

Crypto-assets and Central Bank Digital Currencies: Asset and Liability Management implications

A report prepared by the AFGAP and PwC France & Maghreb

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Introduction

The acceleration of digital assets development and the emergence of Central Bank Digital Currencies (CBDC) raised as much enthusiasm as cautious concerns regarding their potential impact on the banking sector. The progressive integration of digital assets into financial regulation and the acceleration of CBDC projects by central banks globally make these developments a more and more pressing topic to be seriously considered by the banking sector.

As analyzed by the Bank for International Settlements (BIS) in the report “Central Bank Digital Currencies: Financial Stability Implications” published in September 2021, the banking sector will be impacted by CBDC initiatives, as potential bank deposit substitutions by CBDCs could impact banks’ balance sheets structures. That being said, as highlighted by the BIS, the impact may highly differ depending on several factors like CBDCs’ operational designs and distribution schemes. Furthermore, digital assets and CBDCs may represent new opportunities for banks in several areas, namely on business development, efficiency gains and customer demand satisfaction.

On one hand, the private investors as well as professionals contribute to the rapid development of crypto-assets, and on the other hand, the Central Banks have launched their journey on the issuance of CBDC. Therefore, the commercial banks should follow closely the developments of crypto-assets, participate in the discussions on the supervision of crypto-assets and analyze the potential impacts on their businesses. In this context, AFGAP and its members aim to shed light on their potential ramifications on Asset and Liability Management (ALM).

This report, prepared in collaboration with PwC France & Maghreb, presents a few perspectives from a group of French banks’ ALM managers: it does not claim to be exhaustive nor to constitute a position taken by their respective institutions on these subjects.

The first section of this note provides an overview on the developments in the crypto asset economy.

The second section deals with the ramifications on Asset and Liability Management (ALM) that have to be assessed notably for the potential impacts on the balance sheet and financing activities.

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Section I | Crypto-assets and CBDC developments: a brief overview

Introduced by Bitcoin in 2008, blockchains are peer-to-peer internet-based protocols allowing the digital storage and direct transfer of value using cryptography and decentralized verification networks. They were then enriched with the introduction of smart contracts, programmable scripts that can be used to build a wide variety of digital assets and applications.

The sophistication of blockchains and their security have steadily increased over the past 10 years, making so-called blockchain technologies a serious alternative solution used to transact value in digital form worldwide. It namely offers the following advantages:

- Possibility to represent an asset in a unduplicable digital form, allowing the immediate tokenization of value of different kinds of assets: financial assets and notably assets with little liquidity, like music or videos or art. This can potentially increase the liquidity of the underlying assets.
- Immediate transaction finality: the exchange of two assets against each other on a blockchain contains no settlement risks, and therefore potentially reduces collateralization needs. This is true if both exchanged assets are swapped on the same blockchain or on interoperable DLT infrastructures (for example, a tokenized security against a central bank digital currency on Ethereum).
- Programmability of assets, notably money, enabling machine to machine transactions, automatic execution of complex sequences of conditional transactions.

For that reasons, blockchain technologies are considered by numerous commentators as a new layer to the Internet, complementing the “Internet of information” with the “Internet of value”, allowing the direct transfer of crypto-assets between internet users.

Section 1 introduces what crypto-assets are. The reader who is already literate in that matter can skip this section and go directly to section 2 for a specific focus on digital assets and Asset and Liability Management (ALM).

1. Digital assets mapping

This chapter aims at providing a general overview of digital assets. It will first focus on privately issued crypto-assets, and then introduce Central Bank Digital Currencies.

1.1 What are crypto-assets?

As defined in the European Commission’s Proposal for a Regulation on Markets in Crypto-Assets (MiCA), a crypto-asset is a **“a digital representation of value or rights which may be transferred and stored electronically, using distributed ledger technology (DLT)”**.

Until Bitcoin and the invention of blockchains, digital assets transfers were managed through the intermediation of **trusted ledger keepers**. These latter are in charge of keeping the updated account of digital asset transactions. For instance, banks are accountable for keeping their clients’ account balance updated.

Blockchains bring the ability to keep these **ledgers updated without the need of going through a trusted account keeper**. They automate and secure these ledgers through **consensus protocols**. These consensus protocols are composed of a set of rules that

blockchain network participants must follow in order to validate transactions in the network. These rules are encoded in the software that allow digital value transfers without intermediaries and administer the way distributed ledgers are updated and verified.

This means that while crypto-assets are digital objects, they cannot be duplicated, thanks to the use of distributed ledger technologies (DLT). These distributed ledgers record the entire history of crypto-assets ownership transfers and play the role of account keepers, offering full transparency on all transactions on the chain to anyone.

Different types of crypto-assets

Different types of crypto-assets have emerged over time. They can differ based on several variables such as the nature of their issuer, the underlying assets that provide them value, the types of rights they give to their holders, the technical set-up they are based on etc.

From a regulatory perspective, two main categories can be distinguished:

- Crypto-assets that are deemed as securities, also called “security tokens”
- Crypto-assets that are *not* deemed as securities

In France, for instance, crypto-assets deemed as securities are regulated by financial securities regulations. Crypto-assets that are *not* deemed as securities are regulated by a specific set of legal texts, under the “Pacte Law”.

The European regulatory framework currently being built makes a similar distinction.

Security tokens

Security tokens are securities and entitle their holders to financial and potentially voting rights. They use blockchains as record keepers and as exchange infrastructures. They can, for instance, represent bonds, shares, derivatives etc.

In Europe, security tokens are today regulated under the existing financial regulation framework. However, the specific features of security tokens can make regulatory compliance challenging. Therefore, a temporary “Pilot Regime” aims at supporting innovation by setting up a temporary regime dedicated to so-called “DLT market infrastructures” for security token trading and post-trade operations.

Other crypto-assets

- Cryptocurrencies: native digital tokens stored in a blockchain and transferable on a peer-to-peer basis. (ex : bitcoins, ethers, tezees,...). A cryptocurrency is issued directly by a blockchain protocol on which it runs, which is why it is often referred to as a blockchain’s native currency.
- Stablecoins: tokens offering price stability vs. fiat currency or referenced assets. They are backed by fiat currency or by other assets (cryptocurrencies, commodities) Contrary to cryptocurrencies, stablecoins are issued on a blockchain by an issuer with a counterparty risk. They can be issued by commercial banks, like JPMorgan (JPMorgan Coin), by corporates like Casino/Lugh with the euro-pegged

¹ Distributed Ledger Technology makes it possible to exchange and store value. “Tokens” are used as mediums of exchange. They are digital representations of rights / value which ownership is registered on a blockchain. Tokens are created through the development of smart contracts. Smart contracts are programmable scripts executed by DLT networks, allowing the automatic and immutable execution of conditional digital transactions. Tokens can represent real or digital assets. They can be asset-backed or digitally native and somehow represent all sorts of assets, as long as a digital representation is possible.

token Lugh or by Distributed Autonomous Organizations² (DAO) like MakerDAO for the DAI. More details on stablecoins are provided in the next chapter [2.5. The rise of stablecoins and the development of Central Bank Digital Currencies]

- Application tokens, which includes:
 - Utility tokens providing access to a good or service (such as an access to specific platforms or a discount),
 - Governance tokens representing voting power on a blockchain project.
- Non-fungible tokens: digital representation of an object on a blockchain, which can be natively digital (such as a land in a metaverse, a digital picture, etc.), or non-native, in this case representing a real object (such as a painting or a building for example).

