Analysis

Developments in digital finance will reshape monetary policy implementation and central bank services

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Financial market infrastructure will be reshaped in the near future by financial market innovations, such as the increasing tokenisation of assets, and by the growing popularity of instant payment. At the same time, Eurosystem projects such as the digital euro and the distributed ledger technology (DLT) solution Pontes will improve the usability of central bank money in a digital world. For the steering of market interest rates to remain effective, central bank money must continue to be an anchor for the increasingly digitalised financial markets. In practice, this means having modern TARGET services that adapt to changing times, flexible monetary policy instruments, and a collateral framework that takes account of innovations.

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- Tokenisation, distributed ledger technology and the possible introduction of a digital euro will transform payment and financial markets. Central bank money must remain the secure foundation of the system.
- Around-the-clock payment and parallel systems are increasing the liquidity management challenges for banks. Longer TARGET operating hours and automation may ease these challenges.
- Monetary policy implementation and collateral practices must keep up with developments as technology advances, to ensure that interest rate steering remains effective. The Eurosystem's flexible refinancing operations will help in meeting the changing liquidity needs.



Payment, innovations and monetary policy implementation

The central bank plays a key role in payment, as central bank money is the only fully secure, liquid and risk-free asset. Generally speaking, every payment system benefits from the fact that the settlement of payments and securities transactions can be made directly in central bank money. The amount of central bank money can be increased or decreased flexibly, and its value is not determined by market forces either in normal or crisis conditions.

For consumers, digital payment – commonly based on payment cards – may already in its present form seem sufficiently efficient and simple. However, the extensive financial market infrastructure

behind payments can be made even more efficient with the introduction of new technologies.

For consumers, the most familiar forms of central bank money are banknotes and coins. In terms of the digital payment infrastructure, however, what matters are the euros that are held in the central bank accounts of commercial banks and which are not visible to consumers. These deposits are located in the TARGET system, which is maintained by the Eurosystem and in which the commercial banks are participants.

In the future, central bank money may also be in a new, digital form available to consumers if the digital euro being considered by the Eurosystem is introduced. A digital euro would complement current card payment solutions that are provided mainly by third-country payment service providers (third-country PSPs).[1]

Digitalisation has speeded up the payment process, and nowadays payments are frequently almost real-time. Various instant payment systems already enable retail payments around the clock every day of the year. Correspondingly, the execution of securities transactions in the financial markets, for example, has become faster and more efficient. The rapidly changing liquidity needs of the various payment systems have also increased the call for payments in central bank money to be settled around the clock. For the financial infrastructure, the key technologies are the distributed ledger technology (DLT) and tokenisation. These technologies have become more widely known particularly since the cryptocurrency boom started in the early 2010s. The digital transformation currently under way in the financial market involves the increasingly widespread use of these technologies. This does not mean an expansion of the markets in crypto-assets or changes in the central bank's attitude towards so-called native crypto-assets, but instead the increasing uptake of tokenisation, even in the case of traditional assets (e.g. bonds and shares).

In DLT, the various entities and service providers maintain a ledger and agree on its rules together. Tokenisation, in turn, is a process that involves creating digital versions of assets, including traditional assets, in the form of digital tokens on programmable platforms. Tokens are not simply database entries but can be linked with *smart contracts*, i.e. programmes that can perform specified tasks automatically, for example payment of interest. Together, DLT platforms and tokens can enhance the efficiency of payment and the operation of the financial markets more widely, as well as create new types of services. Tokenisation and its future role have been discussed in more detail in the Bank of Finland Bulletin article by Määttä and Snellman (in Finnish).

DLT systems will not replace traditional systems in the near term, but will be parallel to the existing digital infrastructure and centralised ledgers. The ECB has also clearly stated that a digital euro will not replace banknotes and coins, but will instead complement them by offering a digital form of cash.

Monetary policy implementation must keep up with technological advances

Monetary policy implementation means transmitting the ECB Governing Council's monetary policy decisions to the financial markets – normally by steering money market interest rates. The amount of money in circulation, payment processes and interest rate steering are closely interlinked, because commercial banks need central bank money, i.e. liquidity, for making payments – mainly for interbank payments. The central bank steers interest rates by adjusting the price of central bank money. In practice, this takes place via central bank refinancing operations or the standing facilities. A key part of these tools is collateral that banks are required to submit against all central bank refinancing operations. Another way for the central bank to create liquidity in the markets is to purchase securities on its own account. Demand for central bank money is determined not only by payment needs and liquidity buffers, but also by the requirement that banks must keep a certain proportion of their assets in an account at the central bank to fulfil the minimum reserve requirement.

