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The "other" digital euro: the ECB's projects Pontes and Appia

Purpose, functioning, and challenges of the wholesale digital euro projects

While the retail digital euro project receives much political attention, the parallel process to develop a wholesale digital euro for use among financial market participants should not be overlooked. This briefing outlines and explains the European Central Bank's projects Pontes and Appia and discusses their utility and potential for strengthening EU financial market integration. Pontes aims at establishing an interface between central bank money and tradable assets in the form of digital tokens. Appia is a more long-term project exploring the overall ecosystem and governance around such tokenised assets. Our briefing concludes that Pontes and Appia are a necessary condition for the EU to benefit from the promises of this technology, which can help addressing the inefficiencies of fragmented market infrastructures and thus support the Savings and Investment Union. By themselves, however, these projects might not be sufficient to overcome national silos. Doing so is likely to require harmonisation efforts at the level of securities and company laws.

Introduction

In this briefing, we use the term wholesale digital euro to refer to ongoing developments that **move wholesale payments, i.e. payments between financial market participants, closer to distributed ledger technology**. In a way, digital euro is a misnomer in this context since of course already today wholesale payments are in practice digital. Nevertheless, we find the terminology fitting since these developments are potentially at least as transformative for wholesale payments and financial markets as the retail digital euro may be for retail payments.

The key challenge for the administration of financial assets over their lifecycle is trust. Market participants need to be sure that when they buy an asset, delivery takes place for sure when they pay, and *vice versa*. They also need to be sure that their ownership of assets remains ensured regardless of the

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different entities and infrastructures that intermediate asset ownership when the asset does not sit under the owner's mattress. Finally, they need to be sure that different corporate events (say, dividend payments, votes by asset owners, mergers, stock splits) happen as prescribed by law and affect their claims and liabilities accordingly. In today's financial markets, this trust is ensured by chains of tightly regulated intermediaries and infrastructures that need to interact through messages and financial links. **The complexity and number of parties involved weigh on efficiency**, as does the fact that the chains of entities and infrastructures are typically fractured along national borders.

Distributed ledger technology holds a number of promises for financial markets. Financial assets, i.e. claims and liabilities, could be represented as **digital tokens** on a distributed ledger. A **distributed ledger** is a single record of all such information that is accessible to all legitimate parties, and of which exists more than one version, while however all versions should contain the identical records. Trust in the information – i.e. protection against manipulation, in particular – and the identity of the different versions of the ledger is ensured through technical means and governance mechanisms. To a degree, this may obviate the need for agents in financial market value chains that are there to create trust, for instance by providing confirmation of ownership or of ability to pay. Moreover, the potential for all parties to use a common record reduces the margin for errors by reducing the number of messages between parties and avoids the need for reconciliation between the records that different parties today maintain independently. **In a European context, and given a landscape of trading, settlement and safekeeping that is fragmented along national borders, the potential efficiencies and the opportunities for market integration are particularly appealing.** In addition to creating trust at lower cost, distributed ledgers offer the potential of automatization since assets on a distributed ledger can be programmed to do what otherwise the parties to the contract would have to do "manually".

However, after all, **issuers and investors of assets on a distributed ledger will want to be paid in real money**. To achieve the same reduction of needs for reconciliation and messages also on the payment side, either an efficient interface with existing payments accounts is needed, or money itself would have to be represented by tokens on a distributed ledger. In principle, the private sector could achieve that by creating interfaces with commercial bank accounts or by turning commercial bank deposits into tokens. Also, stablecoins could be a means of payment that exists as tokens. However, from the perspective of market participants, neither is ideal since such means of payments are not free of default risk,[1] and the default risk becomes inevitably systemic if, for efficiency reasons, many or all market participants rely on few or even a single issuer of such means of payment. From a sovereignty point of view, this problem is potentially compounded if the providers of such means of payments were established outside Europe.

The obvious solution is to use central bank money, which is risk free: **project Pontes builds a first limited, but fully operational bridge** between distributed ledger-based assets and central bank money. **Project Appia constitutes a way forward beyond this bridge**, to evaluate the possibilities of a further integration of distributed ledgers that host tradable assets and central bank money.

