SPEECH

Preparing the future of payments and money: the role of research and innovation

Keynote speech by Piero Cipollone, Member of the Executive Board of the ECB, at the conference "The future of payments: CBDC, digital assets and digital capital markets", hosted by Bocconi University, the Centre for Economic Policy Research and the European Central Bank

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In this age of accelerated change, digitalisation is redrawing the map of finance and payments. It's imperative to make sure this transformation translates into genuine innovations that improve people's lives and the efficiency of our economies, while preserving financial stability. In that respect, dialogue between research and policy is not just a nice to have – it is a necessity.

Today, I want to pay tribute to the large body of research that we rely on in our quest to answer the enduring question for central banks: how can we adapt our money in the face of change, while preserving the smooth functioning of payment systems, the effectiveness of monetary policy, and financial stability?

This quest lies at the core of our mandate as a central bank. One of our fundamental tasks is to issue money. In the retail space, central bank money takes the form of cash that people can use for everyday payments. For transactions between financial institutions, central bank money is the ultimate risk-free settlement asset, a key pillar of our financial system. So, we have a duty to ensure it remains fit for purpose, even as preferences and technologies evolve.

To fulfil our mandate, we need state-of-the-art research: not just in economics and finance, but also user, market and technological research. This will be key in unlocking the economic benefits of efficient and resilient means of payment, both today and in the future.

In my role at the ECB, I ask myself the same questions day after day. How are digitalisation and new technologies reshaping the payments landscape? And what does this mean for our role in issuing money and overseeing payments systems? This is where research comes in: it allows us to be forward-looking in a structured way. We cannot remain stuck in the past, nor can we afford to act on instinct. Not when the foundations of our monetary system – trust, stability and sovereignty – are at stake.

With all this in mind, we must set a clear course of action and embrace our responsibility as central bankers to help shape the future of payments in the public interest.

The ECB has already taken important steps along this path, together with the euro area national central banks. We have modernised our oversight framework to keep up with the rapid transformation of the payments market.[1] We are working to enable settlement of distributed ledger technology (DLT)

transactions in central bank money in the course of next year.[2] And we are getting ready to issue a digital form of cash for day-to-day transactions – a digital euro.

In the process, we have been working closely with market stakeholders.

For instance, 60 industry participants were involved in testing real and mock transactions to explore possible ways of making private DLT platforms interoperable with the Eurosystem's market infrastructures. This testing covered a wide range of securities and payments use cases, including the first issuance of a digital bond by an EU sovereign using DLT. This has paved the way for two projects we launched earlier this year, both of which have immediate potential to create an efficient and integrated European market for digital assets. Project Pontes will link market DLT platforms and TARGET Services to enable settlement of DLT-based transactions in central bank money, starting in a year's time. Project Appia will explore a more integrated, long-term solution, for instance in the form of a shared ledger integrating central bank money, commercial bank money and other assets, or through a network of interoperable platforms that reduces market frictions and fosters innovation.

Turning to the digital euro, in October 2024 we established an innovation platform to experiment together with market stakeholders. This morning, we published the initial results of this work.[3] These partnerships with close to 70 participants – including merchants, banks, fintech companies and researchers – demonstrate that central bank money itself can support innovation by enabling new applications, fostering market growth and ultimately simplifying everyday payments and processes for people and businesses. The success of this initiative encourages us to continue on this path.

Building on the valuable insights gained from the first round of experimentation, we continue to engage with market participants to refine and expand the scope of these activities. Their feedback will help us shape the next round of the innovation platform, with concrete activities likely to be announced in early 2026. We hope to again elicit strong interest from stakeholders in order to maximise the potential for innovative ideas.

Let me now explain how we have been using research in these modernisation efforts. I will cover three main topics, focusing mainly on retail payments, as I have discussed our vision for innovation in wholesale payments on other occasions[4].

First, I will discuss how research guides us as we adjust to technological changes, showing us how central bank money has continuously evolved to bring innovation while anchoring stability.

Second, I will talk about how research informs our understanding of the way digitalisation is transforming not just the role of public and private money, but also the structure of retail payment markets.

And finally, I will discuss how research helps us to look ahead, anticipate risks and seize opportunities as we shape the future of central bank money.

