

Digital Euro: An assessment of the first two ECB progress reports



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Supporting EU economic governance scrutiny



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Abstract

This study assesses the first two ECB progress reports on the digital euro. It is socially desirable to have a digital euro. However, the envisaged design of the digital euro makes the use case for a digital euro from consumers' point of view questionable, in part because it will offer less convenience than other, commercially provided, digital means of payment. This study lays out some desirable design features of a digital euro that can foster broad adoption.

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LIST OF ABBREVIATIONS

AML	Anti-Money Laundering
API	Application Programming Interface
CBDC	Central Bank Digital Currency
CC	Credit card
DC	Debit card
DeFi	Decentralised Finance
DLT	Distributed Ledger Technology
ECB	European Central Bank
KYC	Know-Your-Customer
POS	Point of Sale

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Figure 1: Rates on overnight deposits are sticky.

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EXECUTIVE SUMMARY

Since Facebook's announcement of Libra in July 2019, central banks, including the European Central Bank (ECB), have accelerated investigations on the introduction of their own retail digital currency.

This study analyses the two reports published by the ECB regarding its investigation for the introduction of a digital euro.

The digital euro can offer many advantages over existing means of payment. However, most of these benefits, as outlined in the two reports, are of a systemic and social nature, rather than being benefits for users.

A broad acceptance and usage of the digital euro requires that it brings benefits not only to consumers but also to merchants. The digital euro needs a platform business model that brings consumers but also incentivises merchants to adopt it.

In addition, considering the social benefits it brings, the ECB should design the digital euro to promote its appeal. The ECB should consider eliminating holding limits and discontinuing penalising remuneration schemes as soon as possible after its introduction. Also, the ECB should consider adding some programmability features to the digital euro.

There are also some challenges ahead.

The deployment of the digital euro by regulated intermediaries results in a conflict of interest, as the digital euro competes with a significant source of their revenue, i.e. payments. To restrict the fees charged to users of the digital euro by intermediaries, the ECB should consider implementing a transparent fee structure that may incorporate subsidies.

Also, while consumers use cash to preserve their anonymity, the digital euro will always leave a data trail. It is therefore key that the future design of the digital euro preserves at least the privacy of its users, which may require the central bank to make compromises with some other objectives.

It is not clear that distributed ledger technology (DLT) is the best way to deploy the digital euro but making it DLT compatible and programmable can foster innovations in decentralised finance.

1. INTRODUCTION

In July 2019 Facebook (today Meta) announced its intention to launch Libra (then Diem), a digital asset aimed at facilitating cross border transfers of funds and financial inclusion.

Facebook could rely on its worldwide network to guarantee broad and fast adoption of Libra. As such, it posed an imminent threat to the monetary sovereignty of central banks.

Since that announcement, central banks, including the European Central Bank (ECB), have accelerated investigations on the introduction of their own retail digital currency. Digital currencies issued by central banks are known as Central Bank Digital Currencies (CBDC).

A retail CBDC is a digital liability of the central bank available to all economic actors of a currency area, including firms and households that can be used for online and offline retail payments.¹

The ECB published two progress reports on its investigation for the introduction of a digital euro.²

This paper critically reviews the two reports of the ECB. In Section 2, it underlines the main features of the digital euro as currently envisaged in these reports. Section 3 argues that the design of the digital euro should enhance its attractiveness for all users. Section 4 explains the main challenge of balancing privacy with fraud detection. Section 5 deals with the conflict of interest when intermediaries would be responsible for deploying the digital euro. Section 6 argues in favour of making the digital euro programmable and such that it can easily be onboarded to the blockchain.

2. MAIN FEATURES OF A DIGITAL EURO AS ENVISAGED IN THE TWO ECB REPORTS

- **Universal access** *"Paying in digital euros should always be an option, irrespective of the entity with which end users open digital euro accounts or wallets and of their country of origin."* (Report 2, p.2). Economic entities (be it European citizens or firms) should always have the option to pay or be paid with the digital euro. In that sense, the digital euro is "legal tender." The reports do not however mention which entities would be entitled to hold a digital euro accounts or wallets. This is particularly relevant for those individuals or organisation domiciled outside Europe or the euro area.
- **Distribution** *"Supervised intermediaries would be responsible for all end user facing roles in the digital euro ecosystems ... [and] for transaction management tasks"* (Report 2, p.5). The distribution of the digital euro would be the responsibility of intermediaries if they are supervised; this includes banks. The tasks include providing the interface between the device storing the digital euro and users. These intermediaries would also have to manage transactions, very much like what banks do when managing transactions involving commercial bank deposits. At the same time, the reports stress that the digital euro should preserve the privacy of users, without however preserving their full anonymity. This requirement is necessary to satisfy Know-Your-Customer (KYC) and Anti-Money Laundering (AML) regulations.

