funds are usually required to be segregated (ring-fenced) from the EMP’s other assets to protect them in the event of bankruptcy. This requirement also varies by jurisdiction and safeguarding method. In

⁴ Whether e-money is redeemable as commercial bank money or central bank money depends on whether the owner has a central bank or commercial bank account and whether the e-money issuer maintains Automated Teller Machines (ATMs) or an agent network to offer cash withdrawals.

⁵ Article 1(1) Directive 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the taking up, pursuit and prudential supervision of the business of electronic money institutions amending Directives 2005/60/EC and 2006/48/EC and repealing Directive 2000/46/EC [2009] OJ L 267 (E-Money Directive).

⁶ This is the case in most jurisdictions. However, some countries term non-interest-bearing deposits, which are issued by non-banks, still deposits.

⁷ See BBVA [64] for detailed safeguarding comparison between different countries.



³ In legal definitions central bank deposits and bank deposits are usually “accepted” instead of issued (as described by Ricks [63], p. 57). However, accepting implies the issuance.

the EU, for example, all safeguarding methods except the insurance policy require segregation. Some countries, like Colombia, do not mandate segregation for any method, leaving customer funds unprotected in the event of third-party bankruptcy.

Money market mutual fund shares

Money Market Mutual Fund (MMMF) shares have similar characteristics to bank deposits and e-money. They maintain a stable net asset value (NAV) of one unit of their national currency per share and they are redeemable for central/commercial bank money at any time. Typically, MMMF shares are registered instruments. The shares are issued when the fund receives money from its customers and invests it in money market instruments. The backing of an MMMF share depends on the type of MMMF. Some funds invest in governmental bonds only (short-term MMMF) while others invest in a broader range of money market instruments (standard MMMF). Despite their money-like features, MMMF shares are rarely used for day-to-day transactions.

Virtual currencies

Virtual currencies include all electronic forms of value used for payments that do not meet the legal definition of one of the previous legal forms. Referring the EU definition a virtual currency is:

“a digital representation of value that is not issued or guaranteed by a central bank or a public authority, is not necessarily attached to a legally established currency and does not possess a legal status of currency or money, but is accepted by natural or legal persons as a means of exchange and which can be transferred, stored and traded electronically”⁸

Electronic vouchers, which are issued upon receipt of funds but are not accepted by third parties, belong to this legal form (Closed-loop system). Also, cryptocurrencies such as Bitcoin and Ether, which are accepted by third parties but do not have a real-world issuer, are virtual currencies.

CBDC access models and legal classification

Generally, CBDC can be defined as “any electronic, fiat liability of a central bank that can be used to settle payments, or as a store of value” [4]. By this definition, CBDC includes central bank deposits, (digital) cash, and central bank-issued e-money. This classification applies when users interact directly with the central bank, though not under all possible access models. These models differ in whether the user can access CBDC directly, i.e. hold and transfer it, or relies on third parties to do so. Previous publications make a distinction between direct and indirect access [3, 6, 16]. With direct access, the user holds CBDC directly at the central bank while with indirect access CBDC is held by a third party and the user holds it only indirectly. This third party may be a financial intermediary or custodian depending on the service it provides [16]. Moreover, there is hybrid access where the user holds CBDC directly at the central bank but access to the funds is provided by a third party.⁹ This paper shows two hybrid access models: One involving Payment Service Providers (PSPs) and another involving Technical Service Providers (TSPs). Direct access and indirect access are mutually exclusive. PSPs and TSPs may be combined with intermediaries and custodians; however, such combinations are not considered in this paper for the sake of simplicity. The access models with their legal classification will be presented in the following. The results of the legal classification are summarized in the decision tree in Fig. 1.

From a technical perspective, CBDC can be either account- or token-based. Account-based CBDC is the implementation of CBDC as a registered instrument. Thereby an electronic ledger is maintained which stores all holders and their respective CBDC balances. A transfer of CBDC would require the involvement of the operator of the register. Token-based CBDC is the implementation of CBDC as a bearer instrument. Thereby the CBDC quantity is stored on an electronic token which is in possession of the CBDC holder. Transfers are conducted directly by the CBDC holder. Two examples of token-based CBDC are e-cash and the GNU Taler, which only require the central bank for authentication operations but no further involvement in the payment process [17]. Digital tokens stored on a Distributed Ledger Technology (DLT) system are not considered token-based in this context, as they use ledger-based account systems [18]. Therefore, they are regarded as a special form of account-based CBDC. One possible utilization of DLT in the context of CBDC will be examined in Section “[Hybrid access through technical service providers](#)” with TSPs. The direct and indirect access models described in this paper are compatible with both account- and token-based CBDC.

⁸ Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and amending Directives 2009/138/EC and 2013/36/EU [2018] OJ L 156.

⁹ See Auer and Böhme [65] for hybrid CBDC from a technical perspective.



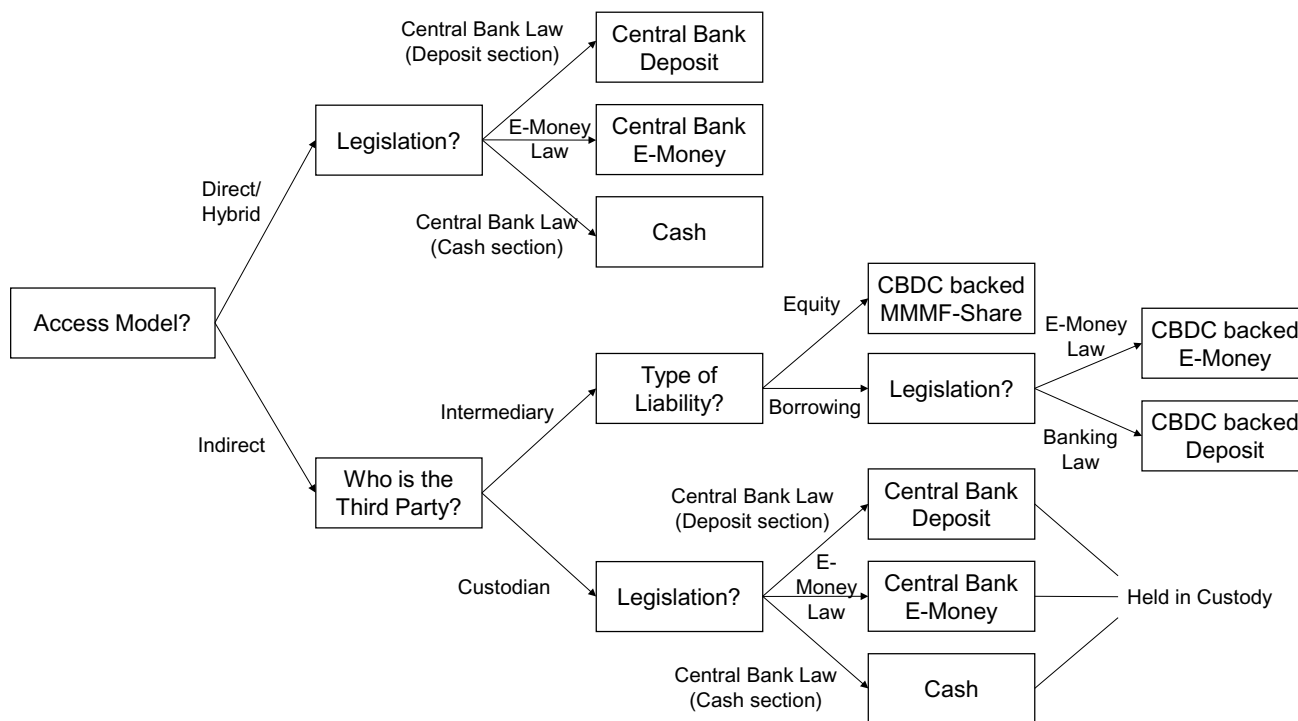


Fig. 1 Legal classification of CBDC. Source: Created by the author

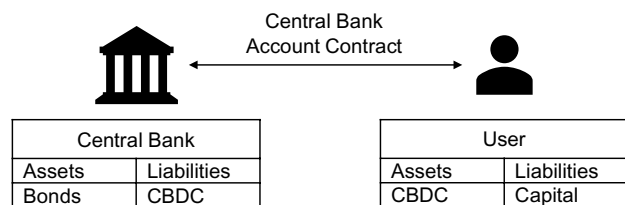


Fig. 2 Direct access. Source: Created by the author

This also applies to hybrid access through TSPs. An exception is hybrid access through PSPs, which is only suitable for account-based CBDC.

