**On CBDC and digital payments[[1]](#footnote-1)**

Globally, payment markets are undergoing a radical transformation. Rapid technological progress, regulatory reforms and rising cross-industry initiatives, by large global digital firms, have led to unprecedented dynamics and are putting established banks and payment service providers under considerable pressure. Payments have been and continue to be the activity most affected by technological innovation. Recent years have seen the introduction of new payment methods, platforms and interfaces, and there are more projects under way.

Wholesale systems are opening access to non-banks, extending operating hours and improving the interoperability of systems. Fast or instant retail payment systems have been or are being developed in many jurisdictions.

The digital payments innovation brings huge benefits to customers and businesses. The Covid-19 pandemic is accelerating our use of electronic payments and digital wallets. As a result, an even larger proportion of payments is likely to take place outside the tightly regulated perimeter of financial services.

In Europe, the payments sector is governed by a number of regulations, both at the level of payment services (PSD2 and EMD2, MiFID and SEPA regulations) and infrastructure (finality directive, SIPS regulation) which provide EU-wide operating procedures and rules as well as oversight mechanisms that aim to reduce risk.

The arrival of a retail CBDC has the potential of a game changer in digital payments. Digital central bank money for wholesale transactions is not new, as banks have been able to access central bank money in digital form for decades. A retail CBDC, taking into account the behavioral inertia of payment habits among certain groups of the population, is likely to act as a compliment in the short run/medium run to banknotes and cash, but may be a substitute over the long run.

1. **Payments amid the Covid-19 pandemic, TIPS and DIAS SA**

The move to a cashless society was in full swing before COVID-19, but it has been accelerated by the perceived risk of infection via hard currency. Before the pandemic, cash accounted for around 44% of in store payments in Europe,

according to Worldpay’s Global Payments Report. Initial analysis suggests this figure fell by almost 10% within a few weeks of the pandemic’s outbreak, with the UK observing a much bigger drop of about 50%.

In Europe, the coronavirus health crisis has had a drastic impact on the nature of transactions. Online transactions have sharply increased, while point of sale (POS) transactions have shifted towards contactless. In Western European countries overall spending has decreased by up to 50 percent year-on-year, with offline transactions decreasing by 60 percent and online transactions by 20 percent. This challenging time is an opportunity to differentiate by promoting value-added services, such loyalty program integration and instant financing at POS.

The Covid-19 pandemic has a major impact in retail payments and leads to marked changes, for at least four reasons. *First,* public concerns about viral transmission from cash have risen. Scientific evidence suggests that risks are low compared with other frequently touched objects. Yet consumers in many countries have stepped up their use of contactless cards, and the pandemic could drive greater use of digital payments. *Second,* as in past periods of uncertainty (e.g. the Great Financial Crisis of 2007–09), precautionary holdings of cash have risen in some economies– even as its use in daily transactions has fallen. *Third,* as physical stores temporarily closed, e-commerce activity surged. *Fourth*, cross-border transactions have collapsed. The pandemic has highlighted both progress and shortcomings in payments. The crisis has amplified calls for greater access to digital payments by vulnerable groups and for more inclusive, lower-cost payment services going forward.

Digital payment solutions have not reached yet their full potential. The Covid-19 crisis is expected to act as a catalyst for planned digital transformations for banks, payment institutions, merchant services providers, and merchants. Retailers must enable consumers to choose how to pay digitally and make it easy for them to select the payment method they prefer; so far only contactless cards have become largely accepted. Digital enablement should address other consumer pain points, such as checkout lines, loose receipts, and almost no loyalty program integration. Beyond traditional payments transactions, holistic handling is becoming an expectation for consumers allowing handling and keeping of receipts, terms & conditions, ability to tip, guarantee documents, and the usage of loyalty points.

Retail payments face two major shortcomings: access by consumers to transaction accounts and cross-border payments. Access is largely a problem for a subset of jurisdictions, and in EMDEs these two shortcomings interact where remittances account for a substantial proportion of GDP. If the payee or the payer does not have a transaction account, their choice of remittance provider is restricted, and the networks of physical locations required to support cash payments are expensive. Despite a G20 commitment to reduce the cost of remittances to 5% or less by 2014, on average costs remain around 7%.

Cross-border payments are those where the payer and payee reside in different jurisdictions. Many of these are also cross-currency payments in different currencies. However, not all cross-border payments are cross-currency. Exceptions include payments within monetary unions or payments in parts of the global economy where there is a common invoice currency. For example, in the European Union, the Single Euro Payments Area (SEPA) initiative has simplified euro bank transfers to make them as cheap and as fast as domestic ones. Globally, the US dollar remains the most common invoice currency, and for many markets, such as oil and other commodities, prices are quoted in USD. CBMC (Cross-border and multicurrency payment) systems have been built to facilitate the various types of cross-border payments. The number of these systems is, however, low – especially if we disregard cross-border systems in currency areas, such as the euro area. Around the world, there are currently about 20 systems that offer cross-border, cross currency, multicurrency or PvP (Payment versus Payment) services. In addition, there are at least four projects that aim to go live in the next few years. This compared with the more than 90 major domestic payment systems in the 27 jurisdictions that are members of the Committee on Payments and Market Infrastructures (CPMI) of BIS.

