Lisbon School of Economics & Management
Universidade de Lisboa

MASTERS IN
FINANCE

MASTER´S FINAL WORK
DISSERTATION

CENTRAL BANK DIGITAL CURRENCIES: IMPACT ON THE BANKING SECTOR

BRUNO ANDRÉ MONTEIRO DA CRUZ BAPTISTA

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SUPERVISION:
PROF TIAGO CRUZ GONÇALVES

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GLOSSARY

APB – Associação Portuguesa de Bancos

AML/CFT – Anti Money Laundering/Combating the Financing of Terrorism

CBDC – Central Bank Digital Currency

CGD – Caixa Geral de Depósitos

DeFi – Decentralized Finance

ECB – European Central Bank

IGCP - Agência de Gestão da Tesouraria e da Dívida Pública

KYC - Know Your Customer

ABSTRACT, KEYWORDS, AND JEL CODES

The issuance of a Central Bank Digital Currencies (CBDC) may bring the opportunity to revolutionize payments if its digital advantages over conventional money are leveraged. As a digital currency, a CBDC can help the financial system to keep up with the digital wave seen in other sectors, facilitating online business and the consumption of digital goods, such as music, and art, among others. The issuance of a CBDC can also have negative impacts on the financial system. Depending on the type of CBDC Central Banks intend to issue, there are potential risks not only for the banking sector and financial stability but also for households and businesses.

This dissertation aims to understand: (1) the impact that the issuance of a CBDC would have on the Eurozone; (2) which CBDC designs could minimize the negative impacts on the banking sector and financial stability; (3) how the banking sector can add value to the Digital Euro. The method used for gathering empirical information was through interviews, collecting testimonies from professionals in the banking sector, whose knowledge and areas of work may shed some light on the impact of the issuance of a Digital Euro and how the banking sector can bring value to the Digital Euro.

With this research, we can conclude that the introduction of a CBDC in the Eurozone, the so-called Digital Euro, could negatively affect the banking sector if not designed with it in mind. From the interviews, it was concluded that, as described in the literature review, in the worst-case scenario, the introduction of a CBDC could lead not only to disintermediation in payments but also, in times of crisis, to bank runs where customers with bank deposits would convert these into deposits with the Central Bank. After collecting the opinions of banking professionals, we concluded that the type of CBDC that would minimize the negative impacts on the banking sector and economic stability would be a CBDC with centralized architecture, account-based access method, a domestic scope, indirect control by the Central Bank, thus maintaining the existing Two-Tier System.

KEYWORDS: Central Bank Digital Currency (CBDC), Digital Money, Banking Sector, Central Bank, Digital Euro, Disintermediation

JEL CODES: E51, E58, E61, G21, O33

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CENTRAL BANK DIGITAL CURRENCIES: IMPACT ON THE BANKING SECTOR

By Bruno M. Baptista

1. INTRODUCTION

The world we live in is increasingly digital, whether in the areas of entertainment, the way we shop, through e-commerce, or even in personal finance and payments, with consumers demanding payment methods that are more adjusted to this digital reality, i.e., "faster, easier, anytime, anywhere" (Barantoni and Holden, 2019, p. 1).

Modern-era money is already digital, putting aside physical records, trillions are moved electronically daily, with no physical movement of coins/notes, however, the method it uses has not changed, continuing to be done using an intermediary (Boyle et al, 2021). With the 2008 financial crisis and the emergence of the first cryptocurrency, Bitcoin, other cryptocurrencies followed, starting the growing trend of crypto assets such as *stablecoins* (Almeida and Gonçalves, 2022, 2023), which ultimately accelerated the need for central banks to, on the one hand, review the role of fiat money in the payments field and, on the other, to create their answer – Central Bank Digital Currency (CBDC) (Sandner et al, 2020).

The issuance of a CBDC may bring the opportunity to revolutionize payments if its digital advantages over conventional money are leveraged. As a digital currency, a CBDC can help the financial system to keep up with the digital wave seen in other sectors, facilitating online business. The issuance of a CBDC can also have negative impacts on the financial system. Depending on the type of CBDC Central Banks intend to issue, there are potential risks not only for the banking sector and financial stability but also for households and businesses.

A CBDC, due to its investment characteristics, may induce households to withdraw their deposits in the banking sector and convert them into CBDCs, i.e., liabilities with the central bank as it is safer since if a commercial bank goes bankrupt, it does not guarantee all customer deposits above a certain amount (Grym et al, 2017). In times of crisis, the safer nature of CBDCs can amplify the withdraws from commercial bank deposits triggering bank runs. Thus, it is important to understand the benefits and risks of these initiatives since they can jeopardize the financial stability of an advanced economy such

as the Eurozone. Despite the growing interest in this topic, there are still very few countries that have already implemented a CBDC and there are even fewer advanced economies that have decided to implement one, with many still in the study phase.

To shed some light on the impacts of an emission of a CBDC in the Eurozone we conducted several interviews with professionals in the banking sector. The selected professionals are responsible for important departments whose issuance of a Digital Euro could have direct consequences in their area (treasury, accounting, portfolio management, or foreign currency management). These interviews will allow us to (1) ascertain the perception of all these professionals regarding the impact that CBDCs will have on the financial sector, (2) understand how the negative impacts can be minimized due to the characteristics of CBDCs, and (3) understand how the financial sector can take advantage of these digital currencies.

With this objective in mind, the methodological approach on which we will rely to collect and analyse the empirical information will be the qualitative approach since our main objective is to "understand and find meanings through verbal narratives" (Bento, 2012, p. 1) of professionals linked to the banking sector regarding the CBDCs, namely the Digital Euro.

This dissertation is structured as follows: In the second chapter, we explain what are CBDCs; what motivates Central Banks to study and possibly issue them; the types and designs of CBDCs; risks and opportunities, and a little context of CBDC studies in the Eurozone. Afterward, in chapter three we present the methodology used for our analysis and show the results obtained from the expert interviews. In chapter four we conclude, by answering the starting questions, discussing their implications, and giving some notes for further research.

2. LITERATURE REVIEW

2.1. Central Bank Digital Currencies (CBDC)

The world we live in is increasingly digital, whether in the areas of entertainment, the way we shop, through e-commerce, or even in personal finance and payments, with consumers demanding payment methods that are more adjusted to this digital reality, i.e., "faster, easier, anytime, anywhere" (Barantoni and Holden, 2019, p. 1). This 'technological revolution' (Caselli, 1999) is the result of a combination of advances in the processing and storage capacity of computers and advances in telecommunications and digital infrastructure, which allow large amounts of data to be collected, managed, and shared quickly, eliminating, and reducing the cost of several tasks (Bolt et al, 2022).

The COVID-19 pandemic has further reinforced this 'digital wave', changing not only the way we work, on a large scale work from home (something that would have been practically impossible a few decades ago), but also by boosting digital payment methods to detriment in traditional ones, such as cash, in an attempt to reduce the transmission of the virus through banknotes and the decrease in withdrawals, due to the temporary closure of non-essential stores (Auer et al, 2020). In most jurisdictions, although cash in circulation did not decrease, there is even evidence of a cautious increase in cash holdings (Boar and Szemere, 2021). The pandemic aggravated the trend that had already been observed: a shift from traditional payment methods (such as cash) to digital ones (electronic money). According to Cheng (2022), electronic records of deposits in the banking system (electronic money) outnumber banknotes and coins in circulation by volume.

According to Carstens (2021), "the payments market is the first entry point to finance and is the foundation of all economic activity" (p. 2). Despite everything moving towards digitalization, cash and payments have seen little innovation regarding the method of recording, with the same account-based method still being used today (Grym et al, 2017). Modern-era money is already digital, putting aside physical records, trillions are moved electronically daily, with no physical movement of coins/notes. However, the chosen method for such has not changed, still being done using an intermediary (Boyle et al, 2021).

With the 2008 financial crisis and the emergence of the first cryptocurrency, Bitcoin, other cryptocurrencies swiftly followed, starting the growing trend of crypto assets such as *stablecoins* thus accelerating the need for central banks to, on the one hand, review the role of fiat money in the payments field and, on the other, to create their own response to it – Central Bank Digital Currency, or CBDC (Sandner et al, 2020).

