

Central Bank Digital Currencies: Design Trade-offs and Systemic Risk

A technical review of CBDC architectures, examining disintermediation risk, privacy trade-offs, and monetary policy implications.

1. What a CBDC Actually Is

A Central Bank Digital Currency is a direct digital liability of the central bank — unlike commercial bank deposits, which are the bank's liability and yours only by extension, a CBDC represents a claim on the central bank itself, the same legal status as physical cash. This single distinction is the source of nearly every design trade-off discussed in this article, because it means a CBDC competes directly with commercial bank deposits as a place to hold money.

Most active CBDC projects separate into two categories: wholesale CBDCs, used only between banks and financial institutions to settle large-value payments (broadly uncontroversial, and already in advanced pilot stages in several jurisdictions), and retail CBDCs, available to ordinary households and businesses (far more consequential and far more contested).

2. Account-Based vs. Token-Based Architecture

Account-based CBDCs work like a digital bank account, with identity verification tied to every holding and transaction — administratively simpler and easier to align with existing AML/KYC frameworks, but offering essentially no cash-like anonymity. Token-based CBDCs instead verify the validity of the digital token itself rather than the identity of its holder, more closely mimicking the bearer-instrument nature of physical cash, but creating harder technical and regulatory challenges around preventing illicit use.

3. The One-Tier vs. Two-Tier Question

The most consequential design choice is whether the central bank issues CBDC directly to the public (one-tier / direct model) or issues it to commercial banks and licensed payment providers who then distribute it to end users (two-tier / intermediated model, sometimes called 'synthetic CBDC' or hybrid CBDC).

A pure direct model would put the central bank in the business of retail account management, customer service, and fraud handling — functions it is neither designed nor resourced for, and functions that would put it in direct competitive conflict with the commercial banking system it is meant to oversee. Nearly every serious CBDC project, including the ECB's digital euro and the Fed's exploratory work, has converged on some version of the two-tier model specifically to avoid this outcome.

4. Disintermediation: The Core Systemic Risk

The central fear among bank regulators is that a retail CBDC, being a direct and risk-free central bank liability, becomes an attractive place to park savings — especially during periods of banking-sector stress, when depositors could shift funds from a commercial bank to the CBDC instantaneously and at essentially zero cost, turning a slow, confidence-driven bank run into an electronic one that could unfold in minutes rather than days.

The standard mitigations under study include per-account CBDC holding caps (the ECB's working proposal has floated limits around €3,000 per person), non-remunerated (zero or below-market interest) CBDC balances to remove the incentive to hold large sums, and tiered remuneration that becomes actively unattractive above a threshold. Each of these mitigations is itself a trade-off: caps and low remuneration limit the disintermediation risk but also limit the CBDC's usefulness as a genuine alternative to bank deposits, raising the question of what problem the CBDC is actually solving.

5. Privacy and Programmability

A digital, traceable form of central bank money raises privacy concerns that physical cash never did — every transaction is, in principle, technically observable to the issuing authority, even where legal frameworks restrict such access. Proponents argue this same traceability is what modern AML and counter-terrorism financing regimes already effectively require of the banking system, and that a well-designed CBDC could in fact offer more calibrated privacy tiers (small transactions private, large ones reportable) than either fully anonymous cash or fully surveilled bank transfers.

'Programmability' — the ability to encode conditions directly into the money itself, such as expiry dates or spending restrictions — is technically possible but has proven politically the most sensitive feature discussed. Most central banks have explicitly disclaimed any intent to build programmable restrictions into retail CBDC design, precisely because the possibility (however remote) generates outsized public opposition.

6. Case Studies in Progress

China's e-CNY is the most advanced major-economy retail CBDC, with hundreds of millions of registered wallets by the mid-2020s but comparatively modest transaction volumes relative to incumbent private payment platforms Alipay and WeChat Pay, illustrating that technical availability does not automatically translate into adoption when strong private alternatives already exist.

India's e₹ (digital rupee) pilot has emphasized offline transaction capability, targeting financial inclusion in areas with unreliable connectivity. Nigeria's eNaira, one of the earliest live retail CBDCs, has seen adoption well below initial targets, a cautionary case study frequently cited in the literature on the gap between technical launch and genuine public uptake.

7. Conclusion

CBDC design is fundamentally a balancing act between competing objectives that cannot all be maximized simultaneously: payment efficiency versus banking-sector stability, privacy versus illicit-finance controls, and central bank innovation versus its core mandate to remain a neutral guardian of the financial system rather than a direct retail competitor to it. The two-tier, capped, low-remuneration model emerging as the practical consensus reflects not a technical limitation but a deliberate policy choice to contain disintermediation risk, even at the cost of a less transformative product than early CBDC advocates originally envisioned.

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