SPEECH

The present and future of money in the digital age

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I would like to thank Federcasse for inviting me to speak at this edition of the *Lectiones cooperativae.* These lectures are an occasion to reflect on issues of broad significance and their implications for the application of the principles of cooperation. They offer us the opportunity to seek a deeper understanding of the changes taking place in the economy and in society.

The topic of this speech – the present and future of money in the digital age – has certain unique features. It is an age-old topic, because we have been talking about money for millennia, from the times of Ancient Greece and pre-Republican Rome. But at the same time it is a topical issue, because the digital revolution is transforming the role and the nature of money.

It is a subject for specialists: economists, lawyers, and technology experts. Yet it concerns each and every one of us. We all use money in one form or another – every day, and often several times a day. And we are all involved in the changes currently under way.

At the international level the digitalisation of money and payments is being examined by the G7 and the G20. In Europe, it is frequently discussed by Finance Ministers in the Eurogroup. It is on the agenda of the European Commission and the European Parliament. It was addressed by the heads of state or government at the Euro Summit last March. And it is of course central to the agenda of the European Central Bank (ECB).

This strong focus can be explained by the far-reaching changes that are under way. Digitalisation is changing the way we work, interact with each other and use our time. It is changing consumption habits, social relations, and our very culture. It is, in effect, changing the way we live.

Money and payments are also undergoing rapid change. Innovative tools are emerging. Not so long ago, cash was more or less the only way to make an immediate purchase. Today, however, we have grown accustomed to using forms of private digital money such as online bank transfers, payment cards and applications on our smart phones or watches. These are changes that directly affect the role of central banks.

In October the Eurosystem opened the investigation phase for the possible introduction of a digital euro: electronic money issued by the central bank.

If a digital euro were issued, it would have significant consequences. It would have not only economic and financial repercussions, for instance as regards the transmission of monetary policy, financial stability, and the operation of the international monetary system. It would also have wider relevance for global geopolitical equilibria and the fundamental rights of individuals, such as the right to privacy.

In my speech today, I will illustrate the key characteristics and implications of this new money. And I will then discuss how we can maximise its benefits and reduce its risks.

The digital euro: what it is (and isn’t)

The digital euro would be a form of sovereign money provided by the ECB in electronic format. It would be used by anyone – households, businesses, commercial outlets – to make or receive retail payments throughout the euro area. It would give citizens the same services they now obtain from

paper banknotes: access to a secure payment instrument that is cost-free, easy to use and universally accepted within the euro area.

The digital euro would complement cash, not replace it. It would provide people with fuller and easier access to electronic payments, promoting financial inclusion. Unlike cash, it could be used not just for people to transfer money to each other or for purchases in commercial outlets, but also for online purchases. And as it would be a central bank liability, the digital euro would, like banknotes, be free of any risk, be it market risk, credit risk, or liquidity risk.

Crypto-assets and stablecoins[1]

The digital euro has nothing to do with crypto-assets such as Bitcoin.

As it would be issued by the central bank, the value of the digital euro would be guaranteed by the State. Crypto-assets, on the other hand, are not issued by any accountable entity: they are notional instruments with no intrinsic value, which do not generate income flows (such as coupons or dividends) or use-value for their owners. They are created using computing technology and their value cannot be ensured by any party or guarantee. Crypto-assets are exchanged by operators whose sole objective is to sell them on at a higher price. They are, in effect, a bet, a speculative high-risk contract with no supporting fundamentals. That is why their value fluctuates wildly; hence crypto-assets are not fit to perform a currency's three functions: means of payment, store of value and unit of account.

The value of crypto-assets is growing rapidly and currently stands at over 2,500 billion dollars.[2] That is a significant figure with the potential to generate risks to financial stability that shouldn't be underestimated. For example, it exceeds the value of the securitised sub-prime mortgages that triggered the global financial crisis of 2007-2008.

In spite of the substantial sums involved, there is no sign that crypto-assets have performed, or are performing, socially or economically useful functions. They are not generally used for retail or wholesale payments, they do not fund consumption or investment, and they play no part in combating climate change.