¹ Some forms of wholesale CBDC only available to regulated banks already exist in the form of central bank reserves.

² These reports are available here: https://www.ecb.europa.eu/paym/digital_euro/investigation/governance/shared/files/ecb_degov220929.en.pdf and https://www.ecb.europa.eu/paym/intro/news/html/ecb_mipnews221221.en.html

- **Settlement** *“The Eurosystem could rely on either traditional technology, DLT or a combination of both for settlement activities. The Eurosystem has not yet taken a decision on the technology that would be best suited for a digital euro.”* (Report 2, p. 7). The ECB has not yet decided which technology it will employ for settling trade with the digital euro. However, it transpires from the two reports that the envisaged model is one where a third party (or a set of third parties) would be responsible for validating the transfer of funds (rather than just Peer-to-Peer).
- **Design (caps and remuneration)** *“On the one hand, quantitative limits on digital euro holdings of individual users could limit individual take-up and the speed at which bank deposits are converted into digital euro. On the other hand, remuneration-based tools could be calibrated to make large digital euro holdings above a certain threshold unattractive compared to other highly liquid low-risk assets.”* (Report 1, p. 9). The ECB envisages the use of limits/caps on holdings of the digital euro, as well as limits for offline usage. (Report 1, p. 9/10). The ECB would use “remuneration-based tools” (read penalty interest rate) to discourage users from holding large amounts of the digital euro.

3. DESIGN AN ATTRACTIVE DIGITAL EURO

The digital euro can potentially offer many benefits over existing means of payment. However, most benefits as specified in the two reports are systemic and social, rather than individual. This questions its broad adoption by users, especially if the digital euro would not preserve the same level of anonymity as with cash and if its design would impose holding limits and use penalising remuneration schemes.

To sustain this claim, I first report some results of the latest ECB survey on how consumers pay (ECB, 2022b) published in December 2022. Based on this survey, I conclude that the demand for a digital euro with a restrictive design will be weak. Then I critically assess the arguments brought forward to impose unattractive design features on the digital euro.

3.1. Why pay with the digital euro?

Although European economies are becoming more digital, the ECB (2022b) reports that most payments are still made at point-of-sales (POS), with only 17% of consumers’ non-recurring payment being conducted online in 2022. Thus, it is sensible to examine how consumers pay at POS to gain insight into the potential adoption of the digital euro. I assume that consumers will prefer paying with the digital euro to paying with bank cards, whenever they *currently* prefer paying with cash to paying with bank cards.

The ECB survey (ECB, 2022b) reports that although consumers say they prefer to use cards, they effectively use cash in most transactions. I argue this discrepancy is not explained by consumers’ revealed preference for cash, but rather by merchants’ card acceptance policy. While discussions have focused mainly on consumers’ choice to adopt the digital euro, I conclude that the digital euro needs a “platform business model” relying on attracting both sides to the trades, consumers and merchants alike.

3.1.1. Why do consumers use cash? Anonymity and awareness

When presented with a list of features for cash that they like, respondents choose “*anonymity preserving*” 40% of the time and “*makes aware of spending*” 40% of the time (respondents could choose several features at once). All other features are less prominent in the mind of respondents.

However, a digital euro cannot preserve the same degree of anonymity as cash, if it is to satisfy AML regulations. Also, it is not clear how the digital euro, as currently envisaged, will succeed in achieving spending awareness.

Therefore, it is very unlikely that those consumers who now prefer to use cash for the anonymity it gives or for the sense of control over ones' spending it procures will even adopt the digital euro when it is introduced.

I analyse the issue of privacy in more detail in Section 4, and I expand on how making the digital euro programmable could help in raising one's awareness on spending in Section 6.

3.1.2. Why do consumers pay with cash when they say they prefer using cards?

The survey shows that only 22% of respondents prefer to pay with cash at POS. 55% of respondents say they prefer to pay with cards, and 22% are indifferent between cash and cards.

Despite the strong preference to pay with cards, at POS cards have a lower market share than cash. Cash was used in 59% of POS transactions while cards were used in only 34% of POS transactions.