Some of the challenges in implementing a domestic payment system are strengthened in a cross-border context. These challenges are both technical and political. On the technical side, there are four key challenges. First, cross-currency payments require an FX conversion at some point. Second, liquidity management in foreign currencies can be costly. Third, ensuring a high degree of technical interoperability across payment systems is difficult. Finally, compliance risks and costs related to AML/CFT are typically higher in the cross-border context. On the political side, cross-border systems often need to have a high degree of shared political will among participating jurisdictions. Furthermore, connecting payment systems in different jurisdictions also gives rise to legal issues.

A few new cross-border systems are expected to be launched in the early 2020s. Beyond numbers, cross-border systems are also extending in scope. Until now, most of the implementations or augmentations have focused on wholesale payments and thus involve RTGS systems. Future projects are increasingly focused on retail payments. For instance, P27, a proposed payment infrastructure for Nordic area countries, will first link automated clearing houses and then retail fast payment systems. Sweden is planning to leverage the pan-European retail fast payment system (TIPS) to settle its domestic retail payments. Instant payments resemble features of cash in a sense that funds are made available immediately to the payee and they can be used for person-to-person transfer. The fact that they can also be used for remote payments makes them an attractive option too for large-volume use cases such as government payments and recurrent payment streams such as remittances (for the time being, mostly domestic remittances).

***1.1 TIPS and DIAS SA***

It is true that a lot has been achieved at the back end of European retail payments systems, most notably under the umbrella of the Single Euro Payments Area, or SEPA. More recently, the Euro system has also introduced TARGET Instant Payment Settlement, or TIPS. The aim of TIPS is to provide a pan-European instant payment settlement service in central bank money. In this way, it will support compliance with the SCT Inst (SEPA Instant Credit Transfer) scheme for PSPs and serve to promote efficiency and market integration in the settlement of instant payments across Europe. Its main features include a) settlement in central bank money extended to 24/7/365, b) payment transactions settled instantly, eliminating credit risk for participants, c) balances on TIPS accounts included in minimum reserve calculations, d) service providers reachable without opening a TIPS account (by being a reachable party), maximum price of 0.20 eurocent per payment for at least the first two years of operation, e) targets efficient settlement in euro, but technically capable of settling other currencies.

The main difference with the service provided by automated clearing houses (ACH) is that TIPS only provides the service in the settlement of instant payments, whereas ACHs play an important role in the clearing layer. Any participant in an ACH necessarily need to have another account in the settlement layer – in its own name or facilitated by a participant in the settlement layer – to discharge its responsibilities.

TIPS account differentiates between three major actors: participants, reachable parties and instructing parties. Participants should be eligible to access central bank money, and the same participation criteria apply as in TARGET2. The entities that are eligible for direct participation in TARGET2 are credit institutions established in the European Economic Area, credit institutions established outside the European Economic Area, provided that they act through a branch established in the EEA and national central banks of European Union Member States and the ECB.

It is worth noting that, automated clearing houses, like DIAS S.A. in Greece, can assume an important role in achieving instant settlement, as they can become instructing parties and offer pan-European reach to its participants. DIAS S.A. will enhance its role in the payment system services and will contribute to the modernization of the payment landscape in Greece and benefit the Greek economy. ACHs will have access to participants' accounts and instruct on behalf of participants without having direct ownership of the accounts. This way, participants in one ACH become reachable for participants in another ACH without any need to establish links between the ACHs. The precondition for this is that ACH participants are either participants or reachable parties in TIPS.

Last year, the European Central Bank has appointed network provider SIA - Colt as well as SWIFT to be the gateway for its Euro system payments, securities, and collateral market infrastructures. This will allow European central and commercial banks, custodians, central securities depositories (CSD) and clearing houses to connect directly to TARGET2, TIPS, T2S and ECMS through a single access interface, the Euro system Single Market Infrastructure Gateway (ESMIG).