2.1.1Definition

According to several authors, notably Cheng (2022), and Bolt (2022), Central Bank Digital Currencies (CBDC) are virtual money in digital form that, like circulating coins and notes, are issued by a Central Bank, and are therefore considered public money. "Unlike bank deposits, a CBDC would not be a claim on the legal tender, it would be the legal tender itself, like cash" (Sandner et al, 2020, p. 6). In this sense, CBDCs have the same three functions of money systematized by Jevons (1876): (1) medium of exchange; (2) unit of account; and (3) store of value. Like cash, CBDCs represent a liability of the central bank and have no intrinsic value but can be redeemable on par with their physical format (fiat money), if that is one of the characteristics that the issuing Central Bank wishes to assign to them. CBDCs can also make use of shared networks, such as *BlockChain* or other Distributed Ledger Technology (DLT), to facilitate settlements or centralized networks owned by the Central Bank (Bolt et al, 2022). Moreover, CBDCs also can be programmable, allowing the issuer to assign conditions or features to them after they are issued (e.g. remuneration of CBDCs through interest rates applied directly to the customer's digital wallet, where these CBDCs are stored) (CPMI-MC, 2018).

2.1.2 Motivations

The history of money is not linear, but in the last few decades there has been a trend of dematerialization of money: it went from commodity money to representative money; with the end of the gold standard, it went to fiat money, and only then to scriptural money, redeemable on par with fiat money (Cunha et al, 2022).

According to Cunha et al. (2022), we can list three technological forces that, when interconnected, have led money to its last stage of dematerialization, the first being consumers' demand for faster, easier, more efficient, secure, and universally accessible

payment methods that only digitalization can provide (Barontini and Holden, 2019); secondly, the increasing role of private digital payment systems, which have created a substitution effect for other forms of payment, leading to a decline in cash payments, threatening the balance between public and private means of payment (Bolt et al, 2022); and finally the success of cryptocurrencies. Among the existing crypto assets, the ones that got the most reactions from Central Banks were *stablecoin*s, that is, cryptocurrencies indexed to a pool of collateral (or other underlying such as fiat currency) to stabilize their value (Sandner et al, 2020). Of the existing *stablecoins*, specifically with the announcement of Facebook's intentions to issue its own *stablecoins* (the *Diem*, formerly named *Libra*), given its vast network of users, approximately two billion, and geographical dispersion, this *stablecoin* could put into question the relevance of money issued by central banks and the current payment system. "The success of cryptocurrencies and crypto assets that, in recent years, have seen an exponential increase in their media coverage and interest from private and institutional investors; there is even a perception that *Blockchain* is the ideal network, where currencies not controlled by governments can circulate and be used", calling into question the role of Central Banks and Monetary Policy (Cunha et al 2019, p. 2).

In addition to technological factors, authors such as Auer and Cornelli (2020) suggest as motivations for the creation of CBDCs: the need for digital money that enhances greater social inclusion, especially in emerging economies, allowing access to a cheap, safe, and efficient payment system. In advanced economies, studies suggest that the motivations of Central Banks are less urgent, being more linked to improving cyber resilience, trading, and settlement of assets in capital markets than social inclusion. According to Boar and Wehrli (2021), there is also the incentive for CBDCs to the reinforcement of monetary policy transmission, allowing the Central Bank to set an interest rate that directly influences the consumption and investment choices of the non-financial sector, something that cannot be achieved using cash, or even, having a real-time database, allowing Central Bank’s to visualize the direct impact of monetary policies on household and business consumption (Bordo and Levin, 2017).

In that regard, the factors described above have led Central Bank to review the need to create an alternative so that public money does not loose relevance, with more and more Central Banks admitting that it is possible to issue CBDCs in the future, although it

is a medium-long term goal (BIS, 2021). According to the findings of the 2020 BIS survey on 68 Central Banks about digital currencies and the future of the monetary system, in 2020, 86% of those Central Banks were already studying CBDCs (up from 65% in 2017), 60% were already conducting CBDC experiments or concepts (up from 42% in 2019) and about 14% had already moved to the development or pilot phase of their CBDCs (up from 10% in 2019); however 3 out of 4 banks were uncertain whether to issue a CBDC due to, among other factors, legal issues (Boar and Wehrli, 2021).

2.1.3 Types and Designs

As a digital currency, CBDCs can be designed with various designs, depending on the needs and needs of the citizens and the Central Banks that issue them. Taking into account the existing trade-offs between opportunities and risks that each type of CBDC entails, there is the possibility of creating CBDCs with very similar characteristics to cash; on the one hand, anonymity and instant validation of a transaction or, on the other hand, establishing synergies with technology, creating a more advanced form of money with more benefits for citizens and society as a whole (e.g: programmable money that can be remunerated at a certain interest rate and/or traceable features being able to bring advantages and improvements in the fight against money laundering and terrorist financing) (CPMI-MC, 2018).

Cheng (2022) divided CBDCs as to their architecture, access methods, target users, and scope of use. Regarding architecture, CBDCs can be decentralized, based on Distributed Ledger Technology, or centralized, using traditional databases where the information is centralized in an intermediary. The decentralized architecture is the same type of technology used by decentralized cryptocurrencies such as Bitcoin, which allows for greater transparency and efficiency in transfers, reducing time and transaction costs for its users, since the data is present in the network and not dispersed among various entities. In terms of payments, this type of architecture contrasts with traditional centralized models, since the latter requires intermediaries to register, validate, and settle transactions.

As for the user access method, CBDCs can be divided between account-based and token-based (Auer and Böhme, 2020). Account-based CBDCs work like bank accounts,

a user proves his identity to access his account and only after that confirmation he´s authorized to make a transaction (which is always linked to his identity), following the "I am therefore I own" principle (Auer and Böhme, 2020, p.7). On the other hand, the token-based method allows user anonymity through cryptographic schemes, removing user identification, as happens in cash payments. This method follows the "I know therefore I own" principle (Auer and Böhme, 2020, p.7), where the user has a pseudonym, and knowing his access code allows him to access his account. Despite the anonymity conferred by this access method, a CBDC can have the so-called 'controllable anonymity', where the central bank decides whether large transactions are tracked and shared by competent authorities, while low-value transactions remain anonymous; in this way, a certain level of control over illegal activities is guaranteed (Cheng, 2022). According to a public consultation conducted by the ECB in 2021, the biggest concern of European citizens regarding the Digital Euro is user privacy. In contrast, citizens' privacy concerns are low in countries like China.

Another major distinction between CBDC relates to the target audience, i.e., whether the use is for Retail or Wholesale. Wholesale CBDCs target financial institutions and the transactions that take place between them. A Wholesale CBDC can be designed to accelerate settlements and reduce counterparty risk between institutions by using smart contracts and tokenizing financial instruments such as debt securities, making the financial system faster and more efficient. This is the type of CBDC most studied by advanced economies, where interbank systems are already relatively evolved and whose concerns focus more on cyber-resilience, efficiency, and robustness of payment systems. (Boar and Wehrli, 2021)

Retail CBDC has a broader scope, also including individuals and businesses. It is a CBDC that can be used directly by individuals, causing real disruption in the current model, as it can lead to the removal of banks as intermediaries (Bech and Garratt, 2017; Houben, 2018). If designed with this intention, a Retail CBDC can enable direct confirmation and settlement between individuals, with no need for intermediaries and their associated costs, making transactions faster and cheaper.

Boar and Wehrli (2021) argue that in the context of declining cash usage and lack of universal access to the banking system, many central banks see CBDCs as a means of

ensuring access to a public, secure and complementary payment option to cash. According to Boar and Wehrli's (2021), these types of CBDCs are preferred in emerging economies, such as the Bahamas and China, where the major concern/motivation is less about payment efficiency and robustness and more about social inclusion, efficiency, and robustness of domestic payments.

Among the retail CBDCs, we can distinguish between those under the direct control of the Central Bank, which assumes a direct role in the registration and settlement of customer transfers, having a one-tier system, and removing the role of intermediaries, such as banks, from these functions. Studies indicate that this type of CBDC could decrease the credit risk (of the end user) and dependence on the private sector. However, by transferring these functions from the private to the Central Bank, there would be an impact on the Central Bank's ability to perform the functions of customer management, Know Your Customer (KYC) and Anti Money Laundering (AML), which could ultimately decrease the efficiency and stability of the payment system. Retail CBDCs can also resemble the 2-tier system model, i.e., CBDCs with indirect Central Bank control, where the Central Bank takes care of the settlement of the financial intermediaries' accounts and the intermediaries are responsible for the customers' accounts. This model is less disruptive since banks maintain interaction with customers: the Central Bank would distribute CBDCs to authorized institutions which, in turn, would distribute them to the customer.