Direct access

In the case of direct access, the user has a claim at the central bank and holds it directly. The legal relationships and balance sheet implications for the account-based variant are illustrated in Fig. 2.¹⁰ The user has a contract with the central bank on a central bank account. The central bank may be legally obligated to provide CBDC by law, which would eliminate the need for a contract.¹¹ CBDC related tasks such

¹⁰ Note that in this and all following figures CBDC has (government) bonds as corresponding assets but theoretically there can be other types of assets such as corporate bonds or mortgage-backed securities, depending on the collateral framework of the central bank.

¹¹ A detailed analysis of this legal relationship is provided in Section “Mandatory for the central bank and potentially involved third party”.

as account keeping and execution of payments are either carried out by the central bank itself or delegated to a third party acting on its behalf. The token-based variant would look similar balance sheet-wise. However, there would be no contract between the central bank and the user, and the user would store CBDC and make payments by himself/herself. Under this access model, CBDC may take the form of a central bank deposit, central bank-issued e-money, or a digital version of cash, depending on the law chosen for its issuance (Upper branch in Fig. 1). While central banks may introduce CBDC as a completely new legal form, if existing legal forms suffice to accommodate the intended CBDC design, introducing a new legal form may be unnecessary.

Indirect access through intermediaries

Intermediaries are one possible type of third parties that can provide indirect access. In this option, financial intermediaries offer users an asset that is fully backed by central bank money.¹² Users do not hold central bank money directly; instead, they hold this intermediary-issued instrument, which acts as a wrapper for central bank money. This access model was already discussed in previous works as “iCBDC” [6] and “Synthetic CBDC” [5]. The legal relationships for an account-based variant are depicted in Fig. 3.

¹² The intermediary may use central bank deposits (reserves) to back its financial instrument but also central bank-issued e-money and digital currency notes are conceivable.



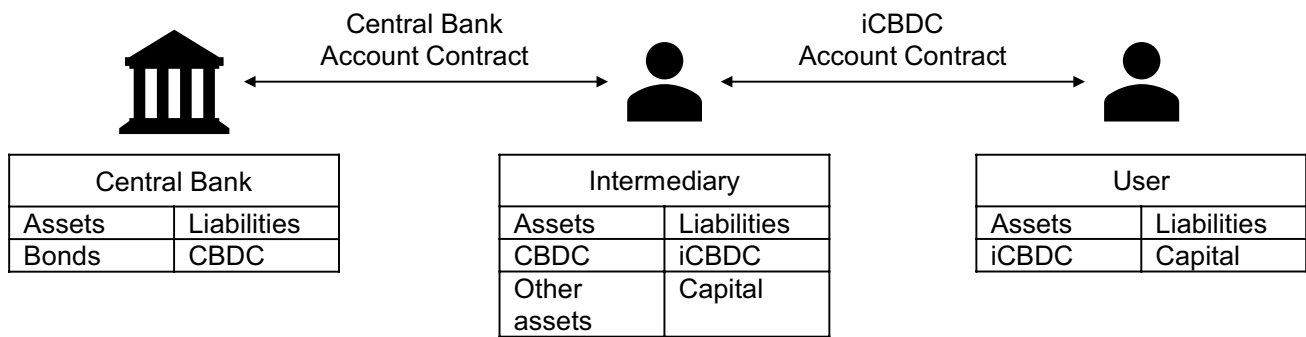


Fig. 3 Indirect access through intermediaries. Source: Created by the author

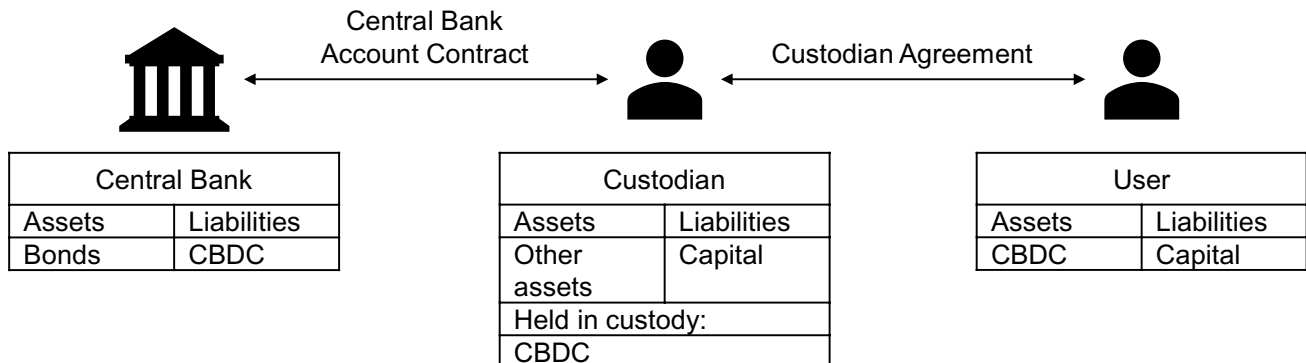


Fig. 4 Indirect access through custodians. Source: Created by the author

The user has a contract on iCBDC with the intermediary, while the intermediary has a contract on a central bank account with the central bank. A direct contract with the central bank is not necessary if the central bank is obligated to provide central bank money to the intermediary. The intermediary also performs related services such as account keeping and payments. In a token-based variant the intermediary would issue an iCBDC token, while the central bank issues a CBDC token for the intermediary, without establishing any contracts between the parties. The iCBDC token is stored and transferred by the user while the CBDC token is transferred by the intermediary. From a legal standpoint, the legal type of the iCBDC liability is crucial. If the liability is equity-based, the user may effectively hold a money market mutual fund (MMMF) share backed by central bank money. Other types of equity securities are unsuitable for CBDC purposes, as they are not always redeemable and do not maintain a stable net asset value. If the liability takes the form of borrowing, it may be classified as a deposit or e-money, depending on the applicable legal framework. For an illustration see the intermediary subbranch of the indirect branch in Fig. 1.

Indirect access through custodians

Indirect access may also be provided by custodians. In this arrangement, ownership and possession of CBDC is separated. The user has a direct claim at the central bank (ownership), but a custodian holds this central bank money on behalf of the user (possession). In doing so the central bank money remains the property of the user. The legal relationships for an account-based variant are depicted in Fig. 4. The custodian has a custodian agreement with the user and a central bank account contract with the central bank. The custodian may maintain a pooled account for all its customers at the central bank or a separate account for each customer. Additionally, a custody ledger must be maintained by the custodian to keep track of the entrusted CBDC. Account-keeping (of the trust assets) and CBDC related services are performed by the custodian. In a token-based variant the custodian would hold the CBDC-token of the user in custody without any contract with the central bank. A transfer of the token would involve the user giving a transfer instruction to the custodian who then performs the actual transfer. Regarding the legal type of CBDC, the custodian can hold a deposit, e-money, or digital cash in custody, depending on what the central bank issues. This is illustrated in the custodian subbranch of the indirect branch in Fig. 1.