1. **Recent developments in wholesale payments and Target 2**

Innovations in wholesale payments have occurred in waves over the past few decades. In 1990 there were fewer than 10 Real Time Gross Settlement Systems (RTGS systems), whereas now there are over 176. The introduction of RTGS decreased the credit risk from wholesale payments, but it also made them more liquidity intensive. Consequently, the second wave of innovation involved the introduction of liquidity-saving mechanisms in the 2000s. Some systems also introduced multicurrency functionality, which supports cross-border payments. Since the mid-2000s, trends have included opening access to non-banks, expanding operating hours and improving the interoperability of systems. Traditionally, only domestic banks have been allowed to directly participate in wholesale systems. There has been a pattern of central banks opening access to non-banks. This has the potential to increase competition. However, the number of non-banks with direct access to wholesale payment systems remains small. The adoption of ISO 20022, which is an international standard for electronic data interchange between financial institutions, contributes to the improvement of interoperability between wholesale payment systems and at the same time succeeds cost efficiency and risk reduction for users of multiple systems.

Large-value and interbank payments systems, largely domains of corporate activity, are critical parts of any country’s payments infrastructure. These large-value transactions (settled in real time over systems like TARGET 2 in EU, CHAPS in the United Kingdom and Fedwire in the United States) are quite low in volume but significantly higher in average value, at roughly $200,000 compared with $3,500 for an automated clearinghouse (ACH) credit transaction and only $60 for a debit-card transaction. Low volume does not imply lower economic value for providers: the average fee on a large-value transaction is nearly eight times that of an ACH transaction.

CHAPS (Clearing House Automated Payment System) is UK’s RTGS system, one of the largest high-value payment systems in the world with over 30 organizations with direct access and several thousand financial institutions with indirect access by making their payments via one or more of the Direct Participants. CHAPS Direct Participants include major international payment and custody banks, financial market infrastructures, the traditional UK high-street banks and more recently, ‘challenger’ banks and non-bank payment service providers. CHAPS represents around 0.5% of UK total payment volumes but 92% of total sterling payment values. In 2019, the CHAPS system settled around £83.4 trillion of payments, equating to an average of £330 billion each working day, or equivalent to the GDP of the UK every six working days. The CHAPS system settled an average of around 192,000 payments each day with an average payment value of £1.7 million.

***2.1 TARGET 2***

The Single Euro Payments Area (SEPA) which extends beyond the EU, affects the lives and businesses of over 500 million people, 20 million companies and 4,000 payment service providers. The European payments market generates more than 130 billion non-cash payments per year, representing approximately one-quarter of the global payments business. For more than 20 years, Europe has strived to improve the efficiency and competitiveness of the payments market.

The Euro system has the statutory task of promoting the smooth operation of payment systems. This is crucial for a sound currency, the conduct of monetary policy, market functioning, and financial stability. A key instrument which the Euro system uses for carrying out this task is the provision of payment settlement facilities. To this end, the Euro system operates the second-generation Trans-European Automated Real-time Gross Settlement Express Transfer system (TARGET2) for the euro. In 2008, TARGET2 replaced the first-generation system, TARGET, which was created in 1999 by the Euro system for the settlement of large-value payments in euro, offering a central bank payment service across national borders in the European Union (EU). TARGET was developed to meet three main objectives:

1. Provide a safe and reliable mechanism for the settlement of euro payments on a real-time gross settlement (RTGS) basis.

2. Increase the efficiency of inter-Member State payments within the euro area.

3. Serve, most importantly, the needs of the monetary policy of the Euro system. Like its predecessor, TARGET2 is used to settle payments connected with monetary policy operations, as well as interbank payments, customer payments exchanged between banks, and transactions related to other payment and securities settlement systems, i.e. ancillary systems. As TARGET2 provides intraday finality, i.e. settlement is final for the receiving participant once the funds have been credited, it is possible to reuse these funds several times a day.

TARGET2 is accessible to many participants. Over 1,000 credit institutions in Europe use TARGET2 to make payments on their own behalf, on behalf of other (indirect) participants or on their customers’ behalf. Taking branches and subsidiaries into account, almost 45,000 banks worldwide (and thus all of the customers of these banks) can be reached via TARGET2. TARGET2 is the most important payment system in the euro area, processing not only the transactions necessary for implementation of Euro system monetary policy, but also the highest value transactions by far. In 2019, TARGET2 maintained its leading position in Europe, processing 89% of the total value settled by large-value payment systems in euro, and in the world, as one of the biggest payment systems. Compared with the previous year, the total turnover processed increased slightly, reaching €441.3 trillion. The total volume of payments fell slightly by 0.8% to 87.8 million transactions.

A digression may be in order here with regards to the macroeconomic dimension –beyond of its payment and settlement ones – of TARGET2.

TARGET balances are positions on the balance sheets of the central banks in the euro area. The Target balances of euro area NCBs in essence reflect the uneven distribution of central bank liquidity within the Euro system. Large cross-border payment flows between banks in the euro area are a normal feature of Monetary Union, and the Target system is essential for the smooth processing of those payments. These positions, which were relatively small and stable before the financial and sovereign debt crisis, were large and negative in the euro area countries most under strain and large and positive in the more resilient euro area countries. Large TARGET balances are essentially the result of the implementation of monetary policy in the euro area in the specific context of the crisis. Given the integrity of the monetary union, TARGET2 balances do not represent financial risk beyond that inherent in the Euro system operations underlying the balances. Such risk is mitigated, through collateral policies.