Technological advances interact with monetary policy implementation in many ways. As central bank money will in future also be needed for, for example, DLT systems operating outside the TARGET system, this will affect the demand for central bank money, which in turn is a key factor in the determination of money market rates. A digital euro would also be a new form of central bank money that can have an impact on monetary policy implementation via changes in the demand for liquidity.

The technological transition may also have a direct impact on the operational framework for monetary policy implementation. A key question at present is how assets based on new technologies should be taken into account in the Eurosystem's collateral framework or how payments related to them can be settled in central bank money. In the short term, the Eurosystem's Pontes project will create a bridge between central bank money and tokenised assets. It will enable the linking of DLT systems to the TARGET system so that payments related to tokenised securities can be settled directly in central bank money.

Over the longer term, the Eurosystem's Appia project will explore an even more extensive change, i.e. the building blocks of a tokenised financial market infrastructure for Europe, and how the different functions of monetary policy implementation could in future be executed directly on a DLT infrastructure and be automated through the use of smart contracts.[2] An example of a concrete experiment is Project Pine, operated under the *Bank for International Settlements* (BIS), which explores the implementation of monetary policy using smart contracts in a DLT environment.[3] The role of central banks in a tokenised environment has been discussed by, for

example, ECB Executive Board Member Isabel Schnabel.[4]

The implementation of monetary policy in a way that takes account of innovation will ensure that the ECB Governing Council's monetary policy decisions are transmitted to the financial markets as intended. If the implementation framework does not keep up with the changes in the world, there is a risk that interest rate steering will weaken, or, alternatively, the introduction of beneficial technologies will be delayed. According to the Eurosystem's updated payments strategy published in March 2026, developing the infrastructure for tokenised assets is important, but central bank money must remain the monetary anchor.[5]

New digital technologies will also receive central bank liquidity from TARGET Services

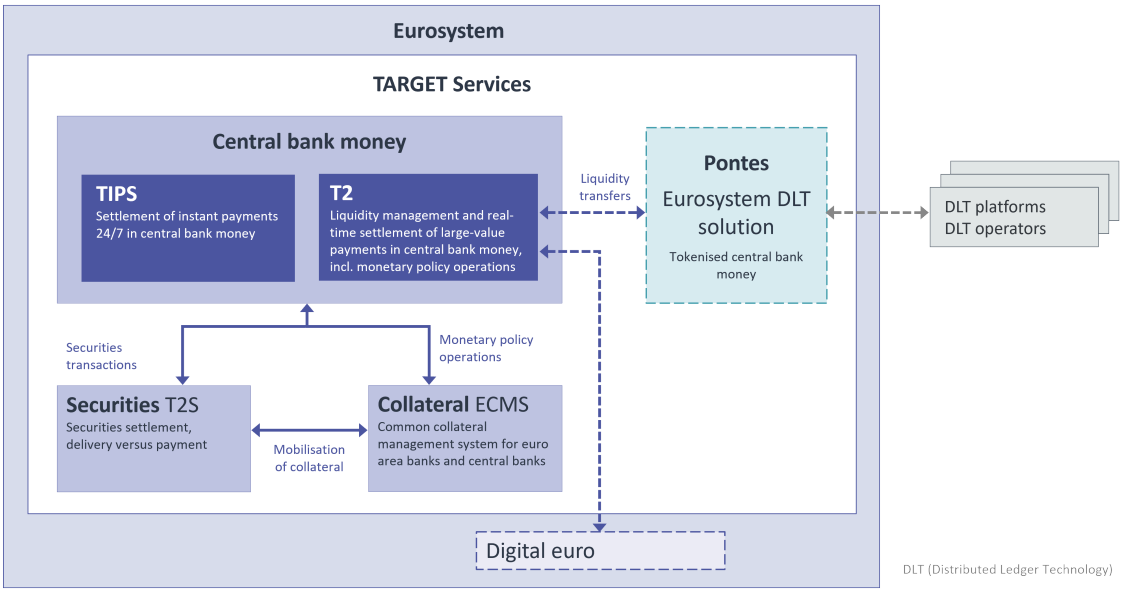
TARGET Services are the Eurosystem's key market infrastructure for payments, securities settlement and the settlement of refinancing operations, as well as for collateral management. The money in the TARGET system is central bank money. The TARGET Services enable the safe and efficient transfer of central bank money, securities and collateral in a financial system that covers the entire euro area. All payments connected with monetary policy implementation and all cash flows related to refinancing operations are settled in the TARGET Services.