In fact, there is clear evidence that they do the exact opposite: crypto-assets can cause huge amounts of pollution and damage to the environment.[3] And they are widely used for criminal and terrorist activities, or to hide income from the eyes of the tax authorities.[4] Moreover, they provide legitimate investors with no protection whatsoever against IT or cyber risks.[5] On the whole, it is difficult to see a justification for the existence of crypto-assets in the financial landscape.

The digital euro also differs from stablecoins.

These are digital instruments whose value is linked to that of a portfolio of low-risk assets (reserve assets) such as currencies or securities. Without appropriate, rigorous regulation, stablecoins too are unfit to perform the functions of money: as they are low-risk but not risk-free, they are particularly vulnerable to possible runs in the event that holders experience a loss of faith.[6]

Their dissemination could influence monetary policy implementation and undermine the efficiency of the securities markets.[7] For example, one of the most widespread stablecoins promises "stability" by investing in low-risk assets such as commercial paper, and holds a large proportion of the stock of these instruments in circulation. In a situation of stress, large-scale sales of assets in response to a sudden increase in redemptions could generate instability throughout the commercial paper market. This phenomenon could spread to other stablecoins and related sectors, eventually finding its way to the banks that hold the stablecoins' liquidity.

These risks could be amplified by a lack of transparency around the composition of reserve assets, by a lack of checks on conflicts of interest between issuers and holders of stablecoins,[8] by cases of fraud[9] or mismanagement,[10] and by the link between stablecoins and crypto-assets[11].

In sum, stablecoins are not therefore so "stable", and that's why I have previously referred to them as "unstable coins".[12] In fact, a third of stablecoin initiatives launched on the market in recent years have not survived.[13]

The risks posed by stablecoins would be reduced if reserve assets could be held entirely in the form of risk-free deposits at the central bank.[14] However, this would limit monetary sovereignty as one of the key tasks of the central bank – money creation – would in effect be delegated to private operators. They would perform that task with the aim of maximising profits, rather than fulfilling public interest objectives such as inflation control and the cyclical stabilisation of the economy. Furthermore, the use of money would become expressly or implicitly onerous. This would affect access to a vitally important service which central banks have been providing to citizens for centuries on behalf of the State for free and in the general interest.

If they are kept within a framework of effective rules and checks, some privately issued digital finance instruments can increase the efficiency of payments, especially international payments. Europe is at the forefront of regulation, supervision and oversight of digital finance[15]. In countries outside Europe calls for stricter controls are becoming louder.[16]

But the largely uncontrolled development of digital finance – in particular decentralised finance[17] – and cross-border interlinkages mean that further action at the global level would be desirable.

In the circumstances I have described, a digital euro would bring stability to the world of digital finance.

Why we need central bank digital money

For the ECB, the need to explore the introduction of a digital euro arises from the evolution of people's payment habits. The way we make our purchases has been changing, especially since the start of the pandemic.[18] Two trends are emerging.

The first is the tendency to use digital instruments.[19] Many of us regularly make payments using cards or apps on our mobile devices.

The second is online shopping. Consumers are buying goods and services – food, clothing, package holidays – not only in bricks and mortar local shops, but more and more on the internet.[20]

Cash is increasingly used as a store of value and decreasingly as a means of payment.[21] The cash stock has continued to increase, driven by the precautionary demand for cash. However, only about 20% of the stock is now used for payment transactions, down from 35% 15 years ago.

Cash purchases are therefore decreasing. If this trend were to continue, banknotes would eventually lose their central role and become a marginal means of payment. Even central banks' efforts to continue to supply banknotes would not be enough to preserve that role in the face of insufficient demand for cash as a means of payment. Citizens could therefore lose a simple, safe and reliable means of payment that is provided for free by the State and universally accepted.

This would create a need to introduce a public digital currency.