Central bank money: stability and innovation throughout history

One of the ECB's most critical challenges is to conceive and design the future of central bank money, especially for day-to-day payments, where it currently only exists in the form of physical cash.[5]

For centuries, society has entrusted central banks with providing cash: a safe and stable medium of exchange which reassures us that our money will always function properly.[6] If we didn't have euro cash, would we be as confident that the euro would retain its role as a unit of account, and that our money would keep its nominal value at all times? Cash underpins our trust in money and our monetary sovereignty.

Throughout centuries of societal transformation, central bank money has remained deeply embedded in the fabric of people's daily lives, evolving alongside technology. And since the launch of the euro, we have all been able to rely on euro cash for day-to-day payments, safe in the knowledge that we can always pay privately and securely, anywhere in the euro area. These characteristics are the bedrock of our trust in public money – and also in other forms of money, because those can always be converted into cash.

However, the use of cash in daily transactions continues to decline, challenging the central role of cash as we know it: in the form of banknotes and coins.[7] Because it is not available in digital form, central bank money risks becoming marginalised as a mean of payment, thereby shifting the balance between public and private money, which has served us well until now.

In recent years, central banks around the world – including the ECB – have been reflecting on how to adapt the means of payment they offer as technologies and preferences change. Most notably, they have been exploring the possibility of issuing a digital equivalent to physical cash.[8]

Economic research reminds us that this effort is far from unprecedented. Throughout history, central banks have repeatedly stepped up to face disruption, adapting and innovating so that they can continue to provide a solid foundation for our financial systems, starting with money itself.

A striking example comes from the United States during the free banking era[9] in the 19th century, when the lack of a common monetary anchor eroded trust in the convertibility of the various forms of money in circulation at the time. This was not an isolated instance – in fact history offers many similar lessons. Many episodes of free banking and competing currencies ultimately gave way to a public monopoly on issuing banknotes[10] that, when delegated to central banks with sound institutional foundations, resulted in more stable financial systems.[11] Adjustment costs were gradual, so commercial banks continued lending with no significant signs of disintermediation. This was no accident – it reflected careful policy design to ensure a smooth adjustment process, yielding long-lasting gains for all stakeholders.

If we were to extract one single lesson from this large body of economic research, it would be this: as technology and preferences evolve, we must keep central bank money fit for purpose and ensure it remains at the heart of the payments system, in order to avoid monetary instability and preserve the singleness of money.

This is a key reason for preparing to issue a digital euro: providing a digital equivalent to cash would preserve the role of central bank money as a retail means of payment in the face of societal and

technological changes. However, this is a delicate task, as it is crucial to maintain a healthy balance between central bank money and commercial bank money. This principle has inspired the design of the digital euro from the very beginning.[12]

Retail payments in the digital age

To preserve this healthy balance, payments systems should remain flexible in their design[13], meaning they should be structurally open and capable of adapting to new practices and technologies.

The central bank's role therefore involves supporting an open, competitive market where private actors drive efficiency and innovation without creating instability – benefiting consumers and businesses alike. While setting competition policy is not the responsibility of the central bank, we are mandated to ensure the efficiency and soundness of payment systems, so we must be alert to retail payments market dynamics.[14]

Looking at Europe's retail payments market, there is cause for concern.

Most European retail payment solutions remain national, covering only a few use cases and lacking pan-European reach. This is a case in point of the situation described in the Draghi report[15]: because European solutions remain fragmented, they do not generate the scale, scope and network effects that are necessary to be competitive at European – let alone global – level. This results in duplication of investment and smaller markets that hamper innovation by not fulfilling their potential on both the supply and demand sides. The ramifications are clear: today Europeans rely on a handful of mostly non-European providers for their daily digital transactions – undermining competition, limiting choice and slowing innovation, often in ways that go against both the public interest and fair competition.[16]

The scholarly works of Baxter[17] and of Rochet and Tirole[18] show why payment markets tend to concentrate. Payments markets are two-sided: consumers prefer payment solutions that are widely accepted by merchants, and merchants prefer the solutions that are widely adopted by consumers. This means that the success of a payment solution relies on strong network effects and powerful feedback loops, which tend to concentrate markets and create "winner-takes-most" dynamics.