TARGET Services consist of four components. T2 enables the settlement of large-value payments in risk-free central bank money; TIPS (*TARGET Instant Payment Settlement*) enables the settlement of instant payments around the clock, every day of the year; T2S is the common platform for securities settlement; and the ECMS (*Eurosystem Collateral Management System*), launched in June 2025, is responsible for the centralised management of collateral used in Eurosystem refinancing operations. Pontes became part of TARGET Services in September 2026.

A key role in the payment process is played by commercial banks which have accounts in the various TARGET Services. Commercial banks manage the flow of funds between the accounts for payment and settlement transactions during the day and overnight. They can also obtain credit from the central bank with various maturities against collateral, as well as intraday credit.

Chart 1.

TARGET Services are the source of central bank money



Source: Bank of Finland.

For new DLT-based market infrastructures, the key question is how transactions executed within them can be settled in central bank money. Third-party DLT platforms are separate from the TARGET infrastructure, so a mechanism is needed between the two to enable the use of central bank money in DLT-based settlement.

Pontes is a solution developed by the Eurosystem that links third-party DLT platforms to TARGET Services, enabling the settlement of DLT-based transactions in central bank money. The pilot version of Pontes went live in September 2026. More enhanced versions are planned to be launched in 2027–2028.

The digital euro would be a digital form of cash issued by the ECB and euro area central banks and available to everyone in the euro area. A digital euro settlement platform would enable the issuance, distribution and management of the digital euro. The settlement platform would be technically separate from the other TARGET Services, but it would utilise the diverse liquidity functionalities of the TARGET system. Central bank money accounts in digital euros would be financed and emptied in the same ways as TARGET Services accounts by transferring central bank money between TARGET Services and the digital euro settlement platform.

Central bank money must be allocated proactively to parallel systems

Commercial banks must manage their central bank liquidity so that it is always available in the TARGET Service in which it is needed: large-value interbank payments and money transfers related to central bank operations are settled in T2, whereas instant payments are settled in TIPS.

The Eurosystem is actively seeking to increase the effectiveness of liquidity management for all market participants. For example, in summer 2026, new automatically triggered, customer-configurable liquidity transfers were introduced in TIPS to support liquidity management. In addition, the Eurosystem simplified in June 2026 the remuneration treatment for assets exceeding the minimum reserve requirement. Funds in TARGET accounts of monetary policy counterparties now automatically earn the same interest rate as deposits with the central bank. This change eliminates the need for separate deposit transactions, and thereby reduces the challenges arising from liquidity fragmentation, as well as operational costs and risks.

The functionalities that automatise and improve the transfer of liquidity will improve liquidity management during the operating hours of T2, but in instant payment systems, in a future digital euro system, and in tokenisation-based systems, payments can take place around the clock, every day of the year. The key friction is that the full services related to payments in central bank money are available only on banking days and are closed at other times, for example at night and at weekends.

Outside the operating hours, additional central bank liquidity cannot be transferred to instant payment systems, and the amount of liquidity cannot be increased via central bank refinancing operations. In practice, this means that the need for central bank money must be anticipated and a sufficient amount of liquidity, including buffers, must be transferred to the instant payment system in advance. The challenges arising from the need to anticipate the demand for liquidity would be effectively reduced by an extension of TARGET operating hours, and the Eurosystem has now started to promote this (see box 'An extension of the operating hours of TARGET Services would decrease the fragmentation of liquidity').

ⓘ An extension of the operating hours of TARGET Services would

decrease the fragmentation of liquidity

Acceleration of the payment process and the transition towards it being round-the-clock 365 days a year was already changing the payment infrastructure before the wider adoption of DLT systems. The operating hours of T2 have been extended significantly since the early days of the euro, and the current operating hours are already quite extensive. Demand for 24/7 settlement is nevertheless increasing as the financial market's transaction and settlement cycles become shorter in the new systems linked to TARGET Services.