Hybrid access through payment service providers

In the case of access through Payment Service Providers (PSPs), the user also holds CBDC as a direct claim at the central bank, but access to the funds is provided via PSPs operating on their own accounts. This model aligns with the Payment Services Directive 2 (PSD2) in the EU.¹³ In this setup, PSPs perform payment initiation services on the user's central bank account, while the central bank executes the payments.¹⁴ PSD2 requires third parties to be licensed as PSPs to initiate payments, although other jurisdictions may not impose such licensing requirements. Additionally, PSPs can offer account information services to enable users to check their balances.¹⁵ Within the scope of this paper, payment service providers include banks, e-money institutions, and payment institutions.¹⁶ The setup of this access model is illustrated in Fig. 5. The user has a contract with the central bank on a central bank account and a payment service contract with a PSP. PSPs are not directly commissioned by the central bank to perform these services; however, law-makers may impose obligations on PSPs to offer them. Furthermore, the central bank needs to provide the PSP with

¹³ Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC [2015] OJ L 337.

¹⁴ Article 4 (15) PSD2 defines payment initiation service as “a service to initiate a payment order at the request of the payment service user with respect to a payment account held at another payment service provider”.

¹⁵ Article 4 (16) PSD2 defines account information service as “an online service to provide consolidated information on one or more payment accounts held by the payment service user with either another payment service provider or with more than one payment service provider”.

¹⁶ According to Article 1 PSD2 also the central bank and public institutions are payment service providers if they are not acting in their capacity as monetary authority.

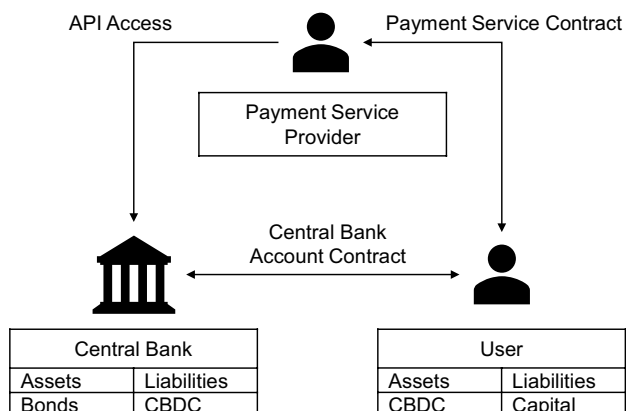


Fig. 5 Hybrid access through payment service providers. Source: Created by the author

an Application Programming Interface (API) that enables communication between the PSPs payment software and the balance sheet software of the central bank, allowing the PSP to initiate payments on users' central bank accounts. This may be designed as a contract or as an obligation of the central bank. The legal form of CBDC under this access model does not differ from that of direct access. The user still holds CBDC as a central bank deposit, e-money, or digital cash, depending on the legal framework used for its issuance.

Theoretically, this access model could also be implemented with token-based CBDC, where the PSP handles payments on behalf of the token holder. However, since the user holds the token and can transfer it on his/ her own there is no obvious reason why an external party should handle it. The case where token-based CBDC is held by a third party, who also offers payment services on it, is described as indirect access through custodians in Section “[Indirect access through custodians](#)”.

Hybrid access through technical service providers

Access through TSPs is similar to direct access with the difference that the transfer and storage of CBDC are offered by TSPs on their own account.¹⁷ This also aligns with PSD2. Following Article 3(j) PSD2 TSPs:

“support the provision of payment services, without them entering at any time into possession of the funds to be transferred, including processing and storage of data, trust and privacy protection services, data and entity authentication, information technology (IT) and communication network provision, provision and maintenance of terminals and devices used for payment services, with the exclusion of payment initiation services and account information services”

According to the German Financial Authority BaFin [19], a TSP would not be classified as a payment initiation service provider, since it does not access the user's account. Actually, the user would initiate the payment on his/ her own. TSPs therefore provide only the technical infrastructure to store and transfer the funds, potentially creating a contractual relationship with the user. If no such contractual relationship exists, the setup would be considered direct access.

DLT is particularly relevant for an account-based variant of this model, as it enables multiple TSPs to maintain a shared ledger with a consistent state, fostering competition.¹⁸

¹⁷ This access model is inspired by the concept of “Decentralized solutions with intermediaries” by Armelius et al. [66].

¹⁸ Armelius et al. [66] point out that not every TSP needs to maintain a full copy of the ledger. One TSP may only hold data of its customers. In database terms this is called “sharding”.



In contrast, a centralized ledger can only be maintained by a single TSP, limiting competition. The legal relations and balance sheet implications for an account-based variant are depicted in Fig. 6. TSPs may apply for licenses to operate a full node within the central bank's network.¹⁹ This license grants them permission to enable issuance and withdrawal of CBDC by the central bank. The user enters into a contract with the TSP on the technical storage and transfer of CBDC. In the case of a distributed ledger, another legal relationship may arise if the user gives its private key (password to access the user's funds) into custody to an online wallet provider. This relationship is not shown in the figure. CBDC could also be issued on existing public DLT networks, such as Ethereum. In such cases, transaction fees must be paid in the native currency of the network (e.g., Ether for Ethereum). However, this approach is generally unfavorable, as the network operators have no contractual obligations and are not legally liable for the functionality of the network.

In a token-based variant with TSPs there would be no legal relationship between the central bank and the TSP, nor between the central bank and the user. Regarding the services offered by the TSP for a token-based CBDC there are two options: The first option is that the TSP provides only a technical storage service, such as a cloud storage service, that can be utilized by the user to keep a backup of the token. The second option is that the TSP provides both storage and transfer services. This can be implemented, for example, by the TSP offering a physical or virtual server to the user. In this case, the token is stored and transferred via the TSP's server rather than the user's personal device.

The legal form of CBDC is not different from direct access and hybrid access through PSPs.

¹⁹ A "full node" is a participant of the DLT network which stores a full or partial copy of the ledger and validates transactions. A full node, which is permitted to change the state of the ledger is called "publishing node". The user would run a "lightweight node" which stores no data and only passes transactions to full nodes [67].

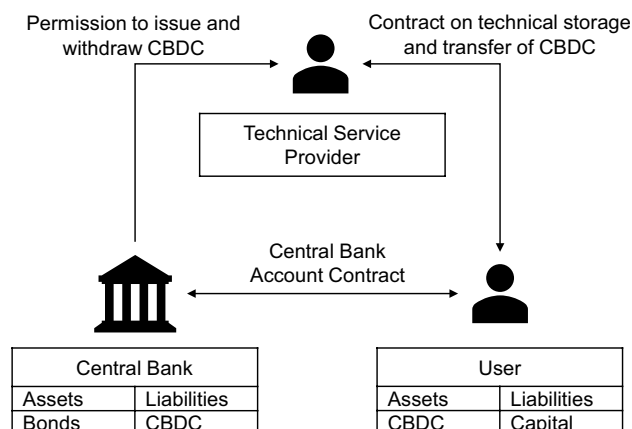


Fig. 6 Hybrid access through technical service providers. Source: Created by the author

Examples of access models and legal forms

This section shows various examples of the described access models and legal forms of CBDC. Examples are provided for the direct access model, the indirect access model through intermediaries, and the indirect access model through custodians. The author could not identify any real-world example of the hybrid access models.

Direct access: central bank deposit

Under the legal form of a central bank deposit, the user holds a deposit directly with the central bank. Historically, this is not unprecedented. Until the mid-twentieth century, it was common for major central banks to accept deposits from the general public [20]. Today, only financial institutions and government entities typically hold such deposits. However, the legal framework to accept deposits from the public still exists in several jurisdictions. This subsection examines the regulations of Germany, the EU (ECB), Sweden, and Japan.