As for their scope, CBDCs can have a domestic scope or be used to enhance cross-border payments by reducing costs and risks and improving efficiency, and three CBDC models are being studied to facilitate payments between Central Banks (Auer and Haene, 2021):

- Model 1 focuses on intermediary risk by facilitating direct payments between the two parties involved using DLT technology. The goal is to make the DLTs of each CBDC interoperable, allowing direct transfers between the two agents involved in the transaction;

- Model 2 keeps the intermediary, but he is responsible for managing transactions and settlements between the two CBDCs that run different systems and can operate in

centralized networks. In this model there is a Clearing System, centralized or decentralized, that matches the operations of the various agents;

- Model 3 refers to cross-border payments between two or more agents, in a common network, where there is a pool with several CBDCs and where settlements and exchange rates can be automated through *smartcontracts*. In this model, there is a single infrastructure, where Central Banks define a single set of rules and standard messages so that all CBDCs can operate on this single platform, with direct settlements among themselves.

Despite the advantages that a CBDC can bring in cross-border payments, in terms of efficiency, cost and speed, most Central Banks focus on CBDC models for domestic use (Auer and Haene, 2021). However, the authors highlight that CBDCs, even if designed with a domestic focus, will have implications across borders, and it is vital to coordinate efforts and find common solutions to improve the current system.

Cunha et al. (2022), in "Making sense of the Digital Money Revolution", systematized all the characteristics already mentioned above, also adding distinctions between authority and access to infrastructure and availability and restrictions to access systematized in the following table:

Table 1: CBDC main characteristics/design goals

Characteristic	Alternatives	Description
Application Area	Wholesale	The currency is intended only for financial institutions which hold accounts in the central bank
	Retail	The currency is intended for use by the general public
Architecture related to Operating Model, Acess Model	Direct CBDC	CDBC is a claim on the central bank; onboarding is performed by either the central bank or intermediaries (respecting KYC regulations); all payments are handled by the central bank
	Indirect/Synthetic CBDC	CBDC is a claim on an intermediary, onboarding is performed by intermediaries (respecting KYC regulations); retail payments are handled by intermediaries, and wholesale payments are handled by the central bank
	Hybrid CBDC	CDBC is a claim on the central bank; onboarding is performed by intermediaries (respecting KYC regulations); retail payments are handled by intermediaries, but the central bank periodically records all retail balances and operates a backup technical infrastructure allowing it to restart the payment system if intermediaries fail
	Intermediated CBDC	Like Hybrid CDBC, but the central bank maintains only a wholesale ledger, rather than all transactions
Access Technology	Account-based access	The value is linked to an account, with ownership tied to identity; no privacy by default
	Token-based access	The value is linked to demonstrated knowledge, like a digital signature, eventually stored in a hardware device; provides privacy by default
Central Bank Infrastructure	Conventional	The transactions are stored in a logically centralized ledger; the actual storage may be distributed, but the control over the information is centralized
	Distributed ledger technologies (DLT)-based	The transactions are stored in a logically distributed ledger; the control over information must be harmonized with a consensus mechanism; may make use of Blockchain technology (like R3 Corda or Quorum)
Interlinkages	National	Access is reserved for residents of a particular monetary
	International	Accessible to non-residents, allowing for cross-border retail payments; this is allowed by default if the access is token-based
Authority maps partially with Infrastructure and Access Technology	Centralized	Only the central bank can verify and commit transactions
	Partially Decentralized	The ledger is run on a DLT, allowing for decentralized transaction verification and commit
Availability and Limitations and Restrictions on Access	Unlimited usage	While theoretically possible, it may conflict with particular central bank goals due to effects on the banking sector, monetary policy, and financial stability
	Geographical limits	Only accessible to current residents of a monetary area
	Value limits	Maximum limits on the amount that can be stored in a particular account or instrument

Source: Cunha et al (2022)

2.1.4 Benefits and opportunities

The issuance of a CBDC may bring the opportunity to revolutionize payments if its digital advantages over conventional money are leveraged, with some authors arguing that its novelty and 'clean slate' should be used to minimize the problems of legacy systems (CPMI-MC, 2021).

As a digital currency, a CBDC can help the financial system to keep up with the digital wave seen in other sectors, facilitating online business and the consumption of digital goods, such as music, and art, among others. In addition, CBDCs can help the economy by making payment processes easier, faster, and more efficient, facilitating new digital business models (BoE, 2020).

Furthermore, CBDCs can help preserve countries' autonomy in such a critical sector as the payments industry, preventing them from being overtaken and dominated by private interests, with the rise of alternative means of payment such as *stablecoins* or even foreign CBDCs (CPMI-MC, 2021). Issuing a CBDC may even become necessary in the future if private solutions such as Facebook's Diem, for example, are widely used, thus threatening countries' sovereignty in financial, economic, and political terms (Cunha et al 2019).

CBDC can bring improvements to the banking industry and can be designed to accelerate settlements and reduce counterparty risk between institutions, through smartcontracts and the tokenization of financial instruments, such as debt securities, making the financial system faster and more efficient. They can also bring advances in the fields of cyber-resilience, efficiency, and the robustness of payment systems (Boar and Wehrli, 2021).

CBDC can also bring innovations at the Monetary Policy level. The programmability of CBDCs allows: (1) the Central Bank to set an interest rate that directly influences the consumption and investment choices of the non-financial sector, something that cannot be achieved using cash (Boar and Wehrli, 2021); (2) that cash has an expiration date (as is being studied with the E-Yuan, China), influencing its citizens' consumption decisions by programming where and when it can be spent (Huang, 2021); (3) building a database, in real-time, allowing the Central Bank to know where and on what households and businesses spend their money, allowing faster and more pertinent adjustments of

Monetary Policy (Mersch, 2017), or to have better visibility on large amount transfers. Although relevant, these types of innovations raise questions regarding citizens' privacy, with some societies more concerned than others (Grym et al, 2017).

CBDCs can help combat illicit activities, money laundering, and tax evasion. According to United Nations estimates in 2021, the amount of money laundered each year amounts to 2-5% of global GDP (see United Nations - Office on Drugs and Crime, 2021). Many illegal activities use cash, given the anonymous nature of the transactions, to carry them out. Since CBDCs are traceable, the history of transactions is recorded, and they could help in AML/CFT enforcement in tax evasion cases (CPMI-MC, 2018).

CBDCs may also reinforce the importance of domestic currencies internationally, if the advantages of their CBDC overlap with other CBDCs, favouring their adoption abroad, stimulating demand among investors, and strengthening their role internationally by preventing other CBDCs from doing so in their place. CBDCs can also decrease frictions in cross-currency payment infrastructures, such as the transfer of remittances, something that to date is time-consuming and entails high costs, thus facilitating trade between countries (Auer and Haene, 2021). According to the World Bank, banks are the most expensive provider of international transfer services, charging an average of 10.49%, while the average, including other providers, is around 6.84% (see World Bank, 2019)

At the level of social inclusion, issuing CBDCs can bring relevant innovations. In 2018, the World Bank estimated that approximately 1.7 billion people in the world lack access to financial services, and of those, approximately 2/3 have smartphone access (see World Bank, 2018). Issuing a CBDC should take into account the most disadvantaged populations, providing them with financial services by including them in faster and cheaper payment systems (Auer et al, 2020). Account assignment to these social classes could, for example, facilitate the arrival of support to families in crises, preventing friction as occurred with stimulus checks in the US during the COVID-19 pandemic (Scher, 2020). This support can be provided through the direct remuneration of users' electronic accounts, created, and assigned for this purpose, facilitating the arrival of support to the most disadvantaged social classes, even when they do not have a bank account (Bijlsma, 2021). Despite the motivations of Central Banks in contributing to greater social

inclusion, this varies depending on whether the economy is advanced or emerging (Boar and Wehrli, 2021).

In countries such as Sweden or even China, where there is a sharp decline in the use of cash as a means of payment, a CBDC, by allowing an additional form of payment, on the one hand, limits the dependence of these economies on private means of payments and on the other hand, maintains the relevance of the role of National Central Banks in issuing currency and their Monetary Policy (Auer et al, 2020). To remain relevant in issuing currency and preserve its autonomy in the payments sector, in a context of declining cash use, Central Banks can issue CBDCs to meet the needs of users, and it should be a cheap, secure, easy, and efficient form of payment to use, without market risk or issuer default, just like cash.