The survey does not answer why there is a discrepancy between preference and usage, but there are two main explanations:

1. Although they would like it, consumers do not have access to cards; However, 94% of respondents reported having access to a payment card.³ This can only explain a small share of the discrepancy and cannot explain why the digital euro would be broadly adopted.
2. Merchants do not accept cards at POS. This is the most plausible explanation. Consumers do not use their cards although they would like it, because the merchants leave them no choice but to pay with cash. It is well recognised that merchants find credit or debit cards expensive, even if merchant fees have been regulated. So especially for small ticket items, some merchants can outright refuse card payments, or they do not have the incentive to adopt the technology necessary to process private payments.

3.1.3. The digital euro needs a platform business model

For the digital euro to gain wide acceptance, it is necessary that both merchants and consumers find benefits from using it.

Merchants will adopt the technology to process digital euro payments if they can avoid the (fixed and variable) costs they face when processing a card payment. However, if the digital euro relies on the infrastructure used to process private cards payments, merchants adopting a payment card terminal expose themselves to the "risk" of having consumers pay with commercial cards. Since these cards entice consumers with rewards, etc., consumers are likely to prefer using these cards over the digital euro at POS, once merchants adopt a terminal to process cards payments.

Also, merchants who already use a payment card terminal for large transactions may still refuse to process small payments with the digital euro if the processing fees are too large.

A broad acceptance and usage of the digital euro requires that it brings benefits to not only consumers but also to merchants. The ECB should make sure that merchants are charged minimal fees to process

³ This is very much in line with the fact that only 3.6% of euro area households were unbanked in 2009/10 (see Ampudia and Ehrmann, 2017).

payments in digital euro, or when they transfer digital euro into bank deposits. The digital euro needs a good platform business model that brings both consumers and merchants to use it.

3.2. Why make the digital euro unattractive?

This section presents the main arguments to make the digital euro unattractive, but it explains that these arguments should not carry too much weight in discussions on the digital euro. Given the social benefits it brings, the digital euro can be and should be attractive.⁴

3.2.1. Caps and limits

The main argument to place caps and other limits on the holdings of the digital euro is to make retail commercial bank deposits more stable.

According to the main argument, the digital euro would provide a safe option to depositors fearing for the solvency/liquidity of their bank. By providing a safe option, depositors are more likely to run on their bank, withdrawing funds and depositing in a digital euro account.

The bankruptcy of Silicon Valley Bank (SVB) in March 2023 has once again shown that uninsured deposits are flighty. However, this does not give credence to the belief that the digital euro (or any CBDC) would make matters worse, because the uninsured depositors of SVB did run on SVB (fast!) although there is no digital dollar.

But there is more: Offering a digital euro with no caps, would help discipline the banking sector, and encourage banks to adopt a safer business model, relying less on deposits for their funding and implicit government guarantees. Banks could then switch to funding instruments with longer duration, thus reducing their maturity mismatch. Such instruments include long-term bonds but also equity. The lower reliance on deposits does not mean that banks will necessarily face higher funding costs. For example, with a higher level of equity, long-term debt holders recognise that they are more likely to be paid, thus reducing the risk premium they require to hold a bank's bond (e.g. Admati and Hellwig, 2013).

Overall, this would make banks more stable, not less, with little impact on their lending activities (see Whited et al., 2022). Also, offering a digital euro would help the ECB better monitor financial stability in real time by inspecting flows in digital euro wallets (see Keister and Monnet, 2022).

Finally, for those depositors holding insured deposits, there is no reason to have caps on digital euro holdings below the deposit insurance level of EUR 100,000. With a well-functioning and trusted deposit insurance scheme, insured depositors should not run on their bank even if it shows signs of hardship.

3.2.2. Remuneration scheme

The reason why the ECB favours a penalising remuneration scheme for the digital euro is to discourage depositors from moving their deposits to digital euro accounts, which would make deposits less sticky.