In Germany, the Bundesbank is explicitly permitted to accept deposits from the general public. Section 22 of the Bundesbank Act allows it to accept deposits from "natural and legal persons in Germany and abroad". However, this does not mean that everyone has the right to hold deposits at the central bank. Following the 2008 financial crisis, the German insurance group Talanx AG requested the Bundesbank for access to a central bank account to protect their funds against future crises. The Bundesbank denied the request, which led to a lawsuit. The court upheld the Bundesbank's decision, stating that accepting deposits from the public does not come within the main tasks of the bank and is only performed at its discretion [21]. It also should be noted that even if the Bundesbank is willing to accept deposits from the broad public, ECB can overrule this. Accepting deposits from the public is not a task that comes within the mandate of the ECB and the national central banks. However, according to Article 14(4) of the ECB's statute, the national central banks are allowed to perform functions other than those defined in the statute.²⁰ The governing council can prevent these by a two-thirds majority vote if these operations are considered as contradicting with the objectives and tasks of the European system of central banks (ESCB). Thus, issuing CBDC is not solely at the discretion of the Bundesbank, but also depends on the ECB.

In Sweden, the legal situation is less clear. The Riksbank assessed whether its jurisdiction allows the acceptance of deposits from the broad public in its two e-krona reports. In the first report, it concluded that issuing deposits to the

²⁰ Protocol (No 4) on the Statute of the European System of Central Banks and of the European Central Bank [2016] OJ C 202 (ECB Statute).



public could fall within its mandate to provide an efficient and safe payment system: “There is no explicit ban on holdings in accounts and if an e-krona contributes to a safer and/or more efficient payment system, it could be considered to come within the framework of the mandate” [9]. Nevertheless, the report suggests the Riksbank Act needs revision. The second e-krona report is more explicit in this regard. It states that issuing the e-krona would come within the mandate, but Article 5 of the Riksbank Act entitles the Riksbank to only accept deposits for monetary policy purposes. This does not exclude the general public from deposits but points out that deposits can only be accepted in respect of the monetary policy. Hence, the Riksbank can issue interest-bearing CBDC or issue CBDC by buying assets from the public or drop helicopter money since the Riksbank would pursue its monetary policy with these options.²¹ Furthermore, the reports also note that the ECB could overrule a national CBDC as in the case of Germany.

The ECB faces similar limitations. Nabilou [10] concludes that the issuance of CBDC may be in line with the ECB’s mandates to promote the smooth operation of payment systems and maintain price stability, but may conflict with other tasks of the mandate and ancillary tasks. Additionally, the author derives from the ECB Statute that the general public cannot access the central bank’s balance sheet. According to Article 17 ECB Statute: “In order to conduct their operations, the ECB and the national central banks may open accounts for credit institutions, public entities and other market participants and accept assets, including book entry securities, as collateral”. This excepts deposits for citizens and non-financial businesses since those do not belong to the group of “other market participants”. Pfister [11] came to a similar conclusion. Nevertheless, there is the option to issue CBDC through Article 20 of the ECB’s statute, which permits the governing council to use other instruments of monetary control than those defined in the statute, if two-thirds of the council is voting in favor. So, the council could resolve the use of deposits for the public for monetary policy as in the case of Sweden.

Another jurisdiction where the direct deposit is prohibited is Japan. The Bank of Japan concluded that CBDC is not allowed under its current law [12]. Article 1(1) of the Bank of Japan act provides the central bank with three tasks: “The purpose of the Bank of Japan, or the central bank of Japan, is to issue banknotes and to carry out currency and monetary control”. Additionally, according to Article 33(1)

of the Bank of Japan Act, the bank is only permitted to take deposits in pursuance of these three prescribed tasks. Since taking deposits from the public is not related to these tasks, the Bank of Japan cannot accept deposits. This still provides the opportunity to issue CBDC with regard to monetary policy, as in the case with Sweden and the ECB.

Direct access: central bank e-money

The central bank could also issue e-money, which can be implemented similarly to a deposit. To do so, either the national e-money legislation must authorize the central bank as an issuer, or the central bank law must permit it. Not many jurisdictions currently allow this. This section examines Ecuador, the EU, and Sweden.

In Ecuador, the central bank issued e-money as part of the Dinero Electrónico system, which was active between 2014 and 2018. During this time only the central bank was eligible to issue e-money.²² Citizens could open accounts, hold and transfer e-money using their mobile phones, smart cards, and computers. Thereby every natural and legal person had an explicit right to use the e-money system.²³ Distribution of e-money, i.e. withdrawal and deposit services, were delegated to so-called “macro agents”, which were businesses, public and financial institutions [22]. Access was handled by the central bank so that Ecuador’s e-money can be considered as a direct access model. The system did not achieve the desired effects so that it was closed in 2018 by the establishment of a new regulation that allowed private companies to enter the e-money market.²⁴

In the EU, the E-Money Directive allows the ECB and national central banks to issue e-money when not acting in their capacity as the monetary authority or other public authorities.²⁵ So, these central banks can theoretically issue e-money at their discretion. The ECB itself may not be able to issue e-money since other operations besides its mandate are restricted to operations “for their administrative purposes or for their staff”.²⁶ The national central banks can perform other operations as is the case with the German Bundesbank and therefore issue e-money. But as in Germany, the national central banks can be overruled by the ECB.

²¹ It may be argued that even non-interest bearing CBDC can be considered as monetary policy since CBDC potentially increases the amount of central bank money in the economy and therefore increases monetary transmission of the discount rate. Against this it may be argued that cash has the same effect but is considered as not related to monetary policy.

²² Article 1 Regulación No. 017/2011 and Article 1(1) Resolución 005–2014-M.

²³ Article 6 Resolución 005–2014-M.

²⁴ White [68] argues that Ecuador cannot be considered as a real example of CBDC since the central Bank of Ecuador is maintaining a currency board with the dollar and thus can potentially default. The Ecuadorean CBDC, however, is not contradicting to the CBDC definition given by Meaning et al. [4]. Though, when discussing CBDC the distinction must be made between CBDC with currency board and CBDC without it.

²⁵ Article 1(1)(d) E-Money Directive.

²⁶ Article 24 ECB Statute.



Regarding Sweden, in its second E-Krona report, the Sveriges Riksbank considers its plans for a token-based CBDC as e-money and claims that it can issue e-money when acting in the capacity of monetary authority:

“A central bank within the EU does not need a license to issue electronic money. And when a central bank acts in the capacity of monetary or public authority, it falls out of the scope of the E-Money Directive and does not need to observe the legislation regarding issuing electronic money. The Project assesses that the Riksbank –if it decides to issue e-money on the grounds stated in Section 6–will be acting in its capacity as monetary authority” [8].

It should be noted that while the Riksbank is indeed excluded from the E-Money Directive when acting in its capacity as monetary authority, this does not imply automatic legal authority to issue e-money. The Sveriges Riksbank Act does not mention e-money issuance, nor do other Swedish laws. Thus, under current law, the Riksbank would not be acting in its capacity as a monetary authority when issuing e-money.

Direct access: (Digital) cash

Another possible legal form of the direct access model is cash. Thereby the central bank issues a digital version of cash. This CBDC would be primarily token-based. Up to now, only the Bank of Uruguay issued digital cash, more specific digital currency notes, within the scope of its CBDC pilot that was active during six months between 2017 and 2018. According to Bergara and Ponce [23] issuing digital currency notes is in line with the Uruguay central bank law since the law does not specify a specific form of currency notes. The digital currency notes must only comply with the same security standards as the physical currency notes. Technically, the pilot was a combination of the token-based and account-based approaches. Every user had an anonymous digital wallet, which stored the CBDC amounts. Additionally, there was a central service provider (Global E-note Manager), which stored a backup copy of each wallet, which was synchronized with the user’s CBDC holdings. Pfister [11] also points out that the ECB could similarly issue CBDC in the legal form of cash. However, this would require amendments to the technical specifications of banknotes and coins.

