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Abstract

We assess retail central bank digital currency (CBDC) against the objective of the uniformity of money. The central questions that arise are whether CBDC could help support the uniformity of money across public and private monies in day-to-day payments; how it interacts with the unit of account and monetary sovereignty; and how its design choices impact its contribution.

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Money Uniformity and Retail CBDC[*]

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Abstract

We assess retail central bank digital currency (CBDC) against the objective of the uniformity of money. The central questions that arise are whether CBDC could help support the uniformity of money across public and private monies in day-to-day payments; how it interacts with the unit of account and monetary sovereignty; and how its design choices impact its contribution.

Introduction

Policymakers are concerned that the rise of new technology-based forms of private money pose a threat to the uniformity of money. This concern is voiced especially about stablecoins, whose market values fluctuate from their par value in fiat currency, usually only slightly but occasionally quite markedly. It has been further accentuated by the continuing decline in the use of cash in retail payments, and the possibility that falling access to and acceptance of cash may prevent

[*] The authors were all members of the Bank of England and HM Treasury CBDC Academic Advisory Group from February 2024 to January 2026 (minutes of these meetings are available at https://www.bankofengland.co.uk/the-digital-pound/cbdc-academic-advisory-group). This discussion paper is a revised version of an analysis of the Uniformity of Money and the Digital Pound the authors prepared for the advisory group. The views expressed are the personal views of the authors and need not necessarily represent the views of the institutions or advisory groups the authors are associated with.

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households and businesses directly exchanging their holdings of private money for public central bank money.

This concern about the loss of the uniformity of money is reflected in the preparatory work undertaken by several central banks for the possible issue of CBDC. The preservation of uniformity of money, which is also referred to as the singleness of money, has been stated as one of the principal objectives in the consideration of issuing a retail CBDC by the ECB (ECB 2022) and the Bank of England (Bank of England and HM Treasury 2023). Other central banks discuss the uniformity or singleness of money in discussion of potential considerations in regard to a retail CBDC, though they do not make it a central goal (e.g., see Sveriges Riksbank 2026).

Our analysis examines the main arguments that emerge from the research literature on the relationship between the uniformity of money and retail CBDC. This is a topic on which different scholars take a variety of positions. Our goal is to provide an overview of the literature and highlight the key points at issue.

This note is organized as follows. First, we discuss what is meant by the uniformity of money, highlighting that this is not inherent but an equilibrium outcome: something that is achieved for any particular form of money if there is an elastic supply or demand that maintains par value. We then consider why uniformity matters, discussing economic costs arising from an absence of uniformity, Next, we consider the potential trade-offs that emerge between uniformity and financial stability, especially with private monetary issue that (unlike public issue) does not take account of systemic externalities; and further discuss the trade-offs that emerge in the design of a retail CBDC—most notably holding limits and remuneration.

We then turn to key policy questions. Does uniformity of money require retail access to public money? What are the sources of departure from uniformity in stablecoins or other innovative private moneys and what measures, including issue of CBDC, can help limit these departures? If a retail CBDC is adopted, can it strengthen the uniformity of money? Our concluding policy summary identifies some key unresolved questions for further research.

1. Defining money uniformity

Money uniformity is primarily considered as the stable exchange rate of one across forms of money within a single currency area. First, it means par between central bank public monies (for example, between cash and reserves). Second, it means par between central bank money and private monies (such as commercial bank deposits or private e-money) used by households and firms. Uniformity is an equilibrium outcome rather than a reflection of monies being technologically identical or having similar features. The condition is equal valuation at the margin through an elastic supply or demand on at least one side of the market to absorb imbalances. Such elasticity may result from rules that compel convertibility at par, from central bank standing facilities, or it can be provided by a “market maker” that arbitrages away differences from a one-to-one exchange rate. A market maker bears the risk of absorbing losses from a break in the par exchange rate, and

the elasticity that underpins par can weaken suddenly in stress (CPSS 2003; Bofinger and Haas 2023; Garratt and Shin 2023).