Both projects are motivated by the same political considerations[2], which also drive the work on the retail digital euro:

1. The ECB has an interest in ensuring the effectiveness of monetary policy by maintaining the function of central bank money as the risk-free asset, including in a tokenised space. This would in other

[1] In the case of stablecoins, the risk might manifest as liquidity or market risk that forces the stablecoin scheme to devalue relative to the money it is pegged to.

[2] See Appia roadmap for further discussion.

words amount to **keeping central bank money as an anchor to both monetary policy and preserving financial stability** in the shift to the DLT.

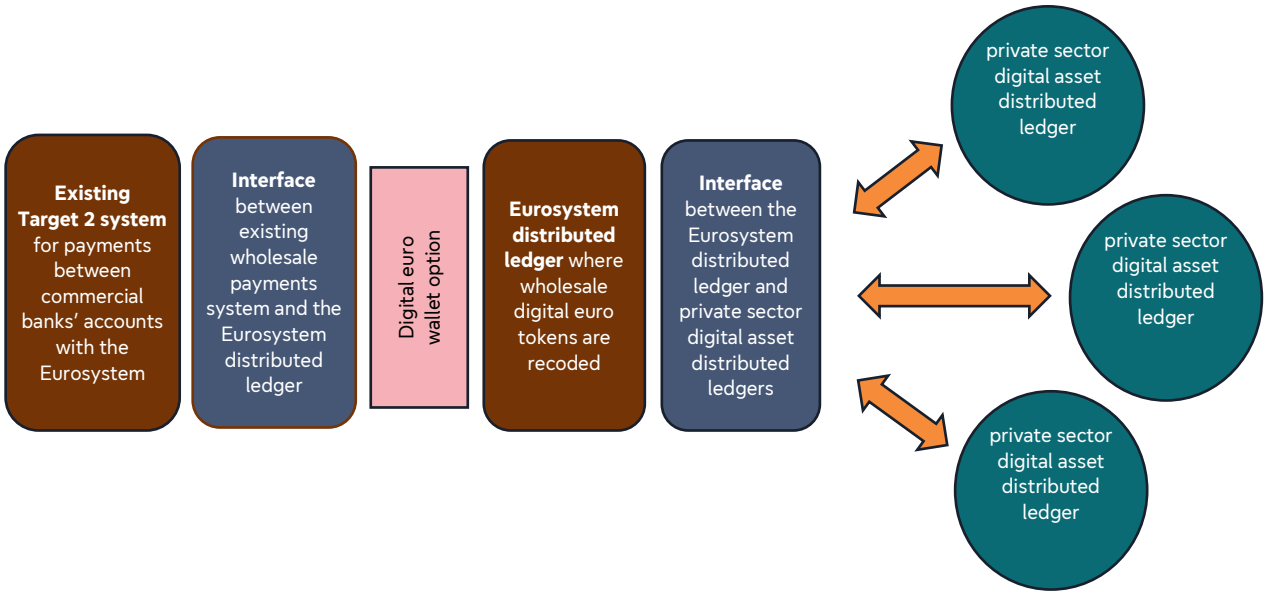
2. There is a political momentum for **exploring the role of DLT in ensuring the integration of financial market** and address the overarching goal of advancing a Savings and Investment Union.
3. In the wholesale space, there is interest for **boosting the strategic autonomy of the euro area** by reducing dependence on "foreign infrastructures, laws or technologies" in tokenised markets.
4. Finally, explorative work on wholesale applications can address the **international role of the euro** by increasing its attractiveness as a settlement asset at the global level.

1. Project Pontes

Project Pontes is a first operational step bringing central bank money closer to assets on distributed ledgers. However, **it does not exactly create a new, distributed ledger-based, wholesale digital euro yet**. The objective here is rather to build a "bridge" (hence the Latin name, presumably), between assets on a distributed ledger and the traditional cash accounts of financial market participants with the Eurosystem. Namely, the project would allow financial market participants to **use their central bank accounts to settle payments for the delivery of assets on distributed ledgers**. From the perspective of market participants, Pontes would ensure delivery of the assets against payment in central bank money, without incurring credit risk – just like today they do not incur credit risk when delivery of traditional securities is matched with payment in central bank money.