1.2 Central Bank Digital Currencies³

As defined by the Bank for International Settlements (BIS), Central Bank Digital Currencies “would be a **digital banknote**. It could be used by individuals to pay businesses, shops or each other (a "retail CBDC"), or between financial institutions to settle trades in financial markets (a "wholesale CBDC")”⁴

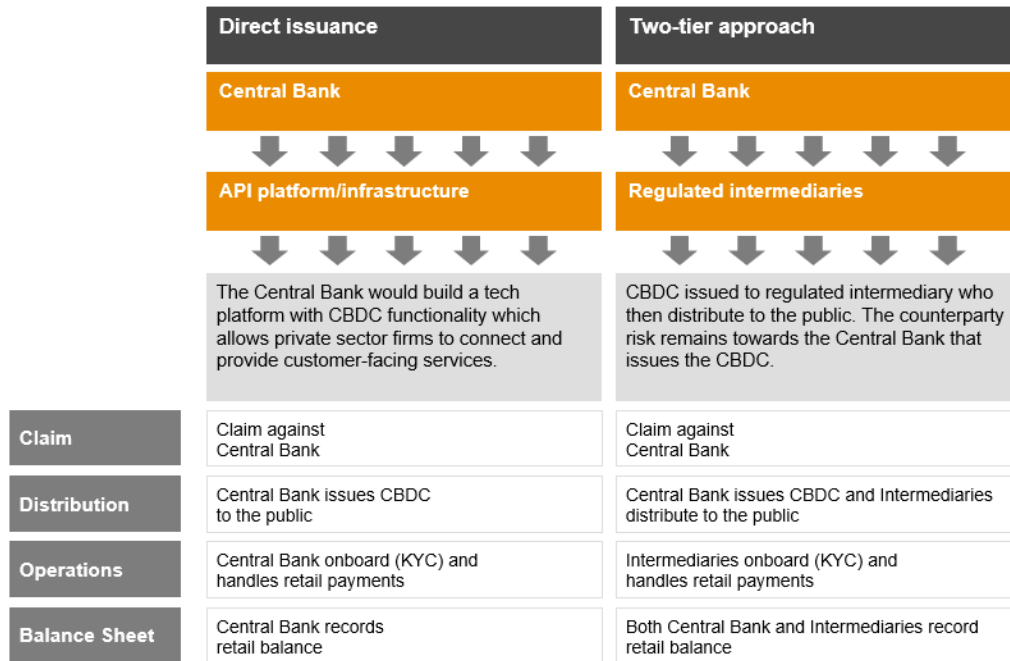
Wholesale CBDCs should benefit the banking players by favoring capital market and interbank payment efficiencies. The impact of retail CBDCs on commercial banks has been more debated. As a matter of fact, the architectural design and operational model on which retail CBDCs are developed can largely determine the way they shall impact the banking industry.

As described in the following figure, two main CBDC operational models can be distinguished.

² DAOs are organizations which rules are written in smart contract codes. They are computer programs that run on the Internet in an autonomous manner, meaning that they do not rely on a legal central organization to fulfill their activities. Anyone can join a DAO as long as they have the knowledge and material resources to do so.

³ Sources: PwC CBDC Global Index, 2021 edition and 2022 edition

⁴ Source: Bank for International Settlement (BIS) Innovation Hub



The direct issuance model is the most disruptive design as it theoretically disintermediates the Central Bank monetary intermediation model, currently involving commercial banks, namely for the distribution process.

The two-tier issuance model provides CBDC holders with a direct claim against Central Banks but uses commercial banks as distribution intermediaries. This operational design appears, so far, to be the model favored by most Central Banks.

2. Beyond the hype: institutionalization of digital assets developments

Crypto-asset ventures have been accelerating over the past few years with the tokenization (digital representation of an asset on a blockchain) of all kinds of assets, including securities, pieces of art, music, videos, real estate, patents, etc. Large financial institutions have been investigating this topic from different perspectives: from efficiency gains they may earn on post-trade processes to new products they could offer to their clients⁵. Over the past few years, the financial sector has been investing in prototypes and experiments to assess the potential integration of such developments. The main objective was to test how crypto-assets could be integrated into their operations and product lines. Exploration and experimenting were characterized by the multiplication of “Proof-of-concepts” (POC) and prototyping.

The “POC stage” now seems to belong to the past. Live projects have since been launched. Crypto-asset projects now also involve most corporate functions - beyond the IT and innovation departments, such as compliance teams, operational risk managers, finance and accounting officers... This is key as they need to make sure these projects integrate well into the overall operational and corporate framework and are launched properly.

Crypto-assets developments might very likely impact the financial sector to its very core. Blockchain technology enables the creation of decentralized financial services: crypto assets and related services present themselves to more and more investors and depositors as alternative solutions to their financial endeavors. The magnitude of this impact is sharply growing and could be disruptive if the growth continues in the following years.

Five global trends are characterizing the acceleration of crypto-asset developments:

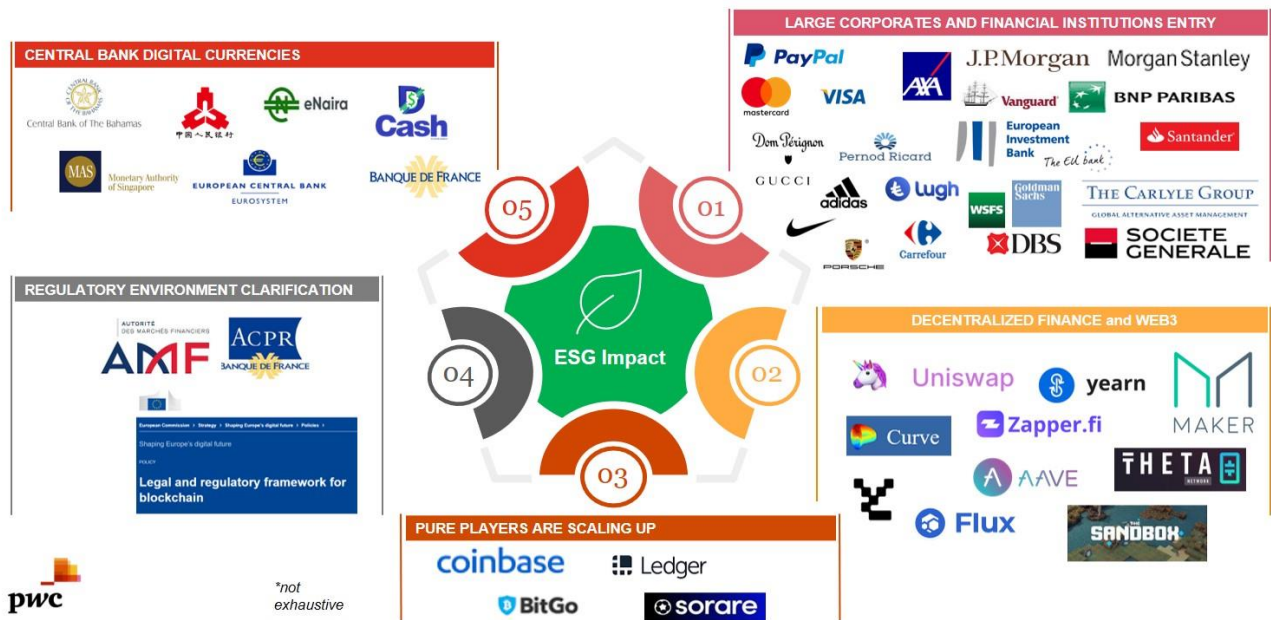
- 1) The exponential adoption of crypto-assets and blockchain technologies by corporates and financial institutions
- 2) The emergence of decentralized finance (DeFi) and the development of alternative disintermediated financial products
- 3) Crypto pure players are scaling up, gaining in size and market impact
- 4) The clarification of the financial regulatory environment
- 5) The rise of stablecoins and the development of Central Bank Digital Currencies

⁵ Blockchains present several characteristics that have been attracting corporate and financial institutions interest over the past few years, including:

- The possibility to represent an asset in a digital form and to make it directly transferable on a peer-to-peer basis without the need of setting up a centralized transactional record ledger.
 - The ability to fractionalize digital assets into smaller units (digits of a unit) potentially bringing additional liquidity to native digital assets and digitized real assets (like music, video files or pieces of art for instance).
 - The quasi immediacy of transaction settlement potentially reducing settlement risks and collateralization needs.
 - The programmability of assets, enabling machine to machine transactions, and the automatic execution of complex sequences of transactions based on pre-agreed conditions.
 - The worldwide availability of digital assets provided the Internet is accessible, namely for the unbanked - potential financial inclusion of 2 billion unbanked people globally.
 - The technical possibility to address a worldwide investor base immediately (under local regulatory constraints).
 - An open source development allowing reduced development costs.
- An infrastructure available 24/7.

Figure 1. Five global trends supporting the acceleration of crypto-asset developments

5 global crypto trends



Source: PwC

2.1 Trend 1: Large corporates and financial institutions entry

As described above, large financial institutions and corporations have been integrating crypto-assets into their operations. This phenomenon seems to accelerate.

Such developments encompass all economic industries, at the global level. This puts some pressure on the banking sector, as more and more banking clients are willing to consider crypto-assets as alternative investments, means of payment or use blockchain based applications to optimize and secure their operations, like in supply chains, for instance.

Illustration 1: Examples of large financial institutions and corporations integrating blockchain technologies or crypto-assets into their operations



In 2021 VISA started offering new services and partnering with various crypto players such as Clothia, which allows crypto users to pay in stablecoins with USDC. VISA also introduced new services such as the Visa Fintech Fast Track which enables a fast issuance of Visa credentials.

Paypal's entry into the world of cryptocurrencies was highly anticipated. In 2021, Paypal launched their "super-app" which includes the possibility to buy, sell and earn interest on crypto-currencies in the US market. It also allows crypto-currency holders to convert them to USD.

Payment giants



MasterCard developed several partnerships to integrate crypto-currencies into their services. The payment giant partnered with Wirex and BitPay to create crypto cards that allow people to transact using their cryptocurrencies. Recently MasterCard teamed up with crypto pure player Bakkt so that users can buy, sell, hold and earn royalties in crypto-currency. MasterCard also announced the acquisition of CipherTrace in order to benefit from the expertise of tracking the activities taking place on various blockchains, to trace transactions, and help identify illicit activities and money laundering.

Finality is a blockchain-based payment system backed by the Nasdaq and 14 financial institutions. Finality intends to address some use cases like interbank payments, business-to-business payments between companies within a bank. The benefits of Finality will be the reduction of counterparty and credit risk, the reduction of operational risk, efficient liquidity management and the ability to move resources from risk mitigation to business growth.



JPMorgan was the first bank to launch a dollar-indexed digital asset: the JPMorgan Coin, which is used for instant wholesale money transfers between accounts of institutional players, large investors, other banks, and large corporations. In late 2020, JPMorgan completed a blockchain-based live intraday repo transaction, with an internally developed blockchain application. In 2021, Goldman Sachs joined JPMorgan in a repo trade settled in JPMorgan Coin, with BNY Mellon providing custody.

J.P.Morgan

Large banks



Société Générale, Santander and Goldman Sachs participated in the European Investment Bank's 100-million-euro tokenized bond issuance as lead investors in 2021.



Goldman Sachs invested in the crypto company BlockDaemon providing cryptocurrency stacking and node infrastructure to institutional firms.



Morgan Stanley, JP Morgan, Goldman Sachs, BBVA, DBS offer their clients the ability to get exposure to crypto currencies.

Morgan Stanley

Morgan Stanley invested \$48 million in "Securitize", a crypto company that raises funds by issuing tokenized securities. In October 2021, Morgan Stanley CEO publicly stated that cryptocurrencies "were not a fad", affirming strategic positioning in this sector. The bank also revealed their exposure to bitcoins through Grayscale funds investment.

More and more companies allow their clients to pay with crypto-currencies.



2.2 Trend 2: Decentralized finance (DeFi) and Web3 offers alternative products accessible to anyone

While large financial institutions are integrating crypto-assets into their operations, “Decentralized Finance” (DeFi) applications are quickly developing. They use conditional scripts, kind of simple IT programs, called smart contracts, to automatically execute and register financial operations on the blockchain. Such contracts enable blockchains to offer various financial services, like stablecoins, lending/borrowing, exchanges of digital assets, asset management, derivatives and insurance, entering into the core businesses of banks.