Minor frictions do not, by themselves, necessarily negate uniformity. Fees to withdraw or receive funds (for instance, ATM charges or merchant service fees) create small, predictable wedges but do not imply a floating exchange rate between monies. The operative question is whether exchange is sufficiently close to par in ordinary retail use or whether relative prices can move under stress. One view treats singleness primarily as a property of the payment itself. As long as a payment denominated in a particular currency between two parties is settled at par in central bank money of that currency (i.e., bank A's liability to bank B is extinguished in reserves at one-for-one), the payment counts as uniform. This holds even if the underlying private liabilities differ as stores of value or small user fees exist at the edges, which allows for small, non-systemic frictions without loss of uniformity (Garratt and Shin 2023). A complementary view emphasizes that seamless convertibility at par is a pillar of uniformity across issuers and systems (Coste and Pantelopoulos 2025; Pantelopoulos 2025). Skeptics of strict retail singleness note that for households the essential requirement is the ability to pay at face value, not necessarily deep two-way markets for exchanging every private money at par with every other (Walker 2025).

Programmability is one dimension among many along which means of payment can differ. The direct programmability of a private money itself, such as potential programmable stablecoins, does not break uniformity as long as supply or demand remains elastic.

Historically, monetary regimes have functioned with limited uniformity—early modern Dutch arrangements around the Bank of Amsterdam are a salient example—reminding that uniformity is shaped by institutions and backstops rather than technology alone (Quinn and Roberds 2007 2023). Across monetary regimes, the relevant comparison is uniformity within a unit of account versus differences across units of account.

2. Why uniformity matters

There are several reasons why uniformity matters. One is that perfect or near-perfect exchange-rate stability across means of payment economizes on information and negotiation costs. When par is reliably maintained, parties transact under a "no-questions-asked" convention; the medium's convenience yield rises and the need for costly due diligence falls, even under symmetric information (Gorton and Pennacchi 1990; Gorton and Zhang 2023). Another is that the unit of account has a public-good character with increasing returns to broad use; the more transactions reference the same unit and settle at par, the lower the economy-wide coordination costs (Issing 1999). Uniformity therefore also reinforces the centrality of the central bank in the monetary architecture, supporting the transmission of monetary policy and monetary sovereignty. A strong unit of account further increases fiscal capacity by enabling the state to issue debt in its own currency on more favorable terms.

The erosion of cash use for payments raises the question of the retail anchor. Banks settle in central bank reserves, which some view as sufficient to anchor the system even if households lack routine access to public money (Walker 2025). Others argue that the presence of retail public money—cash or CBDC—helps maintain trust in commercial bank money, not only through convertibility mechanics but also via psychological channels: depositors feel safer when conversion into unquestioned public money is easy (Armelius, Claussen, and Hendry 2020). Additionally, retail public money can potentially constrain the market power of payment platforms and deposit-takers, limiting fragmentation and preserving the "single character" of the currency in daily life (Lagos and Zhang 2022; Rivadeneyra, Hendry, and García 2024; Gillmore Centre 2023).

Uniformity may also affect trust and confidence more broadly. If the retail landscape comprises multiple monies with different risk and utility attributes, users must infer which monies are "strong" and which are "weak." Bank runs already demonstrate how heterogeneity in perceived safety can propagate. Deposit insurance and resolution mitigate such externalities but do not fully internalise them, particularly as new forms of private digital money proliferate beyond insured deposits (Rivadeneyra, Hendry, and García 2024). In this setting, a readily accessible retail public money may serve as a focal benchmark of safety and value.

3. Trade-offs and design tensions

The same mechanisms that make deposits universally usable at par—credit lines, guarantees, deposit insurance, liquidity backstops—also create moral hazard distortions, generate run externalities and amplify fragility (Gorton and Zhang 2023; Rivadeneyra, Hendry, and García 2024).

An important question is who should choose acceptable trade-offs: market participants or public authorities. Private choices will not internalise network externalities in payments, the public-good nature of the unit of account, or the risk of regulatory foreclosure whereby dominant private actors shape infrastructure to their advantage (Rivadeneyra, Hendry, and García 2024; Bidder et al. 2025). Uniformity constraints may limit entry and experimentation, while insufficient constraints risk fragmentation; policy must navigate these margins. These tensions bear directly on CBDC design. Holding limits and non-remuneration restrict elasticity at the household margin. If unconstrained retail exchange into CBDC is required for singleness, tight limits could induce rationing and a non-par shadow exchange rate in stress, weakening CBDC's anchoring role (Bofinger and Haas 2023). Conversely, these limits could limit the volatility of deposit flows. The calibration problem is to preserve the social benefits of uniformity without unduly elevating instability, recognizing that credibility, market structure, and backstops co-determine outcomes (Gillmore Centre 2023).