There is a growing literature that links the negative TARGET2 balances of some countries with their current account deficits. For instance, Greece imported EUR 84 billion more goods and services than it exported in the period from 2008 to 2010, while almost the same net amount flowed out of Greece via TARGET2 during the same period. The BoG has recorded a steady outflow of funds via TARGET2 since 2008. This means that more central bank funds were transferred via Greek banks to the rest of the euro area than in the opposite direction. The reason for this phenomenon was probably capital flight from Greece: Greek investors transferred some of their assets to the rest of the euro area, and foreign investors withdrew funds from Greece. In this process, the relevant balance sheet positions of the BoG changed as follows: owing to the transfers, the BoG built up a negative TARGET2 balance vis-a-vis the ECB. Greek banks, which held fewer deposits at the BoG owing to their cross-border transfers, had to replenish these deposits, raising loans through the Euro system’s monetary policy operations for this purpose. These loans are shown in the BoG’s balance sheet, where they represent the counterpart of the negative TARGET2 balance. However, providing ample liquidity is one of the core responsibilities a central bank has got in times of financial crisis. At the same time, it is clear that the Euro system’s liquidity aid can only be a temporary measure, until confidence in the banking system and the full functionality of the interbank market have been restored through appropriate political and banking measures. Once this point has been reached, TARGET2 balances can be expected to decline as well.

The TARGET2 balances at the ECB have received a lot of attention in the press and public debates during the past few years, particularly in surplus countries such as Germany and the Netherlands as their potential losses in case of the exit of a single euro country or a complete euro break up are huge. In the worst-case scenario of a eurozone break-up, the surplus countries risk losing their total Target balances. Given the expected further increase in the Target balances until the middle of 2018, and under the assumption that the distribution of the balances over the various eurozone countries will remain roughly the same, the potential total loss for the surplus countries Germany and the Netherlands could rise to around EUR 1000bn for Germany (around one third of German GDP) and EUR 130bn for the Netherlands (around 20% of GDP). In case of the ‘exit’ of a single country, the procedure could be simpler, although calculating the exact size of the ECB’s claim probably will also be complicated and open to debate. That said, the leaving country would need to pay its obligations to the ECB in euros, while its new national currency will probably have depreciated significantly. Although, in theory, the new central bank of the leaving country should be able to print money to fulfil the obligations, the sheer size of the claims would make a default very likely. Also, the more money it prints the more the currency depreciates. In March 2017, the Target liabilities of Italy were equal to 25% of Italy’s GDP. Spain had a deficit of 33% and Greece and Portugal both had deficits of more than 40%. If a country were to default on its obligations to the ECB, the national governments of the countries remaining in the euro area would have to share the losses, in proportion to their share in the ECB’s capital. In the hypothetical event of a Grexit or Itexit, the potential losses for Germany could be around EUR 18bn (0.5% of German GDP) and around EUR20bn (around 3.5% of German GDP), respectively. For the Netherlands, the hypothetical losses would be around EUR 4bn (0.5% of Dutch GDP) and EUR25bn (around 3.5% of Dutch GDP), respectively.

In the years before the eurozone financial crisis, banks in the periphery had easy access to private funds. They received cross-border interbank loans, direct investment or deposits from abroad to broadly compensate for the payment outflows that resulted from the deficits on the country’s trade balance or the acquisition of foreign assets. In short, the countries had broadly balanced cross-border payment flows initiated by the private sector. This reflects that the sum of any country’s current account balance and capital account balance was roughly zero. In other words, no central bank money was needed to finance the current account deficits of the countries in the periphery and their respective NCBs maintained roughly neutral Target balances. During the financial crisis of 2007-2008, in the peripheral countries, a lack of financial flows from the private sector was made up, for the most part, by wholesale funding from national central banks. Central bank money generated in this way flowed out of these countries via the TARGET2 payment system to others, including Germany. As a result, the Bundesbank’s TARGET2 claims on the European Central Bank have risen considerably and, at the end of 2011, amounted to approximately €463 billion.

