



DEPARTMENT OF ECONOMICS

BSc IN ECONOMICS

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# THE DIGITAL EURO AND THE GLOBAL ECONOMY: Issues and Prospects

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Bachelor thesis

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# THE DIGITAL EURO AND THE GLOBAL ECONOMY: ISSUES AND PROSPECTS

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## Abstract

Technology has always been a focal point constantly having new trends to follow. Our everyday lives have been influenced in a variety of ways by the ongoing digitalization of the world economy, which also has an impact on our payment practices. In the current dissertation there has been an effort to highlight and then analyze the evolution of money concluding to a prospective digital currency. Economic history has demonstrated that without money, people encountered problems with the barter system, beginning with the first economies and continuing with the present Euro system. Finding a mean of measurement was prompted by the failure of the barter system, which was the only method used for goods deals. People quickly adopted the use of money as coins as opposed to stones, shells, or rings, leading to global trade, mainly within the Mediterranean. Greece and Greek colonies, could easily trade through a common currency. That same concept, drove the concept of the European Union, an economic and political union with common currency and purposes. Money as currency and as the most acceptable way of exchanges, includes the three main functions, money as medium of exchange, the storage value of money and the money as account unit, which no one other money-experiment like stones could be fulfil. Euro has been disputed for many times during the first and second decade of its use, due to the economic failures such as the economic crises, however it played a crucial and useful role in the Eurozone. With the majority of transactions conducted through cash and banknotes, European Union is now upgrading payments through digital methods, meaning platforms, digital cards or private money, commonly known as stablecoins. After the need of digitalization, not only the European Central Bank but many central banks all over the world has been started to think about the issue of a Central Bank

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Digital Currency (CBDC). The variety of benefits, like the twenty-four-hours availability and the total anonymity, did CBDC's more and more desirable to the public. Monetary policy objectives and tools can be also applied to the CBDC's and there are many scenarios about how CBDC's could be fulfil better or not the main functions of money. The two designs of CBDC as wholesale and as retail, give a different impact to the transfer mechanism in the global economy and the monetary policy decisions, due to the fact that retail CBDC is available to use by people in contrast with the wholesale CBDC, which designed in order to attend to financial institution's needs. Moreover, significant are the changes in payment systems through the using of CBD's than the reserves and bank notes. For these reasons, there are many worldwide examples by the central banks, where tried to examine the issue of CBDC as the main way of exchanges with the most characteristic the Chinese economy with the issue of the digital Yuan. European Central bank, in order to follow the technologically changes and not drop back in contrast with other countries, has been started to focus of the digital euro. After many explanations of why we need a digital Euro in the European area and who will may be the functional design of it, ECB has announced it possible features and their plans of the implementation of the digital euro, where it uses as a supplement of current fiat money. Digital Euro will also have a different effect on monetary policy tools like CBDCs, however this does not mean that digital euro will work negative as a form of investment. The European profitability would alter by the digitized euro, which shift under the size of the balance sheet in the economy and the whole European payment systems and transfer mechanisms will drive to the faster economic efficiency in the European Union. By the increasing European economic growth, there are also positive influence in the independence of the European Union and thus its domination against to the US dollar. However, before the issue of the digital euro, ECB examines also and some further issues, which related with the negative

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consequences of it such as a possible bank run. In the ECB's announcement has given solutions in people's worries about how the digital euro will work in parallel with the banking sector and how might be affected in the future. Another significant issue which makes Europeans to have second thoughts about the digital euro is the similarity of it with the commonly known cryptocurrencies, due to the fact that both of them used the same technology structure. To conclude, the issue of the digital euro could have both many opportunities and challenges, which ECB needs to consider before the introduction of digital euro in the end of 2023.

Key words:

Coins, currencies, digital Euro, CBDC, Money, Economy, Monetary policy, European Union.

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## History and Functions of money

### 1.1 Introduction

The essence of money alters through the years. For decades people associated money with currencies. The different types of money and currencies, just as the clamshells, leathers and beads of the past have no inside value and their use is based merely on the trust people have during their transactions. From the economic aspect, money and currencies are two different meanings. More specifically money is an asset just like a good or item, which is widely accepted by people to use for the final payment of services and goods or the disbursement of the funds. Through money, people describe their amount of income, wealth, and hoard of cash. Still, a shareholder no matter his wealth is not able to buy a commodity as a meal. Instead, he should convert the shares to a commonly accepted medium of exchange, meaning cash. This is the reason why shares and bonds are not acceptable types of the payment. According to economics theory, the difference between money and currencies is that the first is an intangible concept which through the currency takes a physical status in form of coins, or banknotes which are widely accepted as a medium of exchange, a measure of value, and a means of payment. As we will examine below, there was a long evolution of money, to conclude to a common currency in European Union area.

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## 1.2 Economy and money

The history of the economy, started together with human evolution more than 40,000 years ago. When the first economies started to use the barter system, only the direct trade of good was possible, due to the absence of money. For this system to work, it was imperative to have two interest parties, this mechanism is called "double coincidence of wants" (*Alvin E. Roth, Tayfun Sönmez and M. Utku Ünver, 2007, p.828*). For the success of the mechanism, the producers who wanted to get engaged, had to make an arrangement, which was a quite time-consuming process depending on the nature of the transaction. As a consequence, the economical transactions became more and more complex. Thus, the barter system became not sustainable, due to the increasing uncertainty. Still, the need for money was so strong, that humans continued searching possible combinations and use of money in a variety of forms. One of the most unusual types of money was the Wampum, used by Native Americans, consisting of beads, but also the cowrie shells, used by people in Asia and Africa as a medium of exchange.

### 1.2.1 Functions of money

One of the most significant questions regarding the barter system was the reasons why it failed as a sustainable means of monetary transaction. The functionality of the money, is the main reason. From coins to paper money, scientists analyzed that there are three common functions, which make money essential for the growth of the economy and the decline of the use of the barter system. Those functions are:

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### I. Money as medium of Exchange

First and foremost, money serves as a medium of exchange, without money all exchanges would have taken place through the barter system. Nowadays, exchanging goods and services seems highly unlikely. Let's take for example a baker and a shoemaker. In order for the baker to get a new pair of shoes, he should find a shoemaker who is willing to acquire what seems equal value of shoes in the form of bread. Money comes to eliminate any difficulties. By paying in money, the shoemaker would spend the value of shoes, which he earned, in whatever way he wants. Thus, money as a medium of exchange satisfies more customer needs and eliminates the time required for further arrangements. For this reason, money boosts economic efficiency by minimizing transaction costs.

### II. The storage value of money

In the previous example, exchanging shoes with bread, has underlying risks, consisting the arrangement inefficient. A loaf of bread has a limited life-span as a product. This means that it deteriorates, losing its value consisting it unfit for exchange. Exchanging the whole lot of loaves of bread is impossible to be done within the day. On the other side, shoes maybe go out of fashion over the years and their price will lose their value. Storing money relatively maintains its value (with the exception of inflation) and makes it possible to spend at any time, enabling individuals to save their surplus income for a future purchase. Individuals feel the security that their profits will have prolonged value. As mentioned above the only unpredictable variable is the change of inflation. Whilst, money is the most commonly accepted medium of exchange with the others for its storing practicality.

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### III. Money as an Account Unit

Money as an account unit eliminates possible disagreements around the value of the products. Maybe the shoemaker of the previous example believes that his product is superior in price than a couple of loaves of bread. Within the barter system, producers don't have the ability to measure the value of their products or services, with all products having a literal and a subjective value for each individual. With money, both producers and consumers are able to know the exact price of goods, which may also define their supply and demand. The contribution of money as an account unit helps to record financial transactions and thus monitor the products and services, provided within each country per year.

Despite that, there are many economists like William Stanley Jevons, who believe that the standard of deferred payment needs to be added as the fourth function of money. This means that money usage will be accepted globally as a way to evaluate a loan allowing all goods and services to be obtained at the current moment and be paid in the near future.

#### 1.2.2 History of money

And then there were currencies. Artifacts of coins found around the world, puzzle contemporary historians, regarding the date and location of the establishment of the first coins. The earliest calculated date is estimated around 3000 BC in Egypt and Mesopotamia, in the form of golden bars, weighted for every transaction. Their successors were gold rings and

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ornaments with similar use. By *the* 18th century BC, in Babylon, we had the establishment of the first banking system, with the priests of the temple managing loans. There are also early artifacts found in the city of Ephesus in Ionia (current western Turkey) but also in China and western Asia, with the invention of coins acclaimed both by Greek Ionians and Lydians. By 600 B.C. Lydia's King, Alyattes minted the first official money of electrum, which was a mix of silver and gold coins with picture reliefs. At the same time, Chinese skilled craftsmen created coins by throwing bronze into molds. Later on, in the 4th century BC, Greek and Romans performed financial transactions in public bodies or through private entrepreneurs. Needless to say, that contemporary currency units are influenced by Roman originals. The Byzantine empire with its stable currency "solidus", also played a crucial role in today's economic function. The silver denarius in the following century was established by the Frankish Pepin III and became the typical medieval coin in the whole of western Europe.