DeFi applications started to emerge back in 2017. Their use truly accelerated during the 2020 summer, reaching over **200 billion USD** of total value locked in the end of 2021, representing then around 5% of total crypto market capitalization (totaling a bit more than 2 trillion USD in September 2021). As of today, DeFi remains marginal in comparison with the magnitude of traditional finance. That said, DeFi’s pace of growth, the fact that innovative applications are being built in an open-source way and the interest that potentially large investors have already expressed, lead to reasonably anticipate an acceleration of the phenomenon over the next few years.

The **very high nominal returns currently available through** DeFi products likely explain a large part of this growth⁶. Overtime, they might reach a level where the spread with traditional finance rates might tighten and converge to the efficiency differential between “decentralized” (DeFi) and “centralized finance” (CeFi).

Hybrid developments intersecting traditional finance and decentralized finance are starting to emerge. More and more interactions between traditional finance and decentralized finance can be expected, as customers start to consider both options. Furthermore, banks might benefit from those services or could even play a role in decentralized finance and develop services. For instance, Société Générale Forge proposed to Decentralized Finance key player MakerDAO to participate in the refinancing of regulated security tokens. In the proposal⁷, Forge proposes to pledge security tokens to borrow the equivalent of up to 20 million USD in MakerDAO’s stablecoins, the DAI.

If such hybrid developments were to multiply, DeFi growth might further accelerate and even support overall crypto developments, benefiting from institutional investors inflows.

Apart from very high nominal returns, DeFi may present **high innovation potential** in financial services digitization. DeFi provides open access financial applications, and the ability to automate the conditional execution of auditable transactions. Based on open-source code sharing, DeFi benefits from fast pace innovation. Furthermore, DeFi offers a high degree of modularity, enabling DeFi innovators to combine different existing offers to build more complex solutions.

Here are some examples of services offered by DeFi applications⁸:

- **Asset exchange:** Decentralized EXchanges (DEX) allow users to trade crypto-assets for other crypto-assets and stablecoins directly without intermediaries.
- **Lending and borrowing:** Users can lend crypto-assets to borrowers through the use of smart contracts.
- **Asset Management:** Users can participate in baskets of digital assets, aggregators offer the optimization of yield on liquidity pools.

⁶ For yield examples, see: <https://defirate.com>

⁷ See: <https://forum.makerdao.com/t/security-tokens-refinancing-mip6-application-for-ofh-tokens/10605>

⁸ Source: PwC report “DeFi: Defining the Future of Finance”, June 2021.

- **Insurance:** Users can get insured against certain risks related to DeFi like smart contract failure or loss of deposits without going through an intermediary, on a peer-to-peer basis.
- **Derivatives and synthetic asset trading:** Users can trade tokens which value is derived from the performance of underlying assets, directly with each other through the use of blockchain networks.
- **Yield aggregators:** Users can compare different yields proposed by various competing DeFi apps and potentially optimize their crypto-assets placements.

2.3 Trend 3: Crypto players are scaling up, gaining in size and market impact

Most crypto companies, until a few years ago, were considered as start-ups. Some crypto pure players have been growing tremendously through both organic and external growth strategies.

Last year saw a very sharp increase of deals in the crypto industry. The total value of crypto M&A in 2021 has mirrored the rally in crypto prices, with an increase of 4,846%. The average deal size has also increased 3x from US\$52.7mil to US\$179.7mil, driven by some mega US\$1bil+ SPAC deals. The total value of crypto fundraising deals has increased by 645% in 2021 to \$34.3bn. The average fundraising amount has also increased by 143% to US \$26.3mil.⁹

For instance, Coinbase, a cryptocurrency exchange platform founded in 2012, went public in April 2021 and valued at USD 100 billion on their IPO. Coinbase provides services to individuals, institutions and family offices. The cryptocurrency company also offers a service that allows merchants to accept any cryptocurrency as payment from their customers.

In the French market, we can mention Sorare and Ledger.

- Sorare is a French unicorn that offers a fantasy soccer game, where the player can compose a team with soccer player cards using NFTs (more or less rare). It is therefore possible to buy, trade, play against other players of the platform and resell. Sorare uses a layer 2 of Ethereum called Starkware. In September 2021, Sorare raised 680 million dollars (led by Softbank) in Series B.
- Ledger is a French unicorn and one of the leaders in the market. The goal is to secure the holding and transactions in crypto-currencies for individual users by designing physical digital wallets (cold wallet: wallet not connected to the internet in the form of a USB key). Ledger also signed a contract with Engie in 2018. As part of this partnership, Ledger will provide Engie with secure boxes for their wind turbines, solar panels and hydroelectric facilities. Ledger raises \$380 million in Series C funding through 10T Holdings in June 2021.

2.4 Trend 4: Regulatory environment clarification

One of the main external challenges for blockchain players (whether pure players or traditional companies) lies in the uncertainty and immaturity of the regulatory framework.

⁹ Source: PwC 2022 Global Cryptocurrency Mergers and Acquisition and Fundraising Report, published in February 2022.

This threat is followed in importance by human resource (ability to attract and, above all, retain talent) and financial issues (in particular, difficulties in opening bank accounts). The lack of regulatory framework or an immature framework that is ill-adapted to the reality of the new field of blockchain could hold companies back.

France, for instance, is quite advanced in that matter, with a fairly advanced tax, legal and accounting framework for blockchain and crypto assets, as well as clear Anti-Money Laundering and Counter Terrorist Financing (AML-CTF) regulations. The Pacte Law also introduced an Initial Coin Offerings (ICO) optional visa regime as well as the Digital Assets Services Provider (DASP) registration and optional licensing.

By contributing to the clarification of the crypto assets regulatory framework, these developments support the development of the crypto-asset industry. As of May 2022, 37 DASPs have completed the mandatory registration process with the Autorité des Marchés Financiers (AMF)¹⁰, with the latest on the list being the global crypto-exchange platform Binance.

At the European level, two different regulatory regimes are being built in this field:

- The Market in Crypto-Assets Regulation (“MiCA” or MiCAR), for crypto-assets not deemed as securities.
- The Pilot Regime Regulation, for market infrastructure dealing with security tokens.

A formal agreement was obtained as early as December 2021 for the Pilot Regime. Its adoption should be effective by the end of 2022/early 2023. MiCA was submitted to the European Parliament vote on March 14th 2022 and is currently under trilogue discussion for a potential adoption in 2023.

2.5 Trend 5: The rise of stablecoins and the development of Central Bank Digital Currencies¹¹

Stablecoins and Central Bank Digital Currencies developments are a strong support for the growth of digital assets in general. They can namely provide price stability to crypto payment systems and can be used as settlement instruments for more volatile crypto-assets. Their integration into tokenized capital markets and global payment systems should further accelerate the adoption of crypto-assets by large corporates and financial institutions.

