The Digital Programmable Euro, Libra and CBDC: Implications for European Banks

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Abstract

Existing payment systems get more and more disrupted. As a consequence of the global trend of digitizing payments and generating new business models from the use of blockchain-based digital programmable money, several new payment initiatives have been announced recently. Besides "classical" crypto assets, also stablecoins become increasingly important. The announcement of the Facebook-initiated Libra stablecoin is mainly perceived as a game-changer for the financial sector. Today, also central banks discuss the introduction of their own digital currencies, so-called CBDCs. To date, these payment innovations are not sufficiently discussed and analyzed from the perspective of different sectors and industries, as its implications remain unclear since most initiatives have not yet been introduced. At this point, the literature does not sufficiently discuss the implications of these innovations on the financial sector. This paper sheds light on the perception of these payment initiatives by interviewing more than 50 senior experts. In this study, we analyze the impact of digital programmable Euro initiatives, such as the Libra stablecoin, and CBDCs, on banks. We find that both Libra and a Euro CBDC might heavily affect European banks. Experts fear that large-scale financial disintermediation of the financial sector could take place, and digital bank runs could be triggered. Besides these risks, our findings suggest that banks also have the opportunity to develop new business models stemming from these initiatives. Therefore, Libra and a CBDC Euro should not only be seen as threats but also as opportunities.

Keywords: Central bank digital currencies, Libra, banks, digital programmable Euro

JEL Codes: E42, E52, G21

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1. Introduction

Currently, there are tremendous efforts ongoing to digitize payments. As a reaction to the advent of crypto assets and the underlying distributed ledger technology (DLT) with the origination of Bitcoin in 2008, more and more institutions, such as central banks, banks and private corporations, are currently working on initiatives aiming to establish a new technological basis for money. Payments via bank transfers, credit cards, and mobile payment solutions are already fully digital today. Nevertheless, cash is still the predominant means of payment in most industrialized countries, but the use of cash continues to decline (see Bank for International Settlements, 2020). Market shares of mobile payment solutions, like Apple Pay and Google Pay, as well as crypto assets like Bitcoin and Ether, increase steadily. The increasing market shares are also due to a certain inefficiency of the current system: Cash is costly to store, to distribute and to send. Further, the integration with other business processes (e.g., settlement of securities) can be costly and time intensive. Moreover, cross-border payments processed via banks or specialized financial organizations such as Western Union often take several days and are subject to significant transaction fees. Even more, due to the high market potential of digital payments, an increasing number of players from the private and public sector are developing their own digital payment solutions. In this context, more and more initiatives of a DLT-based digital Euro, a so-called digital programmable Euro, enter the market. Such a DLT-based digital programmable Euro is more and more demanded by the industry and aims to address current inefficiencies, to generate new business models in the context of the Internet of Things (IoT) and the machine economy (see FinTechRat beim Bundesministerium der Finanzen, 2020; Klein, Gross & Sandner, 2020). Such digital, programmable Euro projects include, for example, Euro stablecoins, referring to crypto assets that are backed by Euros, such as Libra, commercial bank and e-money money tokenized on a DLT and – potentially – also a Euro central bank digital currency (CBDC).

As the most prominent example of a stablecoin, a Facebook-led consortium announced the project “Libra” in June 2019. In April 2020, the proposal was updated, and Libra now intends to be a general payment infrastructure for traditional currencies with its own digital means of payments (see Libra Association, 2020). The Libra platform will consist of two means of payments: A multi-currency stablecoin that is backed by a currency basket, and various single-currency stablecoins. One single-currency stablecoin will be the Libra Euro that constitutes a form of a DLT-based digital programmable Euro. Libra aims to increase financial inclusion in developing and emerging economies and to increase payment efficiency by decreasing

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transaction costs for cross-border payments as Libra provides a stable, convenient, digital and global means of payment. To date, approximately 1.7 billion people worldwide do not have access to financial services, but two-thirds of them own smartphones (see World Bank, 2018). The Libra consortium intends to facilitate mobile payments by integrating Libra into major social media networks, such as Facebook or WhatsApp, thereby increasing efficiency and convenience.

Besides the private sector, also public-sector central banks consider issuing their own digital currencies, CBDCs. According to a study by the Bank for International Settlements (BIS), 80% of worldwide central banks work on such CBDC-related projects – 20% of surveyed central banks intend to launch a CBDC in the next few years (see Boar, Holden, Wadsworth, 2020). In April 2020, the first CBDC went live in China on a test basis so that in some cities parts of government salaries are already paid via the Chinese CBDC. Also, the European Central Bank (ECB) researches CBDCs and published research papers about a potential Euro CBDC (see European Central Bank, 2019; Bindseil, 2020).

This paper seeks to analyze the implications of the digital programmable Euro (and CBDCs) for the end user, the industry and the financial sector. To date, the implications of Libra and a Euro CBDC remain highly uncertain as both initiatives have not yet been launched and are, therefore, in a conceptual stage. Therefore, it is not yet possible to empirically analyze the economic impact of these innovations. However, it can be expected that the introduction of e.g. Libra and a CBDC would have a significant impact on the European payment sector in general and on banks' business models in particular. On the one hand, Libra would become a relatively cheap means of payment for cross-border payments that could challenge banks' market shares in the market for remittances, but also in domestic payment markets, if Libra was to become a substitute for bank deposits. A CBDC, on the other hand, is a digital form of central bank money. Note that we are agnostic regarding the implementation model of a CBDC, i.e., direct, hybrid or indirect (see Auer & Boehme, 2020). Since central bank money constitutes a claim on the central bank, a CBDC can be classified as less risky than commercial bank money. A CBDC introduction could, therefore, lead to a disintermediation of the banking sector resulting in higher refinancing costs for banks (see Bindseil, 2020) and trigger digital bank runs that could threaten banks' liquidity and banks' business models. Consequently, these innovations could disrupt and challenge banks' profitability. Thus, it is essential to understand the benefits, risks and impacts of such initiatives in order to estimate the expected impact on banks and to discuss proper regulatory responses. Profound analyses

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have to be conducted before both initiatives will be launched to have still enough time to react. Such analyses currently constitute a gap in the literature.

The objective of this paper is to analyze benefits, risks and the expected impact of CBDCs and Libra on banks. For this purpose, we conducted more than 50 interviews with senior experts from various sectors and industries, e.g., central banks, banks, international organizations, academia, associations and others, about the benefits, risks, and the expected impact of the digital programmable Euro, CBDCs and Libra on banks. Our study is the first to survey different sectors and industries about these two digital money initiatives. The current debate about Libra and CBDCs lacks sufficient interdisciplinary exchange even if both Libra and CBDCs are highly relevant for several industries.

Our main findings are as follows: First, a digital programmable Euro is demanded by most of the surveyed experts in order to address inefficiencies of the current financial system and increase automation due to a programmable means of payments. This needs to be highlighted as the majority of the surveyed experts leave no doubt that a DLT-based digital programmable Euro is needed. Second, Libra and a Euro CBDC will heavily affect banks' business models, for example, such that disintermediation of the financial sector and digital bank runs could result from an introduction of a Euro CBDC and disintermediation from an introduction of Libra. Thirdly, experts also see various benefits and new business opportunities that retail, industrial and financial companies can develop and realize in the context of Libra, CBDCs and the digital programmable Euro. Therefore, experts suggest to not only perceive these initiatives as a threat but also as an opportunity.

This paper is structured as follows. In the second chapter, we explain the current private and public sector initiatives in the field of digital money and provide an introduction into stablecoins, Libra and CBDCs. Further, we briefly discuss why Libra and a Euro CBDC could potentially have a significant impact on European banks. Afterward, we outline the methodology used for our analysis. In chapters four and five, we show the results of the expert interviews and discuss their implications. Chapter six concludes.

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2. Background: Stablecoins, Libra and CBDC

2.1 Private sector digital money initiatives: Stablecoins and Libra

This chapter discusses current private sector initiatives for digitizing payments, i.e. in the form of a digital programmable Euro. While the market share of “classical” crypto assets such as Bitcoin and Ether is increasing steadily, ever more new DLT-based crypto assets are launched. Currently, there exist more than 5,500 different crypto assets (see CoinMarketCap, 2020). A large fraction of these novel crypto assets can be classified as stablecoins such as Tether, TrueUSD or DAI. A stablecoin is a crypto asset that bears an underlying mechanism to stabilize its price, for example, by using fiat currencies or government bonds as collateral. Therefore, a stablecoin is a value-stable crypto asset. One reason why Bitcoin and other crypto assets are not yet widely used as means of payment for daily transactions are their high price volatility – an issue stablecoins try to address.