On an ecological level, issuing a CBDC can help reduce the ecological footprint, also following the greener and more ecological goals that countries are increasingly adopting, since digital money does not need raw materials to be produced or transported.

2.1.5 Drawbacks and Risks

A new form of money, giving users direct access to electronic payment methods, can bring many conveniences, but it can also have impacts on the financial system. Depending on the type of CBDC Central Banks intend to issue, there are potential risks not only for the banking sector and financial stability but also for households and businesses.

A CBDC, due to its investment characteristics, may induce households to withdraw their deposits in the banking sector and convert them into CBDCs, i.e., liabilities with the central bank as it is safer given that if a commercial bank goes bankrupt, it does not guarantee all customer deposits above a certain amount (Grym et al, 2017). This would pose a risk to the banking sector and financial stability, as it would increase the cost of funding for banks and, consequently, interest rates for granting credit, reducing the volume of credit granted to the economy (Bindseil, 2020). In this situation (increased funding cost of banks by entering a competition with a CBDC), banks could increase the remuneration of customer deposits to retain them, or even replace this source of funding by borrowing from the Central Bank. But to borrow from Central Banks, banks would need more debt securities (like bonds and mortgage-backed securities) to serve as

collateral, and the increased demand for such assets would increase their price, again leading to an increase in the cost of funding for banks. In turn, this situation would lead to a deleveraging from banks, which would cause a decrease in the supply of credit, preventing an optimal level of investment and consumption, which in turn would translate into a slowdown of the economic activity (Grym et al, 2017).

Faced with a situation of scarcity of deposits and high funding costs, banks could take on greater risks, seeking higher returns, thus increasing counterparty risk (risk of the counterparty not fulfilling its obligations) and enhancing the occurrence of bankruptcies and crises. In a crisis scenario, if the CBDCs do not offer obstacles to withdrawing as cash, households would again be motivated to withdraw their deposits from banks and convert them into Central Bank liabilities to secure their savings. Banks would also be motivated to replace assets considered safe with central bank liabilities, which could have implications for risk-free interest rates and indirectly for other risk classes (Grym et al, 2017).

Issuing a CBDC may also carry risks for the Central Bank itself, as a large adoption of a CBDC could lead to the expansion of its balance sheet, its role in economies, and its risk exposure (Bank of England, 2020). To expand its balance sheet, the Central Bank would have to acquire assets such as debt securities and loans to hold against the issuance of its CBDC. In this scenario, the Central Bank could end up investing in more illiquid assets to expand its balance sheet, also leading to a strengthening in its risk management.

Another risk relates to the costs of providing a digital currency that, to resemble cash, would have no costs to the bearer, the costs being supported by the Central Bank, or third parties involved in the provision.

The Central Bank would also be exposed to legal risks, as it is ultimately responsible for the system, if there is a fraudulently authorized payment or if there is negligence on the part of payment service providers on behalf of the Central Bank. The malfunctioning of the computer platforms underlying CBDCs, and the resulting losses would also be attributable to the Central Bank. Added to this would be the reputational risk if the costly investment in the IT platforms underpinning the CBDC proves to be unreliable and unstable, or if they are subject to cyber-attacks that compromise their users' data. Another situation could occur due to the misuse of data obtained from citizens or even from spying

or selling this data to third parties. Also, the fact that CBDC may enjoy privileges compared to the private sector in payments, could lead to reputational problems and legal issues (Boar and Wehrli, 2021).

Since it is digital money, if there are no limitations on its adoption by citizens living abroad, CBDCs can have implications for capital flows and the exchange rate of national currencies and can affect the orientation and transmission of monetary policy. If foreign citizens start to reinforce their portfolio with CBDCs of a particular country, given its stability when compared to their own, it could strengthen the exchange rate of the CBDC country, making its exports less favourable. Also, at the level of its adoption by citizens living abroad, if the CBDC enjoys a high level of privacy, it could even be an attractive tool for terrorist financing and money laundering in cross-border criminal activities, further strengthened if the CBDC is designed in a way that excludes intermediaries, decreasing control steps and performing KYC (BIS, 2020).

A CBDC and the centralization of information may attract cyber-attacks for profit, theft, or unauthorized data transfer, compromising not only the integrity of the currency and citizens' trust in the currency but also citizens' security and their data (BIS, 2020).

A CBDC can also crowd out the private sector, such as commercial banking and private initiatives, which are an important piece in the innovation and convenience of payment methods (Bolt et al, 2022). As observed throughout history, notably with bank deposits, private money can incite innovation by solving important frictions by being easy to use, low risk of theft, and having better ways to register (Chakravorti, 2016).

2.2 Digital Euro: CBDC in the European Context

In 2020, following the publication of a report on the CBDC, the European Central Bank stepped up its work on the digital euro and at an ECB meeting, Christine Lagarde, Governor of the European Central Bank, said, "we should be ready to issue a digital euro, if necessary." A year later, in July 2021, the ECB announced the launch of the research phase of the Digital Euro project, which would start in October of the same year and last for two years, where "the possible impact of a digital euro on the market will be assessed, by identifying design options to ensure privacy and avoid risks for euro area citizens, intermediaries, and the wider economy." On the same date, the creation of the Digital

Euro Market Advisory Group (MAG) was announced, which will be composed of payments experts to add market knowledge on the issue of how a digital euro can add value to the euro area's complex and dynamic payments ecosystem. In 2023, a new decision will be made on whether to continue with a digital euro realization phase.

Throughout the year, several comments were made by ECB members, notably Christine Lagarde and Fabio Panetta, including that the Digital Euro: (1) would support the digitization of the European economy; (2) comes as a response to sovereignty concerns with the emergence of foreign private digital means of payment, or even other CBDCs, in the Eurozone; (3) would complement cash, not replace it (4) has no ambition to replace banks, nor take deposits from them; (5) will be, preferably, distributed by authorized banks to the real economy (6) has no interest in collecting payment data from individual users, tracking payment behaviour or sharing such data with government agencies or other public institutions (see ECB website).

In the Eurozone, reserve deposits hold in the Eurosystem's TARGET2 system. Central bank counterparties have the right to exchange reserve deposits for cash and vice versa. Commercial Banks then act as a distribution channel for cash on to their customers, i.e., ordinary citizens, businesses, and other entities.

The issuance of a CBDC in the Eurozone can have major impacts on financial stability, as depending on its characteristics, it can have strong implications for the banking sector. A Digital Euro, designed to be a form of digital money and accessible to the public, "could be a strong substitute for bank notes, coins and deposits, leading to significant changes in the financial sector, since the CBDC holder would have a direct claim on the Central Bank and as such would not be exposed to credit risk, as is the case with bank deposits." (Sandner et al, 2020, p. 7). Several authors, such as Bech and Garratt (2017), believe that access to CBDCs, by nature risk-free, could trigger an excessive movement of funds from bank deposits to deposits with the Central Bank, leading to disintermediation and consequently high funding costs for banks. This disintermediation and increased funding costs could lead to another financial crisis. Thus, in crises, holders of bank deposits would convert these deposits into CBDCs with the central bank to avoid credit risk, enhancing the risk of bank runs.

Other authors such as Mersch (2018) also argue for the risk of bank runs in issuing a CBDC, stating that during a systemic banking crisis, holding risk-free CBDCs can become much more attractive than bank deposits enhancing a run-on bank deposit, amplifying the effects of the crisis. Even in the absence of a crisis, an easily convertible CBDC could cause a complete abandonment of bank deposits - jeopardizing the existence of two-tier system banking. In this situation, the efficient flow of credit to the economy would likely be impaired.

Despite the negative impacts described above, namely bank runs and increased funding costs for banks, leading to lower investment in the economy, other authors argue that the introduction of a CBDC in the Eurozone economy could have beneficial effects, namely in reducing excess liquidity. Fegatelli (2022) also argues that the risk of disintermediation is a problem in the introduction of a CBDC, jeopardizing financial stability and monetary policy transmission. However, Fegatelli (2022) also argues that the introduction of a CBDC, with the right characteristics, in an economy could even increase the profitability and competitiveness of the banking sector by absorbing banks' excess liquidity without penalizing their lending capacity in countries where the deposit rate with the central bank is negative. To have this beneficial effect of absorbing the penalty of negative rates on excess liquidity, Fegatelli (2022) argues that the Central Bank: (1) would have to have "control mechanisms to manage the volume and cost of CBDC in circulation" (p.1); and (2) would have to "continue to facilitate access to long-term funding sources, providing banks with funding sources alternative to customer deposits and at an equivalent cost"(p.1). The excess liquidity in the Eurozone stood at 4,595,794 million euros on September 9, 2022 (see ECB, 2022).