The **bridge** that Pontes builds between distributed ledger assets and central bank accounts **consists of three segments**:

1) an **interface** between the distributed ledgers on which eligible assets are recorded and a Eurosystem distributed ledger;
2) the **Eurosystem distributed ledger** that records the ownership of tokens that represent credit on accounts of financial market participants with the Eurosystem;
3) an **interface** between this Eurosystem distributed ledger and the actual accounts of financial market participants.



The middle segment of the bridge offers financial market participants **two options**. Under the first option, **the payment just passes through the Eurosystem distributed ledger** and the sale proceeds represented by the token are as soon as possible credited on the seller's account with the Eurosystem. When that happens, **settlement finality** is achieved in the meaning of Directive 98/26/EC, since this account and the wholesale payment system that connects it to other accounts, TARGET2, constitute what that directive calls a "designated system". This is significant since, given the large amounts of money involved in wholesale securities settlement, any challenges to the finality, as they could for instance be brought in case of bankruptcy of a participant, are undesirable and would undermine trust in the system.

Second, however, there is also the option for financial market participants to **purchase tokens with money from their Eurosystem accounts and store them in a "wallet"**. Then, they could use these tokens as if they were a new form of central bank money and pay for purchases of eligible assets on distributed ledgers, or, naturally, receive tokens as proceeds for sales of such assets. **This is where Pontes comes closest to creating a new wholesale digital euro.** In theory, financial market participants could purchase tokens and use them to buy and sell assets from each other on an ongoing basis. However, Pontes converts any tokens automatically back into Target account credit at the end of the business day. One reason for this may be that settlement finality for the payment effected in tokens is not achieved when the token is transferred, but when it is redeemed for a credit on a Target account. Keeping token ownership over longer periods would thus create a theoretical risk that a payment might be clawed back.

The (limited) option to store value in tokens on the Eurosystem distributed ledger in principle also opens the **possibility for interbank payments in those tokens that are not payments for the delivery of assets on (other) distributed ledgers**. *Per se*, this does not look like an attractive proposition compared to payments in Target2. Inevitably, there is higher operational complexity involved since tokens in wallets need to be managed, funded and defunded in addition to traditional accounts. While Pontes, according to the ECB, will be very fast,[3] it does not provide for instant settlement. So, the real added value is in the link with external distributed ledgers, where asset delivery can be settled simultaneously rather than over the course of days.

The version of Pontes that will go into service in September 2026 is called a "pilot" by the ECB. **Nevertheless, it works with real money and assets**, and the documentation announces an average of 10 transactions per second. This is a level of throughput that could match the average throughput[4] of traditional medium-sized wholesale payments systems. **That said, the Pontes pilot has a number of limitations** that will limit its large-scale usability as a fully-fledged solution for settling payment for distributed ledger-based assets. As mentioned, **settlement finality is not achieved at the level of Pontes itself.** The holding period of tokens is limited to daily opining hours. In turn, opening hours are 9:00 to 16:00 on workdays, falling short of the 24/7 promises of distributed ledger-based finance. Also the total number of users is limited.

Beyond what the ECB calls a "pilot" it is already working on a **"Pontes enhanced product"** that may as early as 2028 – and subject to an intermediated step in 2027 – lift the limitations of the "pilot". Namely, the documentation for the 2028 version posits as "principles" *inter alia*:

- settlement finality for payments in central bank money tokens;
- 24/7 operating hours; and
- ability to hold central bank money token over night.

Once these principles are implemented, Pontes offers fully-fledged distributed ledger based central bank money, and the 2028 timeline does not even appear that far out. It may thus allow for the complete lifecycle of buying and selling assets outside the traditional environment with a distributed ledger based

[3] According to the ECB, 95% of payments will settle in 5 seconds, and the remainder within 2 minutes.

[4] That said we believe that the peak throughput of 10 transactions per second plus 20% might be substantially lower than the peak through put of traditional payment systems (which however have to bear load from payments other than corresponding to securities settlement). That said, we have been unable to find public information on their performance reserves.

quasi-currency. However, we also observe that even the fully-fledged version of Pontes is constructed as an accessory to Target and not quite an alternative system for interbank payments. For instance, we understand that it will achieve settlement finality because legally it constitutes a part of Target, and as such, a part of a "designated system" under Directive 98/26/EC. Therefore, we understand that it will necessarily interact with distributed ledgers that host traded assets through an interface. It does not aim at a self-standing ecosystem on a single distributed ledger that would host both money and traded assets.