As far as the Greek history of coins, each major city had established its own coins made out of silver and bronze. Before the Peloponnesian war, the most widespread coins were those of Aegina, Athens, and Corinth. The first silver didrachm or starter has been found in Aegina depicting a "turtle". The Athenian tetradrachm coins depicted an "owl" and on the Corinthian coins there was a "Pegasus", the mythical horse of Bellerophon. Many Greek islands as Chios, Kos, Thasos, Rhodes, Lindos Cnossus, etc. used also different coins, with many figures printed on one side, mainly inspired by animals and myths. There was the "sphinx" in Chios and "crab" in Kos or Olympus Gods like the god Dionysus in Thasos and the Sun-God Helios in Rhodes. In the classical period (480-until the death of Alexander the Great in 323 BC) the coins start having inscriptions on their one side with the name of the issuing city, like the tetradrachm of Athens with the inscription "ΑΘΕ" of the Athenians. Due to the

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Athenian power, the "Attic" drachm of 4.3 g. of silver was the most acceptable payment service. Then, in the Hellenistic period (323-31 BC) the coins start differentiating in comparison with their predecessors with the portrait of the king appearing on one of their sides, instead of goddesses, heroes, and animals. The most common portrait of the Hellenistic king was that of Alexander the Great and the portrait of Herakles, on bronze and silver coins. The most popular of these were the tetradrachms, which were soon replaced by Athenian tetradrachms. As perceived, Greek drachma played a crucial role in Greek history due to its frequent use. A few years later, in Modern Greece (1828 after the Greek War of Independence, also known as the Greek Revolution of 1821) governor Ioannis Kapodistrias established the first national coin called "phoenix" in the Greek state (Chase, 2011), which depicted the mythical bird symbolizing the Greek Renaissance. However, only a few amounts of those coins were minted because most transactions were done successfully with foreign coins like the Turkish parades and Spanish two-columns. The first "phoenix" banknote was printed on 1<sup>st</sup> July 1831, and after the government resolution on January 4, 1832, all monetary transactions were done only by banknotes and not by coins until the replacement of phoenix by the drachma. After the Kapodistrias assassination, the Greek monarch Otto (1833-1863) reintroduced the drachma used for the period between 1832 to 2000. Since 2001, Greece and the other 11 European countries had started to use the common Euro currency.

Meanwhile, around the whole world, there is a large variety of coins and bank notes used. Bank notes made of leather, were firstly used in China during the Han dynasty (202BC-9AD, 25-220 AD). There is evidence that bank notes out of parchment or leather were also used in Carthage until 146 BC. According to the meaning of "banknote" (commonly known as bill or paper money) (Juels & Pappu, 2003) it was a negotiable promissory note, which brought out

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commercial banks or other authorities due to being paid to the bearer on demand. These banknotes are traded at face value and cashed through the banks for legal tender, usually with gold or silver coins. Nowadays, commercial banknotes have taken the place of national banknotes, which distributed by central banks or monetary authorities. The first known paper money appeared in China with the Yuan dynasty in 1260 CE, whereas the first European banknotes are established in Stockholm's first national bank, founded by Johan Palmstruch. The bank was presenting to clients the option of credit notes and exchanges. The difference between the bank system in the 17<sup>th</sup> century with the current one is that the supply and issuing of money were controlled by private institutions and not by a central bank. Even though the venture of the Bank of Stockholm failed, due to lack of reserves, it urged other European countries to follow the Swedish experiment and minted their own paper money. An example of mass paper currency circulation was the IOU (acronym: I Owe yoU) in Canada. In the 18<sup>th</sup> century, in an effort to reduce coin circulation, the Canadian government, issued what looked like an informal document that acknowledged the existence of a dept. Up to now IOU is used in Canada for formal agreements during business transactions. Another kind of "informal" currency in 1685 were the playing cards signed by the France government and distributed among soldiers as payment for a service instead of French coins. In any case, the increase of the use of paper money in the whole world influenced politics. More and more banks wanted to have foreign currencies to increase international trade. In this way, the first currency market was created. With the international competition between countries often led to currency wars. The country's purpose was to reduce the enemy's buying power by increasing the value of goods. The devaluation of currency made national exports more competitive in the global market competing against the opponent's currency.

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## 1.3 Common currency in Europe

European integration started to be a crucial idea after the end of World War II. After two world wars, bombings, the Great Depression coupled with the increased public expenditures the political interest shifts from war strategies and there is a need to establish a union for the public good. The Economic and Monetary Union (EMU) was established in 1992 by the Maastricht Treaty, which had as its primary goal taking the next move toward the creation of a single Euro currency. When European nations determined they wanted to take part in the EMU on June 1st, 1998, the European Central Bank (ECB) and the Treaty of Amsterdam were both created. The ECB was given the responsibility for monetary policy by the 11 European nations. The goal of the monetary union was to promote further administrative and political integration in order to protect and uphold the stability of the euro. Regarding the widespread use of the Euro, there are two assertions. The first supporters thought that by using a common currency the whole world would become more homogeneous. The rest believed that the unpredictability of governmental moves would be ensured by common institutions and laws under a common euro currency. The success of European integration would be carried out by the institutions that would incur the least amount of heterogeneity costs, according to Draghi, the president of the European Central Bank. This implies that, if heterogeneity costs were minimal, fiscal and political integration would be sufficient to resolve the euro area crisis. A monetary union could become fiscally and politically unsustainable due to the high costs of heterogeneity combined with the higher costs of quitting the euro. A few years later, in 2002, minted the first euro notes and coins from the ECB. Until now, the European Central Bank (ECB) is responsible to manage over 120 central and commercial banks and was created to control the amount of money, which is available in the economy (money supply). The ECB



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has two main functions: (1) The macroeconomic stability by controlling the inflation to be lower and predictable (towards 2%). ECB has the ascendancy to increase and reduce the amount of euro currency in the economy. (2) The rate of stable prices by avoiding excessive and destructive fluctuations in economic activity to have a powerful Euro currency.

### 1.3.1 First decade of Euro

The first decade of the Euro was extremely controversial considering the high expectations of the euro currency and its real impact in the European area. (*Regling et al., 2010*) Supporters of the Euro believed that it was a highly necessary counterbalance to Europe's Single Market, due to it ensuring macroeconomic stability and it will reduce transaction costs. A common currency will boost the insurance of cross-border commerce, which will then lead to investments, shattering the Single Market and economic welfare. The presence of the European Union will grow throughout the globe. The idea that a single currency will result in other growth effects, such as tighter financial market integration, in addition to lowering macroeconomic volatility was dismissed. Other skeptics, wondered about how possible it was to adopt an "optimal monetary policy" and how the euro could be confronted with country-specific shocks. According to the economic theory, real rates would be pro-cyclically, so the real rate would be reduced as inflation rose. Euro has achieved, to abort the expensive changes in endo-Europe exchange rates. The proof of the successful EMU's zone of macroeconomic stability has been shown in the inflation performance during the first decade. Not only the average inflation was near to the European perspective (closer but below 2%) -and thus reduced the price volatility from the previous decades- (Figure 1) but also the levels of standard-deviation of inflation had shown that there was

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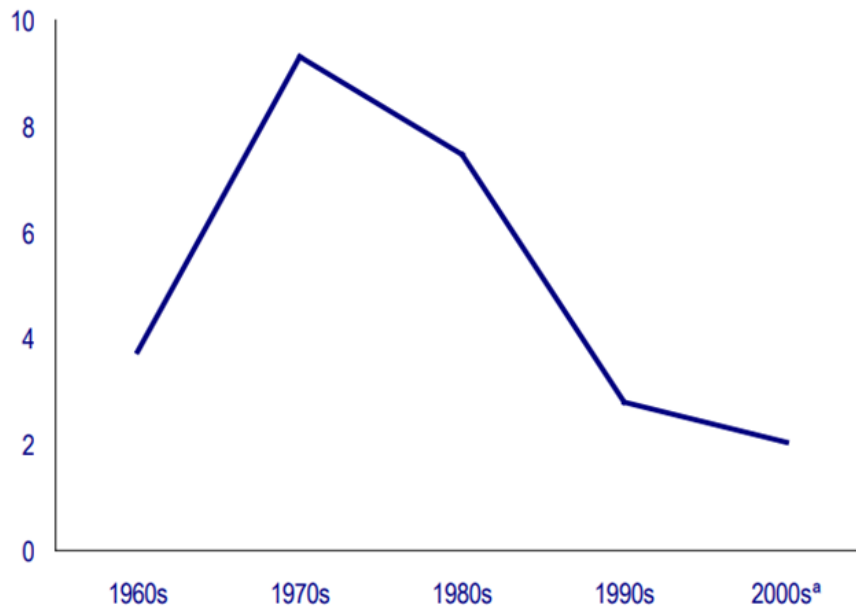
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a more stable economy than the other postwar periods. Fiscal policies also forced the EMU's vision with the fiscal deficits failing to 0.6% of the domestic product in 2007 and 4% in the 1980s and 1990s. The financial crisis in 2000-2004, due to a negative array of disruptions like the "technological boom" in March 2000, the reduction of customers' investment insurance as a result of the attacks on 11th September in 2001, and the bankruptcy of Enron's company, changed the global economy. Ample liquidity, inadequacy in risk management, and low-interest rates were some significant consequences of the crisis. The securitization and funds of loans removed the incentives for lenders to adhere to the proper lending regulations during the second financial crisis in 2007-2009 with the United States' "housing bubble." As a result, global production and trade were reduced, the belief in financial markets disappeared and the whole eurozone suffered from the shock. In 2009 the European Union has also announced a decline of 4% in GDP in addition to 2.5% in the US. However, the new Member States (Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, and Romania) in the European Union have been forced the foreign savings as part of the catching-up and high returns on investment (Figure 2).

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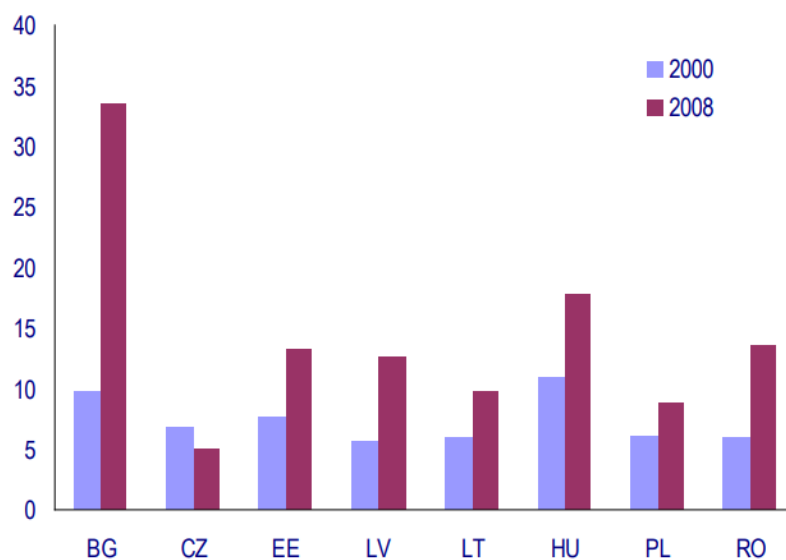
**Figure 1: Inflation in the Euro Area (% , decade averages)**



<sup>a</sup> The period since the start of stage III of EMU. The values for the last 2 years are projections.