There is a distinction between the programmability of payments and the programmability of money (Chiu and Monnet 2026).[1] Programmed payments support the conditional exchange and transfer of money, for example following confirmation of delivery of goods or against delivery of a financial

[1] Chiu and Monnet (2026) show that programmable money may ease commitment frictions so blanket bans are not necessarily welfare-improving.

asset. Programmed payments do not affect the fungibility of the underlying money and so would not normally interfere with the singleness of money (though there are possibly exceptions).

Programmed money directly limits the use of money in exchange and would typically not be considered for CBDC. Programmed money may not be exchanged at par if it does not exchange for an elastic supply of unprogrammed money, and so may result in departure from singleness. If it can be exchanged for other forms of money at all, then this may be at a discount to persuade another party to accept the limitations on its use.

4. Does money uniformity require retail convertibility into public money?

The academic literature largely suggests singleness does not require households to exchange deposits for public money on demand. Par is secured if the central bank converts reserves into cash with some participants and if banks trust each other to deliver reserves in settlement, so that interbank obligations clear at par and retail payments reference that par through commercial bank money (CPSS 2003; Garratt and Shin 2023; Walker 2025). Under this view, uniformity is produced by wholesale convertibility plus robust settlement in central bank money, not by universal retail exchange into public money.

An alternative view emphasizes the trust channel. The presence of retail public money can sustain confidence in commercial bank money for psychological as well as mechanical reasons; households value the option to convert into state money even if they seldom exercise it (Armelius, Claussen, and Hendry 2020). Policymakers concerned that digital platforms and closed-loop systems could compromise uniformity argue that public money should remain present and freely available across the economy so that all private monies reference a common value (Brunnermeier and Landau 2022; Lane 2025).

These perspectives are not mutually exclusive. If CBDC strengthens the unit of account and monetary sovereignty—especially if digital platforms were to operate using foreign currency denominations—CBDC may indirectly support uniformity even if retail convertibility is not strictly necessary in normal times (Brunnermeier, James, and Landau 2019; Gillmore Centre 2023). The key question is which margins must be unconstrained to safeguard par in stress. If household access is one such margin, strict limits and non-remuneration could erode CBDC's effectiveness; if wholesale settlement suffices, modest limits are compatible with singleness across means of payment (Bofinger and Haas 2023; Walker 2025) even if they undermine equal valuation of CBDC at the margin across users.

5. Stablecoins, tokenized deposits and infrastructure

The most salient threat to uniformity from private innovation arises if retail payments migrate into stablecoins with significant fees, limited interoperability, and no credible commitment to par with bank money or cash. Absent regulation that compels convertibility and interconnection, such

ecosystems may fragment the retail landscape. In contrast, tokenized bank deposits that settle in central bank money are, in principle, more conducive to singleness (Garratt and Shin 2023; Gillmore Centre 2024). Historical experience with privately issued money suggests that, without robust backing and regulation, circulating media that purport to be "stable" can deviate from par in stress and trade at discounts that are costly to eliminate (Gorton and Zhang 2023). Industry observers note that stablecoin leaders may have little incentive to accept each other's tokens at par, since network effects reward non-uniformity; market forces alone may not converge to a unified par standard (Koning 2025).

Requiring "always-perfect" uniformity can effectively privilege one architecture over others; the objective should be to secure par at the point of payment without unduly suppressing viable models (Bidder et al. 2025). Theory also indicates that small deviations from par can be efficient when they reflect a trade-off between the benefits of interoperability and of hedging balance sheet risks (Hemingway 2025).

Small departures from uniformity arise for stablecoins such as Tether and Circle's USDC because they employ a two-tier structure, paralleling that between central banks and commercial banks as providers of deposits. Stablecoin issuers do not offer a direct channel for retail issue and redemption (differentiating them from e-money issuers such as Venmo or Paypal). Instead, retail customers exchange stablecoins against the referenced fiat with intermediaries, such as crypto exchanges or retail trading brokerages. Unlike commercial banks, these intermediaries have no obligation to redeem at par; moreover, there are costs and delays in redeeming or obtaining coins from the stablecoin issuer.[2] Because of these frictions, stablecoin prices adjust in response to short-term fluctuations in demand and supply.