But let me say, first, that not everyone agrees with this hypothesis. Some people feel that public digital currency would be redundant, given the vast supply of private electronic payment instruments available.[22] But this theory fails to recognise the central role of public money (that is, central bank money) in the economy.[23]

Confidence in savings held as private money is largely determined by the strength of central bank money – the monetary anchor – and by the convertibility of private money into public money. Central bank money is a safe form of money that is guaranteed by the State, by its strength, its credibility and its authority. Other forms of money consist of private operators' liabilities;[24] their value is based on the soundness of the issuer and is underpinned, in the last analysis, by the *promise* of one-to-one convertibility with risk-free central bank money.[25]

This promise can prove to be ephemeral – for example when private issuers manage their capital or liquidity imprudently. It must therefore be repeatedly confirmed through the conversion of private to public money. For instance, our readiness to deposit our money with banks is underpinned by the knowledge that we can go to a branch or cash machine and withdraw cash from our deposits. This tells us that our money in the bank is safe. It reassures us that we will be able to convert private

money (deposits) into public money (cash) in the future too. Bank runs and financial crises start when confidence in the convertibility of private money disappears.

In practice, many people are unaware of the differences between public and private money. This is what economists call “rational inattention”.[26] However, people know that banknotes protect them from the consequences of intermediaries potentially defaulting and they make their payment and savings choices accordingly.

This does not mean that the safeguards put in place to protect savings – legislation and banking supervision, deposit insurance schemes, capital markets supervision – are not important. On the contrary. They must, however, be flanked by convertibility to ensure the orderly conduct of payments, the stability of the financial system and the soundness of the currency.

Without the anchor of sovereign money, people would have to constantly monitor the safety of private money issuers in order to value each form of money. This would undermine the functioning of the payments system and confidence in savings. History shows that access to public money is essential to instil confidence in private money, ensure the correct functioning of the payments system and safeguard financial stability. Periods in the past when various forms of private money co-existed in the absence of sovereign money – for example the free banking episodes of past centuries – were marked by recurrent crises.[27]

Today, citizens hold central bank money in the form of banknotes. As I mentioned previously, in the future – in a digitalised world – cash could lose its central role. Central banks must therefore ensure that central bank money is fully usable and can retain its role as a payments anchor. That is the primary objective of the digital euro.

Benefits of the digital euro

The digital euro is therefore essential to the orderly conduct of payments in a digital world. But the decline in the use of cash is not the only factor that could transform the payments market. Other factors, also significant, have prompted the ECB to study the issuance of a digital euro[28].

Monetary, financial and political sovereignty

First, there is the need to assert our sovereignty in the monetary and financial fields, in keeping with the goal of safeguarding our strategic autonomy as established by the European Council.[29] The ability to make payments safely and efficiently, without external influence, is a fundamental need for the economy and for society as a whole, especially in a large jurisdiction like the euro area.

Two-thirds of digital retail payments in Europe are currently brokered by foreign operators.[30] Looking to the future, digital currencies issued and controlled outside the euro area – by private actors or foreign countries – could grow in importance, to the point of replacing existing means of payment.

The European financial system would thus be subject to decisions made by foreign actors and this in turn would place our legislative and regulatory powers at risk. A payments system based on technologies and practices designed, managed and supervised elsewhere would undermine the ability of the European authorities to exercise their supervisory control. Such a system could be under-protected from external threats, including IT threats. It would expose people, businesses and states to the danger of the improper use of confidential information. It would make the information needed to combat unlawful activities harder to trace.

And the list could go on. But it is clear that a payments system and financial sector dominated by foreign operators would be unfit to support the single currency, and simply unimaginable in the world’s second economy.

The “colonisation” of the European payments system is not an imminent danger. But nor is it a remote one, given the speed at which digital finance is changing. Since early 2020 the value of stablecoins in circulation has risen from 5 to 120 billion dollars.[31] At the same time, the Big Tech[32] companies have expanded their financial business. The convergence of these two tendencies – the growth of stablecoins and Big Tech’s expansion in the finance sector – could have a drastic impact on the

functioning of financial markets and supplant traditional intermediation and payment services. And that would give rise to the risks I described earlier.[33]

To prevent these dangers we need to adjust the regulatory and supervisory framework. But that is not enough. The transformations under way should be governed by providing innovative and efficient financial services capable of meeting the emerging need for immediacy in our society, as well as the more general trend of digitalisation of the economy. The introduction of a digital euro would be a step in that direction.