Source: European Commission.

**Figure 2: Capital Inflows into NMS (% OF GDP)**



BG = Bulgaria, CZ = Czech Republic, EE = Estonia, HU = Hungary, LT = Lithuania, LV = Latvia, PL = Poland, RO = Romania.

<sup>a</sup> Surplus on the capital and financial account of the balance of payments without reserves.

Source: European Commission.

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Even though the year 2007 has been described as a financial disorder, in an EMU's announcement for the occasion of the first 10 years of the Euro there were no reports or worries about the policy tools during the crisis, however, the euro achievements were celebrated, as the price stability, modest economic growth and lower costs of borrowing money (Dyson2008; EuropeanCommission2008; Enderlein and Verdun2009; Warin2010)

### 1.3.2 Second decade of Euro

After the financial crisis, followed by plenty of incidents, influencing the Euro's stability, the first decade of the Euro was demonstrated to be better than the critic's predictions. In 2009 many European countries came up against a new crisis. The European debt crisis commonly known as the eurozone crisis started in 2008 after the bankruptcy of Iceland's banking system. European countries like Greece, Portugal, Ireland, Spain, and Cyprus did not have the ability to pay for their governmental debt and then started to create the balance-of-payments crisis. (*Dandashly and Verdun, 2020*). To avoid the collapse of the euro and financial contagion the International Monetary Fund (IMF) helped with its financial guarantees. However, countries like Greece were facing difficulties refinancing their sovereign debt. Estonia, Latvia, and Lithuania were the only countries, which experienced a double-shrinking Gross Domestic Product (Figure 3), in addition to Poland, which was the only country, which did not confront the eurozone crisis.

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**Figure 3: Annual Growth Rate (Real GDP %)**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Estonia</b>	6.3	9.4	10.3	7.7	-5.4	-14.7	2.3	7.6	4.3	1.9	2.9	1.7	2.1	4.9
<b>Latvia</b>	8.3	10.7	11.9	10.0	-3.6	-14.3	-3.8	6.4	4.0	2.6	2.1	2.7	2.0	4.5
<b>Lithuania</b>	6.6	7.7	7.4	11.1	2.6	-14.8	1.6	6.0	3.8	3.5	3.5	1.8	2.3	3.8

Source: Eurostat (2019)

As far as the Greek economy, the crisis started with the GDP's deceleration from 4.2% to 3.7% in the second half of 2007. In 2009, Greece's budget deficit was over 15% of its GDP, then Fitch, Moody's, and other rating agencies reduced Greece's credit rating. The International Monetary Fund (IMF) supplied Greece with 240€ billion of emergency funds in exchange for austerity measures, which obligated the Greek economy to control its public finances by reducing pensions by 1% and by limiting early retirement. Some austerity measures were the rise of product prices and the rapid increase of taxes. In 2011, the European Financial Stability Facility borrowed for the second time 190 billion euros from EU countries to Greece to help it to repay its debt. In 2012, there was a "haircut" of debt and in 2014 the Greek economy started to be recovering with a 0.7% of growth. However, in 2015 Greece did not pay its scheduled 1.55 billion euros and after a few days, the IMF announced that Greece was maybe in need of a third loan of 60 billion euros. People after the referendum on June 2<sup>nd</sup>, 2015, said "NO" to the new austerity measures and then all commercial banks amerce a 420€ weekly limit on withdrawals to increase the federal revenues by 1 billion euros in a year. In May 2017, the European Union lent Greece for a third time the amount of 86 billion euros. After many efforts, Greece started to recover again in 2018.

In 2016, the United Kingdom's request to exit the European Union with the British vote (Brexit) had a negative influence on the European area due to the substantial financial interaction between the EU and the UK (*Briefing*

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*Europa.eu.*) The high policy uncertainty, the short-term reputation of the EU, the dissolution of trade, and the impingement of EU institutions were four main views of the consequences of Brexit for stability in the Eurozone.

### 1.3.3 The using of physical cash

Nowadays, more and more people have started to abandon the use of cash and the majority of them prefer to perform their transactions only by digital payments. It is commonly known, that the online and contactless payments have increased in the last 4 years. Most of people believe, that the digitalization of the financial system is the fourth industrial revolution. The cause of this trend was the pandemic of 2019, which vertically increased the need for online purchases, being the only way to buy something and thus eliminating all other traditional payment systems. The rebounded of the Point of sale (POS) was remarkable, as 13% year-over-year market growth broke 2019's market size and the physical cash fell to 9.8%. According to the Worldpay's Global Payment Report in 2022, the value of global POS transactions is predicted to approach USD 58,9 trillion by 2025. Concerning the digital wallets (Apple Pay, Cash App, Dwolla, Paypal, Google Pay etc.), they used to represent 48.6% of the e-commerce transactions in 2021 and it is predicted that until 2025, this percentage will rise up to 52.5%. However, there are many thoughts about what will happen to cash. At the same time, the consumers but also all financially active people are concerned about how resistant are the payment systems during the international conflicts like the recent withdrew of US card networks from Russia, or what will happen to the cash, when a natural disaster or cyberattacks happen and how a central bank could react in advance. For all these reasons, central banks globally, including the European Central Bank created the Central Bank Digital Currency (CBDC).

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## On Central Bank Digital Currency

### 2.1 Introduction

Many central banks all over the world have started to develop CBDCs and some have already implemented them. Today, 114 countries around the whole world, representing over 95% of global GDP, are examining a CBDC. In contrast with 2020 when only 35 countries were considering issuing a CBDC. This trend is probable to be expedited after the financial sanctions on Russia according to the economist's prediction. More specifically, Central Bank Digital Currency (CBDC), also known as Digital Fiat Currency (DFC), Central Bank E-money, or Digital base money, is an electronic form of currency. Instead of issuing physical money, central banks mint and control a digital form, which is available for households and businesses for their payment services. This means that it has not only all the functions of the money that we are extensively using, but also the digital money characteristics. These money are presented as a global and have the legality, insurance and credibility similar to the paper money in circulation. Consequently, instead of printing banknotes, the central banks minted worldwide digital currencies to make the digital transactions easier and faster. For example, if an Australian CBDC was issued, people could use it for their final payments through their mobile wallet plus the added benefit of using it online. The Australian CBDC would have the same face value in Australian dollars (AUD) since it would be minted by the Bank of Australia similar to the common bill. Furthermore, there are many misconceptions about what is considered an official CBDC or which is the credibility difference in terms of digital money and paper money. A Central Bank Digital Currency is not a new invention of another cryptocurrency (like Bitcoin, Litecoin, Dogecoin, etc.) and it is not commensurable with digital

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cash like the prepaid card (Paypal), in which a commercial bank needs to be involved as an intermediary). By issuing a CBDC, there could be an unhampered flow of money, eliminating costs, airbrushing the financial inclusion and could circulate secure money through electronic channels. Still, there is always a danger for financial stability, which has a negative impact on the financial system. There might be two reasons that contribute to the success of the ECDCs operations. With the rapid evolution of technology, in combination with the existence of cryptocurrencies by private organizations and circulation of unofficial digital money like Bitcoins caused notable insecurity regarding the global dominance of the Central Bank on monetary policies. Secondly, the COVID-19 crisis increased the internet businesses and contactless payments based on the belief that paper money is a way for spreading the infection. This demanded to further researches so as to find alternative ways for international payment systems through digital currencies. The above, were only two of the reasons, that urged governments to create CBDCs.

### 2.1.1 Benefits of using CBDC

CBDCs provide the digitalization of economies and thus help the central bank's role for issuing legal tenders and give access to digital transactions with a minimum or zero cost, something that could eliminate the contestable current payment system. The contribution of private forms and lower trade barriers in an open access server could be a technology booster for the global economy. Point of sales (POS) and peer-to-peer (P2P) systems could be also improved. The monetary policy functions are simplified and done exclusively only by the central banks with their value not influenced or determined by the market. For this reason, CBDC could force financial stability by controlling



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liquidity squeezes and central banks could better analyze better the payment flow of data in the global economy. According to the financial inclusion, CBDCs could be a tool for the enhancement of local currency competitiveness, especially for the countries, that want to reduce the US dollar domination as a means of payment. However, CBDCs should be designed with some main features. These features are:

- The anonymity in money transaction
- The availability of money twenty-four-hours per week (24/7)
- The ability to transfer money safely worldwide
- The interest rates in non-zero levels
- The unlimited money transactions

## 2.2 CBDC and Monetary Policy

### 2.2.1 Monetary policy objectives and tools

Central Banks primary aim is to pursue the finance stability. This could be succeeded by monetary policy, where control the inflation expectations. ECB found that, price stability is preserved when inflation's level is near 2%.

Expansionary and contractionary monetary policy are two different ways to control the inflation levels. When the ECB wishes to increase the money supply, then decreases the interest rate, buys government titles or alleviates the reserve requirements for commercial banks. By this way, the ECB forces the economic growth. This mechanism is called expansionary policy.