Indirect access: CBDC backed deposit

An intermediary may issue a deposit that is fully backed by CBDC. In this case, the user holds a deposit, while the intermediary (typically a bank) holds the corresponding CBDC. To issue such fully backed deposits, intermediaries must have access to a central bank account and be permitted

to invest in central bank money. While banks are the most likely intermediaries, non-bank entities could also provide fully backed deposits, as shown in the examples below. The concept of fully backed deposits dates back to the 1930s, when economists at the University of Chicago proposed the “Chicago Plan”, and Irving Fisher introduced the concept of “100% money” [24, 25]. Later, Tobin [26] proposed a similar idea in which banks could offer “deposited currency”. More recent literature also explores fully backed deposits, including Mayer [27] with the concept of a “safe deposit” and Garratt et al. [28] with their “Segregated Balance Accounts”. These works emphasize the need to segregate customer funds from bank-owned funds to ensure that, in the event of bankruptcy, the funds are not part of the bankruptcy estate. Practical examples of fully backed deposits can be found in Norway, the United States (Puerto Rico and Connecticut), and Colombia:

The Safe Deposit Bank of Norway (SDBN), founded in 2013, offered deposits fully backed by central bank money in Norway till 2023 [29]. Its target clientele included asset managers, ultra-high-net-worth individuals, family offices, and corporate treasurers. The bank offered Norwegian krone accounts held at the Norges Bank and euro accounts held at the German Bundesbank. According to Norwegian central bank law, the Norges Bank has the discretion to provide such accounts and accept deposits from banks.²⁷ The bank stated that its license only permitted it to offer this type of account and that its revenue comes from fixed account fees. In financial terms, the bank’s business model was unsustainable. During the three years of operation from 2016–2018, it reported only losses and in 2023 the bank relinquished its license [30–33].

In the US, more precisely Puerto Rico, the Euro Pacific Bank also offered fully backed deposits until its liquidation in 2022 [34]. It was licensed as an International Financial Entity by Puerto Rico’s financial authority and focused on offshore banking. These entities enjoy tax benefits and are exempt from minimum reserve requirements.²⁸ The bank held a reserve account at the Federal Reserve Bank of New York. So, its reserves were likely to be held there. Euro Pacific Bank offered accounts in 13 currencies and accepted both retail and institutional clients, requiring a minimum deposit of \$500. It generated revenue through fees and commissions. The bank was liquidated by the Office of the Commissioner of Financial Institutions (OCIF) due to violations of capital adequacy regulations [35]. Although there were accusations of tax evasion and money laundering, which were never substantiated. The undercapitalization, however,

²⁷ Section 3-1(1)(a) The Norges Bank Act in force from 1 January 2020 pursuant to Resolution of 21 June 2019 No. 804.

²⁸ Section 4 The International Financial Center Regulatory Act No. 273–2012.



did not affect the customer funds and the bank was able to fully repay its depositors, as all deposits were backed by central bank money.

The Narrow Bank Ltd. (TNB), an uninsured bank based in Connecticut US, was a similar initiative that was active between 2017 and 2023. In the US excess reserves held by commercial banks at the central bank are remunerated (also known as the Interest On Excessive Reserves Rate—IOER). The bank aimed to pass all customer deposits through to a central bank account to earn these interest payments [36]. TNB was founded by a former Federal Reserve Bank of New York employee and co-author of the “Segregated Balance Accounts” concept. However, the Federal Reserve (Fed) delayed TNB’s application for a master account for 18 months, prompting a lawsuit [37]. The Fed argued, based on Section 13 of the Federal Reserve Act (FRA), that it “may” rather than “shall” accept deposits from nonmember banks. TNB argued using Section 11A FRA, which states that all Federal Reserve Bank services should be available to non-member depository institutions. The case was dismissed in 2020 as the Fed had not made a final decision and a short processing time was not guaranteed [38]. In 2023, the Fed ultimately rejected the request, citing concerns about financial stability and monetary policy implementation [39].

Another legal implementation with e-money providers can be found in Colombia. Usually, e-money providers are not allowed to accept interest-bearing deposits. This is different in Colombia. The domestic e-money providers (Sociedades Especializadas en Depósitos y Pagos Electrónicos—SEDPE) are permitted to offer interest-bearing deposits to their customers.²⁹ This makes them more similar to payment banks than traditional e-money providers. Customer funds can be deposited with either commercial banks or the central bank of Colombia, enabling SEDPEs to offer indirect CBDC accounts.³⁰ Colombian central bank law permits the central bank to accept deposits from non-bank institutions.³¹ Though, no detailed data are available on the practical use of this access model.

Indirect access: CBDC backed e-money

An intermediary may also issue e-money that is backed by central bank money. In the first place, potential intermediaries include e-money providers, but banks and public institutions may also issue e-money—especially under EU regulations. Adrian and Mancini-Griffoli [5] refer to this access model as “Synthetic CBDC” and outline its benefits

in their paper.³² From a regulatory perspective, e-money providers require access to a central bank account and permission to safeguard customer funds in central bank money. Across countries, three regulatory approaches can be identified: in some, backing e-money with central bank money is required by law (El Salvador and China); in others, it is optional (Lithuania, Brazil, England, and Switzerland); and in some, it is only implicitly permitted (Germany).

Since 2015, e-money issuers in El Salvador have been required to back their e-money with central bank money.³³ Accordingly, the central bank is obligated to accept deposits from e-money providers to facilitate compliance. The central bank law of El Salvador permits the central bank to accept deposits from non-banks.³⁴ Additionally, the central bank issued technical norms to regulate the opening of central bank accounts, especially for e-money providers.³⁵ Furthermore, e-money providers are legally required to open an account for any natural person who provides an identity document, completes a form, and does not already have an account with the same provider.³⁶ The Bank of El Salvador monitors providers in real-time to ensure compliance with the backing [40]. This backing mechanism is intended to foster user trust in the e-money system. As of 2016, there were three issuers—Tigo Money, MoMo, and Servicios Tecnológicos de El Salvador, S.A. [41]—and nearly one million active users [40]. There are also limits on monthly transaction volumes and single transactions. El Salvador, like Ecuador, operates a currency board, which introduces a default risk for their CBDC.

China has implemented a similar approach. Since 2019, all Chinese e-money providers, including Alipay and Tencent (WeChat), have been required to safeguard all customer funds at the central bank.³⁷ The PBOC’s goal is to prevent fraud and protect consumers [42]. Prior to 2019, providers were only required to hold a fraction of funds at the central bank—20% in 2017, 50% in 2018, and eventually 100% by January 2019. This change is reflected in the PBOC’s balance sheet: at the end of 2017, non-financial institutions

²⁹ Ley de Inclusion Financiera No. 1735 2014 (Colombian E-Money Regulation).

³⁰ Article 1 Colombian E-Money Regulation.

³¹ Article 22 Law 31 of 1992.

³² The authors, however, include a trust as the fourth party in their model, that plays the role of a middleman between the e-money provider and the central bank. Considering unregulated stablecoin issuers, a trust may be necessary since customers will not entrust unregulated stablecoin issuers with their money. Licensed e-money providers, however, are usually trustworthy and do not need an additional trust that safekeeps the customer’s money for them.

³³ Article 10 Ley para facilitar la Inclusión Financiera 2015 (Salvadoran E-Money Regulation).

³⁴ Article 55(g) Ley Orgánica del Banco Central de Reserva de El Salvador.

³⁵ Normas Técnicas para el Inicio de Operaciones y Funcionamiento de los Proveedores de Dinero Electrónico.

³⁶ Article 7 Salvadoran E-Money Regulation.

³⁷ No. 114 [2018] of General Office of the People’s Bank of China.



held 0.99 trillion yuan; by the end of 2018, this rose to 1.62 trillion yuan, and by the end of 2019, it flattened to 1.529 trillion yuan [43–45].

More flexible regulations exist in Lithuania, Brazil, England, and Switzerland. In these countries, e-money providers may choose to safeguard client funds in central bank money or through alternative methods.

