

Cash and Freedom in the Digital Age: Functions, Societal Significance and Regulatory Challenges

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ABSTRACT

This paper delivers a clear verdict. In the age of digital payment infrastructures and central bank digital currencies (CBDCs) cash is not obsolete it is essential. It functions as a store of value, a shield of privacy and the last instrument of financial self-determination outside algorithmic control. Data from the European Central Bank, Deutsche Bundesbank, the World Bank's Global Findex and case studies from Germany, Sweden, China and African and Southeast Asian regions expose a consistent pattern. Every crisis drives demand for cash as a safe haven. In weak banking environments it is the only door to financial inclusion. Surveys show privacy is the decisive motive for its survival. CBDC pilots make one fact unmistakable. Without cash trust collapses. The conclusion is uncompromising. Cash is not a payment relic. It is social infrastructure and the physical anchor balancing an increasingly centralised and surveilled digital monetary system.

Keywords: Cash, digitalisation, financial inclusion, privacy, trust, digital central bank currencies

1. INTRODUCTION

The digital revolution is reshaping the foundations of the monetary system. Contactless payments, mobile wallets and central bank digital currencies (CBDCs) are

transforming not only technology but also the power and control over money (European Central Bank, 2011, OECD, 2020; Wullweber, 2021). In this environment, cash remains an anchor. It represents trust, privacy and the ability to act without leaving a digital trace (Hayek, 2012; Sahr, 2022).

This paper examines which functions cash retains in the 21st century and how its societal role changes in an increasingly digital environment. The aim is to empirically analyse the functions, social significance and regulatory challenges of cash. A central question is at the core: How much freedom remains in cash when money goes digital.

The study combines central bank data, international surveys and case studies. It goes beyond economic perspectives and addresses autonomy and trust in a system that is becoming less tangible (Ingham, 2004; Sahr, 2022).