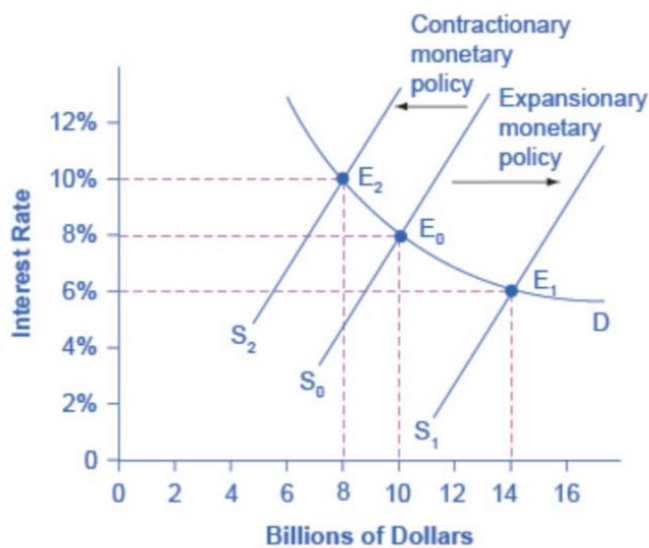
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However, this practice provokes higher inflation. On the other side, a contractionary monetary policy decreases the money supply through the increase of interest rates. The impact of that policy is a lower inflation in the economy (Graph 1). The reason why central banks, for example the Federal Reserves (Fed) or the European Central Bank (ECB) are such important tools for achieving growth and inflation goals is not apparent in the long-term, with the income estimated by the GDP, thus they are stable and any measure could only affect the price. But, in the short-term where the salaries and prices are not stable and do not adjust directly. For this reason, there are changes in the money supply, which influence the actual products and consequently the whole finance stability.

**Graph 1: Monetary policy**



In E<sub>0</sub> is the equilibrium. An expansionary policy will shift money supply right (from E<sub>0</sub> to E<sub>1</sub>) reducing the interest rate. A contractionary monetary policy will shift money supply left (from S<sub>0</sub> to S<sub>2</sub>) increasing the interest rate.

Source: [28.4 Monetary Policy and Economic Outcomes – Principles of Economics \(hawaii.edu\)](#)

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### 2.2.3 European Central Bank's Tools

The Central Bank Digital Currency objectives are the same as the ECB as a continuation of them. The most specific aim of the ECB is to contribute to an open, secure, integrity, and competitive monetary system, which strengthens the technological development in money and caters to the public interest. Three are the significant tools in monetary policy, that both ECB and CBDC have used until now. The open market operations, the refinancing rate, and the minimum reserves.

#### 1. Open market operations

Central Banks could change the money supply by buying or selling titles in open market operations. If ECB wants to increase the money supply, it will buy government bonds from the bonds market. As a result, commercial banks will have more money and thus they will increase lending. On the other side, ECB could reduce the money supply by selling bonds and increase the interest rate. These functions change the bank reserves and affect the supply curve of available funds for loan. Open market operations help ECB to control the amount of liquidity, the interest rate and the financial system.

#### 2. Refinancing rate

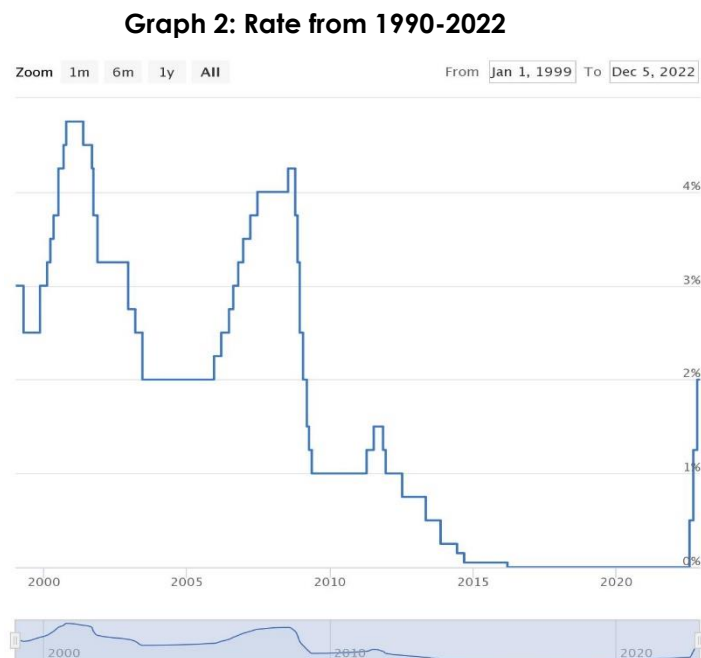
The rate that the ECB charges for a loan is called the refinancing rate or minimum bid rate. ECB appoints a rate, which is agreeable to lend to commercial banks for a short time. To have a successful arrangement for loan, banks give to the ECB their bonds or other assets. The risk of default by the issuer is negligible since the ECB is holding governmental bonds as assurance

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for the loan. The graph-2 below depicts the whole changes in the refinancing rate from 1999 - December 2022. From 1999 the rate of the level was near 3% until 6 October 2000 which there is the highest rate of 4,75% in the economy during the years following the Euro launch of t. From September 18, 2001-05 rates were under 4% until July 9, 2008, when the rate increased near to 4,25%. From 2008-2022 the rate was under 3% and remarkable was that the rate between 2018-2020 was 0% and then started again to increase.



Graph from: [ECB refinancing rate \(euribor-rates.eu\)](https://www.euribor-rates.eu/)

### 3. Minimum reserve

The minimum or "required" reserves (MRR) is the deposited funds, necessary for the accredited institutions, such as banks in Eurozone, to hold by the ECB at their national central bank. Bank's minimum reserve is appointed for a period between six to seven weeks. The amount of funds reserved depends on the bank's balance sheet. In 2012, banks should hold 2% of their customers' reserves with the percentage reducing to 1% by 2016.

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### 2.2.3 The transmission mechanism

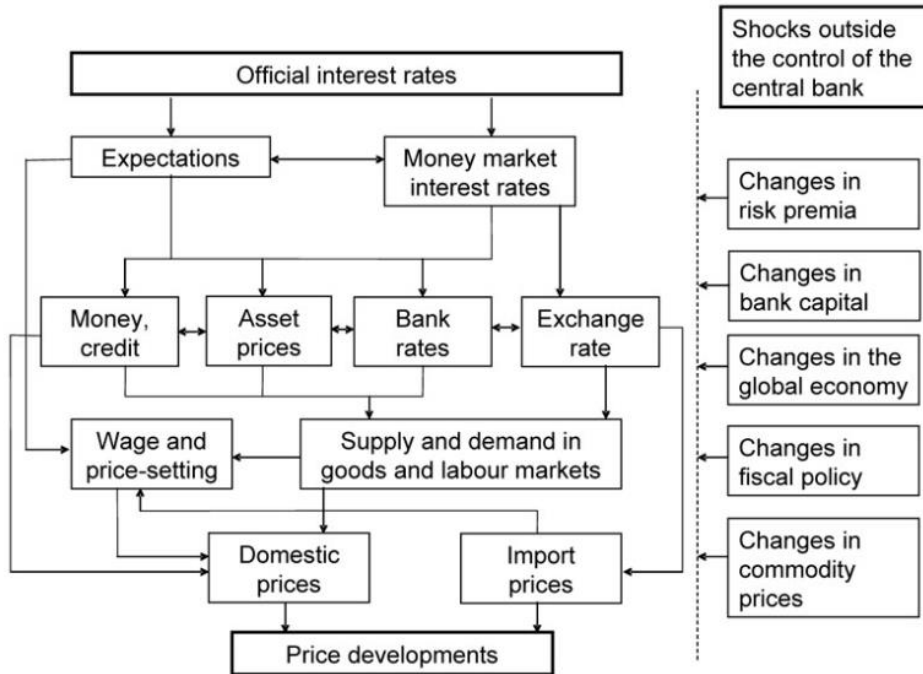
There are many scenarios on how people will react to a higher or lower interest rate. If borrowing costs rise, people may not want to buy a new car or house and businessmen may not want to invest in new equipment or software. The lower level of economic growth indicates lower inflation because lower demand signifies lower prices. However, a higher interest rate can reduce the net worth of businesses, due to the stronger conditions of loans. High rates normally drive to an appreciation of the euro. The exports become more expensive and thus they are reduced and the imports increase and become cheaper. The chart below depicts the main transmission channels and the difficulty of the prediction of monetary policy activity and price level. Changes in official interest rates directly influence money-market interest rates, however, monetary policy can also control future inflation through expectations. A central bank with high credibility reduces households' fear of deflation and there is no need to increase prices for fear of higher inflation.

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Graph 3: Transmission Mechanism



Source: [Transmission mechanism of monetary policy \(europa.eu\)](http://europa.eu)

## 2.2.3 Functions of CBDC currency

As we saw in the previous chapter physical cash has three main functions and central banks are responsible to control the money supply. The question is whether a CBDC could do the same as well as cash. Given that, it will be minted by central banks, leading to the question whether a CBDC could fulfill these functions in the same way or better than the current typical money?

- CBDC as a medium of exchange and as a safe store of value

A CBDC as a medium of exchange should be globally accepted and effective as a payment system. This means, that people can use it for twenty-four hours for their purchases and in any place they wish. According to Milton Friedman,

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a currency, which is minted by the government, should have the same rate of return as other risk-free assets to be an effective medium of exchange (Bordo & Levin 2017). Money with the current type is not as effective as a CBDC due to the high transaction costs with a combination of the need to meet in person or an automated teller machine (ATM) to withdraw it. This process could be extremely difficult for people, who live in remote areas and through physical money could not have the ability to do their daily exchanges. However, a CBDC would be the safest digital asset available for all people and without credit or liquidity risk. The rise of criminality with the susceptibility to thefts is affiliated with the ineffective function of physical money as a safe store of value. A transfer of an enormous number of bank notes and coins between countries could have high risks. On the contrary with a CBDC, the safety during global transactions could be successful because the value will not be saved locally on a device and at the same time reduce this hindrance associated with physical money. For this reason, there are eliminations of returns that current money proposes. This aspect combines with Friedman's statement about the need for some money return to be a currency and an effective medium of exchange. With a CBDC people can have insurance so that their money is more secure and that they can perform their payments more efficiently.