The digitalisation of payments – from cards[19] to apps[20] and beyond[21] – is intensifying these forces. And new risks are emerging as large tech platforms can leverage their wide customer base and bundle payment services with the other products and services they offer. This raises further barriers to entry for smaller European competitors, increases fees for merchants and traps unaware consumers in walled gardens.[22] If left unchecked, these forces could not only shape how we pay[23] but also change the nature of finance and society as we know it.[24]

Moreover, new instruments bring new risks, along with new opportunities. Stablecoins issued by non-European firms could create additional dependencies. And stablecoins denominated in foreign currencies could create currency substitution risks.[25] Stablecoins are growing and their role in the financial system

has expanded from supporting crypto-asset transactions[26] to facilitating cross-border payments. This can be a springboard for stablecoins to compete in domestic payments by partnering with dominant global payment networks.[27]

Stablecoins are a technological novelty that promises to make payments faster or cheaper. However, as highlighted in several papers presented at this conference, they could also pose real risks to financial stability and banking intermediation.[28] Runs on stablecoins could trigger fire sales, sudden deposit shifts and volatility in bank liquidity, amplifying funding pressures.[29]

These dynamics also have the potential to affect our monetary policy.[30] As these assets grow within the financial system, they could raise the cost of bank deposit funding, putting pressure on banks' capacity to extend credit – particularly in the euro area, where banks retain a key role in financing the economy. This, in turn, may disrupt monetary policy transmission, shift demand for central bank liquidity and complicate the ECB's management of short-term interest rates. These challenges are further amplified by the fact that currently 99% of stablecoins are denominated in US dollars.

Shaping the future of payments

The good news is that public authorities are not powerless in the face of these challenges.

Regulation and enforcement are powerful instruments.[31] They help shape markets, set boundaries and reduce risk of abuse.

Yet regulation alone cannot generate the necessary scale, scope and network effects that are key to credible competition, which would make the payments market genuinely contestable.[32] And even the best-crafted regulation will face its limits if the underlying market structure remains skewed[33] and evolves faster than regulators can react.

In other words, while rules can shape behaviour, rules alone cannot establish a truly level playing field or effectively challenge oligopolistic dynamics in such a market.

For decades, cash was a powerful "outside option" – a simple, reliable fallback that preserved choice and kept markets competitive. However, as cash use declines and digital payments rise, this safeguard weakens.

The digital euro would change this by making central bank money available for digital payments, preserving that crucial pillar of freedom to choose an outside option.[34]

But it goes beyond that.

Guided by academic insights[35] and leveraging the legal tender status[36] of central bank money, we have designed the digital euro to allow payment service providers to compete across the euro area. The digital euro would provide open standards that European market players could use to offer payment services on a pan-European level.

With the digital euro rulebook and Eurosystem infrastructure, private providers could scale their payment solutions across Europe at lower costs. In other words, the key to success would be innovative services rather than network size. Without the digital euro, European solutions might not succeed on their own in competing throughout the euro area and across use cases against the solutions that currently dominate the market.

The report we publish today shows that in the private sector there is strong appetite for developing such innovative services using the unique features of the digital euro platform, and there are actors ready to deliver such services.

One of the development avenues we have looked at involves transactions that can be triggered along many more dimensions than is currently the case, considerably expanding payments options for users. At the risk of oversimplifying, we are no longer thinking of payments as just a transfer of money between payer and payee, but as a richer set of instructions that includes information on when the payment will be processed. This makes conditional payments – such as pay-on-delivery– possible. The digital euro's reservation of funds feature makes it possible to release funds only once certain conditions set by users are met, strengthening trust and customer protection. Market participants highlighted how the digital euro would also facilitate services such as encrypted e-receipts, which would only be accessible to the payer and the seller, help them with returns and warranties, and contribute to reducing paper waste. And market participants' ideas do not stop there: the digital euro would enable user-friendly features such as voice-controlled transactions or conversational artificial intelligence agents. And it would make it possible to automate business-to-business payment flows, helping to speed up payments, reduce paperwork and cut costs.

Furthermore, we are designing the digital euro back-end platform to accommodate the most advanced privacy-enhancing techniques and to include future ones as soon as they are ready to be deployed in large-scale payment systems. This will keep the digital euro at the technological frontier in terms of privacy protection. And we will play an active part in pushing that frontier forwards. We will work closely with universities and experts to continue exploring practical research on new privacy-enhancing techniques, aiming to evaluate their potential use in digital euro payments.