The Eurosystem is therefore currently examining the extension of T2 operating hours. The ECB explored through a market consultation the alternative approaches for extending the operating hours of T2. According to the outcome of the consultation, the main reason for desiring an extension to the operating hours is to improve liquidity management for instant payments.

As a result of the market consultation, a short settlement window for liquidity transfers, covering most weekends and TARGET closing days, will be introduced in T2 in the near future. This window will enable commercial banks to transfer liquidity to, for example, their TIPS accounts (enabling the aforementioned automation of liquidity management). This will facilitate the allocation of total liquidity over the weekend, but it still does not resolve the question of borrowing new liquidity. The Eurosystem collateral management system (ECMS) and the central securities depositories' own systems are closed during the weekends, so new central bank credit cannot be obtained in such a window.

The Eurosystem is examining the possibility of extending the operating hours of TARGET Services towards a 24/7 model. This would be a significant change to the current situation and would require substantial system-level changes for central banks and the markets. Market participants therefore favour a gradual extension of the opening hours. Limiting the opening hours of the service has benefits also for system version management, technical maintenance and management of operational risks, among other things.

The need for advance financing and liquidity buffers would decrease if commercial banks could also submit new collateral to the central bank around the clock and obtain central bank credit against it. The focus of preparedness would then shift from anticipating liquidity needs to maintaining sufficient collateral.

Eurosystem's monetary policy implementation framework is flexible in terms of new liquidity needs

As liquidity needs grow and the number of systems using liquidity increases, market participants will have to maintain liquidity in various systems simultaneously. As the surpluses and deficits in the various systems cannot be balanced at all times and future payment flows cannot be fully anticipated, there is an increasing risk of liquidity fragmentation. As a result of this fragmentation, market participants would have to increase the size of their total central bank money buffers because securities cannot be converted into money around the clock for instant payments.

A digital euro may also increase the demand for central bank money. However, the impact of a digital euro on the banking system's liquidity depends on how extensive the use of the digital euro would be and which payment instruments it would replace. If, for example, consumers were to convert bank deposits into digital euros, this would decrease the central bank deposits held by commercial banks. A digital euro would then have the effect of reducing the amount of liquidity in the banking system. To the extent that the use of a digital euro would replace the use of banknotes, only the composition of the liabilities in the Eurosystem's balance sheet would change, from banknotes to digital euros, so this would not have a direct impact on the implementation of the ECB's monetary policy. The impacts of a central bank digital currency on monetary policy implementation have been discussed by, for example, Caccia, Tapking and Vlassopoulos.[6]

In the ECB's demand-driven monetary policy implementation framework, commercial banks can flexibly obtain central bank money through central bank refinancing operations, against collateral. Therefore, a possible increase in the demand for central bank money, whether as a result of a digital euro or a growth in the number of DLT systems, would not automatically cause upward pressure on market interest rates or require changes to the monetary policy implementation framework. On the other hand, if the demand for central bank money grows in the long term, it means that the Eurosystem's refinancing operations or securities holdings will increase correspondingly.[7] If there were too great shift from bank deposits to digital euros, for instance in a financial crisis, this will be curbed by setting an upper limit on digital euro holdings. In addition, the plan would not be to remunerate digital euro holdings, which also distinguishes them from bank deposits.

Currently, neither the accumulation of interest nor the calculation regarding fulfilment of the minimum reserve requirement takes into account balance changes during weekends caused by instant payments. The calculation regarding fulfilment of the minimum reserve requirement is based on the central bank deposit balance on Friday, and, when the Monday TARGET business day starts, the deposit facility interest for the entire weekend (3 days) is paid immediately on the

Friday. So far, changes in the balances have not been significant in terms of the overall situation, but, as the volume of payments increases, they may have an impact on the demand for central bank money and on the money market. Growth in payment volumes outside the current opening hours may also create demand for money market trading during new time windows, such as weekends. The Eurosystem is closely monitoring these developments.

The long-term impact of new technologies on the aggregate demand for central bank money is impossible to predict accurately for many reasons. Firstly, the increasing use of new technologies involves many uncertainties. Secondly, their impact may be different during the transition period and in a 'ready tokenised' world. During the transition period, liquidity may be fragmented among various systems and the amount of liquidity needed may be larger, but in a tokenised world, settlement can be immediate and centralised in one system, in which case the required liquidity buffers may be smaller than at present.