- CBDC as a unit of account

The prerequisite of CBDCs design is to be stable, regardless of being a complement or a replacement of physical money. The price of goods must be reliable and consequently, CBDC will have a 1:1 ratio with the money supply and preserve the current value of money. For example, a stable unit of account like the price and wage fixing assists both households and businessmen to make economic decisions. Since price fixing is determined only by

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businesses, which are running in specific markets and not by a “central planner”, it is only possible for a stable price to be set by a suitable monetary policy. Positive inflation is the main aim of all central banks and is usually restricted to the Zero Lower Bound (ZLB) during the shaping of their policy rates. Subsequently, when the rate is lower than this specific limit, people head to the use of physical cash instead of keeping their money in a commercial bank. If the public started to use the CBDC as the only legal type of money, then the restrictions of physical currency could be eliminated, thus actualizing the implementation of a rate below the ZLB. For this reason, CBDC is a more stable unit of account in addition to the common cash and thus encouraging true price stability through its stable value.

### 2.2.3 Designs of CBDC

There are two different designs of CBDCs, the wholesale CBDC using currency only by financial intermediaries and the retail CBDC used only by the broad economy. The confidence in the currency is the foundation of the monetary system and through them, the “central bank public goods” is created, which supports the monetary system. Central banks’ ambitions are to provide the unit account in the monetary policy, to use their balance sheets to guarantee the conclusiveness of payments, and to control that the payments system function clicks into place. For this reason, regardless of the CBDCs design, it should be tested to fulfill these functions and then to create an open payment platform in a competitive market area. Wholesale CBDCs are used by financial institutions and depended on the two-tier structure, which comprises of the central bank and the customer-facing activities of PSPs. The central bank’s balance sheet adjusts the local payments and the commercial banks with other PSPs are subsidized by central banks. Wholesale CBDCs are responsible not only for interbank transfers but for wholesale transactions and



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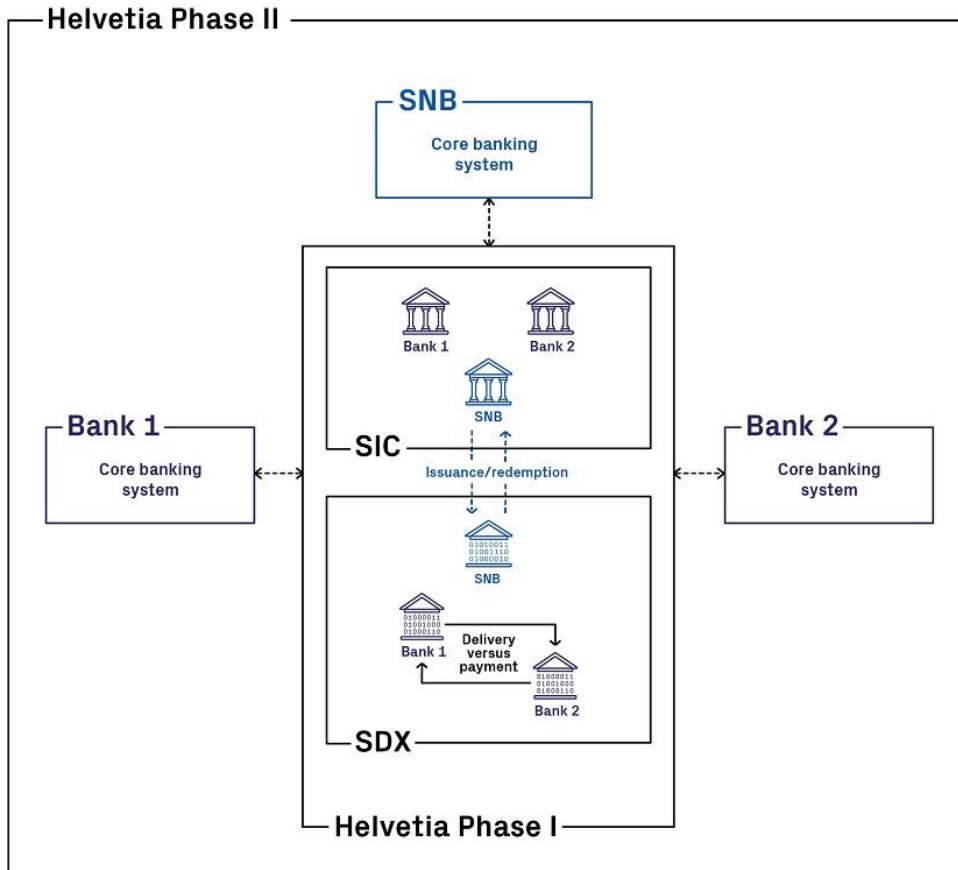
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run in the same way as the common central bank reserves. Settlement is by charging the bank account's net obligations to the system and by crediting the net claim, which the bank account has on the system. In this way, it could force the current delivery-versus-payment methods in the RTGS2 system. In reality, wholesale CBDC could make the central bank money more ready to help in atomization and elimination of risks. The new technology stacks on wholesale CBDCs could enable interoperability.

Project Helvetia by the BIS Innovation Hub Swiss, SIX Group AE, and the Swiss Nation Bank, represented how central bank money could be integrated into a distributed ledger technology (DLT). It is compared two assets (PoC). First, the connection between the SIX Digital Exchange (SDX) and the current RTGS central bank payment system from Swiss Interbank Clearing (SIC), and second the minted of a wholesale CBDC. **1st PoC:** claimed the environment of the Swiss Real Time Gross Settlement system with the SIC system and SDX. Wholesale CBDC issued directly into the DLT system of SIX Digital Exchange by the Swiss national bank and became tokenized assets. As a consequence, **the 2nd PoC:** comprehend commercial banks to the 1st PoC and added the wholesale CBDC into the whole banking apparatus of the central bank. The ability to work together between the DLT of SDX and the Swiss RTGS system SIC is defined and money transactions are arranged in sic balances. Both cases funded legal and effective transfers, however, there are shown different benefits in the economy.

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Graph 4: Helvetia Phase II



LEGEND

- Value transfer
- ←--> Settlement instructions and confirmations
- Account
- Node on DLT

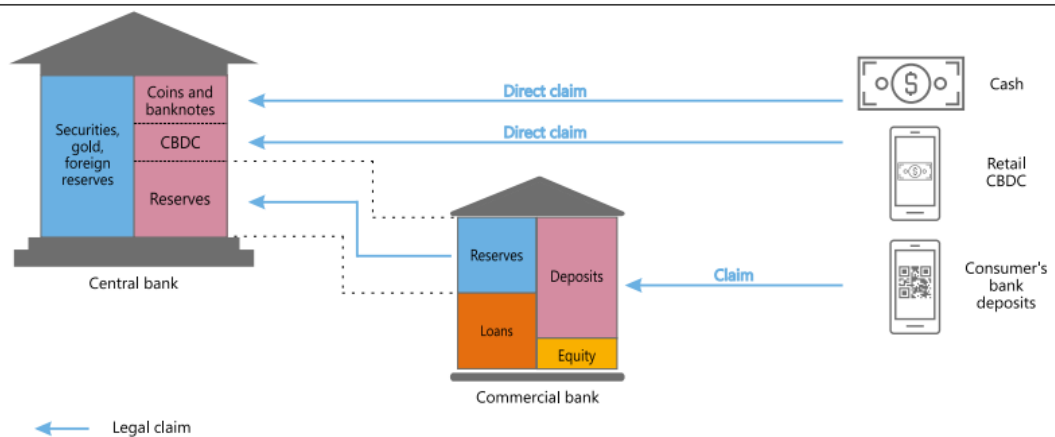
Source: [28.4 Monetary Policy and Economic Outcomes – Principles of Economics \(hawaii.edu\)](https://www.hawaii.edu/econ/28.4%20Monetary%20Policy%20and%20Economic%20Outcomes%20-%20Principles%20of%20Economics)

In contrast to wholesale CBDCs, a wider innovation is the retail CBDCs, which are available for all people to use, like the common physical cash, however, do not require any credit risk for payment system attendees and they are a direct claim on the central bank. Graph 2 below presents a retail CBDC in the monetary system. As you can see a retail CBDC does not need an intermediary such as the other digital retail money, since it is minted with the obligation of central banks. The problem with the intermediaries could be the experience of illiquidity due to a temporary lack of funds or the bankruptcy of credibility, which makes inefficient payments. There are also two different angles of retail

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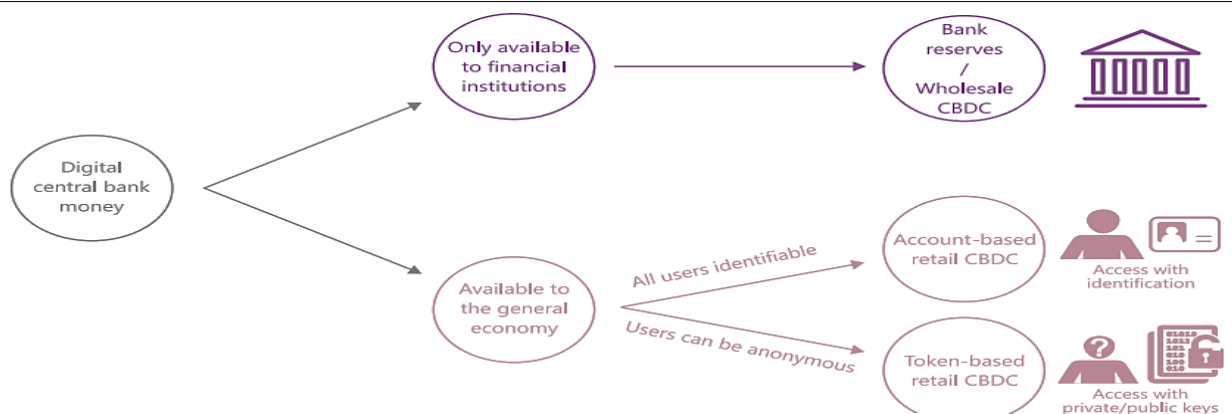
CBDCs, which are presented in graph 3. CBDC is a common cash allowing token-based access and anonymity. People by their sign in through other ID methods like a password could be used them. The other angle is based on verifying the user's identity, which helps to reduce illegal activity in a payment system and gives insurance to the public about their transaction data.

**Graph 4: A retail CBDC and monetary policy**



Source: R Auer and R Böhme, "Central bank digital currency: the quest for minimally invasive technology", *BIS Working Papers*, no 948, June 2021.

**Graph 5: Retail CBDC Angles**



Source: BIS elaboration.