The most prominent and undoubtedly the stablecoin initiative receiving the highest public attention is the Libra project. Libra was announced in June 2019 by the Switzerland-based Libra Association, a consortium of mostly US-based companies; currently 27 companies including Facebook’s subsidy Novi, Spotify and Uber. Libra aims to create a global payment infrastructure with its own means of payment, the Libra tokens. The initiative intends to increase efficiency in cross-border payments and to support financial inclusion. According to the World Bank, providers for cross-border payments, on average, charge a 7% fee for international money transfers (see World Bank, 2019). Such high transaction fees combined with typically slow payment processing reveal severe inefficiencies of the current system. As Libra is based on a DLT, the Libra Association expects to create a payment infrastructure that is more efficient than legacy systems and can process transactions at low marginal cost. The Libra Association seeks to address financial inclusion by providing a secure and user-friendly digital means of payment that can be used on mobile phones and will be integrated into social media platforms, such as Facebook, WhatsApp or Instagram. Currently, 1.7 billion people worldwide are financially excluded as they do not have access to bank accounts. Two-thirds of them own mobile phones (see World Bank, 2018) to potentially conduct transactions in Libra and to get financially included.

Libra is designed as a value-stable means of payment. Price stability is to be achieved by investing the funds obtained from the sale of the Libra tokens in (mainly) short-term

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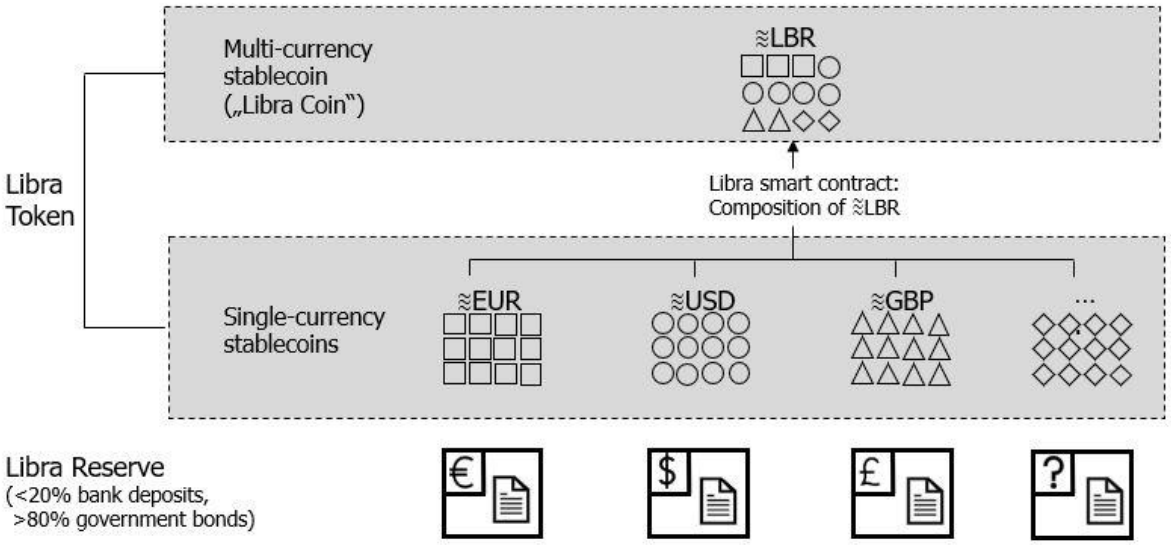
government bonds and (partly) in bank deposits. Libra will, therefore, be fully backed by highly liquid, secure assets. According to the current concept, the Libra platform will consist of two types of stablecoins. Firstly, there will be so-called single-currency stablecoins that are backed by *one* currency. Examples are the Libra Euro that is backed by Euro units and the Libra-Dollar that is backed by US dollar units. Secondly, there will be a so-called multi-currency stablecoin ("Libra Coin") that is backed by a basket of currencies comparable to the special drawing rights (SDR) issued by the International Monetary Fund (IMF). The described Libra stablecoin system is visualized in Figure 1.

Figure 1: The Libra stablecoin system

(Source: Adapted from Groß, Herz, Schiller, 2020)



The single-currency stablecoins will be backed by (at least) 20% bank deposits denominated in the respective fiat currency and (more than) 80% short term government bonds. In case of the Euro area, the Libra Euro will be backed by Euro bank deposits and Euro area government bonds. The multi-currency stablecoin, the “Libra Coin”, will consist of the various single-currency stablecoins and is, therefore, indirectly backed by a currency basket. The creation of the multi-currency stablecoin is highly automated so that a smart contract will create the multi-currency stablecoins automatically without human interaction.

According to the Libra Association’s official goals, Libra will mainly be used in emerging and developing economies, where national currencies tend to be weak so that the stability of Libra would be particularly beneficial. Here, the multi-currency Libra Coin as a token backed by a

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currency basket consisting of strong currencies such as the Euro and the US dollar is an attractive means of payment and store of value. In industrialized countries, the single-currency stablecoins are likely to be of particular interest. One benefit of Libra is that it is based on a DLT and can thus be used as "programmable money" (see Klein, Gross, Sandner, 2020). For example, Libra payments could be programmed to automatically execute a subsequent event Y when a certain event X occurs. In this way, for example, interest payments or other financial flows could be highly automated – efficiency gains that are of particular interest for the industrial and financial sector.

2.2 Public sector digital money initiatives: CBDC

Driven by the developments around stablecoins and the announcement of the Libra project, central banks intensified their efforts to issue their own digital currencies, so-called CBDCs. Central bankers are concerned that Libra could threaten monetary sovereignty if it (partly) replaces banknotes (and bank deposits) as general means of payment. A decline in the demand for banknotes would reduce the importance and power of central banks in the monetary system. To address these risks and to maintain their role in the monetary system, central banks consider issuing their own digital currency that is available to the end user, a retail CBDC.

A retail CBDC would coexist alongside bank money and cash and could be used as a general means of payment for daily transactions. Unlike bank deposits, it would not be a claim on a legal tender but would become legal tender itself, like cash. The ultimate goal of a retail CBDC is thus to digitize physical cash and, therefore, to provide access to central bank money for the end user in the digital age. A retail CBDC could be based on both DLT or on a centralized database. For a discussion about the technological basis of a CBDC see Klein, Gross & Sandner, 2020).

Note that to date, no retail CBDC has been introduced yet. However, 10% of central banks surveyed by the BIS (see Boar, Holden, Wadsworth, 2020) indicated that they are likely to introduce a retail CBDC in the short-term (up to three years) and 20% in the medium-term (up to six years). Further, 15% of central banks consider the introduction of a CBDC possible in the next three years (an additional 18% in the next six years). CBDC pioneers that are likely to issue a CBDC in the next few years are e.g., China, the Eastern Caribbean Currency Union,

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the Marshall Islands and Sweden. In China, the DC/EP project is currently tested, and some parts of salaries of employees in the public sector are already paid on the digital DC/EP wallet.

Moreover, the ECB is also active and it has intensified its CBDC efforts and published various CBDC publications (see e.g. European Central Bank, 2019; Bindseil, 2020). Christine Lagarde stressed at her first press conference as ECB President in November 2019 that the ECB will establish an internal CBDC Task Force. This Task Force is expected to publish a detailed report about CBDC in the second half of 2020. In addition, the ECB has joined a consortium of several central banks, including the Bank of England, the Bank of Japan, the Riksbank and the BIS to share experiences from their analyses of potential use cases for CBDCs and to jointly explore the implications of a CBDC introduction. Thus, it seems possible that a CBDC could become reality in the Euro area within the next decade, but – as our experts also indicated – most likely after Libra is launched.

2.3 Impact on European banks

The discussions on Libra and CBDCs indicate that stablecoins like Libra, and CBDC might have strong implications for banks. Both Libra – in the form of the Libra-Euro – and a Euro CBDC – as a digital representation of Euro banknotes – digitize the Euro and can therefore be seen as a "digital Euro" – if based on a DLT also as a DLT-based "digital programmable Euro". Libra, on the one hand, will be designed as a (relatively) stable, fast and cheap means of payment for cross-border transactions. Libra could, therefore, challenge banks' market shares in the market for cross-border payments. Besides, it cannot be ruled out that Libra will also drive currency substitution in Europe so that payments are more and more carried out in Libra and less in Euro bank money. If indeed less bank money would be used, banks' business models could be threatened. Accordingly, Jens Weidmann, President of the German Bundesbank, argues that Libra is mainly a competitor for commercial banks. Therefore, banks are under pressure to create their own digital payment innovations as a reaction to Libra (see PYMNTS.com, 2020).