Sovereignty and the international role of the euro

A digital euro accessible to foreign users would cut the cost of using our currency in cross-border payments and increase its suitability as a global invoicing currency. This would increase the international role of the euro, thereby strengthening Europe's strategic autonomy, lessening the global domination of the dollar and reducing global dependency on a single source of liquidity. It would strengthen the "Brussels effect": the influence exerted by the EU on the international stage by asserting and advancing its principles, decisions and institutional and legal practices.[34]

ECB analyses show that the effects of this would be significant but less important than the fundamental drivers of the international role of a currency, such as the size of the underlying economy, its economic policies, the development of its capital markets, and the efficiency of its institutions.[35]

Protecting confidentiality

Individuals have a fundamental right to privacy, which is enshrined in national and European regulations.[36] In the public consultation conducted by the ECB in 2020, 43% of respondents ranked privacy as the most important aspect of the digital euro, well ahead of other features.[37]

Such a focus on privacy comes as no surprise. Misuse of confidential data that can be inferred from payments could lay bare private aspects of our lives such as our political leanings, sexual orientation or state of health. This could impinge on personal liberties and interfere with the rights of individuals and with the rules that underpin the functioning of a modern liberal democracy.

The data contained in digital payments are frequently used by private companies for various purposes. Some payment companies are moving from a fee-based business model to a data-driven business model in which services are supplied free of charge in order to obtain detailed information on customers.

Digital payments therefore put privacy at risk and may give rise to misuse of confidential information. Data protection regulations aim to prevent abuses but cannot always keep pace with technological innovation, as was demonstrated by the case of Cambridge Analytica.

If it were offered by an independent public institution such as the central bank – which has no interest in exploiting payment data for any purpose – the digital euro would enhance confidentiality in electronic transactions by protecting against unwarranted intrusions. Sound transparent governance that complies with the national and European regulations would ensure that information on users is only used for permitted purposes, such as combating illicit activities.

Confidentiality is distinct from anonymity.[38] Digital payments could ensure different levels of confidentiality,[39] to be defined in line with general interest objectives. The technical experiments conducted by the Eurosystem confirm this possibility.

In any case, cash will remain available. Consumers will be able to continue to make anonymous payments with banknotes if they wish to do so.

Competition and efficiency

The European digital payments market is highly concentrated. Two US intermediaries handle two-thirds of card payments, while another US operator dominates online payments. Digital payments

seem to be expensive for many users and are in fact mainly used by people with medium to high incomes.

The digital payments market could become more concentrated in the future owing to the expansion of the big tech firms, which have already shown a tendency to adopt anti-competitive behaviours.[40] Benefiting from their very large number of customers, network effects and economies of scale, these operators could obtain very large market shares.[41]

This could cause traditional intermediaries to exit the market and damage competition, leading to an increase in fees and a deterioration in the quality of services with effects on other sectors such as insurance services and credit, and also on commerce itself.[42] In such a context, traditional anti-trust measures may prove to be ineffective given the length of time needed for the investigations and the speed at which the digital economy is advancing.

A digital euro would directly boost competition by making a free and easy to use digital means of payment available to everyone. But it would also have an indirect effect: the option to use the new form of money would allow European intermediaries – including small intermediaries which typically have less capacity for innovation – to offer products with a higher technological content at a competitive cost, making them better able to compete with global operators.

Effects on the monetary and financial system

The digital euro can bring about significant changes in the monetary and financial system which should be analysed in depth in order to assess how to design the new form of money in a way that harnesses its benefits and avoids undesired effects. I will now recall the main topics that are central to the Eurosystem's deliberations.

Monetary policy

Depending on its features, the digital euro could influence monetary policy.

One important aspect is the possible application of interest rates. A digital euro earning no interest would replicate the characteristics of cash; with no limits on holdings[43] it would prevent the central bank from applying rates below zero, so savers – by holding digital euro – would avoid negative returns without bearing the risks and costs of owning huge quantities of banknotes. Conversely, if interest was payable on the digital euro it could strengthen the transmission of monetary policy, but there would be a risk of diverting bank funds.

The impact on monetary policy would also depend on the reallocation of private financial wealth that the digital euro will bring about. Switching funds out of banknotes and into the new form of money would change the composition of central bank liabilities, without other significant effects.

On the other hand, if the digital euro attracted deposits (and the banks did not have the unencumbered reserves to cope with the outflow of funds), it could affect the cost and supply of credit and the transmission of monetary policy through bank balance sheets. The central bank could mitigate or eliminate these effects by increasing refinancing of banks or through asset purchases, thereby expanding its own balance sheet.