The findings of the digital euro innovation platform demonstrate that innovation in the retail space does not depend only on stablecoins – it can flourish using central bank money. In fact, the digital euro would reduce the risk that stablecoins pose to banks. With the digital euro allowing banks to offer consumers access to convenient, widely accepted and innovative payment services, consumer and merchants would have fewer incentives to turn elsewhere.

Conclusion

The questions that central bankers are facing today are not fundamentally new – they always revolve around stability and trust – but the context is changing rapidly. Digitalisation is transforming the payments landscape and its future.

Historian and philosopher of science Thomas Kuhn once observed that Newton's three laws of motion had been "less a product of novel experiments than of the attempt to reinterpret well-known observations".[37]

As technologies and preferences change, central banks are reinterpreting their role in issuing central bank money. And this transformation is accompanied by a change of paradigms on the research side. Many of you in this room, including the pioneers and visionaries that have participated in digital euro innovation partnerships, are at the forefront of this new field of research.

These insights are already helping us as we seek to ensure that the new world of payments will not benefit the few but the many, and that people and firms retain trust in money.

Thank you for your attention.

1.

Our oversight requirements are set out in the SIPS Regulation (Regulation (EU) 2025/1355 of the European Central Bank of 2 July 2025 on oversight requirements for systemically important payment systems (ECB/2025/22)), the PISA framework (Eurosystem oversight framework for electronic payment instruments, schemes and arrangements), and the CROE (Cyber resilience oversight expectations for financial market infrastructures), which is part of the Eurosystem's broader cyber resilience strategy).

2.

See ECB (2025), "ECB commits to distributed ledger technology settlement plans with dual-track strategy", *press release*, 1 July.

3.

ECB (2025), *Digital euro innovation platform – Outcome report: pioneers and visionaries workstreams*, September.

4.

See, for instance, Cipollone, P. (2024), "Towards a digital capital markets union", keynote speech at the Bundesbank Symposium on the Future of Payments, 7 October.

5.

Cipollone, P. (2025), "Shifting payment landscape: what a digital euro will bring", speech at Banka Slovenije, Ljubljana, 10 July.

6.

Tommaso Padoa-Schioppa identified two key shifts behind the establishment of central banks: replacing commodity money with paper money, and substituting bank deposits for physical currency. These two developments, along with the central bank's unique power to issue its own liabilities, put central banks at

the centre of the entire network of payment systems in the economy. See Padoa-Schioppa, T. (2004), *The Euro and Its Central Bank: Getting United After the Union*, MIT Press, Cambridge.

7.

Between 2019 and 2024 the share of cash used at physical point of sale locations fell from 72% to 52% in terms of volume, and from 47% to 39% in terms of value. See ECB (2024), *Study on the payment attitudes of consumers in the euro area (SPACE)*, December.

8.

Numerous central banks worldwide are actively exploring retail central bank digital currency (CBDC) projects. See Di Iorio, A., Kosse, A. and Mattei, I. (2024), "Embracing diversity, advancing together - results of the 2023 BIS survey on central bank digital currencies and crypto", *BIS Papers*, No 147, June. See also Auer, R., Cornelli, G. and Frost, J. (2023), "Rise of the Central Bank Digital Currencies", *International Journal of Central Banking*", October, pp. 185-214.

9.

The free banking era was an 80-year period of turbulence characterised by fragmented, state-issued banknotes, widespread counterfeiting and persistent financial instability. See Eichengreen, B. (2019), "From commodity to fiat and now to crypto: what does history tell us?", *NBER Working Paper Series*, No 25426, January; Rolnick, A.J. and Weber, W.E. (1983), "New evidence on the free banking era", *American Economic Review*, Vol. 73, No 5, pp. 1080-1091. For more about state banknotes, see Rockoff, H. (1974), "The Free Banking Era: A Reexamination", *Journal of Money, Credit and Banking,* Vol. 6, No 2, May, pp. 141-167.

10.