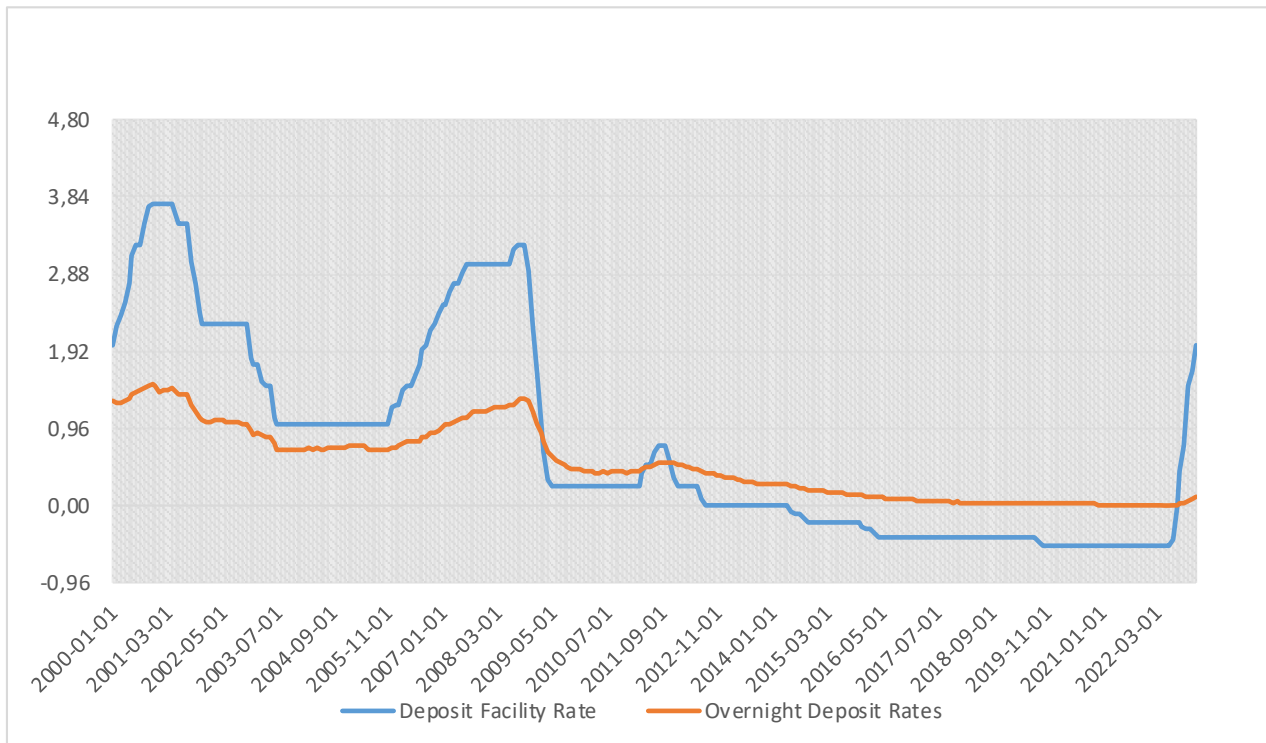
A lower degree of deposit stickiness is however desirable. A common finding in the literature is that banks like sticky retail deposits because they do not have to remunerate retail deposits much (e.g.

⁴ Some of the social benefits of a CBDC that have been mentioned in the literature include inter alia preserving monetary sovereignty and the unit of account, a more direct pass-through of monetary policy, reducing the zero lower bound problem on interest rates, improving the payment system, improving the market for deposits by offering a safe alternative, nowcasting the economy and banks' financial strains. For a summary and an overview of the literature, see for example Auer et al (2022) or Ahnert et al (2022).

Andolfatto, 2021). Indeed, the interest rates that commercial banks pay on deposits are very low and slow to adjust upward, showing a lack of competition on the retail deposits market.

Figure 1 illustrates this claim by showing the ECB deposit facility rate (DFR, blue line) and the rate that European banks pay on deposits (red line) from January 2000 to January 2023. Before 2014, banks were slow to increase their deposit rate relative to the DFR, and they were much faster decreasing it. After 2014, banks felt constrained by a zero lower bound (although overcome by charging management fees).

Figure 1: Rates on overnight deposits are sticky.



Source: ECB and author's calculations

Banks make profits in part by exploiting the stickiness of deposits. A digital euro paying an interest rate would improve the status quo by bringing healthy competition in the market for deposits. Banks can replace deposits with wholesale funding with little effect on lending (Whited, 2022). However, the remuneration of the digital euro should be carefully calibrated, as shown in Chiu et al. (2022).

3.2.3. Programmability

The two ECB reports do not mention if the ECB intends to make the digital euro programmable. Still Panetta (2023) states that *"the digital euro would never be programmable money. The ECB would not set any limitations on where, when or to whom people can pay with a digital euro. That would be tantamount to a voucher. And central banks issue money, not vouchers."*

While it may well be desirable that the ECB commits to never use the programmable feature of a digital euro, allowing users to program the digital euro would be appealing.