In this sense, the objective of this research is to analyse the possible consequences that the issuance of a CBDC could have for the banking sector in the Eurozone, that is if the European Central Bank issues a Digital Euro, how this could affect the banking sector.

To answer this question, several interviews were conducted with experienced professionals in the banking sector from different areas, including accounting, treasury, debt portfolio managers, those responsible for innovation in the payments area of the Central Bank, as well as professionals who have recently changed their professional endeavour to cryptocurrency-related initiatives. These interviews will allow us to (1)

ascertain the perception of all these professionals regarding the impact CBDCs will have on the financial sector, (2) understand how the negative impacts can be minimized due to the characteristics of CBDCs, and (3) understand how the financial sector can take advantage of these digital currencies.

3. METHODOLOGY

With the aforementioned objective in mind, the methodological approach which we will rely on to collect and analyse the empirical information will be the qualitative approach (Madime & Gonçalves, 2022 and 2023; Gonçalves, 2022; Moreno & Gonçalves, 2021; Gonçalves et al., 2018; Saraiva & Gonçalves, 2022 and 2023) since our main objective is to "understand and find meanings through verbal narratives" (Bento, 2012, p. 1) of professionals linked to the banking sector regarding the CBDCs, namely the Digital Euro. CBDCs are a relatively recent theme, and this dissertation aims to take a step further in the knowledge of the topic in question; however, further research and evolution around CBDCs are necessary. Despite the growing interest in this topic, there are still very few countries that have already implemented a CBDC and there are also few advanced economies that have decided to implement one, with many still in the study phase.

The interview, as a qualitative methodological technique, is an essential source of raw material (Foddy, 2002), since it provides the object of study with rich and dense enough empirical material to be used as a research source (Duarte, 2004). Ferreira (2014) considers that the interview, more than collecting true-to-life information about facts, allows access to narratives that comment, value, interpret, relate, and contrasts them with other facts (Ferreira, 2014).

Therefore, we chose to build an interview script with questions that would naturally guide the interview, allowing for an authentic and flexible opinion from the interviewee on the emergence of CBDCs, what reasons led central banks to study their design, what effects they might have on the financial system and how banking may be impacted in the context of issuing a CBDC, rather than what is socially expected of interviewees given their profession (Boni and Quaresma (2005); Ribeiro (2008)). According to Ribeiro (2008), in the use of interviews in scientific research, the main highlights are the

adaptability of the questions, the flexibility to adapt the interviewees to the level of formality, and the high rate of their participation and involvement in the interview, when compared to other methods. Other authors such as Bell (1997) also highlight the quality of the answers developed, when compared to questionnaires or surveys. Interviews also have disadvantages, starting with the interviewer who must reflect on his or her role in the interview and on the way he or she conducts it, avoiding biasing it with his or her ideas. Anonymity is another point where there is a great concern, especially in a topic where the interviewee's opinion does not necessarily reflect that of the entity he or she represents or works for, in more complex topics such as where KYC and AML/CFT policies end and client privacy begins. The association of an individual with their opinions and beliefs may be of concern to the interviewee, as they may differ from those of the entity they work for, with the interviewee preferring in such cases to remain anonymous so as not to feel compromised by what they say in the interview.

The interview script started with a total of 17 questions, which were reduced to 9 (see Appendix 1), tapering to the most relevant questions for this dissertation, allowing the interviewee not only more time for each of the questions but also greater involvement in the interview, since 17 questions would make the interview very extensive and the degree of attention per question could decrease over time. The time factor was quite important, not only in the availability of interviewees and conciliation of schedules with the interviewer but also because, given the time of year, it coincides with the vacation period, where the availability of interviewees is lower.

The script questions were based on the one hand, on the European Central Bank's public consultations with Eurozone citizens, adapted to obtain the perspective of banking sector employees, and on research such as: "The Digital Programmable Euro, Libra, and CBDC: Implications for European Banks" by Sandner et al. (2020), where the authors also sought to understand the impact of *stablecoins* and CBDCs on European banks.

To test the interview script, a test interview was conducted with one of the interviewees, to find out if the script was clear and concise enough to answer all the questions of the study object. After this test interview, it was concluded that the questions were vague and unclear, requiring several interventions by the interviewer, thus preventing fluid and clear speech from the interviewee. As such, topics were created in

each question, which clarify the objective of the question, thus reducing the number of necessary interventions by the interviewer and allowing the interviewee a current and objective line of speech. Also, to facilitate the interview, each interviewee who answered affirmatively to the invitation, received the interview script by e-mail, to form and organize a general idea of what he intended to say in each question, allowing to speed up the interview, which in itself was extensive, having an average duration of approximately 1 hour.

In total, 7 interviews were conducted. Most interviews were conducted face-to-face or via Videoconference, using the Zoom platform or Microsoft Teams, however, others were conducted by email (4 Zoom/face-to-face and 3 by email).

The use of non-face-to-face methods is quite useful in reconciling schedules when the interviewee's useful time is scarce or the reconciliation of schedules between interviewer and interviewee is difficult (Cavellcanti, 2005). The initial idea was to conduct all the interviews using the Zoom or Teams platforms, given the pandemic situation in the country and the ease and/or convenience that they allow, however, the availability of some interviewees in person and the unavailability and/or preference of others, forced more interview methods to be used.

Regarding interviews conducted by video call or face-to-face, interviewees tend to answer in a more complete, comprehensive, and less concise manner, since as they answer, they add examples and ideas that they remember. If on the one hand, the direct discourse with the interviewees allows for more complete and explained ideas, on the other hand, there ends up being more repetition of ideas, even if at the time of the interview the interviewee and the interviewer are not aware of it, being more perceptible when transcribing the interview.

Regarding the interview using e-mail, interviewees tend to provide shorter and more precise answers, since, on the one hand, they have time to think and reflect on the questions asked and, on the other, they have less influence on the interviewer and his opinions and biases (Cavellcanti, 2005). However, the interviewer's lack of guidance may result in answers that are too short, with little substance for the study, fleeing from what is being asked, either by the lack of clarity of the question or by the interviewee's misinterpretation. The failure to capture non-verbal elements in interviews that are not

face-to-face, may also be relevant to the interpretation and exploration of certain responses, allowing the interviewer to 'pull' the interviewee further. Finally, e-mail interviews may lead to longer response times than desired by the interviewer, compromising the research, and clarification in case of doubts by the interviewees is hampered, being easier when the interview is conducted face-to-face (Cavellcanti, 2005).

The interviewees were selected based on their profession and area of work, i.e., specialized employees linked to the banking sector and with comprehensive knowledge of CBDCs, having already formed opinions on the subject. Initially, the goal was to obtain opinions from the 4 largest Portuguese banks, but given the lack of response, we ended up abandoning the criterion of the bank they work for and focusing on professionals specialized in various areas linked to the banking sector. The selection of interviewees was convenience selection (Guimarães, 2018), based on proximity and availability, since the objective of this academic research is to assess the impact of issuing a CBDC to the banking sector, interviewing professionals who have direct contact with this reality seemed to us to be the most appropriate way to obtain answers. Besides the fact that I, as a professional connected to the banking sector, also have facilitated access to these professionals. Most of the interviewees are employees at Caixa Geral de Depósitos (CGD), since it is the largest Portuguese bank and as an employee, I have greater ease in contacting them directly, so they would accept the interview. The selected professionals are responsible for important departments whose issuance of a Digital Euro could have direct consequences in their area (treasury, accounting, portfolio management, or foreign currency management). Some of the selected employees are also part of the bank's task force, together with other banks and the Associação Portuguesa de Bancos (APB), on the topic of the Digital Euro. In addition to CGD, interviews were conducted with the Head of the Divisions of payments systems and payments innovation area at Banco de Portugal (BdP) and the former head of portfolio management at Portuguese Treasury and Debt Management Agency (IGCP) who is now Country Lead of Amber Group, a cryptocurrency custody provider company.