This list of possible effects could continue, analysing in greater detail different potential remuneration methods,[44] possible compensatory measures and aspects such as the impact on the central bank's balance sheet and on seignorage.

But the main consideration is that the digital euro project does not aim to change how monetary policy is implemented. The changes that it will bring will depend on its features, which should be carefully studied and defined, but they would not interfere with the actions of the central bank.

The banking and financial system

The digital euro could affect banks' activities and the functioning of the financial system. In addition, if it is incorrectly designed, it could result in tensions and instability.[45] This could crowd out banks from

the payments market. In addition, in the absence of limits to its use, it could attract large volumes of deposits. This could make banks' funding unstable and more costly and have a negative impact on their profitability and credit offering. Ultimately, it could affect the real economy.

The risks would be greater in times of crisis. If there were doubts about the soundness of intermediaries, savers could transfer their funds out of bank deposits and to the central bank quickly and free of charge, including for large amounts. This could trigger a "digital run" on bank branches. The possibility of this happening could encourage savers to reduce their bank deposits, even during normal times.[46]

However, these risks would only materialise if the instruments put in place to protect financial stability – banking supervision, deposit insurance and the central bank as the lender of last resort – proved to be ineffective.

Above all, these risks can be kept in check by designing the digital euro in an appropriate manner in order to control its use as a form of investment. The debate on this issue focuses on two scenarios. The first foresees the setting of a ceiling on the amount of digital euro that can be held by individual users[47], or on aggregate transactions, i.e. on a weekly or monthly basis – to limit the outflow of bank deposits into the new form of money.[48] The second is based on a two-tier remuneration system which discourages holding digital euro in amounts above a certain threshold.[49]

These constraints would make the digital euro an efficient means of payment available to everyone while ensuring that it would not be used excessively as a form of investment that would crowd out other financial instruments, particularly bank deposits. Their introduction would remove the risk of instability, thus safeguarding financial intermediation.

But in assessing the impact of the digital euro it would be wrong to assume that tomorrow's financial system will be like today's, because it will be different, even without the digital euro. In the absence of government intervention, the system could be dominated by major global players, primarily big tech, who will be much less concerned than the central bank about the stability of the financial system. If properly designed, the digital euro will therefore avoid worse scenarios, thus conferring stability on the financial system.[50]

To ensure the project's success, in order to avoid instability, the digital euro will be introduced in close cooperation with euro area intermediaries who will be authorised to handle the distribution and provision of services to the public, and it will be compatible with the additional services that they offer. This will stimulate innovation: the new form of money will provide intermediaries with a regulatory infrastructure capable of connecting systems that are currently separate, such as retail payment schemes, the digital identity, the digital signature and electronic receipts. This would make advanced payment methods available, such as programmable payments, online purchases subject to delivery of the product, payments based on the use of a certain good or service, or automatic cash transfers to and from the government.

Building on these payment innovations, the digital euro can act as a driver for modernising the financial and economic system as a whole and making it more efficient, extending the use of technology in dealings between households, firms, intermediaries and the government.

The international monetary and financial system

A digital euro that can be used without any constraints by non-residents could affect the structure and functioning of the international monetary and financial system through two channels.[51]

First and foremost, it could increase the international transmission of shocks and exchange rate volatility, by influencing capital flows.[52] This would occur because its liquidity, low risk and potential rate of remuneration would make the digital euro attractive to international investors, reinforcing the relationship between exchange rates and interest rate differentials – the so-called uncovered interest rate parity – and amplifying portfolio adjustments triggered by monetary shocks.

The effects would be considerable for emerging economies that have strong trade or financial ties with the Single Market, as they would be more exposed to effects stemming from the euro area. These

countries' central banks would be forced to take more decisive action in dealing with monetary or real shocks, suffering a loss of autonomy as a result.

Second, the digital euro could spread in third countries to the extent that it would crowd out local currencies, leading to a digital "euro-isation", which could hamper the transmission of monetary policy and lead to financial instability. The risks would be greater for emerging economies that have weak currencies and economic fundamentals, and close trade and financial ties[53] with the Single Market and which are integrated into global value chains.[54]

Conclusion

The digital euro project can be a success if we can ensure effective multi-level cooperation.