A retail CBDC, on the other hand, would be a digital form of central bank money available for the general public and – depending on its implemented structure – could constitute a close substitute to banknotes and bank money. The introduction of a CBDC could lead to significant changes in the financial sector as the holder of a CBDC would have a claim on the central bank and would, therefore, not be exposed to creditor risk, as in the case of bank deposits.

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Thus, a retail CBDC is, like cash, a risk-free means of payment, but in a digital form. Bech and Garratt (2017) and Houben et al. (2018) argue that the availability of such risk-free digital central bank money could trigger excessive transfers of funds from the banking sector to the central bank. One consequence of such a disintermediation of the banking sector could be that banks would experience higher funding costs. As clients would provide less bank deposits, banks would have to change their funding sources, e.g., relying on a higher refinancing by the central bank and the capital markets. Such refinancing would increase bank's funding costs, as central bank and capital market funding is typically more expensive than funding via deposits (see Bindseil, 2020). The resulting higher refinancing costs could put banks under immense stress and could accelerate another banking crisis.

Further, a CBDC introduction could trigger digital bank runs. In such scenarios, clients withdraw a large share of their bank deposits "per click" and convert it into a CBDC. Mersch (2018) explains the bank run risk related to CBDC as follows:

> "During a systemic banking crisis, holding risk-free central bank-issued DBM [CBDC] could become vastly more attractive than bank deposits. There could be a sector-wide run on bank deposits, magnifying the effects of the crisis. Even in the absence of a crisis, readily convertible DBM could completely crowd out bank deposits – putting the existence of the two-tier banking system at risk. In this situation, the efficient flow of credit to the economy would likely be impaired."

To summarize, in the case of a CBDC, bank runs could become more likely as withdrawals in digital form can be carried out easier, cheaper and more quickly (see also Bech & Garratt, 2017; Mancini-Griffoli et al., 2018). Therefore, a CBDC introduction could potentially have negative effects on banks as clients could excessively shift funds from risky commercial bank money to risk-free central bank money.

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3. Methodology

This chapter describes the research methods applied to analyze the research question of how Libra and a Euro CBDC could affect the financial sector. It is our goal to investigate by using expert interviews how experts from various fields, e.g., from banking, central banking, the industry, international organizations, associations, academia and other sectors, perceive these digital money initiatives in order to assess its benefits and risks for the financial sector. This paper primarily uses qualitative research methods (see Saunders, Lewis, & Thornhill, 2009) that interpret data utilizing an open and flexible design (see Corbin & Strauss, 2015).

The nature of the topic of this paper calls for an exploratory study of the research question (see Zikmund, 2003). It is the goal of such a design to clarify the issue of the digital programmable Euro and grasp a better hold on its expected impacts. Like any exploratory study, this paper does not claim to provide final answers to the research questions addressed. Instead, subsequent research will be needed to gain a more sophisticated understanding of the dimensions of the digital programmable Euro, Libra and a CBDC. Nevertheless, this paper also has a descriptive character since concrete phenomena are described by a self-conducted investigation that supports the existing literature (see Zikmund, 2003). Generally, exploratory and descriptive studies complement and strengthen one another, and, therefore, both methods can be used in parallel (see Strohhecker, 2008).

Data for the descriptive character of this study has been gathered using semi-structured expert interviews with identical question sets for each interviewee (see Corbin & Strauss, 2015; Saunders, Lewis, & Thornhill, 2009). Due to the exploratory approach of this paper, gathering objective knowledge as well as personal assessments of experienced and skilled people in the field of digital money is a suitable method to analyze the research questions (see Kaiser, 2014). Furthermore, since we are interested in opinions and sentiments of experts, qualitative interviews are appropriate as they provide a rich and detailed data set (see Saunders, Lewis, & Thornhill, 2009). A guideline-based questionnaire (see Gläser & Laudel, 2009) and open-ended questions were utilized as this is most suitable for exploratory studies since they offer interviewees the possibility to give unique answers. This way, experts are less biased by specific framing of interview questions resulting in a detailed data set (see Zikmund, 2003).

The first set of questions focussed on the digital programmable Euro in general. The experts were asked how important they rate benefits of the digital programmable Euro, such as higher

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efficiency in cross-border payments, near real-time settlement with other assets, rights or goods, and automation. In the second part of the interview, the experts were then asked about CBDCs. Questions were for example “Which benefits and which risks do you see in a retail CBDC?”, “Which impacts might the introduction of a retail CBDC have in the Euro area?”, “How will a retail CBDC impact banking activities (considering e.g., domestic and cross-border payments)?” and “When do you think that a Euro CBDC for the general public (retail CBDC) will be issued by the ECB?”. The previous questions were then modified and asked in a similar fashion in the context of Libra also to ask experts about the benefits, risks and impacts of Libra.

The sample size of this study is 51 (n=51). Potential interviewees have been selected due to their expertise in digital money across various sectors in different jurisdictions. To meet the holistic approach of the study, not only bankers and central bankers but also senior experts from numerous fields have been interviewed (see Appendix A). The expert panel includes senior experts from the industrial sector, from associations, bankers, central bankers, lawyers, academics and other sectors. After the transcription of the expert interviews, the obtained data were rearranged according to systematic criteria (see Kaiser, 2014). For the evaluation, the qualitative data analysis software NVivo has been used for supporting the process of deriving analytical categories from the raw data and for clustering the experts’ statements accordingly (see Pope, Ziebland & Mays, 2000).

The following analytical categories have been selected:

1. Benefits and use cases of the digital programmable Euro
2. Benefits and risks of CBDC and its impact on banks
3. Benefits and risks of Libra and its impact on banks

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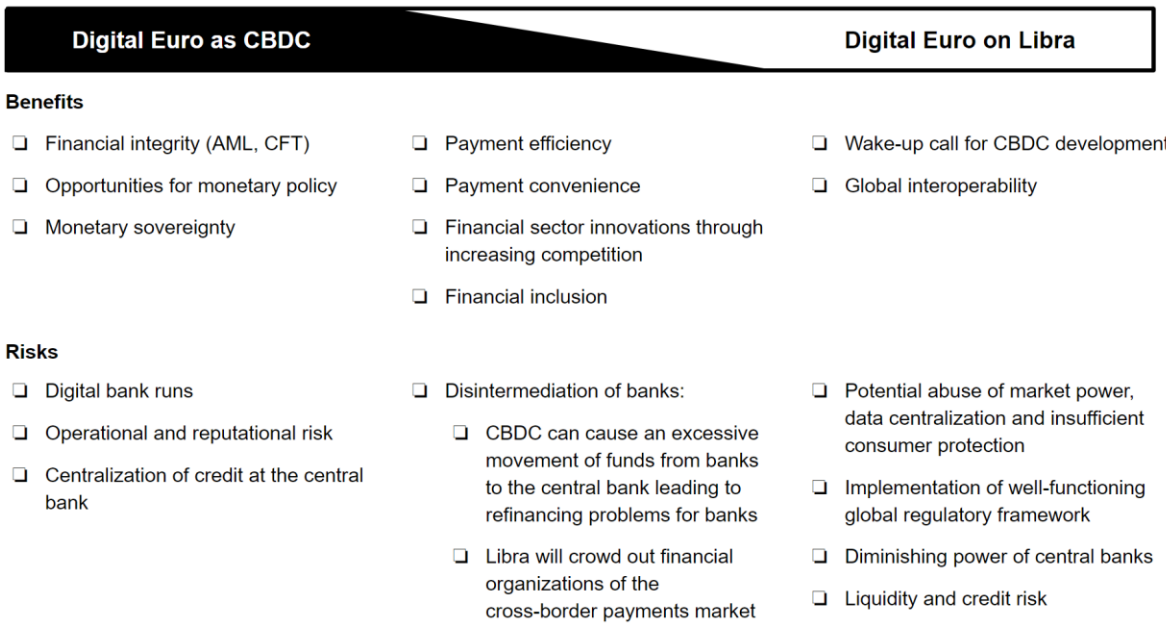
4. Results of the interviews

This chapter presents the results of the conducted expert interviews. The key findings are visualized in Figure 2.

Figure 2: Key results of expert interviews

(Source: Frankfurt School Blockchain Center)



4.1 Benefits and use cases of the digital programmable Euro

The following chapter discusses the results of the conducted expert interviews. The survey first assesses the main benefits of the digital programmable Euro in general, Libra and CBDCs. The experts were asked to quantify the importance of key benefits of the digital programmable Euro on a scale from 1 to 5, where 1 indicates not important at all, and 5 indicates very important. As depicted in Figure 3, automation is regarded as the most important benefit of the digital programmable Euro with a mean of 4.34. Higher efficiency in cross-border payments and near real-time settlement with other assets, rights or goods are rated with a mean of 3.90 and 3.91, respectively. Other benefits of a digital programmable Euro mentioned by the experts were higher interoperability, convenience and financial integrity by simplifying anti-money laundering procedures.