Stablecoins

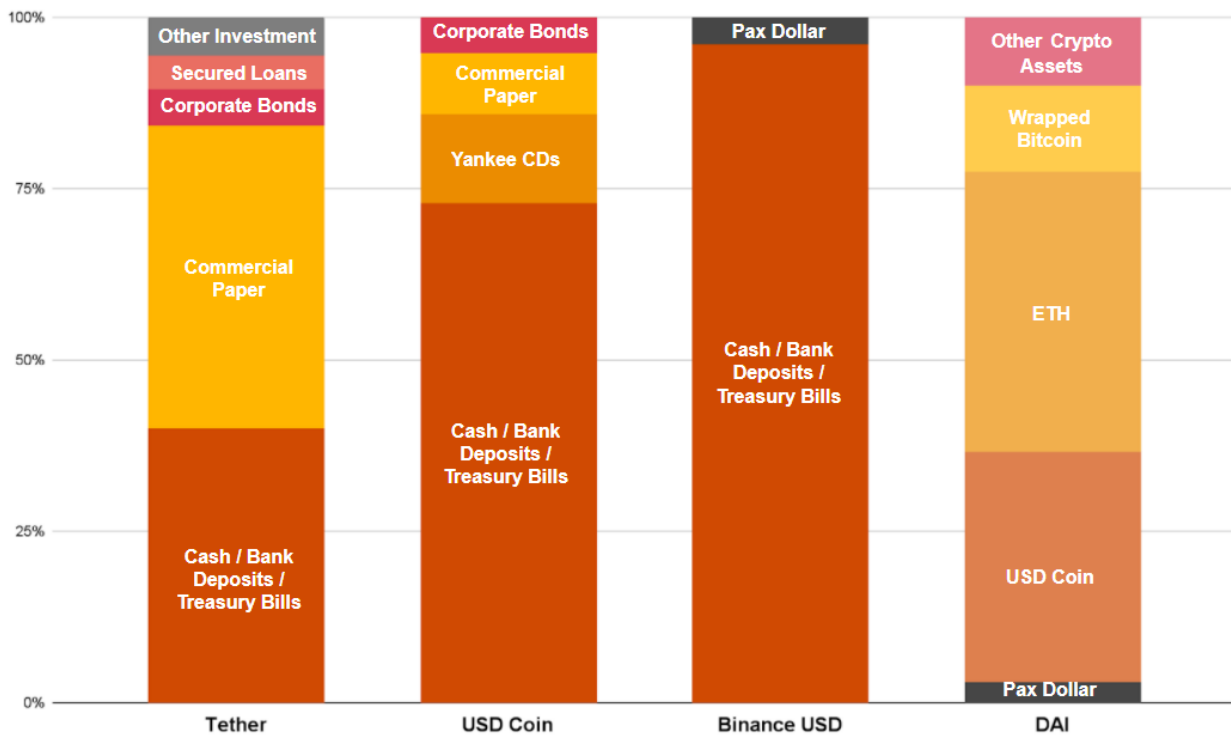
Stablecoins are tokens using a stabilization mechanism, usually backed by fiat currency or an asset pool, as shown in the following figures. Experiments on algorithmic stabilization mechanisms are also being run but remain controversial in their ability to effectively ensure the asset stability.

¹⁰ Source: Autorité des Marchés Financiers (AMF), site internet consulté le 10 mai 2022.

¹¹ Source: PwC CBDC Global Index and Stablecoin Overview, edition 2022, published in April 2022.

Classification	Pegged to
Fiat-backed	Fully backed by cash or liquid assets. Redeemable by the issuer at face value. Reserves are normally maintained by regulated entities. May provide a higher level of transparency, such as detailed attestation disclosures on reserve assets and clear documentation of redemption rights.
Security-backed	Fully backed by non-cash equivalent assets (e.g. corporate bonds, commercial paper). In some cases, some issuers may be able to defer redemption, offer in-kind redemption or impose higher redemption fees.
Crypto-backed	Backed by other crypto-assets. Typically structured on a decentralized, non-custodial basis and are considered part of Decentralized Finance (DeFi)
Algorithmic-backed	Algorithmic protocols which increase or decrease the supply of tokens according to market conditions.
Other asset-backed	For example, by commodities (such as gold) or non-fungible tokens (NFTs)

% of collateral



Source: PwC CBDC Global Index and Stablecoin Overview, April 2022

Unlike other crypto-assets which show high volatility, they aim to be stable. They can be considered as a link between traditional finance and digital finance, with very clear use cases in the context of capital markets (ex: JP Morgan Coin).

In absence of tokenized CBDCs, stablecoins are the only stable mean of payment available on blockchains today.

This opens up a whole panacea of use cases within the **primary debt and equity capital markets, as well as the secondary markets**. Standardization of technology, regulatory approach and legal doctrine will be required.

Alongside use cases directly involved in capital markets, they can play an effective supporting role in **cross border payments**, settling 24/7. Adherence to the highest standards of coin hygiene and sanctions compliance remain paramount and should support further growth and adoption by financial institutions and corporations.

Central Bank Digital Currencies

More than 80% of the Central Banks in the world have been exploring CBDCs since 2014. Progress has been accelerating with some CBDC projects now entering into implementation phases.

Institutional involvement in CBDC continues to strengthen the ecosystem at large, with public stakeholders such as the Bank for International Settlements, the World Bank, the International Monetary Fund or the World Economic Forum, active on the topic.

As explained in [1.2 Central Bank Digital Currencies], Central Banks are working on two main CBDC operational designs:

- Retail applications, where CBDCs can be directly held by citizens and corporates as a form of digital cash.
- Interbank or wholesale applications, where CBDC use is restricted to financial institutions, namely for interbank transactions and financial settlement.

Retail CBDC projects appear to be more advanced in emerging economies with financial inclusion stated as an expected outcome.

Wholesale efforts are mostly conducted in more advanced economies, with more developed interbank systems and capital markets.

To name a few, legal digital tender is in use in The Bahamas and Nigeria with Jamaica and the Eastern Caribbean expected to follow soon. The People's Bank of China began its journey towards a digital yuan in 2014. The country is currently conducting large-scale public trials in selected cities and the e-CNY was one of only three payment methods accepted at the venue during the 2022 Winter Olympics. In February 2022, India's Finance Minister pledged to have a virtual version of the rupee later this year and the following month, the Philippines announced its own pilot implementation of a CBDC.

The Central Bank of Nigeria (CBN) launched e-Naira in October 2021. The digital currency is expected to support the country's target to raise levels of financial inclusion from 64% to 95%.

In March 2022, the US Administration placed 'the highest urgency' on research and development efforts into the potential design and deployment of a US CBDC. The Executive Order highlighted a number of CBDC benefits, including expanding access to financial services, lowering the cost of funds transfers and reinforcing US leadership in the global financial system. The Administration expects regulators to submit a joint research assessment on CBDC implications by September 2022.