Public authorities will have to work closely with private operators – consumers, intermediaries, firms and merchants – to understand their needs and how to meet them. Only then can we avoid two opposite risks: being "too successful" and crowding out intermediaries and private financial instruments, or being "not successful enough" and generating insufficient demand.

As regards ties with private operators, we engage with user discussion groups, with committees made up of banking and payments experts, and with technology experts. For the ECB, the aim of the project is not to enter the retail payments market but to offer an efficient, secure and low-cost form of digital money which intermediaries can use to satisfy citizens' needs.

Our task will be easier if there is genuine cooperation within the private sector itself, between intermediaries in all euro area countries, to launch pan-European payment initiatives capable of offering services across the entire euro area, of strengthening the ability to compete with the major international operators and of consolidating Europe's autonomy.

Cooperation within the public sector is crucial for defining the characteristics of the digital euro and for reconciling the conflicts arising from several objectives: the right of individuals to confidentiality versus the public interest in maintaining the level of transparency required to combat illicit activities; the benefits of allowing the digital euro to be widely used versus the need to safeguard financial intermediation; and the benefits from the widespread international distribution of the new form of money versus the need to avoid instability in other countries.

Some choices relate to monetary policy and the payments system and fall within the remit of the Governing Council of the ECB. Others relate to more general issues, such as the protection of privacy, which require the involvement of Europe's co-legislators. There is already intensive cooperation between the ECB, the European Parliament, the European Commission and the Eurogroup.

Lastly, there is a need for close cooperation at the global level. Around 80 countries are currently assessing the introduction of a digital currency. International cooperation is needed to define shared principles on economic and regulatory issues and to connect the various projects. This type of approach will enable us to build an efficient system for international payments in the future by providing low-cost services to multiple sections of the world's population experiencing hardship, including migrants, thus promoting financial inclusion. The ECB is part of the initiatives launched by the G7, the G20 and the Bank for International Settlements.

The digital euro is an ambitious and complex goal that can improve the efficiency of the economic and financial system. We must make it a driver of stability and inclusive progress, capable of strengthening ties between economies and financial systems at the global level and of overcoming gaps and barriers between countries.

1. The definition of crypto-assets can include assets that are not liabilities of any issuer, and stablecoins. The classification used in the text keeps these two categories separate.

2. See International Monetary Fund (2021), Global Financial Stability Report, "COVID-19, Crypto, and Climate. Navigating Challenging Transitions", October, and Panetta, F. (2021), "Stay safe at the

intersection: the confluence of big techs and global stablecoins", speech at the conference on "Safe Openness in Global Trade and Finance" organised by the UK G7 Presidency and hosted by the Bank of England, October.

3. For example, producing and trading Bitcoin alone wastes huge amounts of energy: the equivalent of the entire annual energy consumption of a country with millions of inhabitants like Switzerland.

4. It is estimated that the amounts of crypto-assets exchanged for criminal purposes are substantial, surpassing 2.8 billion dollars for Bitcoin alone in 2019 (see Chainalysis (2020), "The 2020 State of Crypto Crime", January). Other analyses in 2020 show that the volume of criminal activity exceeded 3.5 billion (see Ciphertrace (2021) "Cryptocurrency crime and anti-money laundering report", February). These studies are backed up by various operations carried out in recent years by Europol and Interpol to break up criminal organisations engaged in money laundering and selling weapons and drugs using crypto-assets.

5. There have been several cases of holders of crypto-assets losing all their savings after having lost their blockchain passwords.

6. Stablecoins can usually be converted to cash. Conversion mechanisms differ, however, from those of bank deposits or electronic money. In the case of bank deposits, one-to-one convertibility is based on deposit insurance schemes, financial legislation, and prudential supervision. The value of e-money holdings is protected by the fact that customers' funds must be deposited with third parties in cash format. The lack of such mechanisms could fuel runs on stablecoins if holders – who bear the risks of fluctuations in the value of reserve assets – expect a significant decrease in the redemption price or perceive the issuers as being incapable of absorbing losses.