2. Project Appia

Project Appia is an investigation project to assess wholistically the digital ecosystem of payments and asset settlement and identify the role of the central bank in this landscape.

Unlike Pontes, which provides an infrastructure to ensure DLT-based cash settlement in central bank money, **Appia is not an infrastructure in itself, but it rather explores several areas,** e.g. definition of standards, governance and technological enhancements, where future developments may be needed. It may therefore result in an infrastructure, including for instance by further shaping Pontes and identifying what priorities should be addressed, defining new services and functionalities demanded by the market or merely informing the standards and the technology to be adopted in the future.

Appia is complementary to Pontes as it examines **what may be needed to further enhance Pontes** and support its evolution. It pivots around a set of high-level principles that however do not prejudge future and more specific legal, technical or operational aspects to be explored in implementation. **Such principles broadly reflect the political drivers of the projec**t, e.g. central bank money as an anchor, reducing barriers to market access, ensuring innovation, competition, efficiency, sustainability and scalability of the solution. They also stress the need to design a blueprint that provides sound legal and regulatory frameworks. Importantly, among the key guiding principles, Appia aims at defining a **governance model that keeps the euro area shielded from critical dependency on foreign infrastructures or legal systems** while preserving its own capacity to supervise and regulate market infrastructure.

This is indicative of the fundamental nature of Appia as a project that investigates not only technical questions but also the **broader political dimension of upholding European governance, control and standards around the wholesale digital euro infrastructure**. Appia can be seen as departing from the recent political drive to have more control on the digital payment ecosystem, including vis-a-vis the rise of foreign-denominated stablecoins, and develop a European approach. For this reason, the Appia roadmap stresses the importance of defining common standards and support strategic autonomy. The roadmap clearly stresses that "the Eurosystem holds that European market stakeholders should primarily rely on utilities that are located, operated and governed in Europe and that are subject to European legal and regulatory frameworks".

Ultimately, **Appia seeks to address an intertwined set of both technical and governance aspects**. Among these "building blocks, for instance, Appia aims to address interoperability, whether there should be a single network as a shared utility or multiple networks, how to interact with the network operated by other jurisdictions. It will explore where and to whom to provide services, how to conduct monetary policy operations and collateral management on the DLT or whether and how to control mobilised assets on DLT not fully operated by Eurosystem. On the governance side, it will look at how to ensure cross-border interoperability and engage with international organisations and private stakeholders on the definition of global DLT interoperability standards in line with EU goals and that may facilitate cross-border DLT links.

Co-legislators may play a role in the future when it comes to the identification of legal and regulatory gaps in ensuring that the system is safe and resilient. This could ultimately provide the European Parliament

with an opportunity to share its views and ensure it can feed into the reflection on future policy developments.

The timeline for this investigation remains rather ambitious, with the Eurosystem indicating its intention to provide "a blueprint for a future long-term solution" by 2028.

3. Benefits for EU financial markets

As we highlighted in the introduction to this briefing, **distributed ledger technology has the potential to allow making the issuance, trading, redemption and corporate event management for securities much more efficient** compared to today's processes. Today's processes involve many intermediaries and infrastructures that are costly to maintain, and since in Europe in particular, value chains of intermediaries and infrastructures are fractured along national borders, the cost problem is exacerbated since scale economies are limited. **The chief benefit of projects Pontes and Appia is to provide a key ingredient, namely settlement in safe central bank money, to an emerging ecosystem of tradable assets on distributed ledgers.**

The June 2025 ESMA report on the EU's "DLT pilot regime" called the absence of integrated, trusted mechanisms for cash settlement "a recurring challenge cited by multiple applicants". According to ESMA, **without access to central bank money settlement for distributed ledger-based transactions, distributed ledger platforms rely on less efficient substitutes**, such as e-money tokens issued by EMIs or simulated cash ledgers. ESMA points out that this introduces additional legal complexity and potential credit risk, particularly for institutional investors. We would even think that institutional investors will not consider assets on distributed ledgers a real alternative to traditional assets as long as there is no mechanism for delivery-versus-payment available that is free of credit, liquidity and market risk and offers settlement finality. This is despite the significant efficiencies that distributed ledgers may offer for recording and transferring asset ownership. And the same time, the projects of the ECB, for the moment at least conceptually, show that a link between central bank money and distributed ledgers is possible.