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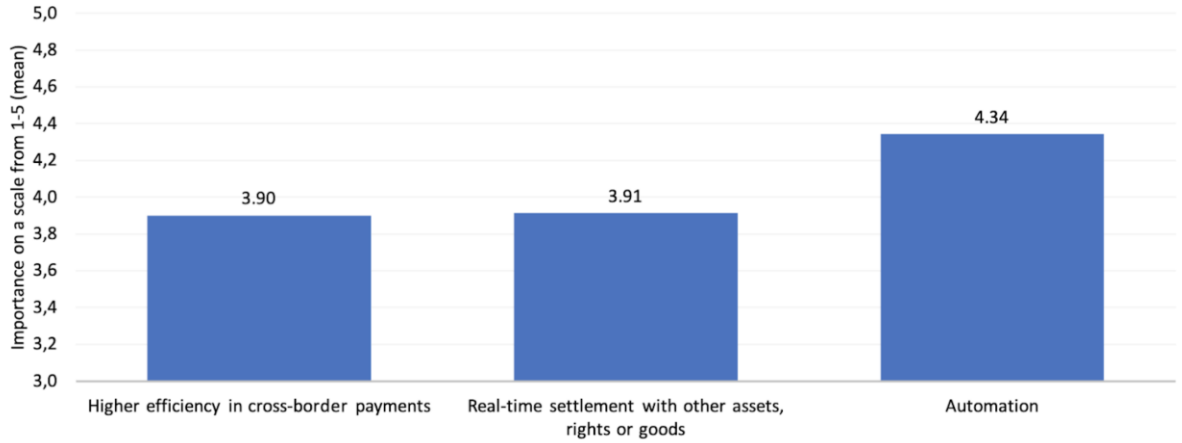
Figure 3: What are the key benefits of the digital programmable Euro?

(Source: Frankfurt School Blockchain Center)



37 experts state that a digital programmable Euro is needed for the general public (see Figure 4). 4 experts do not see a particular need for such a digital Euro. They argue that payment systems are already well-functioning and efficient today. In 4 interviews, experts express that a digital programmable Euro is not yet needed; its issuance will, however, become more urgent in the future. Other experts underline that the need highly depends on the circumstances. Explicitly, expert C1 names the following scenario in which a digital Euro would be necessary: "*If cash would vanish in usage [...] you as a central bank need to offer a basic means of payment to citizens, and that could then be a digital Euro. Or there is a scenario where international means of payment [...] like Libra, would take a very strong position [...] that would be also, maybe from the perspective of European sovereignty, non-desirable, and that could also justify a digital Euro then.*" Further, 4 experts state that the need for implementing a digital Euro depends on the exact design and the underlying circumstances.

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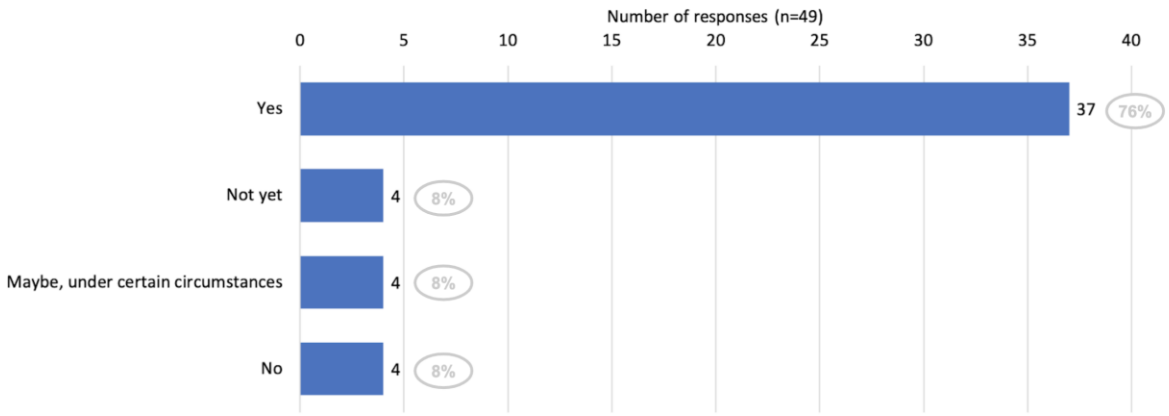
Figure 4: Do we need a digital Euro for the general public?

(Source: Frankfurt School Blockchain Center)



In total, 31 experts, mostly working for banks, associations, or in the industrial sector, are convinced that these benefits can only be achieved if the digital Euro is based on a DLT system. As depicted in Figure 5, 10 experts argue that the digital Euro must not necessarily be implemented on a DLT but that using DLT has significant advantages over other technological choices. Academics point out that DLT is not sufficiently mature yet and more research is needed. Specifically, experts A3 and A5 stress that DLT is the superior technological choice in the absence of a trusted central party. They argue that central banks are such trusted third parties. Still, academics suggest that transparency and interoperability can only be achieved through the use of DLT. 9 experts, mainly central bankers, are undecided whether DLT is the appropriate technology to implement the digital Euro. They do not exclude the possibility that DLT can be used, however, they are also open to other approaches. None of the interviewed experts state that DLT would certainly not be a viable option for implementing the digital Euro.

Furthermore, most experts indicate that the DLT system should be permissioned, meaning that access would be restricted so that participants would need permission to join and interact with the network. Experts D5 and O1 state that the central bank would not agree to open up such a system. Consequently, the system will, therefore, necessarily be permissioned. On the other hand, experts from the industrial sector point out that the economy can only profit from the full advantages of a DLT if the system is permissionless. In the case of a permissionless blockchain, access to the system would not be restricted and anyone could join without permission.

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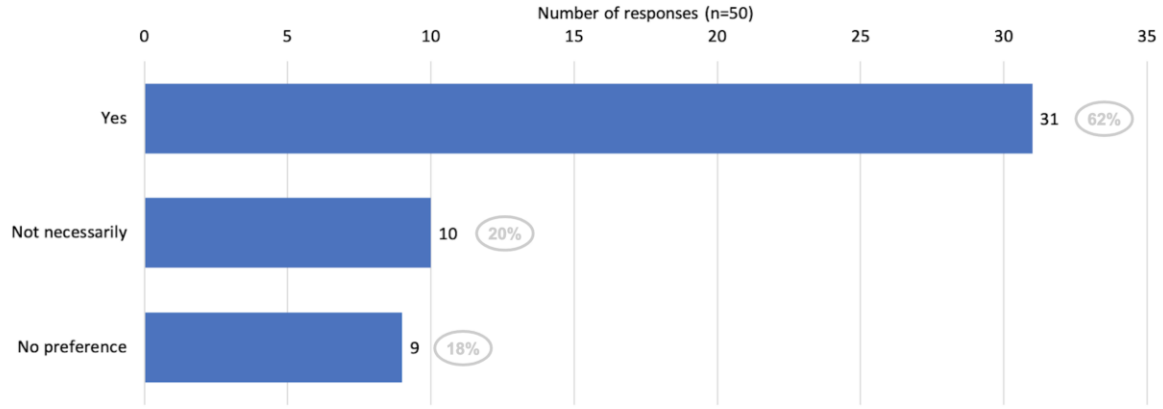
Figure 5: Is DLT the appropriate technology to implement a digital programmable Euro?

(Source: Frankfurt School Blockchain Center)

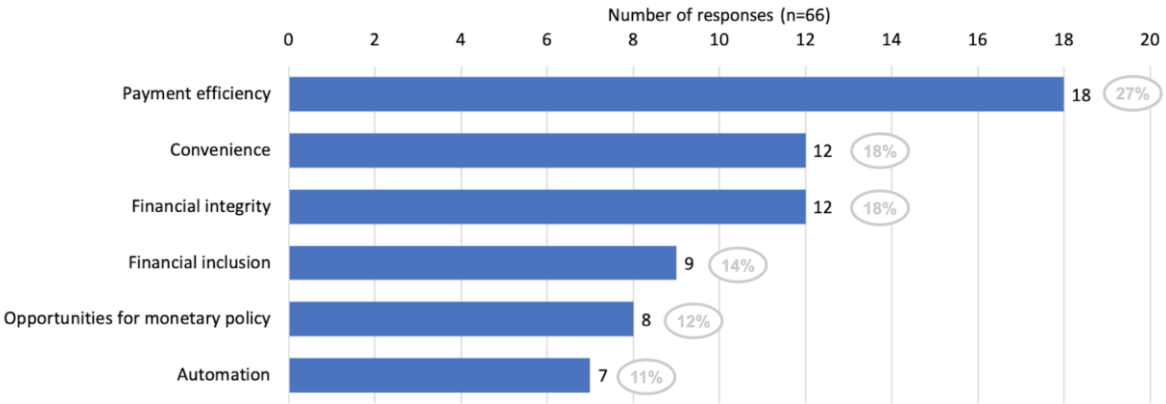


4.2 Benefits and risks of CBDC and its impact on banks

Most experts express that (private) end users would be the primary users of a CBDC. Some experts also see corporations as potential users. Therefore, surveyed experts see the primary use case for a CBDC being a means of payment for the private sector. Moreover, some experts expect use cases in the context of the machine economy and IoT due to the potential programmability feature of a CBDC.