The resulting departures from uniformity are typically small and short-lived but become more pronounced when there are doubts about issuer solvency.[3] Stablecoin de-pegging might limit runs, compared to fixed par value of bank deposits. But preemptive runs out of stablecoins may still occur in anticipation of falling stablecoin prices. Under imperfect information, the publicly visible nature of stablecoin price falls may even amplify runs. A more complex monetary system without uniformity may induce new forms of systemic risk, and risks to confidence in money more generally, that will need to be considered by authorities.

Measures to support the uniformity of stablecoins include: strengthening the rules on the quality of stablecoin reserves and their oversight (to ensure departures from uniformity are limited in magnitude and duration); placing obligations on intermediaries to redeem stablecoins at bands around their stated par-values; and mechanisms to reduce the frictions in stablecoin issue and redemption, for instance by improving the speed and availability of settlement in legacy systems for stablecoin-fiat exchange. By allowing retail customers to hold a direct settlement asset, the

[2] A major source of these costs is continued reliance on legacy banking systems for the fiat leg of stablecoin redemption and issue.

[3] This happened following the failure of Silicon Valley Bank, when it was revealed that Circle held a significant proportion of its USDC reserves at the bank.

introduction of CBDC may support real-time fiat-stablecoin exchange and thus also promote uniformity. Arguably, though, the emergence of tokenized deposits can provide the same benefits without CBDC.

In summary, CBDC can act as a catalyst for uniformity by reinforcing three pillars: settlement finality in central bank money, interoperability across issuers and platforms, and seamless convertibility at—or sufficiently close to—par into the ultimate settlement asset (Coste and Pantelopoulos 2025; Pantelopoulos 2025; Braine, Shukla, and Agrawal 2024). Practically, novel retail payment systems – whether bank-money-based, e-money or regulated permissioned stablecoins—should interoperate with the existing payment infrastructure, and conversion into bank deposits and, within limits, into CBDC should be technically and contractually straightforward (Patel et al. 2024; Gillmore Centre 2024).

6. Does CBDC benefit uniformity?

Even if uniformity does not require retail access to public money, additional convertibility options can strengthen it. CBDC as an investment option for households provides an extra pathway through which deviations from par are disciplined and a salient benchmark for safety is maintained. The effect operates indirectly by reinforcing the unit of account and monetary sovereignty, and directly by offering a settlement-proximate asset that Payment Interface Providers (PIPs) can integrate into digital platforms (Brunnermeier and Landau 2022; Braine, Shukla, and Agrawal 2024; Gillmore Centre 2023). Uniformity is fundamentally needed in the use of money at payment rather than in the precise store-of-value attributes of each instrument. Sufficient uniformity does not require frictionless exchangeability of every retail money at par with every other; what matters is the ability to pay at face value at comparable terms across mainstream venues (Garratt and Shin 2023; Coste and Pantelopoulos 2025; Walker 2025).

CBDC balance limits are not necessarily prohibitive to this contribution. In normal times, households may not approach cap limits; waterfalls and reverse-waterfalls can automate flows so that CBDC liquidity is available at the margin when needed, much as cash historically anchored value despite aggregate cash balances being small relative to M1. That said, stricter limits reduce elasticity in stress and may dampen CBDC's disciplining effect on private monies, suggesting value in calibrations that allow contingent headroom or design features that can be activated if fragmentation risks materialize (Bofinger and Haas 2023).

Financial inclusion adds a further benefit. Lack of uniformity tends to impose higher costs on users with the least capacity to navigate complexity. A simple, widely accessible public money available through regulated providers could mitigate exclusion risks, while other inclusion tools—standards for low-fee accounts, offline functionality, and basic wallets—would complement CBDC's role (Rivadeneyra, Hendry, and García 2024; Patel et al. 2024; Gillmore Centre 2023). More generally, with the growth of the digital economy and the decrease in use of cash, CBDC could be a vital

means for the provision of public money, which may be considered as a right for the public in principle while ensuring a uniform monetary instrument to those most in need in practice.