Indeed, a programmable digital euro would allow consumers to set limits on their expenses, making them aware of how they spend their money. In addition, such limit could be very granular (e.g., a monthly limit of EUR 100 on cigarettes, another monthly limit of EUR 10 on lottery tickets, etc.).

Merchants and firms could program gift cards, fidelity programs, or other perks directly in the digital euro. Lenders would also benefit by limiting the fraudulent spending of loans, thus reducing the need to monitor borrowers.

Also, a non-programmable CBDC would limit its applications in decentralised finance (DeFi) and leave the space to tokenised deposits and other forms of stablecoin. However, as we have recently seen with the collapse of Luna-Terra, or the volatility of USD Coin (USDC) when SVB failed, a stablecoin or a tokenised deposit is truly stable (guarantee the one-to-one peg with some central bank currency) if it is sufficiently regulated and has the backing of the central bank.

Section 6 analyses the issue of programmability in more detail.

3.2.4. Conclusion

Overall, the ECB does not have to restrict the design of the digital euro and make it an unattractive option. By imposing a cap on holdings and adding restrictions on remuneration, the ECB can only limit the uptake of the digital euro. The ECB reasoning makes sense in the short run, when banks adapt their business model and shift away from retail deposits as their primary source of funds. However, in the long run and from a social point of view, the reasons for a restrictive design of the digital euro are not clear.

4. THE OPERATING COSTS OF A DIGITAL EURO

Like cash, a digital euro will not come for free. This raises the question of who will bear the costs associated with distributing and using the digital euro.

4.1. Estimated operating costs for the digital euro

The cost of processing a transaction with the digital euro should be in the ballpark of the costs of using debit or credit cards.

According to ECB (2022a, Table 10 and 11) credit cards (CC) are among the most expensive payment instruments in terms of unit costs (the cost of one card transaction, independent of the amount involved). They also involve relatively high fixed costs, which are mostly borne by banks given the need to assess customers' creditworthiness among other things.

The reported unit social cost of CC use – the sum of all resource costs across all credit card users – is around EUR 1.00 per transaction, ranging from as little as EUR 0.49 in Poland (in 2018) to as much as EUR 1.90 in Denmark (in 2016). The social cost of CC represents 0.05% of GDP in Italy, 0.04% in Poland, and 0.01% in Denmark.

Debit cards (DC) are cheaper. The reported unit cost of DC use is around EUR 0.4 per transaction, ranging from EUR 0.33 in Poland to EUR 0.59 in Italy. The social cost of DC represents 0.06% of GDP in Italy, 0.26% in Poland, and 0.15% in Denmark.

In comparison, the unit cost of cash is EUR 0.32 in Poland, EUR 0.35 in Italy, and EUR 0.6 in Denmark. The social cost of cash is 0.44% of GDP in Italy, 0.78% in Poland and 0.10% in Denmark, reflecting in part that cash is more widely used.⁵

⁵ ECB (2022a) only reports the unit costs for German retailers (and not social unit costs) in 2017: It is EUR 1.02 for CC, EUR 0.33 for DC and EUR 0.24 for cash.

So, if the private sector handles the dissemination of the digital euro, it will also have to bear a significant cost, likely higher than the cost of handling cash. If the digital euro is rather unattractive to use, economies of scale will not be fully exploited, and the unit costs could stay at a high level for a long time. This could deter the private sector from deploying the digital euro, unless it can charge fees for it, which would defeat the purpose of providing a cheap digital alternative to cash.

4.2. Conflict of interest

Finally, it is important to recognise a looming conflict of interest if regulated intermediaries are responsible for deploying the digital euro.

Existing regulating intermediaries such as banks have no interest in the success of a digital euro, because, among other things, it would compete with one of their main sources of revenue. Indeed, the revenue from payments represents 17% of banks' total revenue in 2017 (see Petralia et al 2019). A number that is most likely higher now after the COVID pandemic which saw an increase in the use of non-cash means of payments.

Regulated intermediaries may be willing to suffer the costs of managing transactions with the digital euro if they have other benefits, such as collecting and monitoring users' data, using data to advertise products, or check solvency. However, these activities would be a clear violation of the privacy principle. So, unless banks can charge possibly large fees on the digital euro, commercial banks will place their payment products first with consumers.