Figure 6: Benefits of a CBDC

(Source: Frankfurt School Blockchain Center)



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The surveyed experts see various substantial benefits that a CBDC could bring (see Figure 6). Note that experts were allowed to give multiple answers. 18 experts, mainly from the industrial sector and academia, expect efficiency gains due to lower transaction costs and higher transaction speed. Further, 7 experts expect decreasing (business) costs due to a higher level of automation. Such automation is particularly promising for IoT and the machine economy and stems from the potential programmability of a CBDC. Furthermore, 12 experts expect higher payment convenience as a CBDC could provide a convenient means of payment. 5 experts in academia and the industrial sector stress that a key benefit of CBDC is that it can act as a safe store of value. They suggest that there is a need for safe digital central bank money, for example, in times of financial distress. Expert A4 states that a CBDC will constitute "*a risk-free means of payment, and therefore also a risk-free store of value, which is not the case with bank money [...] even though you have [...] prudential regulation and guarantee schemes, etc. But history shows, it's not sufficient alone*."

12 experts mention financial integrity as another significant benefit of a CBDC and point out that a CBDC can reduce informality, tax evasion, and illegal activities as the central bank can monitor transaction flows more efficiently than with physical cash and commercial bank money. Therefore, also anti-money laundering (AML) and measures to combat the financing of terrorism (CFT) can be implemented more efficiently. Additionally, experts mention that privacy of financial transaction data can be reached more efficiently by the public as compared to the private sector.

8 experts argue that a CBDC can be beneficial for monetary policy. Monetary policy could become more effective if central banks are in control of the issuance of money creation instead of commercial banks. Further, with a CBDC central banks can maintain their role in the monetary system. Academics also argue that an (interest-bearing) CBDC provides a new instrument to conduct monetary policy with a "*potentially faster and stronger, more direct monetary policy transmission,*" as stated by expert A9. According to 9 experts, CBDC will foster financial inclusion.

Further, 4 experts express that a CBDC could preserve European monetary sovereignty in case Non-European payment systems get more and more adopted. Specifically, expert F5 states that a CBDC can increase "the *competitiveness of a national currency overall, if you as a specific country will be able to transparently deploy a retail CBDC and show that it's governed in a way that it's healthy, democratic*." Expert B1 argues that if the ECB does not

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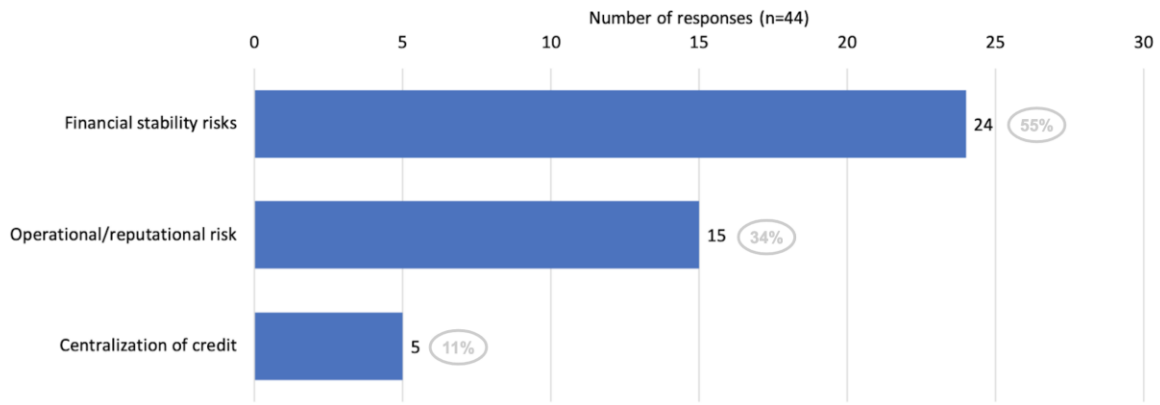
introduce a CBDC, the physical Euro will soon be outcompeted by other payment systems. Accordingly, he states: "*Be it Libra or be it foreign CBDCs – [they] could gain market shares here and this would cost employment and jobs.*" He concludes that a CBDC is necessary to protect European monetary sovereignty.

Maintaining monetary sovereignty by implementing a Euro CBDC is further discussed against the background of China's launch of its own digital currency, the DC/EP project. Most experts expect that the DC/EP project will be an accelerator for the introduction of a CBDC in the Euro area. Moreover, expert D1 stresses geopolitical implications and observes a "*battle between the Chinese and the Americans, who is going to dominate the world of […] digital currencies*". In case the Chinese digital currency – and also the Libra multi-currency stablecoin – is used on a large scale, it will result in diminishing importance of the Euro as a global currency. Specifically, expert A1 states that "*if not only the Chinese but also the Americans start a project like this, I think this would be a wake-up call for the ECB.*"

Figure 7: Risks of a CBDC

(Source: Frankfurt School Blockchain Center)



Besides these benefits, experts also see several risks if a CBDC is indeed introduced by the ECB (see Figure 7). 24 experts mention potential risks for financial stability. This includes bank disintermediation and digital bank runs. Accordingly, experts point out that a CBDC is competing with bank deposits and could drive a disintermediation of funds from the banking sector to the central bank. Further, due to the increased availability of such digital central bank money, the likelihood of bank runs could increase. All of the surveyed central bankers, as well

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as academics, see such risks as critical and argue that a CBDC should be implemented in a way that does not threaten financial stability.

Besides financial stability, 5 experts express concerns from an increased centralization of credit with a larger balance sheet of central banks as a consequence of a CBDC introduction. According to experts O3 and A4, end users could further be negatively affected if CBDC deposits will be remunerated with negative interest rates. Likewise, they warn against significant effects if negative interest rates are accompanied by a potential abolishment of cash.

15 experts see operational risks regarding the implementation process of a CBDC. Accordingly, an implementation is costly and cumbersome and also includes reputational risks if the issuer does not manage to meet the requirements of the public resulting in a low adoption rate of a CBDC. 5 experts from the industrial sector specifically draw upon the difficulties finding an efficient way of designing a CBDC. They underline the issues of cybersecurity, data privacy and the technological implementation. Accordingly, expert I7 stresses that a CBDC might "*increase the feeling of [...] being controlled, being observed and becoming the transparent citizen,*" so that citizens may be increasingly skeptical.

Experts across all sectors seem to agree that banks will be negatively affected by the introduction of a CBDC. 22 of the surveyed experts state that they expect a crowding out of financial institutions offering payment services. Other experts expect that incumbent banks will lose large parts of their market shares, and their business models will be profoundly affected. Precisely, experts expect the number of intermediaries in financial markets to shrink.

13 experts, contrarily, state potential positive effects on the financial industry and banks. The disruptive effects of the implementation of a CBDC could be an enabler for innovation and will open up new business models for banks. Specifically, expert I7 stresses that intermediaries "*would [...] need to specialize more on their value-added services*." Expert A7 is convinced that a CBDC will certainly transform the banking system but that banks are able to adapt to such a change. Others argue that new opportunities will evolve that have the power to reform existing financial institutions.