Lithuania introduced its e-money law in 2011, with a 2018 amendment allowing client funds to be safeguarded in central bank money.³⁸ The central bank law also grants the Bank of Lithuania discretion to offer non-banks access to accounts.³⁹ Thereby e-money institutions do not participate directly in the European Real-Time Gross Settlement (RTGS) system TARGET2, but rather indirectly through the Bank of Lithuania [46]. In a 2019 public consultation paper, the Bank of Lithuania promoted this safeguarding option [47]. According to the paper, 16% of all customer funds from e-money and payment institutions were held at the central bank by the end of 2018, though it is unclear if any institution used this method exclusively.

Brazil passed its e-money law in 2013.⁴⁰ Article 14 of that law explicitly permits the central bank to accept deposits from non-financial institutions including e-money providers, so that these institutions can participate in the national RTGS system Sistema de Transferência de Reservas (STR). The law was part of a broader initiative, begun in 2009, to “democratize access to central bank money” [48]. The Bank of Brazil also issued Circular Letter 3681, allowing e-money providers to safeguard client funds in central bank money or federal government bonds. However, current data on usage of this option is lacking. As of 2018, the Bank reported four e-money providers had settlement accounts [49].

England’s original e-money law, The Electronic Money Regulations 2011, was amended in 2017 to allow e-money providers and payment institutions to safeguard funds in central bank money.⁴¹ A 2019 publication by the Bank of England and other organizations, “Access to UK Payment Schemes for Non-Bank Payment Service Providers”, outlines procedures and account types for non-banks [50]. Among the account types there is a “Client funds settlement account” where e-money institutions can safeguard their client’s funds. However, the Bank of England noted that “excess funds” of customers should be deposited at a commercial bank account instead of this designated account.

In Switzerland, the 2019 introduction of the fintech license Fintech-Bewilligung allows fintech companies to

accept deposits. These deposits must not bear interest and must be segregated from company funds, aligning them more with e-money than traditional bank deposits. Fintechs may optionally safeguard funds in central bank money and are granted access to the national clearing system, SIX.⁴² However, access to central bank accounts remains at the discretion of the Swiss National Bank.⁴³

Some countries do not explicitly allow safeguarding in central bank money, but it is theoretically possible. In Germany, e-money providers are allowed to invest in low-risk assets, which may include central bank money, depending on the interpretation of the financial authority.⁴⁴ What counts as low-risk assets must be specified by the financial market authority of Germany. In theory, central bank money could be classified as a low-risk asset. The Bundesbank is authorized to accept deposits from non-banks, as previously discussed in Section “Direct access: central bank deposit”. Furthermore, the Bundesbank’s general terms and conditions govern e-money providers’ access to central bank accounts [51]. Thereby, e-money institutions have access to a payment system of the Bundesbank, rather than participating directly in TARGET2.

Indirect access: CBDC backed MMMF share

A MMMF may invest all customer funds in central bank money and issue shares to users priced at a fixed value (e.g., one unit of the national currency). This access model is inspired by the “Limited Purpose Banking” proposal by Chamley et al. [52], which advocates transforming all limited liability financial firms into mutual funds. Under this system, banks would no longer create money and could only lend out existing funds. Daily transaction funds would be held in specialized “cash mutual funds,” which invest solely in cash. These funds could be established without full reform in the context of CBDC.

From a legal perspective, two requirements need to be fulfilled for this access model: First, MMMFs need to be able to invest in central bank money, and second, the MMMF must have access to a central bank account. In some jurisdictions, such as the EU and the US, MMMFs are permitted to invest in central bank money. This is the case in the EU and the US. In the EU, MMMFs may invest in financial instruments issued by central banks.⁴⁵ In the US, they may invest in cash, which could include digital

³⁸ Article 25 Law No XI-1868 of the Republic of Lithuania on Electronic Money and Electronic Money Institutions 2018.

³⁹ Article 35 Law No XII-2771 of the Republic of Lithuania on the Bank of Lithuania 2016.

⁴⁰ Law no. 12,865/2013.

⁴¹ Article 23 The Payment Services Regulations 2017.

⁴² Article 14f Bankenverordnung.

⁴³ Article 9 Nationalbankgesetz.

⁴⁴ Section 17 (1)(1)(b) Zahlungsdienstleistungsaufsichtsgesetz.

⁴⁵ Article 9 Regulation (EU) 2017/1131 of the European Parliament and of the Council of 14 June 2017 on money market funds [2017] OJ L 169.



central bank money.⁴⁶ Access to a central bank account is more restricted. In the EU, for example, Germany's central bank could theoretically grant non-banks access. However, under current US law, this is not possible. Section 13 of the Federal Reserve Act and 12 U.S. Code § 342 do not list MMMFs as eligible depositors.⁴⁷

Indirect access: central bank deposit held in custody

In this legal form, a custodian holds a deposit at the central bank on behalf of the user. In certain countries, it is common practice for banks to hold deposits in custody at third-party banks for their customers, often with the third-party bank located in a foreign country.⁴⁸ A custodian central bank deposit would be similar, except the deposit is held at the central bank. Banks and trust companies are the primary candidates for acting as custodians, although other entities may also be considered.⁴⁹ According to Article 18 of PSD2, payment and e-money institutions are eligible to offer safekeeping services, which may permit them to safeguard central bank money. There are also profession-based regulations for custody services. For example, notaries in Germany are required to hold entrusted funds at a commercial bank or even at the central bank.⁵⁰ However, this regulation is unsuited for daily payment purposes as the custodian contract may only be entered into if the funds relate to the notary's regular services.

To offer CBDC in this form, the custodian requires a designated central bank account where customers' funds can be securely held. Banks as custodians cannot simply use their regular reserve accounts, as doing so would commingle the bank's own funds with those of the customer. Currently, there are no real-world implementations in which this legal form is explicitly defined in law. However, there have been efforts in Switzerland and the Netherlands.

The "Vollgeld-Initiative" (Sovereign Money Initiative) in Switzerland initiated a referendum on the introduction of sovereign/positive money, i.e., CBDC, and the prohibition

of commercial bank money creation.⁵¹ The initiative text explicitly proposed custodian central bank deposits: "Financial service providers shall hold transaction accounts for customers off their balance sheets. If the financial service provider goes bankrupt, these accounts do not fall into the bankruptcy estate." [53]. The initiative collected 110,000 signatures in 2015, enabling a referendum in 2018. However, the proposal was rejected, with 76% voting against it and 24% in favor [54].

A more advanced initiative took place in the Netherlands. The Dutch monetary reform movement "Ons Geld" (Our Money) and the Full Reserve Foundation (Stichting Full Reserve) began a similar initiative in 2015 to establish a monetary system similar to the Swiss proposal. After gathering 100,000 signatures, the proposal was discussed in the Dutch Parliament. The parliament voted unanimously in favor of the proposal with two outcomes: first, the introduction of a deposit bank where customers could safely hold their funds; and second, a request to the Netherlands Scientific Council for Government Policy (WRR) for a report on the existing monetary system and its alternatives. Considering the deposit bank, there were various suggestions made on how this deposit bank can be implemented [46]. The Full Reserve Foundation wanted to establish a bank that offers fully backed deposits. The organization rejected the idea as the bank would have had to take part in the national deposit insurance to get access to the European RTGS system TARGET2. This would have meant paying for the potential defaults of other banks, despite the new bank bearing no credit risk. Similarly, neither an e-money institution offering fully backed e-money nor a payment institution acting as custodian could be established, as neither entity type is eligible to participate in the Dutch subsystem of TARGET2 due to the Settlement Finality Directive.⁵² This directive ensures that payments made by system participants are final and unaffected by insolvency.⁵³ In contrast, in countries like Lithuania and Germany, payment institutions and e-money institutions can indirectly participate in TARGET2 through national central banks, and are therefore not impacted by this restriction.⁵⁴ Consequently, the Netherlands' central bank suggested that the Full Reserve Foundation operate as a MMMF that invests exclusively in central bank money,

⁴⁶ Rule 2a-7(a)(14) Investment Company Act of 1940.