Target balances soared during the years of the eurozone debt crisis in 2011-2012. This resulted from funding tensions in the banking sectors of some countries in the periphery (Italy, Spain, Portugal, Greece and Ireland). During this period, private money no longer flowed into the peripheral countries in quantities sufficient to compensate for their payment outflows. Their banks suffered from funding tensions. In order to prevent a banking crisis, the ECB stepped in, accommodating the banks’ liquidity needs, by issuing three-year LTROs with full allotment and by lowering the collateral requirements in the ECB’s regular open market operations. Thus, the shortage in private flows into the periphery was settled in central bank money which resulted in their respective NCBs displaying, in cumulative terms, liabilities in Target. At the same time, the NCBs of countries which are net recipients of private sector flows (e.g. the countries with a surplus on the balance of payments) display claims in Target. The rise in the Target balances during the years 2011- 2012 went hand in hand with sharp rises in sovereign bond yield spreads of the peripheral countries over Germany as well as jumps in CDS spreads of financials. In the first years after the eurozone crisis of 2011-2012, the Target balances declined as financial stress eased. Since the start of 2015 they have been rising again. However, the factors driving the increase have changed. According to the ECB, the German Bundesbank and the BIS these renewed increases largely reflect cross-border liquidity flows arising from the settlement of purchases under the ECB’s QE program (APP).

In terms of volume, in 2019, customer payments accounted for 60% of total TARGET2 traffic, followed by interbank payments (25%), ancillary system payments (8%) and other payments such as central bank operations (7%). Customer payments traffic decreased by 1.73% compared with 2018, driven primarily by lower traffic in the Netherlands (-70.32%) as a result of the country’s move to instant payments. This decline was partially offset by an increase in France (+23.74%). Interbank payments traffic increased by approximately 3.20% compared with 2018, recording in particular a significant increase in traffic in Germany (more than 560,000 payments or +4.54%) and France (around 500,000 payments or +26.09%) and a decline in the Netherlands (around 600,000 payments or -41.60%). These changes were largely due to UK-based credit institutions relocating their point of access to TARGET2 from the Netherlands to France and Germany in preparation for Brexit. Central bank-related payments showed a slight increase of 0.11%. The prospect of Brexit has prompted British institutions that currently access TARGET2 directly via a euro area NCB (i.e. remote access) to find alternative ways to connect. At the end of 2018, some 39 UK-based participants had direct access to seven national component systems of TARGET2.

In 2019, like previous years, the largest contributor to TARGET2 traffic was Germany, which accounted for more than half of the transactions settled in the system. Adding France, Italy, Spain, the Netherlands and Belgium, the share of transactions increases to 88%, which is on a par with previous years. The shares of the biggest contributors to the TARGET2 volume changed as, in comparison with previous years, significantly lower volumes were recorded in the Netherlands, for the reasons mentioned above and additionally due to some customer payment transactions shifting to instant payments.

Since March 2020, the Bundesbank’s TARGET2 balance has been growing again significantly. It exceeded the €1 trillion mark in July. This renewed increase over the past few months can largely be put down to the expansion of the Euro system’s purchase program in response to the COVID-19 pandemic. March 2020 saw the ECB Governing Council further increase purchases under the asset purchase program (APP) and adopt a new program, the pandemic emergency purchase program (PEPP). These measures are the reason why the volumes of the Euro system’s monthly monetary policy net purchases are higher than ever before. The asset purchases have cross-border effects and these generally cause TARGET2 balances to increase. However, Bundesbank experts believe that additional factors might have played a part in the current increase as well. For one thing, there have been other monetary policy operations, including a new series of targeted longer-term refinancing operations (TLTROs), which have created additional liquidity in recent months that has boosted excess liquidity in the system and might also have pushed up the TARGET2 balances through second-round effects. It is not always possible to differentiate between individual factors in the short term; over the medium term, monetary policy and the market environment impact significantly on the level of TARGET2 balances. As long as the Euro system continues to purchase assets, the Bundesbank’s TARGET2 balance will remain high. It is only expected to shrink significantly when the excess liquidity created by the non-standard monetary policy measures within the Euro system subsides again and the cross-border interbank market in the euro area plays a more significant role.

1. **New technologies and the changing landscape in digital payments**

The payments sector is in the midst of rapid evolution, driven by a sharp uptick in innovation, changing patterns in consumer consumption and a number of industry initiatives and shifts in market conditions. Financial technology (“fintech”) has the potential to alter how, where and when payments are made as well as who it is that facilitates them and will eventually redefine the payments landscape. Fintech is changing the face of global payments. Global fintech investment in 2019 reached $135.7 billion, highlighting the enormous strength of the global fintech market. As new payment capabilities come to the fore, cutting-edge technology is transforming how transactions are initiated and processed. This is no longer just a case of new currencies or faster payment methods, but an entire rethinking of transfers of “value” and how these are undertaken. This presents both opportunities and challenges in digital payments. Fintech can be leveraged to improve the design of transaction accounts and payment products, make them ubiquitously accessible, enhance user experience and awareness, and achieve efficiency gains and lower market entry barriers. At the same time, these benefits come with certain risks in terms of operational and cyber resilience, the protection of customer funds, data protection and privacy, digital exclusion and market concentration. If not adequately managed, these risks could undermine financial inclusion outcomes. This underscores the importance of effective regulatory, oversight and supervision frameworks. In addition, particular attention should be devoted to promoting responsible innovation that does not exclude disadvantaged segments of the population, by encouraging designs that are tailored to the needs of these segments.