Further, 12 experts expect commercial banks to be involved in CBDC distribution processes (for more details of such a hybrid form of a CBDC see Auer & Boehme, 2020). Specifically,

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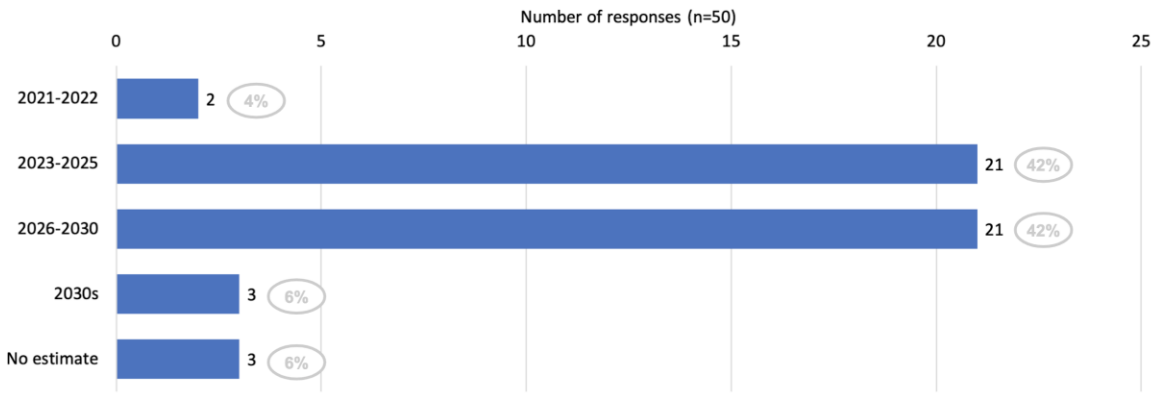
expert D2 describes the potential future role of commercial banks as follows: "*One could foresee a future where the legal tender, which is today physical banknotes, is in future a CBDC and the banking sector, in a similar way as it is doing today, is distributing this legal tender.*" Additionally, 3 central bankers point out that it should be made use of the existing infrastructures of commercial banks and that central banks do not intend to displace incumbent banks or private payment service providers. 5 experts do not see any impact of the introduction of CBDC on commercial banks at all.

As the last question on CBDC, we asked the experts, when the ECB will issue a CBDC. The results are shown in Figure 8. 21 surveyed experts estimate that a Euro CBDC will be issued by the ECB in 3 to 5 years. Another 21 experts expect that a CBDC will be launched in 6 to 10 years. Further, 2 experts expect a Euro CBDC issuance within the next 2 years. 3 experts do not think the ECB will issue a CBDC before 2030. Another 3 experts did not provide an estimate of when or whether at all a CBDC will be introduced in the Euro area.

Figure 8: When will a Euro CBDC be issued by the ECB?

(Source: Frankfurt School Blockchain Center)



4.3 Benefits and risks of Libra and its impact on banks

The majority of the surveyed experts agree that end users will be the primary users of Libra. Some experts see merchants as further adopters, as they are needed to install wide-scale Libra payment systems. Merchants are incentivized to use the Libra payment infrastructure as the Libra platform is likely to be cheaper than credit or debit card schemes. Some other experts suggest that the industry will later on also adopt Libra since corporates might benefit from the

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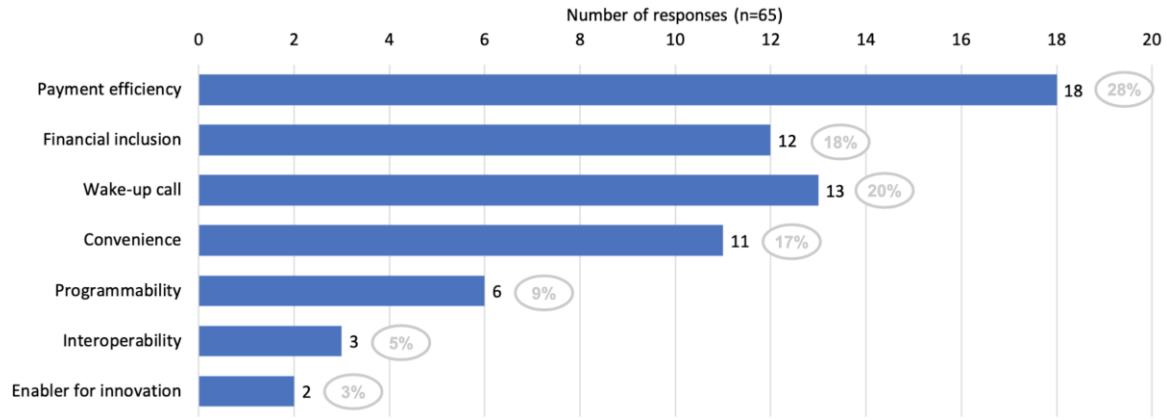
programmability feature of Libra. Mainly experts from the industrial sector state that firms will accelerate their ambitions to make use of IoT and smart contracts in combination with Libra.

Figure 9: Benefits of Libra

(Source: Frankfurt School Blockchain Center)



According to the experts, the Libra project provides various advantages (see Figure 9). Higher efficiency in payment transactions is the most frequently mentioned advantage, with 18 experts stressing that Libra will enable faster and cheaper transactions, especially for cross-border payments. In this context, 11 experts further point out that Libra will offer more convenient transactions than with currently existing means of payment. As pointed out by experts from the non-financial industry, such convenience could be especially beneficial for use cases in e-commerce. 3 experts underline the high interoperability of Libra as a major advantage over CBDCs that are most likely limited in their global use.

12 experts see a significant advantage of Libra in the context of financial inclusion. They stress significant benefits for countries in that the share of unbanked people is particularly high. Likewise, Libra, as a global stablecoin, could provide easy and convenient access to a financial system and a stable currency that could be both used as a means of payment and store of value.

As another benefit of Libra, experts mention increasing competition in the payments market due to Libra's disruptive force. Expert E1 indicates that its implementation will "*shake [...] the international financial system*" and, thus, enable financial innovations. Some experts point out that with increasing competitiveness, the financial sector and central banks now need to act

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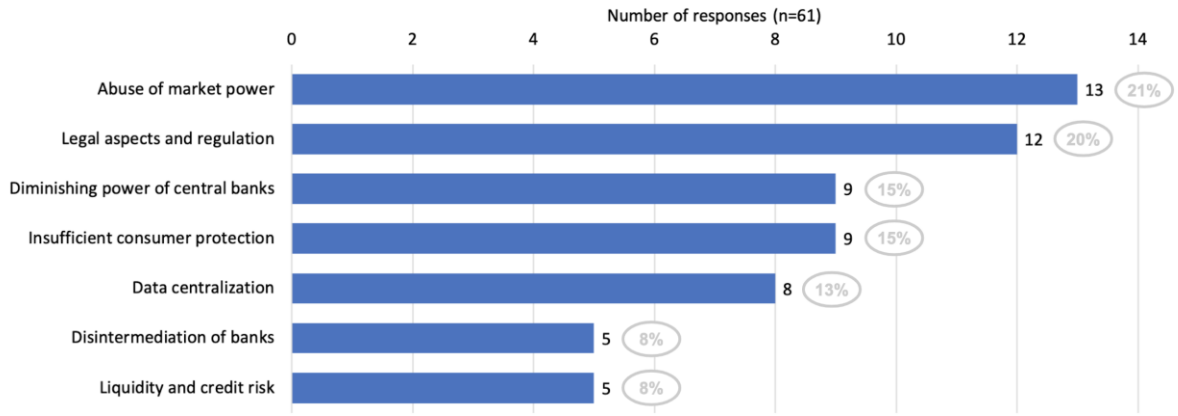
quickly and find responses to Libra. Expert B1 calls it a "*Sputnik moment for CBDC suppliers*" and sees Libra as a wake-up call for current players in the financial system. 13 experts support the view of Libra being a wake-up call for bankers and central bankers.

Figure 10: Risks of Libra

(Source: Frankfurt School Blockchain Center)



Even though Libra is perceived to be beneficial in various dimensions, experts stress that several potential risk factors could arise (see Figure 10). The most significant risk mentioned by 13 experts regards the possibility of Libra abusing its market power. Specifically, expert A4 points out the importance of network effects with respect to payment services and states that the "*network effect will be there from the beginning, in an ideal form.*" According to the experts, Libra is likely to become dominant. Therefore, many experts worry that the Libra Association will abuse its market power. Correspondingly, such fear stems from the fact that Libra will be centralizing large amounts of data if it reaches a considerable amount of users. Accordingly, 8 experts perceive Libra's high degree of data centralization as a threat. Expert B5 identifies potential conflicts in the close relationship between Libra and Facebook, the initiator of the Libra Association and represented by its subsidy Novi. In addition to data privacy, 9 experts mention insufficient consumer protection and privacy risks as further risk factors. 12 experts consider the regulation of Libra to be essential and emphasize that regulatory measures must be carried out diligently. Accordingly, expert C2 expresses that "*it needs to be ensured that money laundering can be avoided – so that risks regarding money laundering and terror financing will not arise*." So far, regulation is not yet in place and also difficult to implement for such a globally operating financial platform.

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Lawyers point to issues related to competition and entity trust law. 9 experts are concerned about the diminishing power of central banks resulting in less efficient monetary policy measures. In contrast, 5 experts, mainly from the industrial sector, argue that many perceived risks regarding Libra are exaggerated. Specifically, expert D1 compares the potential size of the Libra reserve with the volume of large exchange-traded funds (ETFs), which he considers ultimately riskier than the Libra project.