⁴⁷ In the US, Money Market Funds only participate in the reverse repo program, where the Fed sells treasury bonds to the MMMF and the MMMF in response sends money to the Fed [69]. The money is deducted from the central bank account of the MMMFs bank, not from the MMMF itself. So, the MMMF does not interact directly with a reserve account.

⁴⁸ The Gibraltar Financial Services Commission [70] and the Isle of Man Financial Services Authority [71], for example, issued notes on so called "fiduciary deposits".

⁴⁹ In the US and UK this system could be implemented under the trust law.

⁵⁰ Section 58(2) Beurkundungsgesetz.

⁵¹ For more details on Sovereign Money/ Positive Money see Huber and Robertson [72] and Jackson and Dyson [73].

⁵² Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems [1998] OJ L 166.

⁵³ The Settlement Finality Directive, furthermore, applies only to wholesale payment systems for financial institutions. A retail CBDC payment system for retail users only would not fall into the scope of the directive.

⁵⁴ In Lithuania such a participant is called "ABIC holder". For an elaborated analysis see Wortmann [46] (Dutch only).



Table 1 Levels of obligation with examples

Level of Obligation regarding Issuance of CBDC and Provision of Access	Access model and its Legal Forms						
	Direct	Direct	Direct	Indirect	Indirect	Indirect	Indirect
	CB-Deposit	CB-E-Money	Cash	CBDC backed Deposit	CBDC backed E-Money	CBDC backed MMMF Share	CB-Deposit held in Custody
(1) Discretionary for the Central Bank (+ Third Party ^a)	Germany ^b	EU (National CBs) ^b	Uruguay	via EMPs: Colombia via Banks: Norway, US	via EMPs: Lithuania ^b , Brazil, England, Switzerland, Germany ^b	Germany ^b	via Public Institution: Nether-lands
(2) Discretionary for the Third Party ^a					via EMPs: China		via Banks: Vollgeld-Initiative ^c
(3) Mandatory for the Central Bank (+ Third Party ^a)		Ecuador ^c			via EMPs: El Salvador		

Notes: ^a Only applies to hybrid and indirect access models. ^b Only on the sufferance of the ECB

^c Discontinued or rejected

Source: Created by the author

with a separate payment institution facilitating the transfers. However, this solution could not be realized, as MMMFs in the Netherlands do not have access to central bank accounts [55]. Further investigations were postponed until the WRR report was published in spring 2019. As of now, the deposit bank has not yet been implemented.

In response, “Ons Geld” developed its own legal-compliant design called the “Public Depository” [56]. In this model, the treasury would act as a custodian and maintain a pooled account at the central bank on behalf of all citizens, thereby providing indirect access to central bank money. However, external parties such as payment service providers would still need to conduct payments, as public institutions lack the capacity and the necessary licenses to offer payment services. Hence, this model combines custodial and PSP access. Legally, the treasury is explicitly permitted to hold a central bank account under Sections 8(3) and 8(1) of the Bank Act 1998. However, at the European level, this may present complications. Under Article 17 of the ECB Statute, the ECB and national central banks “may” accept deposits from public entities, meaning that De Nederlandsche Bank (DNB) is not obliged to grant the treasury access to a central bank account. Therefore, it remains at the discretion of the central bank whether this form of CBDC is provided.

Levels of obligation

The previous examples showed that CBDC can emerge in the same legal forms across countries but the obligation by law for the central bank and third parties to issue it and provide

access can vary.⁵⁵ This research identified three levels of obligation: (1) Discretionary for the central bank and potentially involved third party, (2) Discretionary for the third party, and (3) Mandatory for the central bank and potentially involved third parties.⁵⁶ Table 1 depicts the framework with examples from Section “Examples of access models and legal forms”. The legal forms, together with the levels of obligation, constitute the conceptual framework for the regulation of CBDC. Each level of obligation is explained in the following.

Discretionary for the central bank and potentially involved third party

At this level, both the central bank and potentially involved third parties are permitted by law to issue CBDC and provide access at their discretion. With direct access, the central bank issues CBDC at its discretion and is free to enter into a contract with the user (if the CBDC is account-based). With hybrid access, the central bank issues CBDC at its discretion and the third party is free to enter into a contract with the user. Additionally, the central bank has the discretion to give PSPs access to the citizen’s account through an API. With indirect access, the central bank has the discretion to issue CBDC for the intermediary or custodian. Intermediaries may issue iCBDC at their discretion and are permitted

⁵⁵ Issuance and access are considered interconnected since CBDC requires access to function as a medium of payment, and CBDC must be issued in order to be accessed.

⁵⁶ There is one additional potential level, in which the issuance of CBDC and the provision of access are discretionary for the central bank but mandatory for potentially involved third parties. The concrete implications of this level for all parties involved can be derived from the three described levels and are therefore not addressed separately.



to invest in central bank money. Custodians are free to enter into a custodian agreement with the user. When issuing CBDC the central bank is also restricted by its core mandates. Central banks are typically tasked with price stability and financial stability as their primary objectives. Nabiliou [10] argues that while CBDC issuance can support price stability and facilitate the implementation of monetary policy, it may also undermine banking and financial stability. This may vary with its design. The economic impact of restrictive CBDC designs with holding limits is likely to be limited, whereas CBDC designs without such limits may have more far-reaching effects. However, according to Niepelt and Brunnermeier [57], the potential negative effects of unlimited CBDC can be mitigated if its issuance is accompanied by an appropriate monetary policy and if the central bank is committed to acting as lender of last resort. If this is not the case, the issuance of CBDC may conflict with the central bank's core mandates. Consequently, under this level of obligation, the central bank is permitted to issue unlimited CBDC insofar as it can mitigate the negative effects that would otherwise conflict with its primary objectives.

Discretionary for the third party

This level applies only to hybrid and indirect access models. In contrast to the first level, the provision of access and issuance is completely at the discretion of the third party. Thus, the third party is granted the legal right to freely provide access to CBDC or issue iCBDC (intermediaries) and the central bank is required by law to provide the conditions for the third party to offer their services. For hybrid access, this means that the central bank is obligated to issue CBDC for the citizens. The central bank is also obligated to give PSPs access to its API. This access to the central bank's API may be regulated in the same manner as access of PSPs to commercial bank's APIs is regulated under PSD2.⁵⁷ For indirect access, this implies that the central bank is obligated to issue CBDC for the intermediary or custodian. Intermediaries have the right or requirement to invest in central bank money. If the central bank is obligated to issue CBDC for citizens or intermediaries, this may require an amendment to its core mandates, which is discussed in detail in Section “Mandatory for the central bank and potentially involved third party”.

Mandatory for the central bank and potentially involved third party

At this level, both the issuance of CBDC and the provision of access are mandatory by law for the central bank and

potentially involved third parties. Citizens thus have a legal right to CBDC. For direct access, this implies that the central bank is obligated to issue CBDC and provide access to any citizen who requests it.⁵⁸ In the EU, the Payment Accounts Directive (PAD) already requires commercial banks to provide citizens with access to deposit accounts, which could be expanded to include CBDC likewise.⁵⁹ With access through PSPs, the PSP is obligated to enter into a service contract with the user and the central bank is obligated to give the PSP access to its API. TSPs would also be required to enter into contract with every citizen who wishes to store and transfer CBDC. Applied to indirect access models this level implies that intermediaries are obligated to issue iCBDC and custodians to enter into a custodian agreement with all requesting citizens. The central bank would also be obligated to issue CBDC for intermediaries and custodians. Intermediaries may be either permitted or required to invest in central bank money. This level may also require an amendment of the central bank's core mandates. Analogously to discretionary issuance of CBDC, mandatory issuance may conflict with those mandates—or the central bank may assume that such a conflict exists—if CBDC is designed without holding limits and potential negative effects cannot be mitigated through suitable measures. This could lead to a situation in which the central bank is obligated by secondary law to issue CBDC but is unable to comply due to its core mandates. In consequence, if the issuance of CBDC should constitute a legally enforceable obligation irrespective of its design or compatibility with the central bank's primary objectives, it must be established as a superordinate task relative to the primary objectives of price stability and financial stability. Otherwise, legal uncertainty would persist, leaving the central bank with discretionary leeway and courts with broad scope for interpretation.