Although digital payments begun with the use of physical instruments (e.g. credit cards), payments have been moving more and more into the virtual domain. These innovative payment services can broadly be classified into online payments and mobile payments, although the increased use of mobile broadband connections for mobile communications is admittedly lessening the importance of the distinction. Also, digital transactions are making use of the distributed ledger technology (DLT) in new business models established to facilitate cross-border payments, namely through peer-to-peer currency exchange platforms, which can match currency buyers and sellers to eliminate the spread on the exchange rate. The first payment application made possible through this technology was the cryptocurrency bitcoin, and the technology has since been used for other cryptocurrencies like Ether. Cryptocurrencies can be used as regular currency and can be managed with digital wallets stored on a smartphone. All transactions are permanently recorded on the blockchain, and new currency can be generated by ‘miners’ who succeed in solving the required algorithm (see below). Smart contracts are a more recent development in the use of DLT for payments, but they have not yet raised the same types of concerns as the other DLT-related forms of payment. In more recent applications, market participants are attempting to design a solution using DLT to make post-trade payments, clearing and settlements more rapid and efficient. However, such applications have not yet been successfully implemented in practice, raising doubts among market participants about the suitability of the technology in this respect.

New technologies that have now started to transform radically the payment services landscape not only by facilitating the delivery of new products but also by improving customer experience are the following:

1. *Artificial Intelligence (AI)* is one of the transformational technologies enabling this industrywide shift. With the ability to ingest and analyze vast amounts of data, AI has the power to transform critical business functions. In the near future AI will dominate the payments industry with computer-vision and voice-activated powered payments that will allow consumers to pay with their facial ID or with voice-recognition technologies. Voice commerce is expected to grow in double-digits in the near-term, based on industry estimates. AI opens a new channel for commerce — one that payments companies can leverage to create more digital touchpoints for consumers to make purchases conveniently and securely. Finally, AI can drive digital transformation for merchants of all sizes by taking payments data to the next level. For example, machine learning algorithms can analyze transaction data to find patterns — seasonal dips in revenue, for example — and help business owners plan and compensate, down to the most minute decimal point. Taken as a whole, AI holds much promise for payments technology companies by being a valuable tool to provide a more powerful payments products, by driving consumers and merchants toward more digital commerce opportunities, and, most importantly, by creating a safer and more secure ecosystem.
2. *Big data analytics* has made inroads into payment and financial services and is expected to become a fundamental business tool in the financial services industry in the near future. New providers are enhancing financial data with other data sets. In Europe, 64% of financial institutions have launched big data analytics, 34% are in a piloting or development stage and only 2% do not have any related activity at all. Current implementations of this technology, especially among banks, are mainly focusing on risk management and the generation of new sources of revenues through new products and processes. Specifically, big data analytics can facilitate the onboarding of new customers through screening processes e.g. by providing information required for KYC and making predictions about a person’s creditworthiness. Big data can improve the precision of real-time approvals and reduce the number of false rejections.
3. *Cloud computing* and delivery models such as banking as a service (BaaS) and payment as a service (PaaS) can facilitate access to technology by PSPs of all sizes and as an enabler of innovation in payments and associated services. Cloud computing may also provide financial institutions with features and services that promote greater security and have higher degrees of operational resilience when compared with traditional practices. For instance, financial institutions can opt to build a private cloud, move across clouds or use multiple cloud service providers for a variety of cloud-based services.
4. The past 24 months have seen initiatives across the globe further experiment with *blockchain technology* in pursuit of the holy grail of a production ready Distributed Ledger Technology (DLT) payments solution. Alongside FinTech initiatives, individual banks, central banks and SWIFT have confirmed their interest in DLT, testing the waters with various trials and proof-of-concepts. Blockchain-based technologies are now seen under a much more pragmatic eye, no more as solutions seeking a problem but as an innovative technology coming with interesting assets like embedded cryptography, resilience, distributed data, and tamper-proof. While yet to be applied to payments, the financial industry is well aware of the potential applications and how game-changing this technology is.

One of the biggest and most researched benefits of this technology is Anti-money laundering (AML). Annually, money laundering makes up 2 to 5% of the global GDP—about $2 trillion. This shows the real implications of money laundering for the global economy. Blockchain is being explored as a fraud and risk compliance solution that addresses some of the most critical problems with current AML procedures. Built on the blockchain, the new solution could leverage the inherent qualities of the blockchain in order to identify and prevent unauthorized transactions. And if combined with artificial intelligence, it could effectively run through strings of data to determine if money laundering activity is occurring. AI would be able to detect patterns in large volumes of data while adapting to changes in criminal activity over time with its machine learning capabilities.