According to the experts, a distinction has to be made between developing and industrial regions when analyzing the potential impact of Libra. Several experts are convinced that the effects of the introduction of Libra in industrialized countries will be minimal. The prevalent opinion is that a new payment system such as Libra is not needed in industrialized countries since there are efficient financial systems in place. Therefore, some experts anticipate that people will remain with their incumbent retail banks and will not use Libra on a wide scale. Nevertheless, a few experts argue that due to the high convenience of Libra and the expected low transaction costs, clients have a reason to change their payment service providers from a bank to the Libra Association.

Experts presume that the impact of Libra in developing countries will be higher than in industrialized countries. In developing countries, (volatile and week) domestic currencies are likely to be substituted with Libra. Accordingly, such substitution has far-reaching consequences for the monetary system and monetary policy of central banks in developing countries. Also, since banking services are often not fully developed and, therefore, not as efficient as in developed countries, experts expect that users are likely to switch to Libra. Additionally, they mention that Libra will be an attractive means of payment and a stable store of value. Experts reach a consensus on the fact that Libra will foster financial inclusion and that it can have positive impacts on economic growth.

Similar to the effects of a Euro CBDC, 25 experts also expect that Libra will drive a disintermediation of financial intermediaries. On the one hand, many of the surveyed experts assume that Libra will take away market shares of banks, credit card schemes or payment service providers. Expert I4 points out that Libra "*could completely take over cross border payments*." On the other hand, 11 experts expect that Libra may transform the financial market in a positive way, so that Libra will "*spur competition, and [...] will create more innovation,*" as expert I13 indicates. Experts in the industrial sector state that Libra will make banks increase

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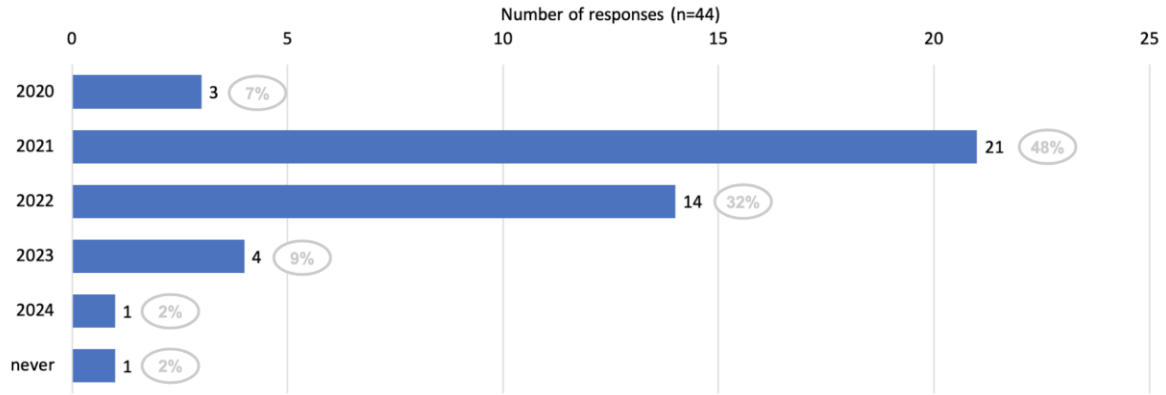
their efforts in investing in new technologies so that banks will also be more innovative in the future.

Other experts expect a limited impact of Libra on banking in developed countries due to the lock-in effect of substantial customers of retail banks. Expert B2 concretely states that "*the bank account is so deeply embedded into the current financial world of the developed countries that it will stay.*" Some experts are even more optimistic and stress that banks will potentially be involved in the Libra ecosystem as Libra will need intermediaries to provide services to end users and could support managing the Libra Reserve.

According to most experts, Libra is likely to be introduced in the Euro area next year (see Figure 11). 14 experts date the implementation of Libra in 2022. Further, 4 experts believe that we will not have Libra in the Euro area before 2023. 3 experts are convinced that Libra will be launched until the end of this year.

Figure 11: When will Libra be introduced in the Euro area?
(Source: Frankfurt School Blockchain Center)



5. Discussion: Impact of CBDC and Libra on banks

Our results indicate that banks might be heavily affected by the introduction of a digital programmable Euro, in the form of Libra, and a Euro CBDC. Recall that in this paper, we are agnostic regarding a direct, hybrid or indirect CBDC model (see Auer & Boehme, 2020). Experts presume that both Libra and a Euro CBDC will have a severe impact on banks' business models and profitability. As described in the previous chapter, one of the main risks

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experts see in a CBDC is a potential disintermediation of the financial sector, when end users convert a high amount of bank deposits into a CBDC. The experts we asked, therefore, fear that the introduction of a CBDC will yield a crowding out of bank deposits as CBDC is mainly perceived as a riskless substitute for bank deposits. Consequently, the refinancing costs of banks could increase as central bank and capital market funding is typically more expensive than funding via bank deposits (see Bindseil, 2020).

Furthermore, experts expect that the availability of a digital form of central bank money could trigger digital bank runs. In the current system, there is also a certain risk that bank runs occur so that clients massively withdraw physical cash from their bank accounts. One example is the bank run in Cyprus in 2013. Households feared that their bank deposits were no longer safe and withdrew more than 40% of their funds within one year. However, the likelihood of such a bank run is limited by monetary and non-monetary transaction costs, e.g., related to the storage of cash and the imposed daily limits for cash withdrawals. In the case of a CBDC, such bank runs could become more likely as withdrawals in digital form can be carried out easier and most of the mentioned monetary and non-monetary transaction costs would no longer arise (see Bech & Garratt, 2017). Note that we abstract from an (unrealistic) scenario where CBDC completely substitutes bank deposits so that bank runs can no longer appear.

Recent publications by the ECB indicate that it is essential for the ECB to preserve financial stability and to prevent a disintermediation of the financial sector and digital bank runs. If such threats cannot be ruled out, according to Ulrich Bindseil, Director General for Market Infrastructures and Payments at the ECB, a CBDC will not be introduced:

> "CBDC should be launched only if the central bank can be confident that [...] undesired structural disintermediation of the banking system, and avoidance in systemic crises of a facilitation of aggregate bank runs, have been solved." (Bindseil, 2020)

However, note that there are already proposals in the literature how to prevent such a disintermediation and digital bank runs. Such proposals include introducing maximum conversion limits of bank money in CBDC (see Panetta, 2018), introducing an exchange rate between bank deposits and CBDC (see Kumhof & Noone, 2018) or implementing a two-tiered interest rate structure on CBDC holdings (see Bindseil, 2020).

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Besides CBDC, a significant number of surveyed experts presume that also Libra will affect banks' businesses. According to the experts, Libra will constitute an additional competitor for banks as Libra will provide an alternative payment platform that competes with banks' payment infrastructures. Moreover, it is also possible that in the future third parties use the Libra network to grant loans denominated in Libra. The availability of such Libra loans could also accelerate a crowding out of bank money. Further, experts expressed that Libra could impact banks' market shares in the cross-border payment business. Libra aims to increase financial inclusion and to decrease transaction costs for cross-border payments. If transaction costs will, in the end, indeed be very low, then clients could switch from classical cross-border payment service providers such as banks or financial organizations such as Western Union or Moneygram to the Libra Association. Such a shift would lower the market shares of banks in the field of cross-border payments. Nevertheless, our results suggest that such potential substitution is more likely to occur in developing and emerging economies as compared to industrialized countries as Libra will most likely be mainly used in developing and emerging countries. Further, experts presume that the impact of Libra on banks will be smaller than the impact of CBDC on banks.

Our results also indicate that banks still have the chance to assert themselves and to mitigate a large-scale crowding out of bank deposits. Despite the expected negative effects on banks, our findings suggest that banks should not only perceive Libra and a Euro CBDC as a threat but also as an opportunity to adjust their business models and to generate new profitable services. In a future scenario with Libra and a Euro CBDC being introduced, banks could generate new business models and services both in the Libra and the CBDC system. Banks are very experienced in conducting Know-Your-Customer (KYC) services and in detecting and preventing money laundering and terror financing. Therefore, a CBDC system could be designed in such a way that banks will keep an important position. In the current two-tiered money system, banks obtain banknotes from the central bank and distribute these banknotes to the end users. Therefore, banks undertake tasks to interact with end users – the central bank does not directly interact with the end user. Therefore, tasks are divided between the central bank and commercial banks in the form of a private-public partnership. Such a two-tiered system is also imaginable for a CBDC so that banks would continue to distribute central bank money, not only in the form of banknotes but also in the form of a CBDC, for example in a hybrid CBDC model (see Auer & Boehme, 2020). Such a two-tiered system is, for example, suggested for most of the current global CBDC initiatives, e.g., in China and in Sweden (see Weisbrodt & Gross, 2020). Also, the ECB suggests the use of a two-tiered system in a CBDC publication (see ECB, 2019). Therefore, a CBDC can also be set up in such a system where banks remain important.