For an analysis of the case of England, see Presnell, L.S. (1956), *Country Banking in the Industrial Revolution*, Oxford University Press, Oxford. For an analysis of the case of Switzerland, see Baltensperger, E. and Kugler, P. (2017), *Swiss Monetary History since the Early 19th Century (Studies in Macroeconomic History)*, Cambridge University Press, Cambridge. One notable exception to this trend was Scotland in the 18th and early 19th century. See Bordo, M. (2021), "Central bank digital currency in historical perspective: another crossroad in monetary history", *NBER Working Paper Series*, No 29171, August.

11.

For an analysis of the case of Sweden, see Grodecka-Messi, A. and Zhang, X. (2025), "Central Bank Liquidity Support, Bank Lending, and the End of Currency Competition", *Sveriges Riksbank Working Paper Series*, No 454, August. For an analysis of the case of Canada, see Grodecka-Messi, A. and Zhang,

X. (2023), "Private bank money vs central bank money: A historical lesson for CBDC introduction", *Journal of Economic Dynamics and Control*, Vol. 154, September. See also Xu, C. and Yang, H. (2024), "Real effects of supplying safe private money", *Journal of Financial Economics*, Vol. 157, July.

12.

In the case of a digital euro, the combination of no remuneration, a holding limit and a waterfall system with commercial bank accounts would avoid the risk of destabilising outflows of deposits from banks. To calibrate the digital euro holding limits, the ECB has been developing a methodology that focuses on balancing user-friendly payments with monetary policy and financial stability considerations. The methodology involves a deep assessment of how holding limits might impact the broader economy, including effects on bank liquidity, reserves and the overall transmission of monetary policy. See ECB (2024), *Preliminary methodology for calibrating holding limits*, 10 December.

13.

Padoa-Schioppa, T. (2004), "Shaping the payment system: a central bank's role", speech delivered at the Bank of Korea's Conference on Payment Systems, Seoul, 13 May.

14.

This is also reflected in the Article 22 of the Statute of the European System of Central Banks and of the European Central Bank, which tasks the ECB with promoting the efficiency and soundness of clearing and payment systems. Moreover, according to Article 127(1) of the Treaty on the Functioning of the European Union, the ECB must act in accordance with the principle of an open market economy with free competition, favouring an efficient allocation of resources.

15.

See Draghi, M. (2024), "The Draghi report: A competitiveness strategy for Europe.

16.

Cipollone, P. (2024), "Innovation, integration and independence: taking the Single Euro Payments Area to the next level", speech at the ECB conference on "An innovative and integrated European retail payments market", Frankfurt, 24 April.

17.

Baxter, William F. (1983), "Bank interchange of transactional paper: Legal and economic perspectives", *Journal of Law and Economics*, Vol. 26, No 3, October, pp. 541-588.

18.

See: Rochet, J.C. and Tirole, J. (2002), "Cooperation Among Competitors: Some Economics of Payment Card Associations," *Rand Journal of Economics*, Vol. 33, No 4, pp. 549-570; Rochet, J.C. and Tirole, J.

(2003), “Platform Competition in Two-Sided Markets,” *Journal of European Economic Association*, Vol. 1, No 4, pp. 990-1029; Rochet, J.C. and Tirole, J. (2006), “Two-Sided Markets: A Progress Report,” *Rand Journal of Economics*, Vol. 37, No 3, pp. 645-667.

19.

Two-thirds of card-based transactions in the euro area are processed by international schemes. Some 13 euro area countries are entirely dependent on non-European systems for payments. In the United States, three networks process about 85% of transactions. See: Wang, L. (2025), “Regulating Competing Payment Networks”, *Kilts Center at Chicago Booth Marketing Data Center Paper*.

20.

For example, Apple’s dominance in mobile devices and its control over mobile wallets on iOS has raised antitrust concerns, prompting a formal investigation by the European Commission. See: European Commission (2024), “Antitrust: Commission seeks feedback on commitments offered by Apple over practices related to Apple Pay”, press release, 19 January.

21.

See BIS (2019), “Big techs in finance: opportunities and risks”, *Working Paper*, No 1129.

22.

See Cipollone, P. (2024), “Monetary sovereignty in the digital age: the case for a digital euro”, keynote speech at the Economics of Payments XIII Conference organised by the Oesterreichische Nationalbank, Vienna, 27 September.

23.

For instance, mobile payment services are becoming more intertwined with related markets such as e-commerce, social media, digital advertising and cloud services. While this integration offers certain advantages to consumers, it also has the potential to strengthen market dominance across these interconnected industries, raise barriers to entry and hinder future innovation. See OECD (2025), “Competition in mobile payment services”, *background material for Session 4 at the 146th meeting of the Competition Committee*.