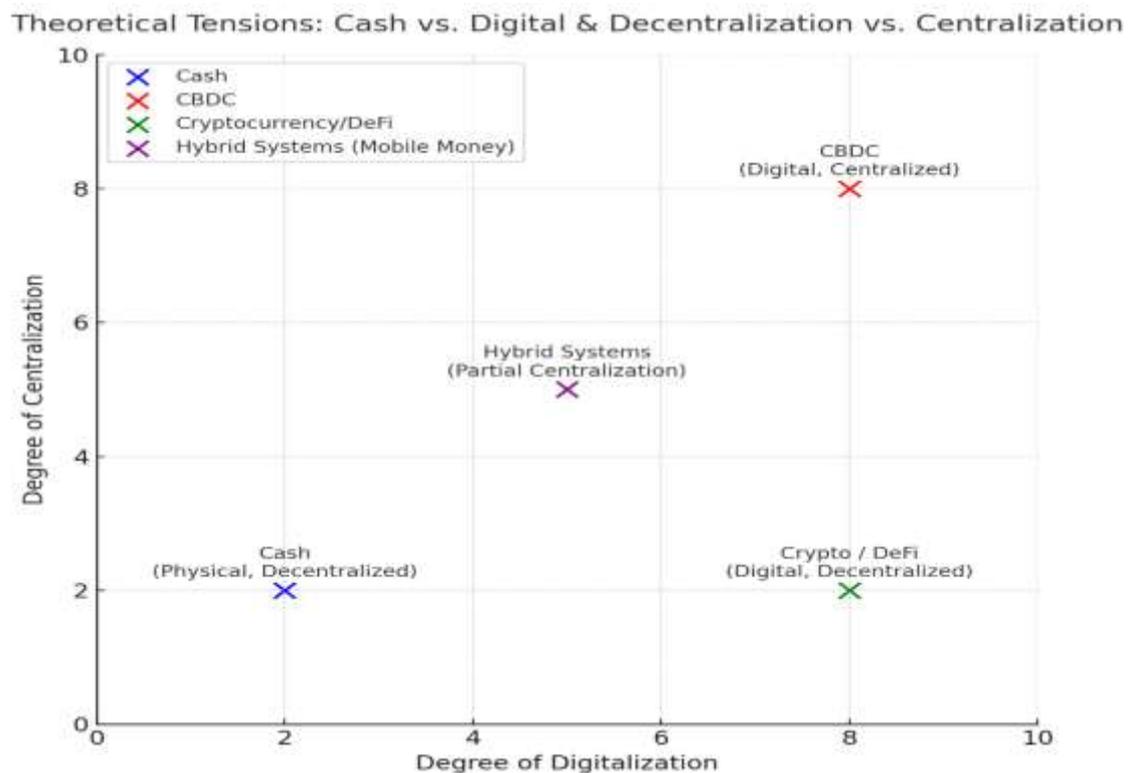
2. THEORETICAL FRAMEWORK

Functions of Money and the Specific Role of Cash: Money is more than a technical invention. It is a social promise enabling value, trust and exchange (Ingham, 2004; Polanyi, 2001). The classic functions medium of exchange, store of value and unit of account have shaped economic systems for centuries (European Central Bank, 2011; Keynes, 1936; Hicks, 1967; Issing, 2014). Cash fulfils these functions in a unique way: it is immediate, anonymous and physical. No

digital system can replicate this combination (McLeay, Radia, & Thomas, 2014). Cash and Individual Freedom: Cash is not neutral. It carries a political dimension. Holding value outside digital infrastructures means independence from banks, platforms and state control (Hayek, 2012; Sahr, 2022). In this tension, cash becomes an instrument of personal freedom. Knapp (1918) saw money as a state construct. Cash demonstrates that trust in value can exist beyond code and servers. Digitalisation and Monetary Transformation: The digital payment revolution dismantles old structures. Mobile payments, instant transfers and central bank digital currencies do not merely change processes; they shift the balance of power in the monetary system (OECD, 2020; Wullweber, 2021). Cash stands in direct opposition: it is analogue, decentralised and independent. This clash is not primarily

technical but political: it is about control, privacy and social trust (McLeay et al., 2014; Mehrling, 2017). Central Bank Digital Currencies (CBDCs) as a Break: CBDCs mark the most radical rupture in modern monetary architecture. They promise speed, inclusion and absolute control. At the same time, they concentrate power and erase anonymity. They are not a mere technical update; they rewrite the relationship between state, market and individual (Andolfatto, 2018; Chen & Nesterov, 2023). Pilot programmes in China and Sweden expose a paradox: CBDCs can reduce costs and expand access (Müller & Kerényi, 2022). Yet when cash disappears, trust collapses. Without a physical counterweight, digital infrastructures mutate into tools of surveillance rather than autonomy (Wullweber, 2020).

Figure 1. Theoretical Tensions Between Forms of Money. The diagram positions different monetary forms on two axes: the move from physical to digital and the shift from decentralized to centralized structures. Cash sits in the lower-left quadrant as a tangible, distributed medium of exchange. CBDCs occupy the upper-right corner, combining full digitalization with central authority. Cryptocurrencies and DeFi claim the digital yet decentralized field, while hybrid systems such as mobile money inhabit the in-between space, blending central oversight with digital rails. Source: Own elaboration.



This visualization exposes the fault line of the monetary system. The horizontal axis marks the leap from paper and coin to code and network; the vertical axis charts the pull between autonomy and control. Cash stands as the physical, decentralised anchor of privacy. Opposite it, CBDCs concentrate power in a fully digital core. Cryptocurrencies challenge that centre with decentralised code, while hybrid systems hover uneasily in between. The figure makes clear: debates on money are battles over power and trust, not just technology

3. RESEARCH QUESTION AND HYPOTHESIS ANCHORING

The digitalization of money challenges the foundations of autonomy and trust. The guiding research question is: *How do the functions of cash transform in the digital age and what are the social and regulatory consequences.*

Linking theory and hypotheses

H1 draws directly on Minsky's financial instability hypothesis, which emphasises the return to safe and liquid assets when systems destabilise (Minsky, 1986). Cash, as the most immediate and liquid store of value, reflects this dynamic in times of crisis.