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Also in the Libra system, banks could become essential players. First, banks could join the Libra Association and would get financially rewarded by a share of the transaction fees and a share on the interest income from the Libra Reserve assets as all members of the Libra Association. Secondly, banks could act as designated dealers or virtual asset service providers in the Libra ecosystem. Designated dealers, on the one hand, are intermediaries between the Libra Association – that creates Libra units – and the end user – who then spends the created units. Besides distributing the Libra tokens, designated dealers also buy government bonds for the Libra Reserve and provide them to the Libra Association as collateral. Such tasks could be conducted by banks that would get financially rewarded in return. Virtual asset service providers, on the other hand, are third-parties that offer services on top of the Libra network. Therefore, banks could e.g., provide custody services and develop their own wallet solutions on top of the Libra network. Also, banks could, in theory, grant Libra denominated loans. Accordingly, our results suggest that also in a Libra and CBDC system, banks could become essential players. Consequently, these innovations should not only be seen as threats but also as opportunities to diversify and generate new business models.

Besides an active role in the Libra and the CBDC system, banks could also drive their own initiatives in the field of payment innovations. DLT provides new opportunities, for example, for DLT-based pay-per-use business models within the framework of IoT. Here, a programmable and digital form of the Euro serves as a backbone for applications in the fields of e.g., Industry 4.0, mobility and energy. The emerging networked economy facilitates new forms of inter-organizational and inter-industry collaboration. Within this framework, banks could act as issuers of a DLT-based (digital programmable) Euro and tokenize commercial bank money for the use in e.g. integrated business ecosystems. Our results show that the industry demands such a DLT-based Euro e.g., in the field of IoT, the machine economy and prospective digital business models. Therefore, banks could address this market gap and generate new business models by providing such a DLT-based Euro.

6. Conclusion

Our analysis suggests that the introduction of the digital programmable Euro, Libra, and a Euro CBDC would have strong implications for the industry and the financial sector. Our main findings are as follows: First, a digital programmable Euro is demanded by most of the surveyed experts in order to address inefficiencies of the current financial system and increase automation due to a programmable means of payments. Second, Libra and a Euro CBDC will

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heavily affect banks' business models, for example, such that disintermediation of the financial sector and digital bank runs could result from an introduction of a Euro CBDC and disintermediation from an introduction of Libra. Thirdly, experts also see various benefits and new business opportunities that retail, industrial and financial companies can develop and realize in the context of Libra, CBDC and the digital programmable Euro. Therefore, experts suggest to not only perceive these initiatives as a threat but also as an opportunity.

The surveyed experts expect that Libra will be introduced before a Euro CBDC. More than 80% of the experts estimate that Libra will be launched in the Euro area by 2022 and a Euro CBDC by 2030. According to our surveyed experts, banks will be heavily affected by the introduction of Libra and a Euro CBDC and should take precautions so that, in the end, new business models will emerge. The mentioned benefits of Libra and a Euro CBDC and the high relevance of the aspect of programmability point to one fact: These two initiatives are not necessarily an end in themselves but rather a vehicle to achieve a desired objective, i.e., the digital programmable Euro. Our findings suggest that bank-related opportunities emerge besides the discussed risks for banks. Such a digital programmable Euro can create significantly higher efficiency for cross-border payments, enables near real-time settlement with other assets, rights and goods and, above all, a high degree of automation. Therefore, such a digital programmable Euro is demanded by the Association of German Banks (see Bundesverband deutscher Banken, 2020). As a result, this in turn forms the basis for business models associated with the machine economy in the fields of e.g. Industry 4.0, logistics, mobility, energy and IoT. The cross-sectoral application of digital money implies that the introduction of a digital programmable Euro will not only affect banks, but also the industrial, non-banking, sector. Such a vehicle opens up cross-sectoral business opportunities that could not be achieved in the absence of a digital programmable Euro. In this respect, a significant portion of the surveyed experts regard DLT as the appropriate technology for the implementation of a digital programmable Euro.

Our results provide a number of implications. First, banks should not solely regard Libra and CBDC as a threat, but also as a reason to take innovative action to adjust their business models as well as to generate new profitable services. First, banks could become essential pillars in the Libra and CBDC system in order to generate returns. In addition, banks may provide services within the scope of their traditional range of operations, such as custody and distribution of digital money, along with services such as AML and KYC. Third, a digital programmable Euro enables the programmability of money through smart contracts and thereby enables automated processes as well as financial services such as interest payments,

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loans, escrow accounts, leasing and factoring. Therefore, a digital programmable Euro could also yield efficiency gains for banks. Fourth, with the introduction of a digital programmable Euro, a high degree of interoperability could be achieved across multiple payment ecosystems. Such interoperability is of particular importance when considering the requirements of the machine economy, in which machines such as cars, industrial plants or sensors are also involved in processing payments. In this context, banks could act as accelerators to develop an interoperability standard in a banking consortium.

It should be noted that further research on this subject is required as this study is exposed to limitations. Our sample of 51 experts may not be sufficient to obtain a full picture of the implications of Libra, CBDC and the digital programmable Euro for European banks. Future research could, therefore, increase the sample size and the geographic reach of the surveyed experts. Moreover, a sample bias could also result from the disproportionate origin of a large fraction of the experts from Germany. We acknowledge that the discussions about the digital programmable Euro, Libra and CBDCs are mainly conceptional as these initiatives are not live yet. Therefore, high uncertainties about the exact design of these initiatives remain. Nevertheless, now is the time for banks to develop positions, strengthen them and ultimately create new business opportunities.

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Appendix A: Expert interview participants

No.	ID	Field of work	Country	Profession
1	A1	Academia	Germany	Professor
2	A2	Academia	Germany	Research Assistant
3	A3	Academia	Switzerland	Research Assistant
4	A4	Academia	Switzerland	Professor
5	A5	Academia	Denmark	Research Assistant
6	A6	Academia	Germany	Professor
7	A7	Academia	Spain	Research Assistant
8	A8	Academia	Republic of Korea	Research Assistant
9	A9	Academia	Switzerland	Professor
10	B1	Banking	Germany	Chief Economist and Head of Research
11	B2	Banking	Germany	Digital Markets Development Manager
12	B3	Banking	Germany	Managing Director
13	B4	Banking	Germany	Digital Office
14	B5	Banking	Germany	CFO
15	B6	Banking	Germany	Senior Trader
16	B7	Banking	Germany	Undisclosed
17	C1	Central Banking	Pan-European	Undisclosed
18	C2	Central Banking	Germany	Undisclosed
19	C3	Central Banking	Ukraine	Undisclosed
20	C4	Central Banking	United States	Undisclosed
21	D1	Associations	Germany	Head of Research
22	D2	Associations	Germany	Undisclosed
23	D3	Associations	Germany	Director of Economics
24	D4	Associations	Germany	Research Assistant
25	D5	Associations	Germany	Partner Lawyer
26	E1	International Organization	United States	Economist
27	F1	Consultancy	Germany	Director Digital Finance
28	F2	Consultancy	Germany	Research Assistant
29	F3	Consultancy	Germany	Research Assistant
30	F4	Consultancy	Germany	Senior Expert

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31	F5	Consultancy	Germany	Expert Principle
32	F6	Consultancy	Germany	Knowledge Specialist
33	I1	Industry	Switzerland	Chief Economist
34	I2	Industry	Barbados	Executive Vice Chairman
35	I3	Industry	Germany	Project Leader
36	I4	Industry	Germany	Business Expert
37	I5	Industry	Germany	Research Assistant
38	I6	Industry	Denmark	Research Assistant
39	I7	Industry	Germany	CTO
40	I8	Industry	Germany	Consultant
41	I9	Industry	Germany	CEO
42	I10	Industry	Germany	Founder and CEO
43	I11	Industry	Germany	Chief Business Development Officer
44	I12	Industry	Canada	Solution Architect
45	I14	Industry	Germany	Consultant
46	I13	Industry	United Kingdom	CEO
47	L1	Lawyer	Germany	Legal Partner
48	L2	Lawyer	Germany	Head of Digital Assets and DeFi
49	O1	Others	Germany	Co-founder
50	O2	Others	Germany	Head of Innovation
51	O3	Others	Germany	Research Assistant

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