In addition to the total amount of liquidity, technological solutions may also have an impact on how often and how suddenly commercial banks need central bank credit as liquidity needs change rapidly and possibly on an intraday basis. A demand-driven monetary policy implementation framework in which commercial banks can apply through intraday credit operations, the marginal lending facility or one-week main refinancing operations, against adequate eligible collateral, for as much central bank financing as they need, will be very flexible, for example if banks have unexpected needs for central bank money. Even though the existing monetary policy implementation framework is already quite flexible, this does not preclude consideration of even more flexible instruments for providing central bank money as the payment and securities settlement cycles become faster.

Wider adoption of DLT systems will be significant for monetary policy implementation even if no central bank money is involved

As DLT systems become more common, their significance for monetary policy implementation will not be limited only to DLT systems operating with central bank money. Ultimately, all systems that are used for payment, saving and financing, and thus for the determination of interest rates in society, are material to monetary policy implementation. As the volume of transactions in DLT-based systems increases, the importance of these systems for monetary policy will grow.

For the implementation of monetary policy, it is important that the ECB's policy rates are transmitted equally in the financial markets, both between traditional and DLT-based systems. It is therefore important that technological solutions and, for example, market regulation enable

efficient markets between the various systems. The central bank must therefore continuously assess whether the reference markets and benchmark rates remain appropriate and whether they provide a sufficiently representative picture of financing conditions.

Tokenisation, once it is widespread, may have a significant impact on the dynamics of deposits accepted by central banks, as households and businesses would be able to transfer their assets to tokenised asset classes more flexibly than at present – for example outside the stock exchanges' current trading hours. A digital euro may have a similar impact. From the perspective of the user, digital euros would be more like money in a payment account than physical cash. Transferring digital euro holdings would be more efficient and quicker than transferring cash, and therefore the demand for digital euros could be assumed to respond to interest rates and uncertainty more rapidly than the demand for banknotes.

The increasing pace of the financial system also has an impact on financial stability: bank funding can become more sensitive to market movements, and banks may transfer assets more quickly between the various service providers. If investors and customers lose confidence in the bank, liquidity outflows may become faster and easier also during weekends. This may hamper the authorities' actions in bank resolution. These are key issues that must be taken into account continuously in the implementation of monetary policy. However, in the boldest scenarios for the future of tokenisation, the question is much broader than implementation, namely in which direction will the current European bank-centric financial system develop as a result of technological advances? From the perspective of interest rate steering, it is important in all future scenarios that central bank money remains at the core of payment.

Tokenisation will also affect central bank collateral

The Eurosystem accepts as collateral for central bank refinancing operations a wide range of marketable and non-marketable assets. A broad collateral framework facilitates access to finance and market liquidity both in normal and crisis situations.

Over the years, securities have transformed from being in traditional physical paper form, first to book-entries managed in the book-entry systems of central securities depositories, and more recently, as a result of technological advances, to fully digital assets than can be issued and managed on DLT platforms. DLT assets can be native DLT assets that are in the DLT environment throughout their life cycle, whereas traditional assets (e.g. bonds and shares) can also be converted into tokens.

Even though the importance of tokenisation for the entire financial sector is still minor, tokenisation is moving ahead in many areas. According to a recent ECB publication[8], tokenisation

initiatives have focused primarily on the issuance of debt instruments, money market fund units, and repo markets, which are essential for monetary policy implementation and collateral management. International central securities depositories in Europe have already introduced their own DLT-based market infrastructures in which securities can be issued by and settled using DLT technology.[9] In France, for example, there is a joint project by the Banque de France and Euroclear to tokenise the largest commercial paper market in the euro area through DLT technology. Finland's commercial paper market, which is still based on physical documentation, has fallen behind in this respect.[10]

If traditional financial instruments were transferred into tokenised form at an increasingly rapid pace in the coming years, but the central bank's eligibility criteria do not evolve accordingly, this could have an impact on the sufficiency of collateral. On the other hand, this could lead to market fragmentation, and in the longer term reduce the effectiveness of monetary policy implementation.