The interviews aimed to understand the opinion of the interviewees, regarding the impact that the issuance of a CBDC in the Eurozone would have on the banking sector. Thus, the questions asked were divided into four groups: (1) what is the opinion of the interviewees regarding crypto assets and CBDCs, namely the motivations that led to the

increased interest in these assets; (2) what are the possible impacts of a CBDC in the Eurozone, both positive and negative; (3) what type of CBDC could be designed to minimize the negative effects on the financial sector and (4) how can banking participate and add value to the Digital Euro.

After transcribing the interviews, the data obtained was simplified and transformed into key phrases to facilitate their understanding. We also used these keywords in the NVIVO software to obtain a *Cloud of words* with the 100 most used words in each of the four groups described above in order to support the results obtained. The results obtained in NVIVO are in Portuguese since the interviews were also conducted in Portuguese.

4. RESULTS AND DISCUSSION

This chapter intends to show the results obtained from the interviews conducted.

To facilitate the reference of the interviewees, they were grouped by the company where they work, assigning a letter to each company and a number to each employee of the same company (see Appendix 2)

4.1 Motivations for cryptocurrencies and CBDCs

Most respondents said that cryptocurrencies, such as Bitcoin, emerged at a time of distrust concerning the soundness of the banking system, particularly due to money printing (Quantitative Easing) and low or even negative interest rates, distorting several financial assets. This is how cryptocurrencies emerged, based on decentralized technologies (without the need for intermediaries), as an alternative to the banking system. Respondents believe that what led to their popularity, were the high rates of return of these types of assets, capturing the attention of the masses for a new investment opportunity, with returns far above average, ignoring volatility and lack of regulation, i.e., by pure speculation. The pandemic and the lockdowns are also pointed out by the interviewees, as a factor that boosted, even more, the interest in crypto assets, with people confined at home and, in many cases, with access to an extra stimulus (e.g., stimulus checks in the US, moratoria, and layoffs) to invest in these assets with above-average

returns, hoping to make profit. Another point mentioned for the increase in interest was the lack of taxation of the profits.

While most respondents have a negative or indifferent opinion about cryptocurrencies, stating that they cannot be considered as currencies as they do not meet the criteria of the store of value, respondents B2 and C1 had more positive opinions. Most interviewees described cryptocurrencies as pyramid schemes or as means that facilitate illicit activities, due to their characteristics of anonymity and lack of regulation, hence are an ideal instrument for illicit transactions. Nevertheless, interviewees B2 and C1 described crypto assets as a new asset class, with very promising technology that can bring beneficial innovations to citizens around the globe, either by lowering costs in cross-border transfers or even through social inclusion in countries with weak currencies and where the national currency is not a functional currency, due to hyperinflation. All respondents believed that of these types of assets, *stablecoins*, namely Facebook's *Libra*, are the biggest threat to banking and public money if not regulated enough. All interviewees are in favour of regulating cryptocurrencies, either for warranting it credibility, for defending the interests of citizens, or even for defending the interests of society, reinforcing AML/CFT in the transaction of cryptocurrencies.

As for CBDC, the interviewees pointed to several factors that led Central Banks to consider issuing them. Among these factors were: the decline in the use of cash, in some countries such as Sweden, which is not yet a problem across all countries; the digitalization trend, and the younger citizens' appetite for digital means of payments, to which the Central Bank has not yet provided solutions, these segments being dominated by private parties such as MasterCard, Visa and Paypal; and the emergence of cryptocurrencies, namely the *stablecoins* of technological giants such as Facebook's *Libra*, compromising the sovereignty of national currencies, making citizens subject to the private interests of these companies and the commercialization of their data. Response to the emergence of cryptocurrencies, was the reason presented as most relevant in the interest of Central Banks in issuing CBDCs, with interviewee A1 (member of the Banco de Portugal) stating that the "ECB and the national central banks are the guardians of confidence in the Euro currency" and that "for there to be confidence in the Euro currency, there has to be a guarantee of convertibility between the Central Bank Euro and the Commercial Bank Euro, we [Central Bank] have to guarantee that all citizens have access

to the Central Bank currency which, at the moment, is only done through cash". While most interviewees stated that the decision to issue a CBDC by Central Banks was reactive, to respond to threats from private initiatives such as *stablecoins* or other foreign CBDCs, such as China's E-Yuan, interviewee A1 argued that it was a proactive response, defending the interests of citizens, by providing a public, secure and digital currency, responding to the digital needs of citizens. Still in this sense, interviewee A1 also stated that maintaining the role of the Euro as a "monetary anchor", ensuring the “possibility of conversion at any time, between Commercial Bank Euros and Central Bank Euros” was the first major objective of the European Central Bank in issuing a Digital Euro.

As for the perception of respondents regarding the issuance of a Digital Euro, opinions are polarizing, with respondents A1, B3, and C1 having positive or relatively positive opinions and respondents B1, B2, B4, and D1 having negative or relatively negative opinions. In the first group, respondents express the advantages of a programmable Euro, responding to the needs of citizens and the threats of private currencies, with the potential to improve current payment systems. The second group, on the other hand, expresses concerns about the risk of disintermediation that the issuing of a Digital Euro would have on the European system and the risk of centralizing payments in a Central Bank, centralizing too much power and information in a single entity. This second group states that the risk that the issuance of a Digital Euro would have in the Euro Zone, where there is a developed and efficient system, would be higher than the advantages that it could bring to citizens.

Figure 1: Motivations for cryptocurrencies and CBDCs

As we can see from the Figure above, the NVIVO results help corroborate our results with some of the most used words from the interviewees being: “Digital”, “Cryptocurrencies”, “Technology”, “Cash” and “reactive”.

4.2 Possible impacts of a CBDC on the Eurozone

Most interviewees stated that, in an advanced economy such as the Eurozone, the greatest risk in issuing a CBDC is the risk of disintermediation, compromising financial stability, and increasing the risk of bank runs, but they also highlighted the benefits that a programmable Euro can bring to citizens or even to the banking sector if it is designed to meet their needs. All interviewees stated that a Digital Euro is not a necessity for the time being. However, while some argued that a Digital Euro is necessary for the future, others questioned whether it would bring any innovative advantages since in the Eurozone we already have fast and cheap payment systems and where it is relatively easy to access a bank account.

As for positive impacts, at the top of the spectrum was interviewee A1, who highlighted the fact that the Digital Euro could "be a dematerialized bill, making use of everything technology allows us, from programmable payments” to peer-to-peer transfers, being "a solution that integrated everything" among existing private solutions. Interviewee A1 also highlights the possibility of instant payments throughout the Eurozone, rather than the existing individual private solutions (e.g., MBWay in Portugal

and Bizum in Spain); and the fact that a Digital Euro has no risk, since, unlike a commercial bank, "a central bank does not go bankrupt", this being one of the biggest advantages for the citizen over digital money from commercial banks. Respondents in the center of the spectrum, namely B1, B3, B4, C1, and D1, highlighted the possibility that a Digital Euro could help the banking sector in the settlement of assets, through smartcontracts, making settlements immediate and with less operational risk. As for the advantages for citizens, the same interviewees highlighted the sovereignty of the national currency as a means of payment, preventing a massive adoption of crypto assets by citizens, such as stablecoins and foreign CBDCs; the security of a Digital Euro as a digital means of payment and as a risk-free instrument since the Central Bank will not go bankrupt. The social inclusion of the most disadvantaged social classes was also pointed out by some interviewees, such as B2 and C1. However, B3 and D1 state that in the Euro Zone it is relatively easy to have access to a bank account, since there are already minimum service accounts, with reduced prices, and this is not an advantage when compared to what already exists. Interviewees B2 and C1 also highlighted, in terms of social inclusion, the possibility and ease of providing support to the most disadvantaged social classes, such as incentives or vouchers for food and basic needs, as these more disadvantaged populations are more likely to have no access to bank accounts. Improvements in AML/CFT execution were also pointed out as an advantage of CBDCs by respondents B1, B3, B4, C1, and D1. If distributed networks are used, CBDC allows for greater traceability of transactions, since everything is in a single ledger, something difficult to obtain with cash (given its anonymous nature) or even when there are many entities involved in transactions making it difficult to track. Finally, the environmental footprint was also presented as an advantage for issuing a Digital Euro, since it does not require raw materials and transportation, as with cash, nor does it use technology like the proof-of-work of Bitcoin, which requires large amounts of electricity consumption.