7. See Panetta, F. (2020), "The two sides of the (stable)coin", speech at Il Salone dei Pagamenti, November.

8. See the report prepared by the President's Working Group on Financial Markets, the Federal Deposit Insurance Corporation and the Office of the Comptroller of the Currency "Report on Stablecoins", November 2021.

9. See Mizrach, B. (2021), "Stablecoins: Survivorship, Transactions Costs and Exchange Microstructure".

10. See Commodity Futures Trading Commission press release, "CFTC Orders Tether and Bitfinex to Pay Fines Totaling $42.5 Million".

11. In September 2021, approximately three quarters of exchanges of crypto-assets on trading platforms involved stablecoins. In that sense, stablecoins are also tainted by the illegal activities associated with crypto-assets.

12. See Panetta, F. (2021), interview with Financial Times, conducted by Martin Arnold, 20 June.

13. See Mizrach, B. (2021), op. cit.

14. See Panetta, F. (2020), "From the payments revolution to the reinvention of money", speech at the conference organised by the Deutsche Bundesbank on "The Future of Payments in Europe",

November.

15. The European Commission recently introduced a Proposal for a Regulation on Markets in Crypto-assets (MiCA). The ECB has updated its Payment Instruments, Schemes and Arrangements (PISA) supervisory model for electronic payment products to include digital payment tokens such as stablecoins.

16. With regard to the United States, see "Report on Stablecoins", (2021), op. cit., and the remarks of the Securities and Exchange Commission Chair, Gary Gensler, before the Aspen Security Forum, August 2021.

17. Decentralised finance (DeFi) is designed to provide financial services without intermediaries, using smart contracts on blockchain and stablecoins to facilitate the transfer of funds. See Bank for International Settlements (2021), "DeFi risks and the decentralisation illusion", BIS Quarterly Review, December.

18. See Panetta, F. (2021), "Cash still king in times of COVID-19", keynote speech at the Deutsche Bundesbank's 5th International Cash Conference, Frankfurt am Main, June.

19. If given the choice, almost half of euro area consumers would prefer to pay with cashless means of payment, such as cards. See ECB (2020), "Study on the payment attitudes of consumers in the euro area (SPACE)", December.

20. Internet sales in the euro area have doubled since 2015. In August 2021 the Eurostat index of retail sales via internet or mail order houses (seasonally and calendar adjusted, index 2015=100) stood at 206.

21. See Zamora-Pérez, A. (2021), "The paradox of banknotes: understanding the demand for cash beyond transactional use", *Economic Bulletin*, issue 2, ECB, Frankfurt am Main.

22. See Waller, C.J. (2021), "CBDC: A Solution in Search of a Problem?", speech at the American Enterprise Institute, Washington, D.C., August.

23. For an analysis of the role of public money in the economy, see Panetta, F. (2021), "Central bank digital currencies: a monetary anchor for digital innovation", speech at the Elcano Royal Institute, Madrid, November.

24. For example, deposits are a liability for banks.

25. One-to-one convertibility with the common monetary anchor is what makes these regulated forms of money convertible with each other at par and is why they are perceived as interchangeable when making payments.

26. See Sims, C. A. (2003): "Implications of rational inattention", Journal of Monetary Economics, 50(3), pp. 665-690.

27. 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.