H2 is grounded in theories of monetary access and institutional economics, particularly Martignoni's work on currency as infrastructure for inclusion (Martignoni, 2018). In regions with weak banking networks, cash becomes the primary interface with the monetary system.

H3 relates to Hayek's argument for monetary autonomy and Sahr's analysis of privacy as a structural feature of physical money in contrast to digital payment systems (Hayek, 2012; Sahr, 2022).

H4 builds on Wullweber's perspective on "shadow money" and McLeay et al.'s insights on central bank balance mechanisms. It treats cash as a regulatory anchor in the face of CBDCs (Wullweber, 2020; McLeay et al., 2014).

H5 is linked to Ingham's sociological theory of money and OECD findings on trust. It

posits that physical currency sustains institutional credibility within the monetary order (Ingham, 2020; OECD, 2020).

These hypotheses are not abstract assumptions. They are direct probes into the link between money, power and freedom. The five hypotheses were chosen to cover the core functional dimensions of cash in the transition to a digital monetary system. H1 addresses the crisis function as a store of value and instrument of trust, which is historically well-documented in monetary theory and provides a benchmark for systemic resilience. H2 focuses on financial inclusion, linking cash to access in regions with weak banking infrastructure, making it essential for assessing social consequences. H3 isolates privacy as a behavioural driver, reflecting the shift towards data-driven payment environments. H4 examines the role of cash in relation to CBDCs, capturing regulatory dynamics in emerging digital architectures. H5 links cash to institutional trust, connecting individual behaviour with systemic stability. Together, these hypotheses build a framework that links the economic, social and regulatory forces shaping money, making cash a key marker of power and freedom in a digital monetary order.

4. METHODOLOGY AND EMPIRICAL ANALYSIS

The study uses a mixed-method design to follow the shifting role of cash in the digital age. Quantitative time series from central banks and international survey data provide the backbone for analysing long-term trends in circulation and payment behaviour. These numbers are placed against qualitative case studies that capture the social and regulatory forces behind them. Together they allow a layered reading: data traces the patterns; context explains why they matter. The choice of case studies is intentional rather than illustrative. Sweden was chosen as it represents the furthest point toward a cashless economy. Its almost fully digital payment landscape serves as a stress test for systemic resilience and public trust once

physical money recedes from daily life. Germany provides the counterweight: a mature market where cash retains cultural weight and acts as a proxy for privacy and autonomy. China enters the analysis for a different reason. It runs the world's largest central bank digital currency pilot, making it a living laboratory for state-driven digital monetary design. The case raises the question of whether control and trust can coexist in a fully centralised digital architecture. Sub-Saharan Africa and Southeast Asia add yet another layer. In these regions, cash is not a leftover from the past but the practical gateway to financial inclusion (Demirgüç-Kunt, Klapper, Singer, Ansar, & Hess, 2022). It enables participation where digital infrastructure is thin and networks unstable. Taken together, these cases form more than a sample; they trace the edges of the monetary map. From near-total digitalisation to low-tech inclusion, from decentralised autonomy to centralised control, they define the spectrum within which cash and digital currencies interact, conflict and evolve.

5. EMPIRICAL ANALYSIS

The results are clear. Across different datasets and regions, cash responds to stress in a predictable way. When systems falter, people turn to physical money. During the 2008 financial crisis and the COVID-19 shock, cash in circulation spiked within weeks, underscoring its role as a store of value and a last resort of trust when institutional confidence erodes (Keynes, 1936; Belke & Polleit, 2009; Deutsche Bundesbank, 2019; Minsky, 1986). In regions with weak banking infrastructure, cash is not just a payment medium. It is the entry point into the monetary system. Evidence from Southeast Asia and sub-Saharan Africa shows that without physical currency, large parts of the population would remain excluded from financial participation (Martignoni, 2018). Surveys add another layer. They reveal privacy as the key driver behind cash usage. In a digital environment dominated by traceable transactions, this

motive consistently outweighs convenience and cost. Cash becomes more than a habit it turns into a deliberate choice for autonomy (Hayek, 2012; Sahr, 2022).