As for the negative impacts, the universal response among all respondents was the risk of disintermediation, even leading to bank runs in crisis scenarios, compromising the financial stability of the Eurozone. The interviewees stated that if citizens realized that a Digital Euro would be a risk-free currency and if there were no limits on obtaining and using it, citizens would be encouraged to transfer the money they have in their accounts at commercial banks to an account with the Central Bank, especially in crisis scenarios,

thus diminishing the bank's main source of funding at a time when economies need credit the most, further exacerbating the effects of crises. This would undermine the current Two-Tier System, where the central bank would have a direct relationship with customers, removing the banking sector from its intermediary functions. Most interviewees argued that if the Digital Euro is introduced in competition with deposits in commercial banks, the impacts to the banking sector would be immeasurable, negatively affecting not only their access to low-cost funding (customer deposits) but also their revenues, by reducing the revenue raised through fees. Of the respondents, B2 presented the most pessimistic scenario, stating that if there were no limits on holding a CBDC, it would ultimately lead to the end of the banking industry as we know it.

The remaining respondents presented less pessimistic scenarios, arguing that the Central Bank would not jeopardize the current system, since it meets citizens' needs. Among these interviewees, A1 and B3 stood out, arguing that, should Digital Euro enter a competition with deposits, the banking sector itself would have to change, specializing and performing more customer-related functions, since it is with commercial banks that costumers have a historical relationship, not the Central Banks. Thus, interviewee A1 defended that "there will always be room for both banks", with an incentive for commercial banks to innovate and try to integrate into Digital Euro and in everything that is the relationship with the end consumer, "whether in onboarding procedures, updating devices, but also customer authentication", since the Eurosystem doesn't have this kind of know-how. Interviewee B3 argued that disintermediation may be positive for society since it increases the overall efficiency of the banking activity and may be negative in the short term for those working in this industry. Interviewee B3, also stated that the "paradigm will force banks to change the way they operate, having to become institutions specialized in research and evaluation of financing opportunities" and that, in this context, only a few financial institutions may survive and will be smaller in size. Still, on the negative impacts, interviewees B2 and B4 raised the risks of centralization of power and information in a single entity, compromising the privacy and data of citizens and even its possible monetization (e.g., through the sale of citizens' data to third parties), while interviewee A1 defended the opposite, stating that "being a Big Brother is not the objective of the Central Bank".

Finally, it was mentioned the risk that, after the introduction of a CBDC, the Central Bank will use new tools to control economic growth, either by applying negative rates (until now impossible through cash) or, as is being studied with the Chinese CBDC (E-Yuan), assigning an expiration date to money, forcing citizens to consume before a certain date, thus increasing household consumption in economic slowdown scenarios.

Figure 2: Possible impacts of a CBDC on the Eurozone

As described above, the NVIVO results show that “Monetary Policy”, “Bank run” and “Disintermediation” were some of the most used words by the interviewees.

4.3 Design that minimizes the negative impact of CBDC

Most of the interviewees said that the most important thing in issuing a CBDC, is to not jeopardize the financial stability of the Eurozone and that they think this is the vision of the European Central Bank.

As for CBDC’s target audience, the answers were mixed. On one side of the spectrum were respondents B1, B2, and B4, who argued that the Digital Euro should be Wholesale, solving problems and frictions existing in the current system, facilitating settlement of securities, and enabling smartcontracts. The same group argued that this model would minimize the impact of issuing a CBDC in an evolved and functional payment system such as the Eurozone. Interviewee A1, on the other hand, advocated that the Digital Euro should be for Retail since the banking sector already has access to a Digital Euro through Target2 systems and that these could have some improvements such

as 24/7/365 access. The remaining interviewees, B3, C1, and D1, advocated a hybrid solution, where Digital Euro could be simultaneously for Retail and Wholesale, providing improvements to both.

As for the architecture, most of the interviewees argued that it should be centralized. Contrarily, interviewee A1 stated that decentralized technologies, such as DLT, do not cause disintermediation and can make transfers faster and cheaper for end users, but that these same advantages can be achieved with centralized technologies. The remaining respondents stated that a decentralized architecture would lead to a decrease in business and could drive not only banks away from payment solutions but also other payment solution providers.

As for the access method, most respondents stated that an Account-method would be the best solution while maintaining the relevance of the banker's role with customers. This model was also presented as the best in tasks such as customer support, KYC, and the execution of AML/CFT. Interviewees A1 and B3 argued, however, that the method should be mixed, also offering cash-like features, such as anonymity and immediate validation of transactions, to encompass the needs of citizens more concerned about their privacy.

Most respondents also stated that Digital Euro should maintain the existing Two-Tier System, not compromising the role of the banking sector. This way the central bank would continue to act on the banking sector and the banking sector on the citizens. With the Indirect Control Model, the European Central Bank would distribute the Digital Euro to authorized institutions and they would be responsible for distributing it to citizens. The interviewees stated that if the Central Bank acts directly with citizens, giving them direct access to their balance sheet, the role of banking would be threatened and could lead to bank runs, compromising financial stability. The indirect model would ensure that commercial banks maintain customer relationships and continue to perform their KYC and AML/CFT functions.

As for the scope, most interviewees stated that Digital Euro should focus on the Eurozone, as given the complexity of the project and the problems between jurisdictions, this should be the initial focus. Interviewees B2 and C1, however, argue that at a later stage, Digital Euro should have a cross-border component, addressing citizens' problems with

international transfers, which are described by interviewee B2 as "too high and time-consuming".

To minimize the risks of disintermediation, the interviewees proposed limitations to the Digital Euro, making it less appealing than bank deposits, thus preventing the leakage of these deposits into the Central Bank's liabilities. Among the solutions presented to mitigate disintermediation, the following stand out: a limit on the maximum amount held by clients in Digital Euro, or even the application of negative rates after certain amounts, discouraging citizens from holding all their savings in CBDCs, since they are safer than with commercial banks. Interviewee A1 mentioned that in countries like Portugal, negative remuneration is prohibited by law, and believes that limitations on the volume and number of transactions would be more effective in mitigating disintermediation. However, most respondents think that in crisis scenarios, none of the measures presented would be sufficient to dissuade customers from converting their deposits with commercial banks into deposits with the central bank, inevitably leading to bank runs. However, interviewee B2 added that if Digital Euro suffers too many limitations, it risks having "little adoption by citizens" and will ultimately fail.

Finally, regarding the possibility that the Digital Euro could be legal tender, interviewees A1 and B3, stated that as a digital means, they had doubts about the applicability, since it would force all merchants, even small ones, to have digital means of payment. Interviewee A1, even stated that "in an ideal world, it should be legal tender", but that he does not believe that it will happen, not at an early stage.

Figure 3:Design that minimizes the negative impact of CBDC

As expected with the results described above, the NVIVO results also show that "Account-based", "Two Tier", "Hybrid", "Wholesale", and "Retail" were some of the most used words by the interviewees.

4.4 Banking sector added value to Digital Euro

All interviewees stated that the banking industry's added value is its relationship and interaction with the customer. Interviewee B2 even stated that "the relationship has always been banking and customers because the human factor is still important", whether in onboarding and informing customers about the services, or in delivering a simple-to-use product, in which citizens do not have to worry about the mechanisms involved, they just need a simple product that they can use. Interviewees B2 and C1 also highlight the alignment of interests between the private sector and customers, since for private companies to prosper, they need to gain market share and this only happens when they can provide a good service to customers, who otherwise go to the competition. Interviewee A1 also highlights the role of commercial banking throughout the chain, being fundamental in the process of communication and customer information consequently being an opportunity for commercial banking to innovate and come up with new solutions for their customers. Interviewee A1 states that commercial banking has a role in the entire chain, except in the issuance and settlement of CBDC, since this role

necessarily is assigned to the Central Bank, since it will affect their balance sheet and they need to have control over it.

Most of the interviewees also mentioned all the procedures that commercial banking already performs, such as customer support, and all the remaining services that are invisible to the end customer, such as risk analysis and business assessment, KYC, AML/CFT, and compliance. However, interviewee B3 had a contrary opinion to the others, stating that although commercial banking has a fundamental role with the customer, this will diminish over time, becoming increasingly decentralized, and becoming a more niche service.

Figure 4: Banking sector added value to Digital Euro

Finally, the NVIVO results are again in line with the results described above. as we can see in figure 4, some of the words and acronyms most used by the respondents were: “KYC”, “Onboarding”, “AML/CFT”, “Know-how”, “customer education” and “Solutions”.