28. This paragraph only covers the main benefits of a digital euro. For a full analysis see ECB (2020) "Report on a digital euro", October.
29. The heads of state or government espoused the principle of European strategic autonomy at the summit of 2 October 2020.
30. ECB (2019), Card payments in Europe, April.
31. See Panetta, F. (2021), "Stay safe at the intersection: the confluence of big techs and global stablecoins", speech at the conference on "Safe Openness in Global Trade and Finance" organised by the UK G7 Presidency and hosted by the Bank of England, October.
32. The term Big Tech refers to technological giants such as Google, Amazon, Facebook and Apple (GAFA).
33. See Panetta, F. (2020), "The two sides of the (stable)coin", speech at Il Salone dei Pagamenti, November; Panetta, F. (2020), "From the payments revolution to the reinvention of money", speech at the Deutsche Bundesbank Conference on the "Future of Payments in Europe", Frankfurt am Main, November.
34. See Bradford, Anu (2012), "The Brussels effect", *Northwestern Law Review*.
35. See ECB (2021), "Central bank digital currency and global currencies", *The international role of the euro*, Frankfurt am Main, June.
36. The right to privacy is enshrined in the European Charter of Fundamental Rights.
37. The other features highlighted in the consultation were the security of payments and usability throughout the euro area, which were ranked first by 18% and 11% respectively.
38. See Panetta, F. (2021), "A digital euro to meet the expectations of Europeans", introductory remarks at the ECON Committee of the European Parliament, April.
39. The degree of privacy could vary, for example, depending on the amount of the digital euro transaction or whether the payment takes place remotely or in person.
40. See "Into the danger zone. American tech giants ae making life tough for startups". *The Economist*, 2 June 2018, https://judiciary.house.gov/uploadedfiles/competition_in_digital_markets.pdf?utm_campaign=4493-519
41. See Panetta, F., (2020), "The two sides of the (stable)coin", op. cit.
42. For example, in November 2021 Amazon announced to customers in the United Kingdom that from 2022 it would cease to accept Visa credit cards issued in the United Kingdom and offered affected customers a discount of GBP 20 on their next purchase via an alternative payment method.
43. See the paragraph on the effects on the banking and financial system.
44. With a rate of return that is fixed or variable, only positive or even negative, the same as or different from the key ECB interest rates, etc.
45. The impact of the digital euro on the banking and financial system is explored in greater detail in Panetta, F. (2021), "Evolution or revolution? The impact of a digital euro on the financial system", speech by Fabio Panetta at a Bruegel online seminar, February.

46. See Kumhof, M. and Noone, C. (2018), "Central bank digital currencies – design principles and balance sheet implications", *Staff Working Paper*, No 725, Bank of England, May.

47. See Panetta, F. (2018), "21st century cash: central banking, technological innovation and digital currencies", in Gnan E. and Masciandaro, D. (eds.), *Do We Need Central Bank Digital Currency?*, Conference Proceedings 2018/2, SUERF, pp. 23-32.

48. For example, individual users could be allowed to hold a maximum of €3,000, with a provision for amounts above this threshold to be transferred automatically to a bank account.

49. For example, a certain rate of return could be established for amounts up to €3,000, with penalising remuneration set for amounts above that figure. This proposal was put forward in Panetta, F. (2018), "21st century cash: central banking, technological innovation and digital currency", in Gnan E. e Masciandaro, D. (eds.), *Do We Need Central Bank Digital Currency?*, Conference Proceedings 2018/2, SUERF, pp. 23-32; Bindseil, U. (2020), "Tiered CBDC and the financial system", *Working Paper Series*, No 2351, ECB, Frankfurt am Main, January; and Bindseil, U. and Panetta, F. (2020), "Central bank digital currency remuneration in a world with low or negative nominal interest rates", VoxEU, October. An in-depth analysis of how we could avoid the digital euro being used excessively as a form of investment is outlined in Bindseil, U., Panetta, F. and Terol, I. (2021), "Central Bank Digital Currency: functional scope, pricing and controls", *Occasional Paper Series*, No 286, European Central Bank, December.

50. At the same time, the digital euro could make it easier for the authorities to intervene in times of stress, for example by providing the central bank with real-time data on aggregate savings outflows.

51. The impact of the digital euro on the international monetary and financial system is explored in greater detail in Panetta, F. (2021) ""Hic sunt leones" – open research questions on the international dimension of central bank digital currencies", speech at the ECB-CEBRA conference on international aspects of digital currencies and fintech, October.

52. See Ferrari, M., Mehl, A. and Stracca, L. (2020), "Central bank digital currency in an open economy", *CEPR Discussion Paper Series*, No 15335, October; and Committee on Payments and Market Infrastructures, BIS Innovation Hub, International Monetary Fund and World Bank (2021), "Central bank digital currencies for cross-border payments: Report to the G20", July.

53. See Aviat, A. and Coeurdacier, N. (2007), "The geography of trade in goods and asset holdings", *Journal of International Economics*, Vol. 71, No 1, pp. 22-51.

54. See Ikeda, D. (2020), "Digital Money as a Unit of Account and Monetary Policy in Open Economies", *Discussion Paper Series*, No 20-E-15, Institute for Monetary and Economic Studies, Bank of Japan, December.

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