If the ECB is to deploy the digital euro via regulated intermediaries, it should establish a transparent fee structure for the digital euro, possibly involving subsidies, to limit the amount that intermediaries can charge users – merchants and consumers alike – of the digital euro which would limit its adoption.

5. CHALLENGE: BALANCING PRIVACY AND FRAUD DETECTION

Privacy is the ability of users to control the type and amount of data they can share with others. So privacy is not the opposing of sharing data, but it is control over sharing (Acquisiti et al., 2016)

There is a strong distinction between privacy and anonymity. A user retains anonymity whenever it is impossible to trace a transaction back to that user. Therefore, cash preserves anonymity. However, any digital transactions will, almost by definition, leave a data trail, and therefore cannot guarantee the full anonymity of the parties to the trade. Therefore, by its digital nature, a digital euro cannot preserve the *full* anonymity of its users.⁶ The question is whether it can or should at least preserve their privacy.

There is a tension between preserving privacy and ensuring that the digital euro is not used to conduct fraudulent activities. When funds are onboarded to the digital euro device, the intermediary in charge of managing the transaction can ensure that the funds are not sourced from fraudulent activities. However, when those activities are settled with digital euro directly, privacy will necessarily conflict with the level of monitoring necessary to discourage fraudulent activities.

Also, it is not yet clear how the ECB will reconcile privacy with the stated design that *“supervised intermediaries would be responsible for transaction management tasks,”* which implies that intermediaries have access to transaction data.

However, as previously mentioned, anonymity is a key factor that motivates consumers to use cash. So, a design that compromises users' privacy might dissuade them from adopting the digital euro, thus resulting in low adoption.

The danger of violating one's privacy would seem limited if the monitoring of transaction is done by a trusted public institution, and the ECB clearly states in its first report that *“The Eurosystem has no interest in exploiting individual payment data for any purpose”* (Report 1, p. 8). However, the challenge lies in enabling a certain level of surveillance while ensuring that data of past transactions remains inaccessible to anyone other than the users themselves.

Preserving the privacy of its users should be a primary consideration in the development of the digital euro. This could require the central bank to make compromises with other objectives.

⁶ One may think that Bitcoin preserves anonymity, but it is more accurate to say that Bitcoin preserves pseudo-anonymity, because all Bitcoin transactions linked to an address can be publicly observed by just (freely) downloading the Bitcoin blockchain. While it may be difficult to connect a specific Bitcoin address to the identity of its owner, it is not impossible, especially if someone uses their real identity to sign up for a Bitcoin exchange or if they engage in transactions that reveal their personal information.

6. FUTURE DESIGN: PROGRAMMABILITY, CENTRALISATION

6.1. A programmable digital euro

Programmable money is digital money that has built-in control logic. The simplest example of a programmable money is a digital money that is programmed to only purchase apples or set to expire after some programmed date.

Programmable money can achieve the same as conditional payments, but it goes a step further. For example, unlike conditional payments, programmable money can expire beyond a payment deadline. There is also an issue of governance: Conditional payment requires the consent of the payment system manager (say an application programming interface - API - manager) while programmable money is done directly. Moreover, conditional payments demand trust in the intermediary to make timely payments, which is not necessary with programmable money.

There are good reasons to think that the programmability of the digital euro would encourage its adoption and foster technological innovations.

First, ECB (2022b) reports that *“The perceived key advantages of cash were its anonymity and protection of privacy and the perception that it makes one more aware of one’s own expenses.”* Making the digital euro programmable would allow consumers to be in control of their expenses, e.g. by allowing them to program limits at the beginning of each month. A well-designed system would even allow setting limits on specific items. Also, being programmable, a digital euro could help fight money laundering activities, for example by restricting its redemption in physical cash.

A programmable digital euro would help the development of decentralised finance (DeFi). Being programmable, the digital euro could be the settlement asset of choice for smart contracts. Smart contracts are self-executing digital contracts with the terms of the agreement between buyer and seller directly written into code. This allows for automated, transparent, and secure transactions without the need for intermediaries.

A programmable digital euro could also allow for the tokenisation of assets, such as stocks, bonds, and real estate, making them easier to trade and transfer. Tokenisation would also enable fractional ownership, allowing more people to invest in these assets and potentially increasing liquidity. Precisely, a programmable digital euro, being a direct liability of the central bank, could be used as the preferred settlement asset and thus help the development of the market for tokenised assets.