While the ECB's Governing Council will make the final decision on whether a digital euro is needed, policymakers within the Commission and across Europe are already convinced. Germany and France last year urged the ECB to speed up the process amid fears that the eurozone could get left behind.

Central banks have not yet decided whether the CBDC will be account based or token based¹². However this technological choice is key to determine the usability of CBDC on blockchains.

2.6 Environmental, Social and Governance (ESG) impact is getting more and more attention by the crypto ecosystem

Since the emergence of cryptography in the 1940s and the first Bitcoin transaction in 2009, the digital world, and especially blockchain, has constantly evolved, with its environmental impact becoming a growing concern over time. As the adoption of blockchain technology becomes more widespread, the issue of its energy and carbon consumption remains a crucial challenge, raising questions surrounding protocol design and carbon footprint measurement.¹³

Protocol design: Proof-of-Work vs. Proof-of-Stake

A blockchain like Bitcoin relies on a method of block verification called Proof-of-Work (PoW), which is designed to be energy intensive.¹⁴

In a Proof-of-Stake (PoS) protocol, the block producer, known as a staker, is selected based on the number of coins staked in the relevant blockchain cryptocurrency. Instead of mining, users can validate and make changes to the blockchain based on their existing stake in the cryptocurrency. Unlike PoW, PoS does not require powerful machines carrying out complex calculations to operate. This approach reduces the complexity of the decentralized verification process which can lead to significant savings in energy and operating costs.

Due to concerns about cost, energy intensity and scalability, emerging blockchain applications are increasingly relying on PoS and other less expensive, less energy-intensive verification methods. In response to energy concerns, Ethereum also reaffirmed their will to move their consensus mechanism from PoW to PoS.

¹² As highlighted by the St Louis Federal Reserve, tokenization involves a change in the design of transaction verification. Blockchains brought to digital assets the ability to incorporate a “token-based” transactions verification system. At the opposite, an “account-based” verification system requires the intermediation of an account-keeper, trusted to keep the registry of assets ownership.

- In a token-based system, with physical or digital coins, the recipient may ask: “is the money I am being paid with real or fake?”; the recipient doesn’t have to know anything about the payer, he has to verify the payment object itself. Cash and many digital currencies are token-based.
- In an account-based system, the recipient may ask: “is the payer the true owner of the money he is giving me?”; the recipient must verify the identity of the payer (a priori the account holder). Bank accounts and most forms of commercial bank money are account-based.

¹³ Source: PwC, “Blockchain and crypto: how business is finally reaping the rewards”, published in April 2022

¹⁴ In a PoW protocol, the block producer, known as a “miner”, is selected according to their ability to solve computational problems. Put simply, miners have to find a number of a fixed length with several characteristics. To do this, they run a protocol that generates random numbers. The more computational capacity a miner has, the faster they can generate numbers, increasing their chance of validating the block and winning the bounty. To increase their computational capacity, miners are now widely using ASIC (application-specific integrated circuit) computers that are specifically designed to win PoW mining as frequently as possible. These machines can rarely be used for other purposes and must be replaced quickly as new ASICs are created and released on the market. As more miners join the network in the hopes of profiting from the sharp year-on-year rise in cryptocurrency prices, PoW is becoming more difficult.

By design, the difficulty of PoW mining increases every four years and there is a strict cap on the total number of cryptocurrencies that can be mined, further intensifying competition between miners. These factors mean that miners need increasingly powerful and energy-intensive computers and data centres to compete.

Environmental footprint measurement

The life cycle assessment (LCA) approach can be a useful tool for measuring the environmental footprint of a blockchain, and PwC has already implemented this approach for blockchains. It can be used to analyze a blockchain's environmental impacts in relation to its main transaction function, and to answer questions such as:

- What environmental impacts can blockchain have?
- Which main life cycle stages and sub-stages have the most significant impacts?
- What are the main factors influencing these impacts?

This approach takes the blockchain's entire life cycle into account, as well as all the elements required to run the protocol, including use of the Internet. Equipment considered in the model is analyzed throughout its life cycle from the acquisition of raw materials to its end of life.

***Section II | AFGAP's
analysis of potential
impacts on Asset and
Liabilities Management
(ALM)***

The current section essentially presents implications on the functioning of banks in terms of ALM and lists several stakes for the banking system raised by AFGAP. Of course, any potentially evolving situation like this will also create new opportunities that commercial banks would identify and seize in due time.

This section presents:

- The impacts identified on banks' balance sheet, particularly in terms of deposits and their potential substitutions by other liabilities, including with specific refinancing operations that could be adopted by Central Banks;
- Potential impacts on the modeling in terms of liquidity and interest rate;
- The increase in the role of Central Banks for their monetary and regulatory roles.

1. Implication on banks' balance sheet and activity

1.1 Potential banks deposit substitution

CBDCs potential impacts

CBDCs offer specifically one of the lowest risks and could consequently attract significant amounts of cash, depending on their technicalities. Beyond the transfer from bank deposits to CBDCs in normal circumstances, there could be potentially more significant transfers in stress situations depending on the perception of relative safety and, to a lower extent, the difference in yield. Preliminary estimates of such transfer lead to a limited though material portion of banks deposit that may migrate to CBDCs. The extent of these shifts will need to be carefully considered when finalizing the design of the CBDC.

As an illustration, with the introduction of a cap on deposits in CBDC and the level of their remuneration, Central Banks could introduce two levers that could limit the shift of deposits and control the impact on the banking system.

Many Central Banks work actively on their own CBDC projects, but they are still far away from making their choice on the technology to be used, on the measures to limit the impact on financial stability, cyber and litigation risks. To accompany CBDC development, Central Banks will have to apply stringent limitations to their use to guarantee financial stability.

Stablecoins potential impacts

A portion of deposits could also transfer to Stable Coins that are made available by private issuers. Any emerging trend will need to be identified and monitored. Currently, Stable Coins issuers are mostly tech companies that are very agile, quickly respond to the needs of the digital economy and are equipped to address cyber risk and without having to factor in financial stability considerations. However, banks could also envisage issuing their own Stable Coins and contribute to their mass adoption.

Central Banks have not yet decided whether the CBDC will be account based or token based. If they choose not to issue a token based CBDC, stablecoins will gain even more importance as they will be the only stable mean of payment on blockchains.

Transfers made towards Stable Coins would result in lower bank deposits, though part or all of those proceeds may be re-intermediated if deposited back in banks. The impact could even be neutral to the bank balance sheet, if bank deposits are eligible as Stable Coin's collateral. In that case, when a customer of the bank purchases Stable Coins, the account balance of the customer will drop, but the collateral manager will deposit the same amount of money again in the balance sheet of the bank.