CBDC pilot programmes in Sweden and China expose a structural fact. Digital currencies can improve efficiency and broaden access, but they do not replace the stabilising effect of cash. Central banks themselves describe physical money as the necessary counterweight to centralisation and a condition for maintaining public trust (Wullweber, 2020; McLeay et al., 2014). OECD data highlights a further dimension. Where cash usage drops abruptly, trust in financial institutions weakens. This is not a minor behavioural shift. It suggests that cash carries a psychological weight within the monetary system that digital infrastructures have yet to replicate (Ingham, 2020; OECD, 2020).

Taken together, the evidence draws a consistent picture. Cash is not a relic. It is a structural element of monetary stability, a bridge to inclusion, and a rare instrument of privacy in a data-driven economy.

6. CASE STUDIES IN GLOBAL COMPARISON

Sweden – the low-cash experiment

Sweden's payment market has changed quickly. Over a decade, the share of cash users dropped from 39 % to under 10 %. By 2016, cash accounted for less than 2 % of transaction value (Sveriges Riksbank, 2020). The shift was rapid, almost linear, until the pandemic interrupted it. Early 2020 brought a brief reversal: withdrawals went up, and circulation rose. The Riksbank reacted with a clear statement. Even in a nearly cashless economy, banknotes remain part of national preparedness (Sveriges Riksbank, 2023).

Germany – balancing tradition and digitalisation

In Germany the tone is different. Cash use declines, but slowly, and it still dominates everyday payments. In 2023, 51 % of all transactions were cash-based, down from 58 % two years earlier. The value share fell

to 26 %, debit cards moved ahead at 32 % (Deutsche Bundesbank, 2023a). Then came March 2020: in just a few weeks cash in circulation increased by more than ten billion euros (Deutsche Bundesbank, 2020). Surveys explain the pattern. Privacy is named by 63 % of respondents as the main reason to use cash, with convenience and spending control following (Deutsche Bundesbank, 2023b). Germany shows a mixture of cultural habit and institutional trust.

China – digital innovation in balance with cash

China's e-CNY pilot is large in scale and ambition. Since 2020, several hundred million users have joined. Yet the People's Bank of China keeps physical notes in circulation and calls them a necessary counterweight. Here the language is institutional, not cultural. Maintaining both forms is described as a requirement for trust and balance in the monetary system (People's Bank of China, 2023).

Africa and Southeast Asia – cash as a gateway to inclusion

The picture in Africa and Southeast Asia is practical. Cash is the bridge. In Tanzania, 45 % of adults had a mobile money account in 2021; only 23 % held a bank account (World Bank, 2022). Mobile systems expand, but infrastructure gaps keep physical currency central. It enables participation where digital rails do not yet reach. In these regions, cash is not residual; it is the starting point that supports the slow build-up of digital payment systems (Demirgüç-Kunt et al., 2022).

7. DISCUSSION AND INTERPRETATION

The evidence from the case studies and data sources provides a mixed but coherent picture of cash in the digital age. In times of crisis, its role becomes visible. When markets falter, people choose a tangible store of value. Germany's cash circulation increased by more than ten billion euros

within weeks during March 2020, and even Sweden's low-cash system saw withdrawals rise at the start of the pandemic (Deutsche Bundesbank, 2020; Sveriges Riksbank, 2023). This supports the hypothesis that cash acts as a stabilising instrument when institutional trust is under pressure. At the same time, the long-term trend shows declining everyday use even under moderate stress, hinting that cash is moving from daily transactions toward being a reserve instrument.

Inclusion tells a different story. In Tanzania and other parts of sub-Saharan Africa, cash is still the main bridge into the financial system. With 45 % of adults using mobile accounts but everyday trade relying heavily on physical money, the data underline that cash provides access where infrastructure is weak (World Bank, 2022; Demirgüç-Kunt et al., 2022). Yet the counterpoint is visible as well: in Kenya and Southeast Asia, mobile networks are beginning to deliver services cash cannot match, turning physical currency into a transitional tool rather than a permanent solution.