The same argument also works the other way around: the advantages of tokenising assets on distributed ledgers may turn out over time to be so large that market participant would get drawn to the technology and abandon traditional clearing and settlement even though they have to compromise – **in the absence of an adequate central bank money settlement mechanism** – on the efficiency of the payment leg. **In such a scenario, stablecoins or tokenised deposits would displace central bank money as a payment means.** At a system level, the resulting avoidable credit, liquidity and market risk of individual participants would in our view lead both to avoidable welfare losses and avoidable systemic risk. Looking at it this way, projects Pontes and Appia, if successful, will guard against the systemic cost and risk of the proliferation of less efficient settlement in stablecoins or tokenised commercial bank deposits.

Meanwhile, the number of distributed ledger-based solutions that are being tested in the private sector may result in inefficiencies. Distributed ledgers may be able to integrate trading, ownership and corporate events management of assets, reducing the number of intermediaries and infrastructures along the value chain. Yet costly fragmentation may persist across the multitude of providers or technologies that currently emerge. As a partial remedy, **Pontes offers a single pool of liquidity for payments related to all these private sector distributed ledgers that link to it**, which promises important efficiencies since market participants will not have to keep liquidity available in different stable coins or tokenised bank deposits linked to the respective asset ledgers. Beyond that, **Appia has the additional potential of harmonising asset ledgers or even providing the impetus to bringing them together on a single ledger.** That said, we would however also not overestimate the cost of variety among private distributed ledgers. At the base, traded assets on distributed ledgers enable value chains with less overheads and interfaces. Therefore, we find them likely to exhibit lower fixed cost, but also less pronounced scale economies than traditional clearing and settlement, so that different technological solutions might still relatively efficiently coexist.

4. Developments in other jurisdictions

Several central banks are exploring the **potential of wholesale CBDCs.**

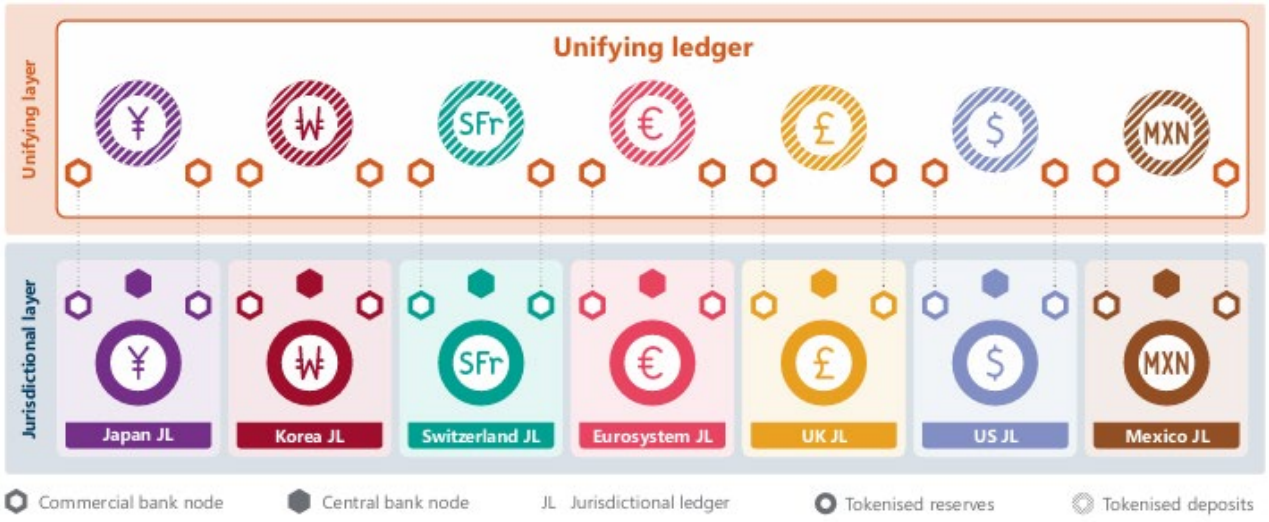
Project Helvetia of the Swiss National Bank is one of the most advanced examples of such exploration. It has recently entered its third phase running until June 2027 to explore how to settle transactions with tokenised assets. The Swiss experience rests on the **issuance of digital Swiss franc for financial institutions that uses the same DLT infrastructure as tokenised assets**, allowing for an integrated approach with simultaneous transfers. As the pilot progresses, there would be an expansion in the range of transactions for which the wholesale digital Swiss franc would be made available. The project also explores an alternative synchronised approach by allowing for settlement in traditional central bank money by linking the DLT settlement platform and the real-time gross settlement (RTGS) system of the Swiss Interbank Clearing payment system.