The Eurosystem has taken the first step this year in accepting DLT-based assets as eligible collateral for Eurosystem credit operations.[11] As of March 2026, the Eurosystem has accepted as eligible collateral marketable assets issued in central securities depositories using DLT-based services. Like any other eligible marketable assets, these must still comply with Eurosystem collateral eligibility criteria and collateral management requirements. These criteria include availability for settlement in eligible (traditional infrastructure) securities settlement systems, reachable via TARGET2-Securities (T2S). These assets must be mobilised as collateral in the ECMS system, in line with the Eurosystem's existing collateral management practices.

Even though at this point, securities issued using DLT-based services must be settled and mobilised as Eurosystem collateral in existing technology systems, it is worth noting that this is just the beginning. The Eurosystem wants to encourage innovation and technological progress and to enhance the development of DLT-based markets. The Eurosystem is currently examining if and how assets that are exclusively on DLT-networks could fulfil the eligibility criteria for central bank collateral, and how they could be submitted as collateral.

The Eurosystem upholds the basic principles of the monetary policy counterparty and collateral framework, such as the adequacy, safety and efficiency of collateral as well as equal treatment of counterparties. It is therefore important to ensure that DLT-based assets could be used as collateral in a reliable and secure manner, also across borders. The regulatory framework for DLT-based assets in the European Union currently consists mainly of the Markets in Crypto-Assets (MiCA) Regulation and DLT Pilot Regime Regulation.[12]

As a result of the technological transition in payment and financial systems, the range of financial market participants is also expanding and diversifying. The Eurosystem's monetary policy counterparty framework is centred on a bank-based system, i.e. central bank refinancing operations are accessible only by supervised, financially sound credit institutions. Correspondingly, only credit institutions have been accepted as TARGET system participants, as a rule. Following amendments to the Eurosystem policy[13] that entered into force in October 2025, payment institutions (PIs) and electronic money institutions (EMIs) specialising in payment transmission are allowed to access TARGET, which will support the uptake of instant payments. Similarly, new entities in the form of DLT platforms and operators will join the market alongside central securities depositories. DLT platforms that meet the Eurosystem's eligibility criteria can join Pontes, enabling the settling of DLT transactions using central bank money.

The rapidly changing technological and operational environment underlines the importance of central bank money as the most secure and most liquid payment instrument. The new and old infrastructures will probably continue to exist in parallel for many years to come. Nevertheless, the changes brought about by technological advances require active monitoring and preparatory work to ensure that the tools for implementing monetary policy remain effective and ready for future challenges.

Notes

1. See Tuomas Välimäki, 'Esko Antola Lecture: Digital euro – A European alternative for digital payment', 27 August 2026 (in Finnish) and the ECB's website on the digital euro. ↑

2. See Miki Kuusinen (2026), Eurosystem examining promotion of digital finance via tokenisation and DLT, Bank of Finland Bulletin (in Finnish). ↑

3. BIS Innovation Hub: Project Pine: Central bank open market operations with smart contracts. ↑

4. Central banks on-chain: speech by Isabel Schnabel, Member of the Executive Board of the ECB, at the Jackson Hole Economic Policy Symposium on 'Financial Innovation: Implications for Payments and Policy', ↑

5. The Eurosystem's comprehensive payments strategy (March 2026). ↑

6. ECB Occasional Paper Series Central bank digital currency and monetary policy ↑

implementation.

7. The future role and potential features of structural operations are discussed in more detail in the article 'Structural operations will meet part of the banking system's liquidity needs in the future' by Matti Ilmanen, Rasmus Rannikko and Sivi Palmén. ↑

8. See: The role of the Eurosystem in the scaling-up of a tokenised financial ecosystem. ↑

9. Euroclear Bank's D-FMI Digital Financial Market Infrastructure; Clearstream Banking SA's D7 DLT Digital Issuance. ↑

10. For more information, see the article by Niko Herrala 'The Finnish commercial paper market is taking a digital leap' (in Finnish). ↑

11. See: ECB paves way for acceptance of DLT-based assets as eligible Eurosystem collateral. ↑

12. Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and Regulation (EU) 2022/858 of the European Parliament and of the Council of 30 May 2022 on a pilot regime for market infrastructures based on distributed ledger technology. ↑

13. Eurosystem sets policy on access by non-bank payment service providers to its central bank payment systems. ↑

Keywords

digital euro, monetary policy implementation, payment systems