Privacy emerges as a consistent driver. In Germany, 63 % of respondents name it as the main reason for using cash (Deutsche Bundesbank, 2023b). Notes and coins do not log behaviour or create data trails, making them an instrument of personal autonomy in a monitored payment environment. Digital systems are starting to integrate privacy-enhancing technologies, which could reduce this advantage if users trust the institutions behind them.

CBDC pilots in Sweden and China add another layer. Both central banks explicitly identify cash as a counterweight to digital currencies, necessary to preserve balance and avoid over-centralisation (People's Bank of China, 2023; Sveriges Riksbank, 2023). This supports the view that physical money provides a decentralising function inside a centralised architecture. At the same time, some CBDC designs include offline and anonymised transactions, suggesting that if such models scale successfully, the

regulatory role of cash could shrink over time.

Trust links these findings together. Rapid reductions in cash availability correlate with lower confidence in financial institutions among certain groups (OECD, 2020). Germany's surveys reinforce this link, while Sweden's experience shows that trust can also persist without cash under specific institutional conditions (Deutsche Bundesbank, 2023a). This tension suggests that cash is not the sole carrier of confidence but remains one of its strongest signals.

Taken as a whole, the discussion shows cash changing function rather than disappearing. In crises, it acts as a fallback (Keynes, 1936). In weak infrastructure, it provides inclusion. For individuals, it protects privacy. Within CBDC regimes, it balances power. Across systems, it supports trust. The debate is less about volume and more about guarantees. Cash shifts from being primarily a means of payment to becoming part of the architecture that underpins monetary stability and social autonomy.

8. REGULATORY DIMENSION

The rise of digital currencies changes the nature of monetary authority. Central banks are no longer only printers of notes; they are architects of networks and custodians of data. In this environment, cash takes on a new role. It is not just a means of payment but a counterweight inside the regulatory framework. Its physical form limits total centralisation and preserves access beyond digital rails. In Germany, this view shapes policy: the Bundesbank repeatedly defines cash as a public asset, vital for trust and universal access to money (European Central Bank, 2011; Deutsche Bundesbank, 2023a). Sweden offers a sharper contrast. Here, the rapid fall of cash use to below ten percent of daily payments triggered a policy debate. The Riksbank stepped in, not to speed up the shift but to slow it. Cash was declared part of national emergency preparedness, alongside power grids and communication systems. The argument was simple: a fully digital

payment network without a physical fallback lacks resilience (Moch, 2024).

International bodies add another perspective. The OECD frames cash as an element of competition policy, ensuring that no single payment network monopolises access. The BIS describes it as redundancy built into the monetary architecture, a safeguard against technical failure and systemic shocks (OECD, 2020; Bank for International Settlements, 2023). These institutional voices show that the debate is not about nostalgia but about system design.

Central Bank Digital Currencies: Opportunities and Risks

CBDCs are often presented as the next step in monetary evolution. Moch (2024) outlines their promise in three words: efficiency, inclusion, control. Digital currencies issued by central banks can cut settlement times, lower costs and offer direct access to households outside the banking system. In China, the e-CNY pilot demonstrates how a CBDC can extend central bank reach in a highly digitalised market.

The same innovation carries weight. A fully digital currency centralises oversight and turns payment data into a single point of control. Without strong privacy protections, CBDCs risk becoming tools of surveillance (European Central Bank, 2011). Sweden's e-Krona debate and the U.S. discussions on a digital dollar underline that public trust hinges on two guarantees: anonymity and the continued presence of cash (Moch, 2024).

Design offers a path between these poles. Offline payments, limited traceability and technical safeguards can bring digital money closer to the autonomy cash provides. Yet, as Moch (2024) notes, technology is not enough. It requires governance frameworks and institutions capable of earning trust over time. Until that is achieved, physical currency remains the clearest guarantee of independence inside the system.