A likely path for the continuing evolution of payments is sustained low—but non-zero—cash usage, further growth in card and bank-deposit-based digital payments, and some expansion of non-bank digital payments that do not become dominant. Less likely, but relevant, is a landscape where domestic or possibly even foreign-currency stablecoins achieve substantial share and bank-tied payments diminish, with "cash-near-zero" plausible in the medium run and complete disappearance of both cash and bank-tied payments only in the long run if at all. The key threats to uniformity rise with closed-loop dominance and fall with enforced interoperability and convertibility. Tokenized bank deposits and CBDC can replicate most functional attractions of non-bank tokens while remaining tied to central bank settlement (Garratt and Shin 2023; Pantelopoulos 2025).

Uniformity's value may be particularly important during times of financial stress. When uncertainty rises, users who are not financially sophisticated may find it difficult to distinguish and evaluate sufficiently the relative safety of different private monies, especially if exposures are correlated across issuers. Under such conditions, deviations from par can be self-reinforcing in private digital monies with fragile redemption structures. A retail public money helps by sharpening the signal about what is unquestionably safe and potentially reducing panics where users exit "everything" because no focal benchmark exists. The possibility that CBDC would be lightly used in tranquil times does not eliminate its potential value as a ready-to-scale backstop in times of stress, provided design allows contingent adjustments consistent with monetary policy and financial-stability frameworks (Bofinger and Haas 2023; Patel et al. 2024; Gillmore Centre 2024).

7. Implementation considerations and policy options

A pragmatic approach is to design CBDC for the most likely path of payments—continued dominance of deposit-based digital payments with low, persistent cash use—while ensuring robustness to less likely but consequential states, such as negligible cash usage or the rise of dominant retail stablecoins.

First, embed interoperability and convertibility. New payment systems should interoperate with RTGS, and conversion rules for private digital monies that reach scale into bank deposits and, within user caps, into CBDC, may be considered. This mirrors the historical role of convertibility into cash and reserves in tying private monies to public money (CPSS 2003; Coste and Pantelopoulos 2025; Braine, Shukla, and Agrawal 2024; Gillmore Centre 2024).

Second, enable value-adding programmability of payments while preserving core uniformity. Allow PIPs to provide programmable payment services on top of CBDC so that features that draw users to non-bank tokens can potentially be replicated in a safe environment. Such programmability of payments can be useful and poses little threat to uniformity. This need not include direct

programmability of money, limiting its use in exchange, though there may be some use cases where this might be desirable even though it leads to some departure from singleness.

8. Conclusion and research priorities

The balance of arguments suggests that CBDC is not strictly necessary for the broader goal of singleness of money if wholesale convertibility and settlement in reserves continue to function robustly. However, CBDC would likely foster uniformity by reinforcing the unit of account and monetary sovereignty, providing an additional convertibility path at the retail margin, constraining fragmentation from closed-loop platforms, and serving as a focal benchmark in stress, particularly in potential future scenarios in which cash usage falls much further or retail stablecoins are widely used in the economy. If CBDC is tightly capped and non-remunerated, these benefits of CBDC remain but are lessened because elasticity at the margin helps sustain par in adverse states (CPSS 2003; Bofinger and Haas 2023; Garratt and Shin 2023; Armelius, Claussen, and Hendry 2020). Moreover, binding caps break uniformity—in the sense of equal valuation at the margin—across users.

Several research questions merit priority. First, which margins of convertibility must remain unconstrained to safeguard par under stress, and how do CBDC limits interact with those margins (Bofinger and Haas 2023; Garratt and Shin 2023)? Second, to what extent does retail access to public money causally foster trust in commercial bank money beyond the mechanical convertibility channel (Armelius, Claussen, and Hendry 2020; Rivadeneyra, Hendry, and García 2024)? Third, what are the indirect effects of CBDC on the strength of the domestic unit of account in a digital economy with platform-specific currencies or even foreign-denominated tokens (Brunnermeier, James, and Landau 2019; Brunnermeier and Landau 2022)? Fourth, to what extent are there tradeoffs between the social benefits of uniformity and of programmability of payments and programmability of money (Chiu and Monnet 2026; Pantelopoulos 2025)? Empirical case studies exploiting episodes of stress in banks and stablecoins—tracking spillovers into bank equity and debt markets—would be particularly informative. Taken together, the singleness-of-money case for CBDC rests less on immediate transaction-flow volumes and more on preserving a uniform currency in an evolving retail landscape. By anchoring par across monies in daily use, strengthening the unit of account, and keeping open channels of convertibility and interoperability, CBDC can help safeguard the uniformity that underpins efficient payments, effective policy, and monetary sovereignty.

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