***4. Cryptocurrencies, stablecoins, and tokenized assets***

We now take a closer look at the field of digital currencies and tokenized financial assets and the potential risks ahead.  
**Cryptocurrencies:** their initial proposition was for decentralization and disintermediation of incumbent financial intermediaries. A decade after the introduction of the perhaps most prominent example, which is Bitcoin, it seems unlikely that the latter will become useful as money. Bitcoin seems to be doing particularly poorly on the store-of-value function that history shows is a prerequisite for a useful role as currency and wide acceptance. The extremely large fluctuations in the price of Bitcoin expressed in US dollars are recognized as a key impediment of Bitcoin becoming a “useful” currency. The observation notwithstanding. Bitcoin bas succeeded however in showcasing the technological validity of its underlying technology, which is that of blockchain. As a result, the development of alternative digital coins (henceforth altcoins) using blockchain or other distributed ledger technologies has been facilitated. As of mid-2020, there are about 6088 altcoins in existence of a total market cap of $337.28 billion (as of August 5, 2020).  
**Stablecoins:** they are designed to have a stable value vis-à-vis fiat currency. They thus aim to directly address the above noted shortcoming of Bitcoin and other examples, which is an extreme price volatility value vis-à-vis fiat currency. Stable coins are pegged to (the value of) fiat currency, commodities, other crypto assets, or indices. The largest stablecoin in terms of market capitalization was created about five years ago, although issuance of new stable coins has peaked over the past two years, resulting in a set of above 200 stable coins in existence by mid-2020. Examples of stable coins include JPMorgan Coin, Tether and Libra.

**Tokenized assets**: Tokenization is the process of digital representing an existing real asset on a distrusted ledger. Asset tokenization involves the representation of pre-existing real assets on the ledger by linking or embedding by convention the economic value and rights derived from these assets into digital tokens created on the blockchain. Tokens issued in asset tokenization exist on the chain and carry the rights on the assets they represent. Acting as store of value. When it comes to financial assets, tokenization of securities (equity and/or debt) is seen by the market as the sector with the most imminent potential for growth. This is mainly driven by the recent hype around tokens issued in, mostly unregulated, Initial Coin offerings (ICOs) and currently trending ‘ Security Token Offerings’ or STOs, seen by the market as the regulatory-compliant successor of ICOs aiming to raise capital, as well as ‘Security Tokens’ representing existing securities in secondary DLT markets.

**Potential risks ahead**

A potential take-off in digital financial assets and tokenization activity would also affect repo activity for the funding of positions, as well as on securities lending activities used as part of trading strategies. The shift of the above activities ‘on-chain’ would allow for direct and faster unwinding if collateral, easier mobilization of collateral across security pools, more efficient use of balance sheet and lower capital intensity associated with such activities.

The use of DLT can expedite and condense trade clearing and settlement to nearly real-time, reducing counterparty risks and freeing up collateral, producing capital efficiencies for participants in the trade. The post-trade multi-step process is simplified, and the back-office administrative burden is lowered significantly. Experimental application of DLTs on clearing and settlement has, however, produced mixed results and hurdles in the development of the technology will need to be overcome for the application to arrive at the stage where it can provide better performance than systems currently in use.

In a nutshell, as the financial payments system becomes more digital, it will be important to strike a balance between the protection of individual data and privacy, versus the governments’ imperative to enforce laws, regulations, and taxes. The issues in payments need to be examined holistically, along with other privacy concerns arising from data gathering by banks, large tech companies and governments.

**5. Digital payments and the arrival of CBDC**

We distinguish between wholesale and a retail CBDC. In any case the principle of “the expected social benefits should exceed social costs” should be met unconditionally.

***5.1 A wholesale CBDC***

Digital central bank money for wholesale transactions is not new, as banks have been able to access central bank money in digital form for decades. With its established TARGET services, the Eurosystem already operates an efficient digital infrastructure for wholesale money: TARGET2 (T2) for wholesale payments (see section 2 above), TARGET2 Securities (T2S) for the settlement of securities, and the TAGET Instant Payment Settlement (TIPS) service for instant payments (see section 1 above). One of the key objectives in introducing a CBDC , would be to reinforce the stability of the financial sector by ensuring that sovereign money remains the key asset at the core of the payment system, used for the settlement of the majority of wholesale transactions. The question that emerges is whether, for this purpose, settlement in central bank money should be available at all times for wholesale transactions and, if so, what are the possible technical options to achieve this and to facilitate its use for the settlement of transactions conducted via distributed infrastructures. (*ECB Report on a digital euro,* p. 52).