Finally, a programmable euro could also enable greater financial inclusion by allowing for the creation of digital wallets and payment systems that are accessible to individuals who may not have access to some traditional banking services.⁷ Programmability can help these individuals accessing credit in the DeFi ecosystem, for example via crowdfunding. By programming the use of the borrowed funds, creditors can better prevent fraud and make sure the money is used for the intended purpose. Traditionally, banks are responsible for this type of monitoring and naturally charge a fee for it. A programmable digital euro would also allow them to reduce their monitoring activities by directly programming the use of their loans. So, a programmable digital euro can reduce transaction costs, even for traditional regulated intermediaries, and increase economic activity.

⁷ Depending on the design of the digital euro, this may or may not require online access. For example, the digital euro could be programmed offline which would automatically disable its offline use. The programmed digital euro would be enabled as soon as there is online access, for instance at POS when merchants could share their wireless network. In this example, users would not necessarily have to pay for an internet provider to benefit from the programmable features.

Of course, one can argue that a stablecoin issued by commercial banks (also known as tokenised deposits) could work just in the same way as a digital euro. Tokenised deposits would however bring fractional reserves to the blockchain and all the problems that go with it. These problems include excess leverage of banks, run risk, and moral hazard due to the too-big-to-fail problem. The same is true for (non-bank) stablecoins that are backed by bank deposits, as the recent demise of SVB has shown.

Banks will of course argue that tokenised deposits is the only viable solution to the need for a stablecoin (see Swiss Bankers Association, 2023). But a digital euro would allow the blockchain ecosystem to develop new, more direct, ways to do finance, that do not rely so much on intermediaries, be it APIs or highly leveraged financial intermediaries.

However, a programmable digital euro would bring new issues to the fore, that need to be carefully weighed against the above benefits. First and foremost, a programmable digital euro could be used by governments or the central bank to control how people spend their money. The government could order the central bank to set rules (e.g., it cannot be used to purchase cigarettes), or program the digital euro to expire after a certain period or to only be used for specific purposes. This level of control would severely limit financial freedom.

Moreover, the very fact that the digital euro is programmable could facilitate tracking, monitoring and controlling the flow of money by the government. This could be efficient when monitoring financial stability, as I have argued above. However, a rogue government with access to data about individuals' spending patterns, could use that information to target specific groups or individuals, potentially leading to discrimination and unequal treatment.

6.2. A digital euro on a distributed or centralised ledger?

The ECB has not yet expressed a view regarding the underlying technology of the digital euro. However, it should be stressed that Distributed Ledger Technology (DLT) is not necessary to implement any CBDC, which can use a traditional centralised record system, thus economising on the multiplication of verification costs and the use of energy.

DLT has some advantages that could make it an attractive option for the implementation of a digital euro. For instance, DLT can offer a transparent system that is more resistant to tampering, hacking, and other fraudulent activities. The fact that transactions are transparent does not mean that privacy is not satisfied if it is impossible to trace a wallet ID back to an individual or entity.

DLT can also enhance programmability, which would allow for the creation of smart contracts and other advanced financial applications that could enhance the functionality of CBDC. However, implementing DLT for the digital euro would require significant infrastructures and regulatory support, and it would also need to be designed with careful consideration of its potential risks and drawbacks.

Since the ECB specifies that regulated intermediaries should be responsible for "transaction management tasks," it is difficult to envisage the broad usage of DLT, unless the ECB thinks of DLT as *permissioned* DLT, whereas a set of nominated institutions would be responsible for updating the ledger. A permissioned DLT does reduce the duplication of costs, however it introduces points of failure, a problem that is minimised in a fully distributed ledger (see Auer et al., 2021).

7. CONCLUSION

The recent events involving Silicon Valley Bank and Credit Suisse have shown that the banking system remains fragile without the implicit (or explicit) backing of public funds.

The main role of banks, that is investing in the economy, should therefore be separated to the largest extent possible from their role in facilitating payments.

In that respect, a digital euro would be a game changer. It would provide a natural means to pay, encouraging banks to reduce their reliance on deposits. This would reduce the need to bail them out in times of market turmoil. Shareholders and bond holders would then impose more discipline on banks than is currently the case.

However, the digital euro should be made attractive to users. While limits could be imposed when it is first introduced, the ECB should be open to removing these limits as soon as possible. Also, remunerating digital euro holdings would make it more attractive and would force banks to redistribute some surplus to depositors. Finally, adding programmability features to the digital euro would enhance its adoption by giving consumers control over their spending, and allowing easy onboarding to the blockchain.