24.

Tirole, J. (2023), “Competition and the Industrial Challenge for the Digital Age”, *Annual Review of Economics*, Vol. 15, pp. 573-605.

25.

See Bank for International Settlements (2025), “The next-generation monetary and financial system”, *BIS Annual Economic Report*, 24 June; Cipollone, P. (2025), “The quest for cheaper and faster cross-border

payments: regional and global solutions", speech at the BIS Annual General Meeting, 27 June; and Lagarde, C. (2025), "Cutting through the noise: exercising good judgment in a world of change", welcome address at the ninth annual conference of the ESRB, 3 September.

26.

Adachi, M., Da Silva, P., Born, A., Cappuccio, M. Czák-Ludwig, S., Gschossmann, I., Pellicani, A., Philipps, S. Plooij, M., Rossteuscher I. and Zeoli, P. (2022), "Stablecoins' Role in Crypto and Beyond: Functions, Risks and Policy", *ECB Macroprudential Bulletin*, July.

27.

In just over a year the number of actively used stablecoins rose from roughly 60 to more than 170, and global market capitalisation climbed from about USD 125 billion to roughly USD 255 billion – with some 90% of that value concentrated in two issuers and about 99% being US dollar-denominated. See: Aldasoro, I. et al. (2025), "Stablecoin growth – policy challenges and approaches", *BIS Bulletin*, No 108.

28.

William, C. and Phelan G. (2025), "Digital currency and banking-sector stability", *Journal of Financial Stability*, Vol. 78, June.

29.

See Azar, P. et al. (2024), "The Financial Stability Implications of Digital Assets", *Economic Policy Review,* Vol. 30, No 2, Federal Reserve Bank of New York, November; Charles-Emmanuel, C. (2025), "Toss a stablecoin to your banker", *Occasional Paper Series*, No 353, ECB; and Bains, P. et al. (2022), "Regulating the Crypto Ecosystem: The Case of Stablecoins and Arrangements", *Fintech Note*, IMF, September.

30.

For a full discussion on this aspect, see: Lane, P. (2025), "The digital euro: maintaining the autonomy of the monetary system", keynote speech at University College Cork Economics Society Conference 2025, 20 March.

31.

In Europe, the intervention of EU regulators – e.g. through the Interchange Fees Regulation – was necessary to reduce the risk that dominant players set excessive fees. For examples outside the EU, see Payment System Regulator (2025), "MR22/1.10 Market review of card scheme and processing fees: final report", and U.S. Department of Justice (2024), "Justice Department Sues Visa for Monopolizing Debit Markets, press release.

32.

See European Court of Auditors, (2025), "Digital payments in the EU – Progress towards making them safer, faster, and less expensive, despite remaining gaps", *special report*, 01/2025.

33.

The UK Payment Systems Regulator concluded that standard competition remedies are unlikely to address weak competition in UK card scheme and processing markets. In particular, it found that Mastercard and Visa are in a stronger position than alternative providers because acquirers would face substantial costs, challenges and complexity to implement substitutes, and acquirers and merchants have limited ability to steer consumers toward alternative payment methods. See UK Payment Systems Regulator (2025), "MR22/1.10 Market review of card scheme and processing fees: final report".

34.

The draft Digital Euro Regulation guarantees free basic payment for consumers. It also introduces caps on merchant charges and mandates reporting and monitoring of payment costs of existing comparable means of payment to calibrate the appropriate cap.

35.

For a discussion on this, see: Usher, A., Reshidi, E., Rivadeneyra, F. and Hendry, S. (2021), "The Positive Case for a CBDC", *Staff Discussion Paper*, Bank of Canada, 20 July; and Liu, Y., Reshidi, E. and Rivadeneyra, F. (2023), "CBDC and Payment Platform Competition", Bank of Canada, 17 May.

36.

Cipollone, P. (2025), "The digital euro: legal tender in the digital age", introductory statement at the Committee on Economic and Monetary Affairs of the European Parliament, Brussels, 14 July.

37.

Kuhn, T. S. (1962), *The Structure of Scientific Revolutions*, University of Chicago Press.