<sup>1</sup>Payment Service Providers also called Merchant Service Providers are the third-party businesses, which help company's proprietors to accept broad limits of online payment methods like credit and debit cards, e-wallets etc.

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<sup>2</sup> *Real-Time Gross Settlement is a dedicated system where money is transferred from one bank to another without any waiting period after the settlement of the process and then settled on a one-to-one basis, without bundling.*

### 2.3 CBDC and payment systems

CBDCs' design forces competition and efficiency in payment systems. It is commonly known that money transactions across borders have shown that they have increased settlement duration. Transfers carried by Visa take two days and American Express may last from 2 to 5 days for their successful completion. Moreover, many companies have large engaged sums due to slow settlement times. Independent of the CBDC's design, it could be another choice to perform faster payment systems with lower settlement time. A CBDC could perform settlements all over the world in fractions of a second. In this way, there is an effectively distributed ledger without the need for agreement between banks. Companies could also reduce the costs, related to such payments and could lower the high fees during cross-border payments. Many people during the financial crisis immigrated to wealthier countries. A large amount of their income was transferred back to their homeland. Those remittances are the biggest resources for the inflow of capital to emerging economies, however, they are not safe in money. CBDC could reduce the uncertainty regarding the security of the transactions and help those payments to be cheaper. Table 1 below presents a set of different features on CBDC, which could support a safe store of value in a systemic financial crisis and help in financial stability.

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**Table 1: Attributes of central bank money – reserves, bank notes and CBDC**

Attribute	Reserves	Bank notes	CBDC
Denomination	CAD <sup>a</sup>	CAD	CAD
Legal tender	No	Yes	Yes
Convertibility: Exchange between reserves, bank notes and CBDC	Par	Par	Par
Interest-bearing	Yes	No	Yes
Central bank fees	None	None	None
Access	Only financial institutions (FIs) that are direct clearers in large-value payment system can access reserves	Non-exclusive; anyone can use bank notes. No particular technology required	Non-exclusive; but access to related technology is required
Availability	Subject to operating hours of the large-value payment system	24/7	24/7
Confidentiality of use	All participating FIs are known to the central bank	Anonymous	Users known to the central bank or its agents; could be anonymous to counterparties.
Supply by central bank	Discretionary decision by central bank, depending on its objectives	Perfectly elastic; demand-determined	Perfectly elastic; demand-determined
Distribution channel used by central bank	Participating FIs have accounts at the central bank, which are used for distribution of reserves	Through regulated FIs that have accounts at the central bank. FIs ensure anti-money-laundering (AML) and know-your-customer (KYC) compliance	Through regulated FIs that have accounts at the central bank. FIs ensure AML and KYC compliance
Finality/irrevocability	Final and irrevocable once the risk control tests are satisfied	Immediate, at time of transaction	Timing of irrevocability depends on the technological solution
Payment network structure	Centralized, settles on the book of the central bank	Distributed, bilateral; not tiered	Depends on the technological solution

a. Denominated in the sovereign currency; for Canada, the Canadian dollar (CAD).

Source: Bank of Canada

## 2.4 Experience from the global economy

Central banks all over the world have already started to create wholesale or retail CBDCs. The most common evidence of CBDC currency is in China with the digital Yuan, which is also known as e-CNY, e-RMB, or simple e-yuan. The

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e-Yuan was minted by the People's Bank of China (PBOC) and it is a digitized version of the physical yuan. It is not a type of cryptocurrency and its value is equal with the RMB. Only Chinese citizens have the ability to buy a e-Yuan and save their e-yuan money in digital wallets. By using a QR code they do their daily transactions. The foreigners, have the ability to use a e-Yuan through a digital form, only with the condition to live in one of twelve pilot cities that use the e-Yuan and have a bank account there. Another popular example is the Bakong project from the National Bank of Cambodia, which is based on blockchain technology. People can use their digital money for their payments through Bakong's smartphone app and transfer their money to others by scanning QR codes or admitting the recipient's phone number thought to have a bank account except for people who have a Cambodian mobile phone number. These are some of the pieces of evidence in the retail CBDCs currencies like:

- The Sand Dollar: Created by the Central Bank of Bahamas and using NZIA Cortex DLT technology provider. After 2019 with the successful Sand Dollar pilot project, Central Bank of Bahamas announced that the off-the-shelf application for the public's payments systems will be provided by the using of Sand Dollar, however it is in a very early stage until now. Sand Dollar valued 1to 1 with the Bahamian dollar. *(Dilmegani,2021)*
- e-Hryvnia: Controlled and managed by the Ukrainian central bank. In December 2018, National Bank of Ukraine completed a two-month pilot project with main aim the cashless payments and the financial inclusion.

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- e-Peso: A non-DLT retail token with GSMT technology founded by the Central Bank of Uruguay. In 2019, IMF recognized Uruguay as the global pioneers in preemptive angle in assessing the CBDC case.
- Dinero Electronico: A non DLT mobile money by the Central Bank of Ecuador, it will be used as an electronic cash for the Ecuador community however, it did not achieve to continue it aims and as a result was canceled.
- e-Krona: Created by the Sveriges Riksbank with the technology provider R3 Corda and DLT. By the announcement of Riksbank, e-krona could strengthen the payment systems, could help to ensure the functions of money, which physical money could not do it anymore and could solve the problem of cash-usage.
- Digital Lira: A retail token by the Central Bank of the Republic of Turkey. Its main aim was to create a strong financial sector with lower cost in order to become Istanbul more attractive through the wide trustworthy financial instruments.

On the other hand, there are many global tries to create wholesale CBDC currencies. (*Atlantic Council, 2022*). The Inthanon-LionRock project from Thailand and Hong Kong was the try to the invention a wholesale CBDC in 2018. The Bank of Thailand (BOT) corporate with the Hong Kong Monetary Authority (HKMA) and commercial banks in Thailand in Hong Kong wanted to investigate the application of Distributed Ledger Technology (DLT1). Their main aim is to boost wholesale cross-border funds transfers and payments through a streamlined intermediation model until known in real-time and atomic Payment-versus-Payment (PvP) settlements. Moreover, in the case of

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the Singapore pilot Project Ubin there was a need to explore the blockchain with DLT for clearing and reaching a settlement on payments and titles. This is a multi-year project with many phases, which presents challenges for the financial industry. The goal is for the central bank of Singapore to make the current systems more efficient based on central bank-issued digital tokens. Similar to Project Ubin is Project Jasper by the central bank of Canada. Project Jasper was the first effort, where a central bank took part in a DLT experiment in corporate with the private sector to understand how DLT could help the wholesale payments system. Other examples of wholesale CBDC currencies are the Cross-border interbank payment and settlements by the UK, Project Khokha by South Africa, Project Stella in Europe, and Project Aber in UAE. The figure below shows the different global projects. According to Europe, the European Central Bank (ECB) in corporation with the Bank of Japan (BOJ) started in December 2016 the Stella Project, which is a research and development project focused on the creation of a digital euro. The main aim of the project is to understand the potential benefits and challenges of introducing a digital euro in the European area as well as to understand the technical and operational aspects of its implementation. In the follow figure showed the global CBDC landscape:

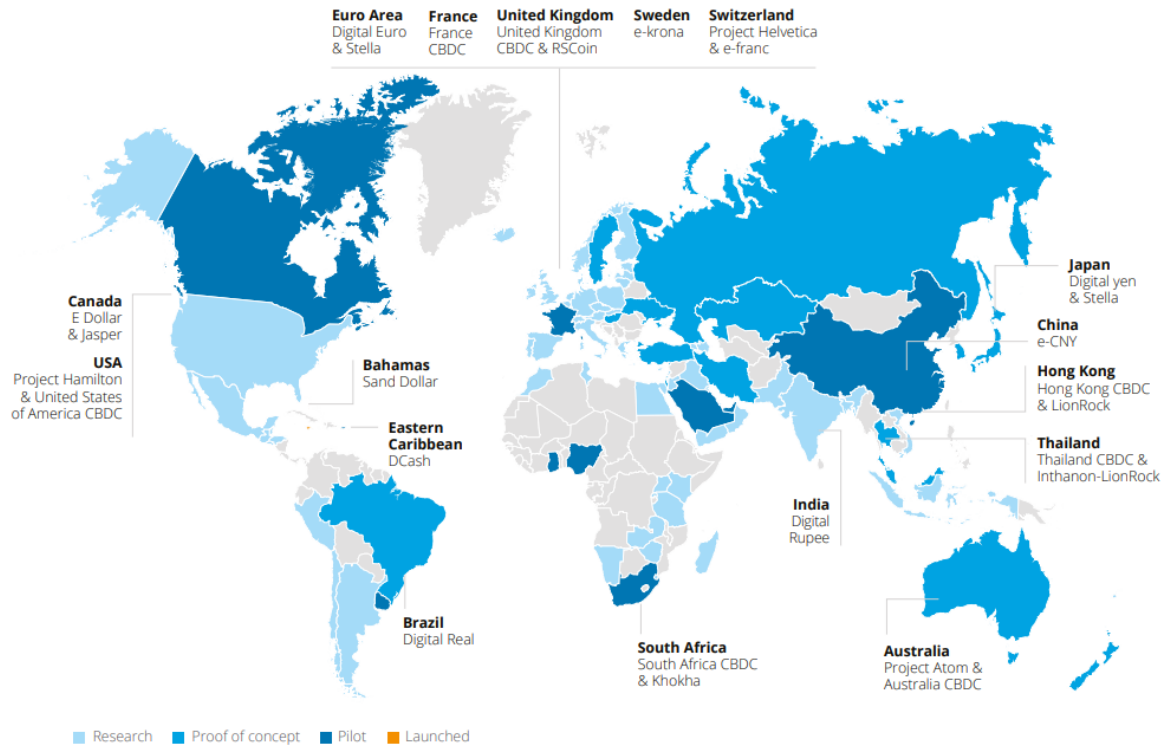


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**Figure 4: Global CBDC landscape**



Source: CBDC tracker ([cbdctracker.org](https://cbdctracker.org); data as of July 2022)

## A Digital Euro

### 3.1 Introduction

The Digital Euro has been the main project of the European Central Bank. Christine Lagarde, the president of ECB, has declared that, the digital euro is a bold European challenge, which will influence the whole community and not just another stand-alone project. One of the main reasons behind the beginning of the creation of digital Euro might have been the increased global competition between CBDC's and the need for a digital currency in the Eurozone. However, in a video speech on 7<sup>th</sup> November 2022 Christine Lagarde announced that, the emergence of a digital currency is not a speed

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race and that the research of a CBDC in the euro area is in an advanced stage. The ECB's operations around the digital Euro were published in October 2020. The experimental operations by ECB's High-Level Task Force followed analyzing the positive and negative aspects of the introduction of a digital euro, investigating possible functional and technical issues arising by its use. In January 2021, the Governing Council published a report, which focused on the distribution model, the possible design option, the data privacy and transfer mechanism of a Digital Euro. It is estimated that until October 2023, ECB will have completed all processes and the Commission will be able to announce the regulation under which the digital Euro will be issued. (*Europa.eu, 2022*) More specifically, the Digital Euro will be a secure and user-friendly electronic currency, issued by the ECB and it will function as a digital token for the European payments just like physical money. The digital Euro signifies a legal responsibility of the Eurosystem presented electronically as a complement to physical money and central bank deposits and not as a replacement of them. There is no specific plan yet, about its circulation, still but many believe that, it will be available for the public or at commercial banks through an application app.