In the UK, **the Bank of England (BoE) has recently explored the use of DLT for wholesale money issuance and settlement in its DLT Innovation Challenge**. This has contributed to identifying important governance and operational resilience aspects in the wholesale space. The BoE has explored the settlement of **tokenised transactions through synchronisation with various DLT platforms**, which is not too distant from the approach of the Eurosystem focused on interoperability. At the same time, the initiative has shown the relevance of further exploring the use of wholesale central bank money to meet the needs of financial market participants as well as balancing out broader governance considerations. Moreover, **UK authorities cooperate with a private payment system** called Fnality, that is sponsored by a number of large banks as investors. In the UK, this system has received a designation comparable to that under our Directive 98/26/EC, so that payments in the tokens of Fnality already today achieve settlement finality. **The construction chosen here is that the tokens, by contrast to Pontes, are not issued by the central bank, but are collateralised by credit on a specific account with the central bank.** Technically, this model is a stablecoin, a token backed by liquid assets, but it has the potential to avoid credit, liquidity and market risk typically inherent in stable coins provided the issuer assures the promised backing with legal certainty.

The Monetary Authority of Singapore (MAS) is quite advanced in its work on wholesale CBDS, which explored **use cases with the private sector**. In November 2025, it has announced the completion of a live trial for settlement of interbank overnight lending transactions using wholesale CBDC. In this case, the settlement relied on a shared ledger allowing market participants to use a common asset – the Singapore dollar wholesale CBDC – to settle tokenised asset transactions.

In terms of international initiatives, major central banks – including the ECB and the US Federal Reserve (Fed) – are engaged in the **Project Agorá** of the Bank of International Settlement (BIS) and the Institute of International Finance (IIF). This global initiative focuses on **multi-currency cross-border settlement through the tokenisation of central bank reserves and commercial bank deposits via a shared DLT platform**. Instead, the developments of standards for securities is not in scope. The idea behind it is to develop **a two-layer architecture with individual jurisdictional ledgers** where tokenised central bank reserves are recorded **connected by a unifying ledger**. Participants would have access to this unified ledger where tokenised commercial bank deposits would be recorded. This would provide a shared platform with "*sufficient commonality to enable atomic settlement and integration with payment workflows between tokenised reserves and tokenised deposits*". While the design does not necessarily prevent the recording of tokenised reserves on the unifying ledger or of tokenised deposits on a jurisdictional level, communication and synchronisation across ledgers is made available by a set of rules and procedures to enable coordination across nodes operating on the separate ledgers.

Figure 1: The two-layer architecture of Project Agorá



Source: *Project Agorá*

Project Agora provides a solution for national central banks to continue pursuing the development of domestic infrastructure in autonomy while allowing for a global integrated approach through the shared ledger. In this perspective, it underlines the importance of "*Additional work on governance, rules and oversight (...) to support safe and scalable deployment while preserving jurisdictional autonomy*".

5. Possible challenges / open questions

DLT infrastructure can, in principle, host securities from multiple jurisdictions on a single platform, enabling cross-border issuance, trading and settlement without the custodian chains and bilateral CSD links that currently fragment European post-trade infrastructure. **The Appia roadmap explicitly connects the initiative to the CMU and Savings and Investments Union agendas, noting that DLT offers "an opportunity to move towards a more integrated and innovative financial market" and could "lower barriers to entry for new players entering the ecosystem."** These are prospective benefits contingent on the ecosystem developing as envisaged — but the enabling infrastructure that Pontes provides is the *necessary* first step.