Considerations on the optimal regulation of CBDCs

This section briefly addresses the question of how the issuance of CBDC and access to it be regulated regarding a retail variant that is accessible to the broad public. As demonstrated, this question encompasses three aspects: the access model, the legal form, and the level of obligation. Regarding the different access models, trade-offs must be

⁵⁷ See Article 66 PSD2.

⁵⁸ For account-based CBDC, this means that the central bank is obligated to maintain an account for the citizen, while for token-based CBDC that the central bank provides the software to hold CBDC tokens.

⁵⁹ Directive 2014/92/EU of the European Parliament and of the Council of 23 July 2014 on the comparability of fees related to payment accounts, payment account switching and access to payment accounts with basic features [2014] OJ L 257.



considered, especially if the CBDC is account-based CBDC. The inclusion of third parties (PSPs, TSPs, intermediaries, and custodians) may reduce operational responsibilities for the central bank. At the same time, it generates dependencies on third parties, requires their continuous availability. Moreover, indirect access models increase complexity: with intermediaries, two assets must be maintained (iCBDC and CBDC), while with custodians, an additional custody ledger must be kept alongside CBDC, which may increase backup costs and slow down transactions. For token-based CBDC, such trade-offs do not arise. Since users store and transfer CBDC themselves, the central bank's operational duties are limited, and the involvement of third parties would only introduce additional dependencies and complexity. Therefore, for token-based CBDC, the direct access model may be the most suitable option. For account-based CBDC, on the other hand, the hybrid access model may be the most favorable option since it best balances the trade-offs, as it reduces the central bank's operational duties without being as complex as indirect access models. There are also possible solutions to the risks posed by third-party unavailability. Potential founders of PSPs or TSPs could be subsidized, or banks could act as PSPs or TSPs, which would significantly increase the number of available third parties and reduce reliance on any single provider.

Considering the different legal forms it all comes down to the desired design of the CBDC. Remunerated CBDC can only be implemented as a deposit, while unremunerated CBDC can be implemented as e-money. If the CBDC design deviates significantly from these existing forms of central bank money, a completely new legal form may be required. However, if the design aligns with one of the three established forms, there is no need to create a new one. There is, however, an issue with the legal forms provided by intermediaries, namely the remaining default risk. Even if all intermediary assets are invested in safe central bank money, there remains a possibility that the third party could go bankrupt due to operational risks, causing users to lose their funds. If the intermediary is a regular bank, the customers' iCBDC funds are not protected against this risk, as they would fall into the bankruptcy estate of the bank. This risk also applies to money market mutual funds offering CBDC-backed shares—while the customer retains the same number of shares, their net asset value could decline. Only today's e-money providers, which apply segregation or ringfencing of customer funds, can ensure that their iCBDC cannot default. Thus, e-money may be the only viable legal form for retail CBDC provided by intermediaries.

Lastly, there is the level of obligation of the central bank and third parties on how legally binding the issuance and provision of access to it is. Historically—and in nearly all current jurisdictions—CBDC was intended by legislators

for monetary policy implementation and interbank payments, primarily used by commercial banks. For these purposes, Level 1 regulation—Discretionary for the central bank—seems appropriate, since it gives the central bank full control over the money supply and monetary policy. By contrast, CBDC intended for retail payments and non-bank usage, as it was and is the case with the examples in Ecuador and El Salvador, has been regulated under Level 3—Mandatory for the central bank and third parties. Here, CBDC is meant to be universally accessible and used by the general public, which requires a legal obligation on the central bank to provide it. Also in the current debate, several authors identify universal accessibility as a fundamental characteristic of a retail CBDC [58–60]. Given this requirement, a Level 3 regulation is necessary for retail CBDC—otherwise, central banks or third parties could arbitrarily exclude users from access.⁶⁰ A Level 2 regulation—Discretionary for the third party—may be applied in special cases, when legislators want to give third parties the maximum contractual freedom.

Discussion and conclusion

CBDCs can be considered the next milestone in the evolution of money [61]. The evolutionary process towards a CBDC involves economic, legal, and technical considerations. This paper focused on the legal dimension and developed a guide for the legal assessment of CBDCs. First, the paper addressed the question of how the issuance of CBDC and access to it can be regulated. It was argued that CBDC regulation encompasses two components. On one hand, there is the regulation of the legal form of CBDC. It was shown that the legal form depends on how access to CBDC is provided and under which law it is issued. In the case of indirect access, it is also crucial to determine whether access is provided by an intermediary or a custodian. On the other hand, there are varying degrees on how obligatory the issuance of CBDC and provision of access can be for the central bank and third parties. This paper identified three levels of obligation. At the first level, the issuance of CBDC and provision of access is at the discretion of the central bank and potentially involved third parties. At the second level, provision of CBDC is entirely at the discretion of the third party. At the third level, issuance and access are mandatory for the

⁶⁰ Another adjacent aspect which is not addressed in depth here is holding limits. CBDC can be designed to have holding limits on the maximum amount an individual can hold or no limits at all. A universally accessible retail CBDC would require some minimum amount that the user can hold, otherwise it would not be universally accessible. Whether CBDC should incorporate holding limits, however, is a broader design issue that extends beyond its mere issuance and thus beyond the scope of this paper.



central bank and potentially for third parties as well—meaning that citizens would have a legal right to CBDC.

Second, the paper explored the question of how CBDC issuance and access to it should be regulated. Regarding the levels of obligation, it was argued that only the mandatory issuance and provision of access is in line with universally accessible CBDC. As for the access models, hybrid access may provide the best trade-off between benefits and drawbacks with account-based CBDC. Direct access may be better suited for token-based CBDC.

The findings of this paper have implications for research around the legal assessment of CBDC. Previous research was restricted to mostly one CBDC access model or one jurisdiction. This paper supplements this research by providing a general foundation of the legal assessment of CBDC based on various access models and jurisdictions. This enables CBDC researchers to distinguish between different levels of obligation and legal forms when conducting their analyses. The levels of obligation can be considered as an additional design option in the discussion around CBDC. Furthermore, this research contributes to a better understanding of the ambiguous term CBDC. It investigated the legal meaning of CBDC and showed multiple explanations in terms of legal forms. This, in turn, allows researchers to derive more precise policy implications. Additionally, this paper showed the connection between CBDC and money reform proposals such as Sovereign Money/ Positive Money, Limited Purpose Banking, and the Chicago Plan. It turned out that each reform proposal has its own counterpart for the implementation of CBDC.

There are also practical implications arising from this paper, particularly for central banks. The framework may help central banks assess their legal authority to issue CBDC. Many central banks are likely to examine whether they can issue CBDC under their existing legal mandate and may be focused solely on direct access models. This research shows that additional access models and legal forms can be considered.

Finally, the conceptual framework developed in this paper may aid policymakers in identifying how CBDC can be legally implemented. As a result, the framework may prove useful in parliamentary debates and legislative processes concerning CBDC.

The findings point to several opportunities for future research. This paper did not address other legal aspects of CBDC. Hence, future research might investigate whether CBDC should have legal tender status, or to which extend current AML/CFT laws apply. Additionally, examining more jurisdictions may uncover further regulatory approaches and possibilities.

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Declarations

Conflict of interest The author states that there is no conflict of interest.

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