### 3.1.1 Why we need a Digital Euro

The European Union report on digital euro presents the various reasons why a common digital currency in the Eurozone. The report firstly mentions that, a digital euro could be a way to force the digitalization and independence of the European Union strategies. The digital Euro could be fulfilling the gaps in the payment system and could help the digitalization of the financial sector and providing insurance, supporting certain new business models. This scheme will also support online payments and will provide an easy to expand

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solution for the future transactions. Secondly, the digital Euro in combination with conventional money, could mitigate the extreme phenomena such as a cyber incident, a natural disaster or a pandemic, which obstruct the payment services thus giving a solution in the possibility of an outage of private cards and ATMs. Thirdly, by stopping the use of cash as a means of payments could increase other private forms of money and private payments solutions. For this reason, the digital euro could help to satisfy the consumer's needs for payments better than today's cash. Fourthly, the digital euro could advance the functions of money as a store of value and medium of exchange. By this way, ECB could reduce the influence of the other "stablecoins" initiatives by private actors, which threaten the European Union role and drive to political domination and thus eliminate the need of currency substitution. Fifthly, ECB will have the ability to appoint the payment rate on the digital Euro and control the monetary policy. The effect of monetary policy that should be adopted due to the digital euro is carefully explained in the next chapter. Sixthly, a digital Euro could have an ecological footprint of payment systems in contrast with cash. This would be successfully completed by featuring the cost and energy efficiency of digital Euro than other payment solutions.

### 3.1.2 How will be the functional design of digital Euro

A well-designed digital Euro needs to have some significant features to fulfill the ECB's requirements, although there is not a specific design plan yet. These possible functional specifications include:

1. **Accessibility:** Users could have direct access to digital Euro, which means that, the central bank needs to have a support system as user-facing services or indirectly access through supervised intermediaries, which will be responsible for the provision of such services.

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2. **Privacy:** User's privacy could be protected by providing different levels of privacy. Digital Euro users could first verify their access services with their legal identity and secondly the ECB and the providers of services need to have other degrees of privacy in case of indirect access. Offline transactions should be considered, together with large value transactions, and establish regulations for the operator to approve or exclude certain transactions.
  
3. **Restrictions on digital euro for using it as an investment:** Euro systems need to design the digital euro including the limitation tools in order to protect surplus shifts of commercial banks into digital euro. Thus, the demand of the digital euro should be controlled, with European citizens having free access to the digital currency, and restricted access to citizens of other countries.
  
4. **Availability and utility Offline:** Money transactions, which are not confirmed online could be successfully completed through a "trusted hardware" like a central register. By this way, the digital euro will be available twenty-four hours from the European community without the need of an internet connection. Thus, the public could use an offline digital euro with the condition to be online, at some other time, in order to charge their digital euro wallet with more money.
  
5. **Legal part:** The Eurosystem could invoke different articles as basis for the different possible types of digital euro, as a monetary tool such as bank reserves (Article 127 (2) of the TFEU with Article 20 of the ESCB), as a retail CBDC for the households (Article 127(2) of the TFEU with

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Article 17 of the ESCB), as a specific settlement for some types of payment (Article 127(2) of the TFEU in conjunction with Article 22 of the Statute of the ESCB) etc.

### 3.2 Digital Euro and ECB monetary policy

The issue of the digital Euro needs to fulfill the terms of ECB requirements, regardless of its type, in order to eliminate any negative effect on the monetary policy, such as a dispute of the commercial banks role, a negative effect on risk-free interest rates and a successful financial stability in Europe. The digital euro, which people use as a form of investment, could give the ability to people to transfer their commercial bank deposits into the central bank converting them into liabilities. In this way, the funding costs of banks and as a consequence the interest rates of bank deposits may increase, limiting the bank growth variable from the economy. Commercial banks could respond to this by using a stable system of loans by rising their remuneration or by grouping them with other services such as mortgages. Other solutions may be the boost of outright holdings of titles in combination with an overall increase in money supply. This means that, banks could have the ability to replace lost funding loans with a loan from ECB. However, this will require an increased demand for guaranties and affecting the interest rate. Moreover, the digital euro could negatively affect the financial stability, assuming the financial intermediation of banks. When there is a demand for increasing funding costs, banks may need to deleverage and reduce the supply of credit and leaving an optimal level of investment. Still, the cost for borrowers could be higher than the bank's expectations and therefore the economic transaction could be eliminated. Furthermore, if the crucial role of commercial

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banks as deposit-taking is slid over and stops interfering in the payment system, then the banks will have less and less information about their clients, and this may cancel their risk evaluation ability. This means that, digital euro would possibly replace the traditional business model of banks and thus reduce their role as money multiplier. Commercial banks may not be able to control liquidity in the economy and take new profits, due to the changes on the open market operations and the number of reserves. Banks might be against the increasing inherent danger in their balance sheet. On the other side, investors could replace their secure assets like sovereign bonds with the digital euro, something that will influence first the risk-free interest rate and then the other risks. When people also experience an economic crisis, then they will have the ability to rapidly shift their bank deposits to the digital euro, due to the mistrust of the depositors in banking sector. If the functional barriers to money as digital euro are lower than cash, this could increase the possibility of bank closure and an unstable economy. For all these possible situations, ECB needs to examine the impact of digital euro access as a retail token and as an intermediary. For example, ECB could avoid the danger to the banking sector by remunerating the digital euro holdings at a variable rate. A variable remuneration enables the commercial banks to adjust the interest rate in parallel with the policy rate changes and to exceed the effective lower bond (ELB). Furthermore, the remuneration digital euro could become negative during a business cycle, in order to avoid the possibility for a liquidity trap. However, this implies that there would be total replacement of banknotes to deter cash accumulation, something that ECB have already committed not to happen in the economy.

According to the Bindseil (2020), the uncontrolled demand of the digital euro could easily happen, when there are negative interest rates and digital euro is remunerated at a zero-interest rate. Users could also understand money as

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the least costly means of payment. Bindseil advises against this scenario of a step-wise remuneration digital euro with different interest rate during the economic periods and in any case. The digital euro in first tier would be remunerated at a non-negative interest rate and in the second tier there would be an unattractive rate. In both tiers the remuneration would transfer in parallel with policy rates. However, Bindseil's solution conceals the negative impact that the digital euro would have on the consumer, who may have difficulty adapting to a digital euro.

### 3.2.1 Digital Euro and ECB's tools

Some of the ECB's tools, which will be affected by the issue of the digital euro are:

- **Interest rate:** An interest-bearing digital Euro would allow the ECB to more easily pass through interest rate changes and handle the zero-lower bound, strengthening monetary policy.
- **QE Efficiency:** A digital Euro that consumers and producers can use, might make it easier to handle quantitative easing (QE) programs without having an impact on the bank's balance sheet, which would help the economy by providing "helicopter drops."
- **Exchange rate:** With other currencies, a jurisdictional digital euro could completely alter the present global liquidity. The deleveraging of the economy can be accelerated through the exchange of a digital euro with another worldwide currency.
- **Credit channel:** Because it will establish the lower limit of money holdings, a reimbursed digital euro does not independently determine the interest rate. When individuals start to switch their holdings to digital euros, banks could prepare for a potential loss of funding without raising the cost of funding.

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### 3.2.2 Digital Euro and balance sheet

The size of the balance sheet in the economy would shift under a digitalized euro, which would alter European profitability. If digital Euro notes are issued, they won't have a significant impact on the balance sheet or risks even if they partially supplant banknotes. If non-European citizens converted a sizable portion of their personal finances into digital euros, there might be a substantial increase in the size of the European balance sheet. The ECB needs to acquire assets, such as deposits or titles against the virtual euro, in order to compel an expanded balance sheet. Additionally, the digital euro has expenses, just like real money. For the first time since their issue, incomes would shift with an adjusted digital euro. Commercial banks may be required to provide "longer-term refinancing operations" (LTROs) by the ECB if they lose a significant amount of assets. In this manner, the ECB could quickly decide how lucrative the compensated digital euro and interest rate, will be, including the LTROs. The digital euro's IT infrastructure also plays a significant part. If it is broken, this could result in harm and loss. For this reason, the ECB should pay attention to both the size of the balance sheet as well as its financial obligations, such as the supply of retail payments.