Banks might have to become stablecoin issuers to become part of the blockchain economy.

1.2 Consequent impact 1: reciprocal impact on banks' financing capacity

To provide loans to the economy, banks need funding sources that are deemed stable. The stability is assessed through internal metrics and regulatory metrics.

The 1-month Liquidity Coverage Ratio (*LCR*) and the 1-year Net Stable Funding Ratio (*NSFR*) are standardized regulatory metrics designed by the Basel Committee on Banking Supervision (*BCBS*) and that have been factored in European regulatory framework through the Capital Requirement Regulation (*CRR*). Stability factors are allocated to deposit in the calculation of these metrics. For instance, retail deposits are deemed one of the most stable funding sources with a regulatory stability factor around 90% of initial balances.

Hence, the potential loss of retail deposits as stable funding sources by the commercial banking system could lead to a direct loss of their loan financing capacity for almost a one-to-one ratio.

Second round effects should also be factored in the analysis. Indeed, the retail deposits that would be remaining in the balance sheet would probably be considered less stable as banks would have to consider the possibility of customers shifting their bank deposits to crypto-assets they would deem similar. The lower stability of remaining retail deposits would also be detrimental to bank loan financing capacity.

As an illustration, a 10% removal of retail deposits would reduce loan financing capacity by - 9% (i.e., $90\% \cdot 10\%$) of retail deposits; The 90% remaining retail deposits may have to be considered as less stable (say from 90% to 85%) further impacting the loan financing capacity by - 4.5% (i.e. $(100\% - 10\%) \cdot 5\%$). Hence, the total impact is the sum of first round and second round effects is a loss of loan financing capacity of - 15% of retail deposits.

This is illustrated below with the LCR requirement, with D for retail deposits, L for loans and H for High Quality Liquid Asset (HQLA):

Table 1. Example on the impact of deposit loss and reduced financing capacity on LCR

Initial State			First Round Effect			Second Round Effect			Round	Changes
Assets	Liabilities	➔	Assets	Liabilities	➔	Assets	Liabilities	➔		
L	90		L	81		L	76.5		L	-15%
H	10		H	9		H	13.5		D	-10%
	100 D			90 D			90 D			

Source: AFGAP

This analysis does not consider the detrimental feedback loop that lower loans could lead to lower deposits (i.e., the 90 would be reduced as a by-product of providing lower loans to the economy).

In Europe where the financing of the economy is intermediated by banks for 75% (vs. 25% in the US), the lower bank financing capacity would have detrimental impact on the economy, more than in other jurisdictions whereby market intermediated financing is more developed.

Globally, for the loan financing capacity to be unchanged, the maturity transformation would have to be partially shifted from banks to non-banks, the latter not being subject to regulatory requirements applicable to banks. However, after having implemented regulatory reform to limit maturity transformation in the banking industry after the 2008 Global Financial Crisis (GFC), it would appear odd to displace some maturity transformation out of the regulated banking industry.

1.3 Consequent impact 2: impact on ALM modeling

If Commercial Bank's deposits were to shift to CBDC, banks might also lose the knowledge of their customers derived from attached transactions and flows. Indeed, banks would have access to less information regarding the client behavior in normal and stress situations. This would lead banks to be more cautious and could in turn affect client credit ratings and loan pricing.

This would also probably affect the modeling of cash accounts: with a shortening of the modeled liabilities, as a portion of the most stable transactional accounts would be transferred to CBDC and the remaining would be deemed less stable. Thus, both volumes and terms of financing capacity would be reduced.

It is also possible that these effects would be more significant for less wealthy customers as a higher portion of or all their deposits would be in the form of CBDC or stablecoins, depriving banks of their knowledge, leading to higher perceived risk and higher risk premium charged in loans' interest rates. Somehow, the inclusion objective of the CBDC could lead to higher bank loans' interests for more fragile customers.

It is to be noted that in the scenario where the chosen infrastructure would use commercial banks (see section I part 1) as bookkeepers of the CBDC, these effects would be partially mitigated as the knowledge would not be lost... but the CBDC-intermediated deposits could still not be used to grant loans and the non-CBDC-intermediated deposits would be deemed less stable. The prudential treatment (e.g., leverage ratio, contribution to deposit guarantee schemes) of CBDC-intermediated deposits would need to be considered as they would still affect the size of their balance sheet without value for them.

Both CBDC infrastructure solutions would weigh on the financing capacity in terms of volumes and costs through both the increase in funding costs and the increase in credit risk margins.

1.4 Potential banks' mitigation action 1: increase in deposit remuneration offset by higher loan rates

As described previously, the nature and magnitude of the impacts of deposit shift or additional financing costs for commercial banks are very sensitive to the design of CBDC or stablecoins.

To mitigate the loss of deposits, the relative attractiveness of deposit accounts may be enhanced through increase in their remuneration rate.

If banks were to increase the remuneration rate of deposits, this increase would have to be offset by an increase in loan rates granted to their clients. Banks are intermediaries, and if their funding sources are made more expensive, the funded loans would mechanically become more expensive as well.

In the case part of the currently non-remunerated deposits were to become remunerated, there would be a decrease in the base of the deposits that could be rate-wise modeled and replaced in the medium to long term, leading to reduce the banks margin generated on deposits... which would also have to be offset with higher loans rates.

In addition, the shift from non-remunerated to remunerated deposits would also reduce the natural compensation between non-remunerated (i.e. fixed) demand deposits and fixed rate mortgage loans (that represent more than 90% of mortgages in France for instance).

1.5 Potential banks' mitigation action 2: searching for funding from the market and more dependance on long term financing from Central Banks

Given the annual average amount of issuance by European Banks and current individual footprint of several banks, it does not seem conceivable that banks can substitute the deposits loss by medium- and long-term funding in the financial market. In addition, such extra market medium/long term funding, if available, would come at a higher cost of liquidity that would affect not only the incremental amount but the whole amount of market medium/long term funding. This increase in costs would have to be passed through higher rates for loans (Fund Transfer Price mechanism).

Consequently, either banks receive alternative funding by the European Central Bank (ECB), or they will have to deleverage some activities, which would significantly affect the financing activities. For this reason, it may become necessary for the ECB to design some kind of perpetual Targeted Long Term Refinancing Operations (TLTRO), which will also raise issues developed below (e.g., availability of and dependence to ECB-elected collateral and prices for its funding).

2. Increased Roles of Central Banks

2.1 Central Banks to compensate the funding gap

Since bank deposits represent a key source of financing the economy, the introduction of a CBDC and the consequent substitution of a portion of bank deposits could have a significant impact on the financial system and requires Central Banks to assess systemic risks and to provide financing solutions to the banking sector. These solutions could be similar in their operation to Targeted Long Term Refinancing Operations (TLTRO) and should be defined for two aspects: the cost and the associated eligible collateral.