However, it is a *necessary* step only insofar as one sees settlement in central bank as central to developing a distributed ledger future for European capital markets. **A first question one might pose is indeed whether the ECB should promote central bank money over private sector solutions such as stablecoins and tokenised deposits.** As we have explained in this briefing, we believe there are important economies in doing so and markets might even naturally gravitate to a public sector solution in this context. But one should not hide that the ECB's decisions today may have important structural implications in the long run; and the case of the UK shows that solutions that offer settlement finality can in principle also be engineered with regulated private sector systems.

We recall that one promise of distributed ledgers was that they could enable decentralised finance, and in relation to assets, atomistic trading. Basically, this gets at a world where individuals do not approach their broker when they want to buy securities who then routes an order to an exchange that is settled with many others at a central counterparty and then booked in a central depositary, before the securities appear in the individual's broker account while the cash consideration disappears from it. Rather, in a decentralised finance world, individuals would trade directly with one another, and the distributed ledger sorts out the exchange of on-ledger securities and on-ledger cash tokens internally without involving intermediaries. **Both Pontes and Appia decidedly do not promote this vision;** individuals would still trade through intermediaries since the ECB would limit availability of central bank money tokens to intermediaries. This may well provide for an efficient outcome since liquidity of individuals is pooled in commercial bank accounts and can be lent out subject to reserves being held with the central bank, while individuals might not invest their liquidity as efficiently. Nevertheless, also a decentralised finance world without intermediaries also offers efficiencies since no money is spent on intermediaries' overheads and the relative efficiencies of both possible worlds are hard to tally.

At this juncture, it seems nevertheless plausible that the ECB should, as it does with Pontes and Appia, move to realise possible economies the distributed ledgers offer in centralised finance. A more economical centralised finance model would anyway reduce the relative economies of decentralised finance. Nevertheless, it cannot be excluded that the attraction of decentralised finance for individuals will at some point be such that they anyway turn to it; that would the raise the hard question if central bank money for securities settlement should be more widely available, so that individuals do not resort to stablecoins rather than deposits.

A more immediate challenge might be the scope of any ECB-operated distributed ledger infrastructure. While Pontes is clearly limited to central bank money tokens, we imagine that under the Appia discussions, the question will come up if additional efficiencies could result from hosting also the asset tokens on the Eurosystem's distributed ledger. After all, this avoids an additional interface and a trusted public infrastructure that hosts private assets certainly has attractions. It might also give a big boost for market integration. **However, it might be less conducive to competition and innovation if a public ledger ended up crowding out private ones.** Moreover, the ESCB Statute as it stands limits the Eurosystem to providing clearing and payments facilities, whereas a distributed ledger would also provide the infrastructure for issuance and safekeeping. The alternative to a Eurosystem infrastructure for assets and money, namely

making central bank money tokens available directly on private sector ledgers, is however unlikely to appeal to the ECB since it would deprive the ECB of ultimate control over the ledgers recording its liabilities.

Finally, we should point out that projects like Pontes and Appia alone will not *suffice* to reap the benefits of tokenised assets. **Whether securities can be turned into entries on distributed ledgers does not only depend on technology, but also on the diverse national laws governing these securities.** Some debt instruments may still be relatively easy to bring onto distributed ledgers as long as they do not require a particular legal form. However, when national law requires a particular form, an entry in a distributed ledger may not work anymore, requiring instead a traditional instrument lodged with a traditional securities depositary. For company shares, this is yet more likely to be a constraint; they are most likely to require continued safekeeping and administration in line with national laws by specialised national securities depositaries who know for instance how to invite to a general assembly in line with a given national commercial code.

The depositary receipt constitutes an existing instrument in traditional clearing and settlement that allows trading the right to a share – as opposed to the share itself - when trading the share is difficult. A similar crutch can be built in the world of distributed ledgers. the entry on the ledger might be a right to a share rather than the share itself, which would instead rest with a qualified securities depositary while the token on the distributed ledger is traded. However, this approach clearly limits the possible efficiencies since trusted securities depositaries are still needed and probably will continue to live in fragmented national silos to reflect differences among national commercial codes and securities laws. **Thus, ironically, the same diversity of national securities laws and commercial codes that has created the silos of national intermediaries and market infrastructures is likely to also hamper with the emergence of more efficient distributed ledger-based asset trading.** This problem remains to be addressed, regardless of the ECB's efforts.

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