What emerges is not a choice but a balance. Cash anchors decentralisation and privacy; CBDCs bring speed and new policy tools. A robust monetary architecture will need both.

The challenge for regulators is to design their coexistence deliberately instead of letting one erase the other.

CONCLUSION, LIMITATIONS AND OUTLOOK

The findings of this study draw a clear line through the role of cash in the digital age. In times of crisis, it resurfaces as a stabiliser. March 2020 in Germany and the parallel movements in Sweden confirmed H1: when trust in systems weakens, people fall back on physical money (Deutsche Bundesbank, 2020; Sveriges Riksbank, 2023). The effect is not marginal; it shows cash as a systemic safety valve.

Financial inclusion tells another story. H2 stands strongest where infrastructure is weakest. In Tanzania and similar economies, cash remains the first bridge into formal finance. It is not a cultural remnant but a functional necessity (Demirgüç-Kunt et al., 2022; World Bank, 2022). Yet the counterpoint is visible: mobile networks are closing the gap, hinting that cash's role may shift from long-term solution to transitional instrument.

Privacy anchors the social dimension. H3 finds direct support in the German data: 63 % choose cash for its ability to protect identity and autonomy (Deutsche Bundesbank, 2023b). In a digital environment built on traceability, this is not nostalgia but a conscious act of self-limitation against exposure. At the same time, advances in privacy-preserving digital systems raise the question of whether this advantage can be replicated in code.

CBDCs sharpen the regulatory focus. H4 underlines cash as a counterweight inside a centralised architecture. Both Sweden's e-Krona debates and China's e-CNY pilot confirm that coexistence, not replacement, preserves trust (Moch, 2024; People's Bank of China, 2023). The risk is structural: a purely digital currency without physical balance creates a single point of power over value transfer.

Trust ties these threads together. H5 points to a deeper layer of the monetary system:

confidence is not only about balance sheets, it is also about signals. The presence of cash communicates stability. Its abrupt absence, as OECD data suggest, can fragment public confidence, especially among excluded groups (OECD, 2020).

Limitations

The study captures only part of the monetary reality. It draws on official statistics and structured case studies, but large sections of informal cash economies remain outside the data. In many countries, these hidden flows make up a substantial share of transactions. Rapid changes in digital infrastructure, especially in emerging markets, outpace the time series used here and create blind spots in the analysis. All CBDC projects are still in pilot stage. Any statement about their long-term impact is necessarily preliminary and subject to revision once live systems operate at scale. The behavioural drivers of cash use are taken mainly from surveys. They reveal strong trends, yet they are tied to specific cultural and institutional settings. Without deeper qualitative work across multiple contexts, they cannot be assumed to represent universal motives.

Outlook

The trajectory is not binary. Cash is not vanishing; it is changing function. Its weight moves from everyday transactions to systemic guarantees. CBDCs bring efficiency, speed and new policy tools, but their design will determine whether they complement or undermine autonomy. Future research should focus on hybrid architectures, where physical and digital money operate as parts of a single system designed for resilience and inclusion.

The conclusion is less about preference and more about structure: cash and CBDCs are not adversaries but counterweights. Their coexistence may define the stability of money in the decades ahead (European Central Bank, 2011).

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Enrico Moch holds a doctorate in economics and teaches as a lecturer at various universities, including the DHBW Ravensburg and as an assistant professor at the IIC University of Technology. As Academic Director of the GrandEdu Research School in Germany, he combines academic excellence with practice-orientated teaching. His research interests include the Austrian School of Economics, AI governance, technical data protection and the institutional governance of digital platforms. Dr Moch publishes regularly in specialist journals, is involved in interdisciplinary book projects and runs the podcast "GrandEdu Research School - Der Wirtschaft auf der Spur!".

He is also actively involved in academic peer review and is committed to the transfer of knowledge between research and practice in order to provide long-term support for current economic and social issues.

Declaration By Author

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