To ensure the proper functioning of this financing tool and to compensate for the lower financing capacity, Central Banks may have to enlarge the eligibility criteria of the current TLTROs¹⁵, for example: the discount applied on the eligible assets, the credit quality of the assets, the assets maturity, the minimum outstanding amount, the eligibility for additional asset classes not allowed currently, or to simplify the terms on asset encumbrance across Euro-zone countries. These criteria could also be stable over the duration of the TLTROs and not be subject to pro-cyclical changes (e.g. hardening of the criteria adopted in adverse economic situations). To avoid having to mobilize HQLA assets, which would adversely affect banks' LCR and therefore their financing capacity, eligible assets could extend well beyond these assets.

The future Central Bank financing system will have to consider the effects induced by an increased portion of asset encumbered, so as to prevent the banks from being perceived as riskier and leading to increased financing costs.

As Central Bank refinancing is intended to offset the crowding-out effect on the most stable and cheapest deposits from banks, their costs will need to be low and, in any case, significantly below market funding costs.

The terms of these refinancing will also have to be significantly longer than the current TLTROs to ensure the refinancing of medium / long-term credits both from the point of view of volumes and prices (i.e., the financing cost should be fixed on the basis of a homogeneous maturity with the originated credits).

¹⁵ <https://www.banque-france.fr/politique-monnaire/cadre-operationnel-de-la-politique-monnaire/les-mesures-non-conventionnelles/tltro>

2.2 Central Banks to extend their supervisory roles

AFGAP believes that Central banks should extend their regulatory and supervisory frameworks to monitor and facilitate the new stablecoins and CBDC system in constant evolution. This applies notably to liquidity requirements to frame the transformation role of those actors as well as to capital requirements for risks they bear for themselves, for their customers and for the systems.

It seems crucial that the regulators act in a coordinated way and put in place homogeneous rules to the traditional and decentralized financial system.

The European MiCA (Markets in Crypto Assets) regulation is an attempt to regulate crypto asset service providers, but it regulates only entities based in Europe or offers marketed in Europe. However, attention should be paid to international development as non-European CBDC, stablecoins, or crypto-assets may be made available to European customers and the materialization of the risks attached to those would affect the European economy. An international coordination of regulations is needed to make sure that global offers can be efficiently regulated.

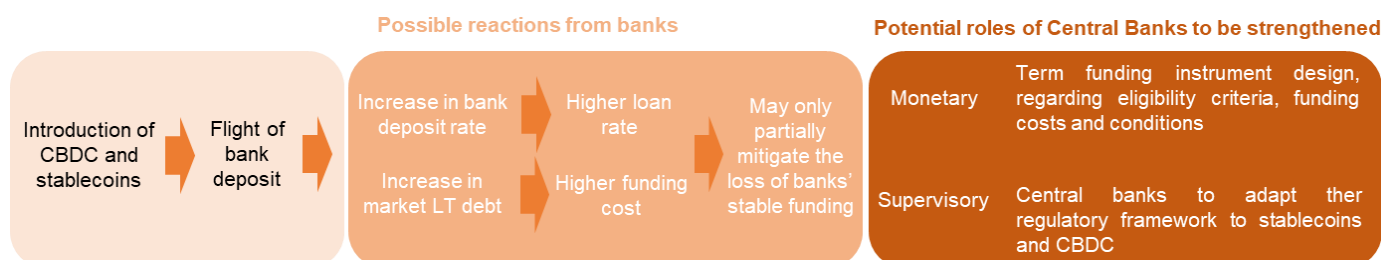
As described in the first section of this document, stablecoins is a very heterogeneous asset class. Depending on the structure, there is no contractual right for the owner that stablecoins can be redeemed in fiat currency. Given the increasing risks coming from stablecoins, there should be a common interest to protect holders of stablecoins and financial markets from adverse effects.

Recently Stablecoins are more and more included in the regulatory framework, as observed in the United States:

Federal Reserve Chair Powell said on 15th of July: “(...) my point with stablecoins is they're like money funds, they're like bank deposits, and they're growing incredibly fast but without appropriate regulation... And if we're going to have something that looks just like a money-market fund or bank deposit ... we really ought to have appropriate regulation and today we don't.”

Given this diversity of possible approaches and their potential consequences in terms of financial stability, even on the business model of banks, it appears that a regulation and a classification are needed to qualify the stabilization mechanisms and the soundness of the governance.

3. Main Take-Aways



The introduction of CBDC and stablecoins will happen in a near horizon and could result in profound evolution for bank's balance sheets, financing capacity and ALM, leading to new risks and opportunities.

A flight of bank deposits to CBDC or stablecoins is to be anticipated and preliminary estimates lead to potential limited though material reduction in bank's deposits. Nevertheless, the extent of the transfer would depend on the characteristic and limitations applied to CBDC or stablecoins.

On a medium term, the shift from banks deposit could lead to a reduction of bank loan financing capacity, noticing that European banks play an essential role in providing loans to the economy (i.e., 75% of loans are provided by banks in Europe).

To limit this loss in their financing capacity banks could be incited to increase deposit rates which would in turn lead to higher loan rates as higher funding costs would be factored in loans' rates. Banks could also become more dependents to market long term financing which could lead to higher funding costs too.

The new role of Central banks is crucial to control and limit the impacts on banks and the financial system and allow innovation development.

For their monetary role, they may have to design term funding instrument, such as Target Long Term Refinancing Operations (TLTRO) to offset the funding gap open by the introduction of CBDC:

- Eligibility criteria would have to be extended compared to currently applicable ones;
- Funding costs should be as low as market conditions allow;
- Conditions should be stable over time to be manageable.

For their supervisory role, regulation should be homogeneous to banks and crypto assets, notably stablecoins, in order to monitor and facilitate the evolution of the global banking and non-banking system.

Moreover, Regulators have to find a way to regulate efficiently decentralized organizations and not only legal entities or intermediaries, eventually by imposing rules on the developers of the protocols or licenses which are the condition to issue DeFi applications.

At the same time this is a challenge and an opportunity for the banking system, as they will have the possibility to develop new payment services and facilities:

- Insurance of stablecoins offering control on the collateral, ideally under the form of bank deposits.

- Issuance of tokenized assets to target investors interested in digital assets worldwide;
- Custody in crypto-assets;
- Secondary markets in crypto-assets;
- Cash management services, cross border payments;
- Payments services in supply chains, conditioned payments / programmable

This could facilitate innovation and new business development for the banking system and therefore lead to a global enhancement of the industry.

AFGAP will keep monitoring those developments and their ramifications on ALM and the banking industry. AFGAP is committed to contribute to the design and implementation of sound and robust developments of such new items and services.

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