Other reasons for issuing a wholesale CBDC include the reduction of the settlement costs and times arising at present from the numerous financial and payment intermediaries. Moreover, to provide the market ,unlike stablecoins, with a sovereign digital asset whose value and acceptance is strictly equivalent to other forms of currency issued by the central bank, namely risk free of any liquidity and/or credit risk.

Focusing in the Eurozone, the potential benefits by issuing a digital wholesale currency include the following: a) strengthen the euro’s role as an international currency in global trade and payments and FX reserves.

b) enhance competition in the market of payment services by encouraging the access of new participants: for instance, non-bank PSPs may get involved as intermediaries in the provisions of a CBDC. c) a first class opportunity to modernize all three major market infrastructures with distributed ledger technology , preventing so the disorderly tokenization of infrastructures. For example in the T2S field, a wholesale CBDC would facilitate central banks to a provide a solution to settle transfers of tokenized securities that maintains the benefits of use of central bank money and those coming from a DLT environment (fast execution, etc).

As a matter of fact, a number of European large commercial banks (eg Commerzbank, Santander, Societe Generale, etc) have issued security tokens on a blockchain, effectively representing a new class of financial assets settled in commercial bank money. These sort of initiatives could eventually fuel demand for a wholesale CBDC in the Eurozone.

***5.2*** ***A retail CBDC***

A digital euro could be provided either through an account-based system or as a bearer instrument**.** For instance, in the former case, users’ holdings would be recorded by a third party that would determine, on behalf of the payer and payee, whether a transaction is valid and would update the respective balances accordingly. This is the approach today adopted by major electronic payment solutions. It would allow the central bank issuing CBDC to control transaction flows (either directly or through intermediaries). However, this method cannot be used in so far as users or the central third party are not online.

A CBDC could be provided as a web-based service and/or through dedicated physical devices such as smart cards. Whereas in the first case a broad range of devices could be used (for example, computers, mobile phones ) and an internet connection would be necessary, the second case would require payer and payee to have specific compatible devices that could also enable offline use. Of course, a digital euro could be provided through both a physical device and a web-based service.

Regarding the technical implementation of a digital euro at the level of the back-end infrastructure and end-user access solutions, the ECB Report is quite detailed ( see pp. 36-43). Hence, two approaches are considered for the back-end infrastructure: centralised and decentralised. In the first approach, digital euro transactions are recorded in the Eurosystem’s ledger. In the decentralised one, the Eurosystem sets rules and conditions for the settlement of digital euro transactions that are then recorded by users and intermediaries. In both approaches, supervised intermediaries can operate either as mere gatekeepers or as settlement agents. Gatekeepers would authenticate end users and deal with activities such as Know Your Customer (KYC), AML and CFT62 requirements; they may also provide the technical connectivity between users and the Eurosystem’s infrastructure. The basic functions of gatekeepers are therefore similar to those of commercial banks in the primary provision of cash to the economy. Settlement agents, conversely, would in addition execute digital euro transactions on behalf of their customers and may provide storage facilities for digital euro holdings. (*ECB Report on a digital euro,* p.37)

The Eurosystem would need to ensure integration of different end-user access solutions to make digital euro services universally accessible and allow their interoperability with the market ecosystem. Were the Eurosystem to provide digital euro payment devices or applications, they should conform to industry standards to the extent possible. Different options are possible depending on the type and the use of hardware or software solutions. Whenever the end user accessed digital euro services, authentication and authorisation should be conducted, applying the strong customer authentication requirements referred in the revised Payment Services Directive (PSD2). This means that, in order to grant access to digital euro holdings or payment initiation services, private payment service providers – and possibly the Eurosystem – should adopt technologies that guarantee safe end-user authentication and secure storage of personal data. PSD2 requires that a payment transaction be authorised only if the payer has given consent to execute it. In a scenario in which the Eurosystem issues a digital euro, a key question would be whether the consent is given to the central bank or to a supervised intermediary. The Eurosystem would therefore need to develop specific know-how on the approaches and technologies used for strong customer authentication. *(ECB Report on a digital euro,* p. 42).

Although at present there is little indication of a meaningful demand in the EU from market participants (payment services providers, users, etc) for a retail CBDC, this may well turnaround under different circumstances in the not so distant future. The high level of access to banking services among consumers and businesses, the plentiful and diversified supply of cashless instruments from private sector initiatives, including mobile payments using the latest technological innovations and more recently instant payments, seem to imply a low scale of substitution for cash and banknotes in the short term, nor the more so when high-denomination notes ( EUR 100 to EUR 500) account for 50% of euro currency in circulation which is driven mainly by a motive for confidentiality or unlawful activities. On the other hand, the substitution effect will be rather big during a crisis ,especially at the expense of bank deposits and in an environment of prolonged negative interest rates.

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1. This is the extended and edited text version of the second part of an interview with the Frankfurt based journalist David Barwick (on 11th December 2020). [↑](#footnote-ref-1)