The long-term effects on banks would be limited. They can adapt their business model to accommodate to that new environment. While this could be costly for banks in the short-term, the long-term social benefits of a more resilient banking system and a more efficient payment system would likely be large.

REFERENCES

- Acquisti, Alessandro, Curtis Taylor and Liad Wagman (2016) "The Economics of Privacy", *Journal of Economic Literature*, 54 (2), 442–492. <https://doi.org/10.1257/jel.54.2.442>
- Admati, Anat and Martin Hellwig (2013) "The Bankers' New Clothes" Princeton University Press. <https://press.princeton.edu/books/paperback/9780691162386/the-bankers-new-clothes>
- Ahnert, Toni, Katrin Assenmacher, Peter Hoffmann, Agnese Leonello, Cyril Monnet, and Davide Porcellacchia (2022) "The Economics of Central Bank Digital Currency," ECB Working Paper No. 2022/2713, forthcoming in *International Journal of Central Banking*. <http://dx.doi.org/10.2139/ssrn.4191600>
- Auer, Raphael, Jon Frost, Leonardo Gambacorta, Cyril Monnet, Tara Rice and Hyun Song Shin (2022) "Central Bank Digital Currencies: Motives, Economic Implications, and the Research Frontier" *Annual Review of Economics*, 14 (August), 697-721. <https://doi.org/10.1146/annurev-economics-051420-020324>
- Auer, Raphael, Cyril Monnet, and Hyun Shin (2021) "Distributed ledgers and the governance of money" BIS Working Papers 924. <https://www.bis.org/publ/work924.htm>
- Andolfatto, David (2021) "Assessing the impact of central bank digital currency on private banks," *The Economic Journal* 131, pp. 525–540. <https://doi.org/10.1093/ej/ueaa073>
- Ampudia, Miguel and Michael Erhmann (2017) "Financial inclusion: what's it worth?" ECB Working Paper No. 1990. <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1990.en.pdf>
- Chiu, Jonathan, Mohammadreza Davoodalhosseini, Janet Jiang and Yu Zhu (2022) "Bank market power and central bank digital currency: Theory and quantitative assessment," forthcoming in *Journal of Political Economy*, <https://doi.org/10.1086/722517>.
- ECB (2022a) "Costs of retail payments – an overview of recent national studies in Europe", ECB Occasional paper No. 294. <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op294~8ac480631a.en.pdf>
- ECB (2022b) "Study on the payment attitudes of consumers in the euro area," December 2022, https://www.ecb.europa.eu/stats/ecb_surveys/space/shared/pdf/ecb.spacereport202212~783ffdf46e.en.pdf
- Keister, Todd and Cyril Monnet (2022) "Central bank digital currency: Stability and information," *Journal of Economic Dynamics and Control* 142, pp. 104501. <https://doi.org/10.1016/j.jedc.2022.104501>
- Pannetta, Fabio (2023) "The digital euro: our money wherever, whenever we need it" Introductory statement at the Committee on Economic and Monetary Affairs of the European Parliament, January 2023. <https://www.ecb.europa.eu/press/key/date/2023/html/ecb.sp230123~2f8271ed76.en.html>
- Petralia, K, T Philippon, T Rice and N Véron (2019), "Banking Disrupted? Financial Intermediation in an Era of Transformational Technology", *Geneva Report* 22, September. <https://cepr.org/publications/books-and-reports/geneva-22-banking-disrupted-financial-intermediation-era>

- Swiss Bankers Association (2023) "The Deposit Token" White Paper, March 2023. https://www.swissbanking.ch/Resources/Persistent/9/4/1/1/941178de59b98030206fc15ac8c99012f65df30b/SBA_The_Deposit_Token_EN_2023.pdf
- Whited, Toni M. and Wu, Yufeng and Xiao, Kairong, Will Central Bank Digital Currency Disintermediate Banks? (May 17, 2022). <https://ssrn.com/abstract=4112644> or <http://dx.doi.org/10.2139/ssrn.4112644>
- World Bank (2019) "Financial Inclusion," World Bank Europe and Central Asia Economic Update, Spring 2019. <http://hdl.handle.net/10986/31501>

This study assesses the first two ECB progress reports on the digital euro. It is socially desirable to have a digital euro. However, the envisaged design of the digital euro makes the use case for a digital euro from consumers' point of view questionable, in part because it will offer less convenience than other, commercially provided, digital means of payment. This study lays out some desirable design features of a digital euro that can foster broad adoption.

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