5. CONCLUSION

From the study conducted, we can conclude that the emergence of CBDCs could represent a major risk to the banking sector and the financial stability of the Eurozone. In line with extant literature, there are several reasons that have led Central Banks to study the possibility of issuing a CBDC, including the decline in the use of cash, the growing trend towards digitalization, and the rise of cryptocurrencies, namely stablecoins, compromising the sovereignty of national currencies and the ability of Central Banks to exercise Monetary Policy.

According to the results obtained, the main motivation for Central Banks to issue a CBDC is related to the emergence of stablecoins, therefore being a reactive response from Central Banks to maintain the relevance of national currencies as a means of payment, preventing citizens from being subject to the private interests of technological giants while safeguarding the privacy of their data and ensuring a continued access to a public, digital and secure means of payments.

With this research, we can conclude that the introduction of a CBDC in the Eurozone, the so-called Digital Euro, could negatively affect the banking sector if not designed with it in mind. The introduction of a Digital Euro could affect not only the banks' cost of funding, as it will compete for customer deposits, but also their sources of revenue, namely fees. If Euro Digital competes with bank deposits, banks could be forced to seek other sources of funding, including from the Central Bank, thus increasing banks' funding cost and their ability to lend to the economy, leading to less than desirable economic growth.

From the interviews, it was concluded that, as described in the literature review, in the worst-case scenario, the introduction of a CBDC could lead not only to disintermediation in payments but also, in times of crisis, to bank runs where customers with bank deposits would convert these into deposits with the Central Bank with the ease of a few clicks. The risk of a bank run is due to the safer nature of CBDCs when compared to bank deposits, since the Central Bank does not go bankrupt, customers would have an incentive to convert their bank deposits into deposits at the Central Bank, and this incentive is exacerbated in times of crisis. We also concluded that in times of crisis, no

limitation applied to Euro Digital would be sufficient to prevent a bank run, either through negative fees or limitations on the amount and number of transfers.

Despite the negative impacts described above, there are also benefits to issuing programmable Euro not only for citizens but also for the banking industry. For citizens, a Digital Euro can bring benefits such as easier, faster, and more efficient payment processes, facilitating new digital business models. The Digital Euro can also bring benefits to the banking sector, as it can bring advances in the fields of cyber-resilience, efficiency, and the robustness of payment systems, or even be designed to accelerate settlements by tokenizing financial instruments and smart contracts, reducing counterparty risk between institutions.

After collecting the opinions of banking professionals, we concluded that the type of CBDC that would minimize the negative impacts on the banking sector and economic stability would be a CBDC with centralized architecture, account-based access method, a domestic scope, indirect control by the Central Bank, thus maintaining the existing Two-Tier System. Therefore, the European Central Bank would distribute the Euro Digital to authorized institutions and these would be responsible for distributing it to citizens, leaving the banks with an intermediary role, maintaining customer deposits, and minimizing the risk of bank runs. As for the targeted public, the results did not allow us to conclude the best model, since the answers were mixed between Retail and Wholesale, while the literature tells us that advanced economies are more focused on studying wholesale CBDCs (Boar and Wehrli, 2021).

With the characteristics described above, we believe that the banking sector would maintain its relevance as a financial intermediary, keeping its relationship with the customer alive, whether in the distribution of Digital Euro or the execution of the KYC and AML/CFT practices. There should also be limitations to the Digital Euro, making it less attractive than bank deposits, preventing the flight of these deposits to the Central Bank's liabilities, either through a limit on the maximum amount held by clients in Digital Euro, or even the application of negative rates after certain thresholds. However, in crisis scenarios, we concluded that none of the measures presented would be sufficient to dissuade clients from converting their deposits with commercial banks into deposits with the central bank. It should also be avoided that the Digital Euro suffers from too many

limitations, running the risk of gaining little adoption by citizens and ultimately failing. Finally, in the first stage, the Digital Euro should not be legal tender, due to existing practical limitations, namely the lack of ability of small merchants to bear the costs of digital means of payment.

With the results obtained, we can affirm that the banking industry's added value is its relationship and interaction with the customer since the human factor continues to be important, whether in onboarding processes or in customer support and all other services that are invisible to the end customer, such as AML/CFT. Despite the challenges presented by CBDCs, the banking industry must innovate itself, minimizing its disadvantages when compared to new digital solutions (such as the emergence of decentralized technologies that threaten its position as an intermediary) and leverage its added value and know-how to be part of this digitalization of money.

Further research on the topic will be needed, as this paper is constrained by several limitations. The sample is small and may not be sufficient to have a broad view to gauge the implications of introducing a CBDC in the Eurozone. The respondents are all Portuguese and mostly male, and therefore the geographic dispersion of respondents, gender, and roles could be widened to reduce the bias that may exist in the sample. The fact that most CBDCs are still being studied also turns the discussion into something very conceptual, and there is little practical evidence that allows us to be certain about the conclusions reached.

CBDCs may be an evolution of money as we know it, forcing the banking industry to review its role and its business model, seeking solutions and products for its customers to remain relevant as a financial intermediary.

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APPENDICES

Appendix 1: Interview Guide (English Version)

1. What is your opinion, as a professional connected to the banking sector, regarding the phenomenon of cryptocurrencies, *stablecoins*, and other cryptoassets?

-What are the reasons that have led to their popularity, especially in the last few years?

-Are they an opportunity or an investment risk for individuals?

-Should there be more regulation?

-Are they an opportunity or a threat to the banking business?

2. What do you think about CBDC and what do you believe are the motivations that lead the ECB to study the possibility of creating a Digital Euro?

-What is your opinion regarding CBDC's

Are-Trying to capture public interest in cryptocurrencies?

-Reception of disintermediation by mass adoption of foreign cryptos, *stablecoins*, or CBDCs?

-Interest, on the part of the ECB, in capabilities in the technology?

-Reactive or proactive response by the ECB?

3. Is there room in our payments market for a Digital Euro and should it be more than a digital form of conventional money?

-Does it make sense, given that there are private solutions such as instant (fast) payments and minimum service (cheap) accounts?

-Should it be limited to serving the functions of banknotes and coins (public money, instant validation of a transaction, anonymity in transactions, serving the functions of the unit of account, store of value, and means of payment), in a digital context and of declining use of physical money or should it take advantage of technology to go further?

4. What are the most important aspects that you think a CBDC should focus on and where it can bring the most value to citizens?

5. What are the consequences of the implementation of a CBDC for the transmission of Monetary Policy (MP)?

-Opportunity to enhance transmission of Monetary Policy directly to households by applying interest rates on wallets?

-New instruments of MP to boost consumption, such as direct crediting in wallets, negative interest rates, or even expiration date (as seen in the e-Yuan tests)?

-Database creation that allows the ECB to see in real-time when, how much, and where households spend their money?

6. What impacts would a CBDC on a Distributed Ledger Technology (database shared by institutions, countries, etc) have for Banking and payment service providers?

-Improved settlement of financial instruments by tokenizing them?

-Risk to intermediaries if customers can use peer-to-peer, thus promoting disintermediation?

-Could it compromise and drive away private sector innovation in payment solutions?

7. Do you think that negative rates on customer deposits in CBDCs, will be enough to prevent banks from disintermediation? If limitations are applied to the Digital Euro, will it not hinder its adoption by citizens?

8. What Main considerations should be considered when launching a CBDC and in your opinion what is the best way to do it in the European context?

-Do not compromise the current model or the intermediation of banking or innovative payments and money?

-Token or Account?

-Wholesale or Retail?

-Direct or Indirect Control (One-Tier or Two-Tier System)?

-Domestic or Cross-border

9. How can the banking sector participate and bring more value to the digital Euro?

-Know-how?

-Onboarding and customer education?

-Customer management and support services?

-KYC/AML/CFT?

- Investment portfolios?

Appendix 2: Expert interview participants

No.	ID	COMPANY	POSITION	DEPARTMENT
1	A1	BANCO DE PORTUGAL	Head of Division	Payment Systems Department Area of innovation and payment policy
2	B1	CAIXA GERAL DEPOSITOS	Head of Division	Treasury
3	B2	CAIXA GERAL DEPOSITOS	Trader	Money Markets
4	B3	CAIXA GERAL DEPOSITOS	Head of Division	Accounting
5	B4	CAIXA GERAL DEPOSITOS	Trader	Capital Markets
6	C1	AMBER GROUP	Country Lead	N/A
7	D1	Anonymous	Anonymous	Anonymous