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### 3.3 Digital Euro and European payment systems

The digitalization of the payment system and specifically a central bank money could be useful for ECB in order to control the payment system and to secure their domination on monetary policy. Fabio Panetta, a member of the ECB Executive Board, described the issuance of the digital Euro as a powerful European payment system that can be helpful for any digital payment and provide economic efficiency (Fabio,2022). This could be successful through two different types of digital euro (1) as a way for person-to-person payment transactions and payments for physical stores or (2) as a way for payments between users and governments (maybe for public welfare benefit or public taxes). In order to offer ground-breaking payment services based on the digital euro, the private sector intermediaries' input will be crucial in this area. According to the ECB consultation in April 2021, both the general public and business owners express their preference for using intermediaries to guarantee their payments and their personal data when using the digital euro. Only 10% of citizens specifically advocate for the anonymity of their financial transactions, and the majority of them think that euro payments should be accepted by existing payment systems and given the option to be programmed.

#### 3.1.2 Transfer mechanism

The account-based system or the server could provide the digital euro's transfer method. (*Progress on the investigation phase of a digital euro, 2021.*) A third party will keep track of deposits made from the payer's bank account to the payee's bank account, providing evidence of a successful transaction. Therefore, if digital euro is used as an account-based currency, it will function

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exactly like current money transactions. In this manner, it will enable the ECB to fully regulate transaction flows. When using a bearer digital euro, where ECB lacks direct authority. Payee and payer will be in charge of verifying all transactions, so only the level of a digital euro payment device could apply holding restrictions in conjunction with transaction volume and user target-group segmentation.

### 3.1.3 Digital Euro as payment services

All bearer payments must use a digital euro device, which requires users to confirm their names. This could be quickly accomplished using fingerprints, a second passcode, or iris scanning. People might only log on when they need to receive a payment and then stay offline after that. Modern technology should guarantee the security of any personal information stored on the device. Additionally, digital euros could be offered as a web-based server using a laptop, a phone, and other digital devices as long as they were online at the time, or as a tangible device like a smart card. With a smart card, users can share compatible gadgets without a connection to the internet. Users might pre-fund their devices in order to keep their money available offline. However, in order for offline payments to succeed, the appropriate proofs are required. Unusual is the worry that the risk of hacking or counterfeiting would rise if there was no central bank security at all, something that might occur in offline transactions. By utilizing the digital euro in physical payments, the ECB would also gain the support of more citizens. Offline payments require a common European solution for POS and P2P transactions in addition to the reality that they rely on extremely secure front-end standards. The following two charts examine the findings of an ECB survey on public and professional preferences for online and offline payments:

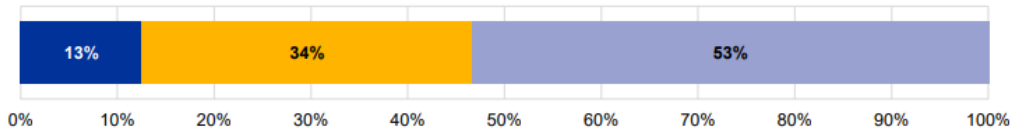
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**Graph 7: Citizen's and professionals' preferences**

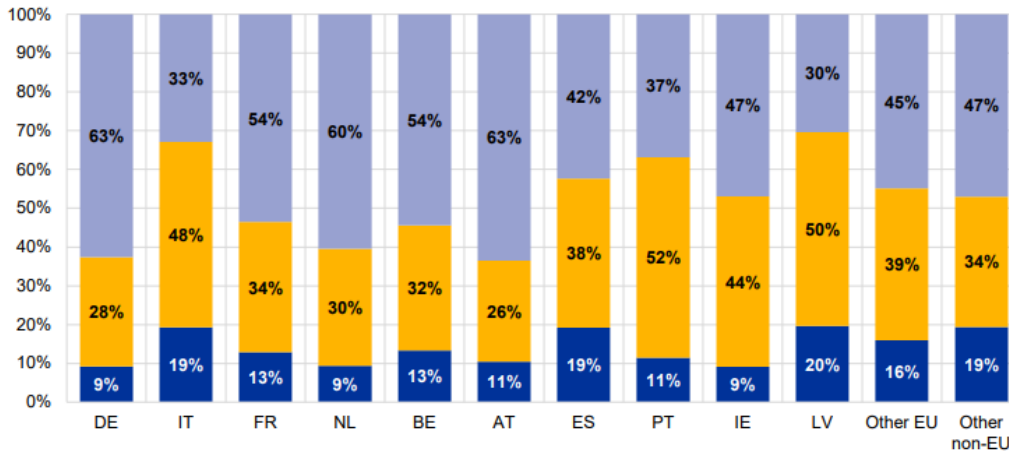
Preference for privacy/offline, innovative solutions/online and hybrid solution

- Potential for additional services, allowing innovative features (online)
- A combination of both (online and offline)
- Privacy and protection of personal data (offline)

**a) All citizens**

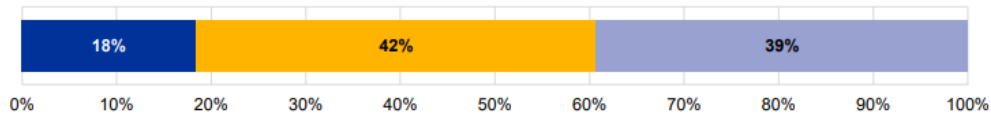


**b) Citizens per country**

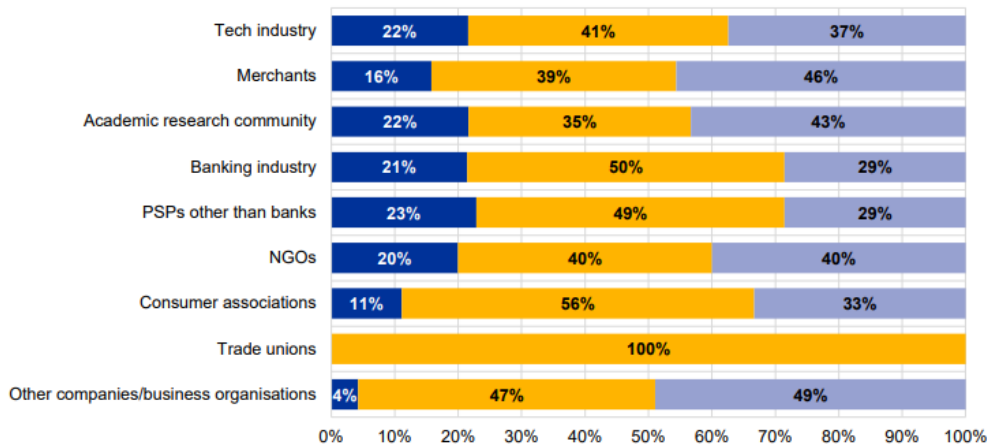


**Graph7: Citizen's and professionals' preferences**

**c) All professionals**



**d) Professionals by type**



Notes: Percentages shown are rounded to the nearest whole number. Panel (b): focus on the ten most represented countries.

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### 3.4 International role of digital euro

According to the European leadership, the international role of the Euro is a vital element for the independence and influence of the European Union in the global economy. This implies a European strategy of autonomy and, consequently, more independence in the substructure of international payments. The euro needs to maintain its status as a reliable method of payment for international trade that doesn't cause any hiccups to the European economy. The decline in the percentage of the world's foreign currency reserves in euros from 20% to 19.7% in the first quarter of 2022 to the third quarter of 2022, however, could be attributed to various events, including the Ukraine War, China's "ZERO-COVID" policy, and the global energy crisis. Russia's products were essential because Europe was a net energy importer. Due to the fact that the US is a net energy exporter and was unaffected by the energy crisis, the US's share of global foreign currency reserves increased from 59.79% to 58.8% in the same year. In order to prevent the US Dollar from completely dominating global trade, the European Union looked into the possibility of a digital currency that would support the international function of the euro in addition to the euro currency. The ECB may strengthen their dominance and power at the cost of other currencies if the Euro become digital. This could be accomplished with ease by increasing the demand for the euro and luring in foreign businesspeople to back its use. The introduction of a single digital currency for the Eurozone could compel the ECB's values while also supporting the Euro's function. However, the functional architecture of the digital euro should enable it to compete with other digital currencies, such as the Chinese e-Yuan.

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### 3.4.1 Digital Euro VS US Dollar

The digital euro may facilitate cross-border transactions, be more widely used than other digital currencies outside of the Eurozone, and thereby elevate the standing of the single currency in the world. The ECB believes that the digital euro may present a fresh chance to undermine or even depreciate the dominant US Dollar. Other CBDCs like the e-Yuan and perhaps the potential problems with the digital euro pose a danger to the US dollar's status as the world's reserve currency. It is, however, incredibly challenging to completely replace the US Dollar. The US dollar has served as the world's reserve currency and is still used for the majority of foreign transactions. The US Dollar accounts for half of the international bank savings, compared to the euro, which only made up a third. Additionally, American companies like Mastercard, Visa, and Paypal, as well as Chinese companies like Alipay and UnionPay, are the most well-known international companies affiliated with financial transactions. For these reasons, it is still unclear whether the problem of the digital Euro in the Eurozone could be as potent as the US Dollar's current hegemony.

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## Further issues on digital euro

### 4.1 Introduction

In the following chapter there will be a quick report on the impact and possible issues of the application of the digital euro in the European Union. Many people and financial institutions are already concerned by the thought of the digital euro, due to the fact that it may have negative results in the banking system such as a possible bank run. Many non-Euro-supporters have been discussing beforehand about the possible impact of CBDCs on commercial banks and the possible ECB's solutions. Commercial banks have already published, functional CBDC's design choices and focused on successful and secure money transactions. Central Bank currencies are a crucial addendum in the banking sector and have become the starting point for radical changes in the entire financial system. A CBDC like the digital euro could lead to a total change for the function of both the domestic and the global economy. Furthermore, another significant aspect of the digital euro is the identification between the cryptocurrencies. The main concern that most European citizens had, when the ECB announced the first decision for issuing the digital euro, was, how possible is it for the digital euro to become another "bubble" asset like the current "private currencies". Many people criticized the safety of digital euro and thus identified them as other digital currencies they are still unable to know the differences between them. It is commonly known that, both CBDCs and digital other digital currencies use the digital medium for their exchange thus they have the same digital structure. However there have many significant differences.

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### 4.2 Digital euro in banking sector

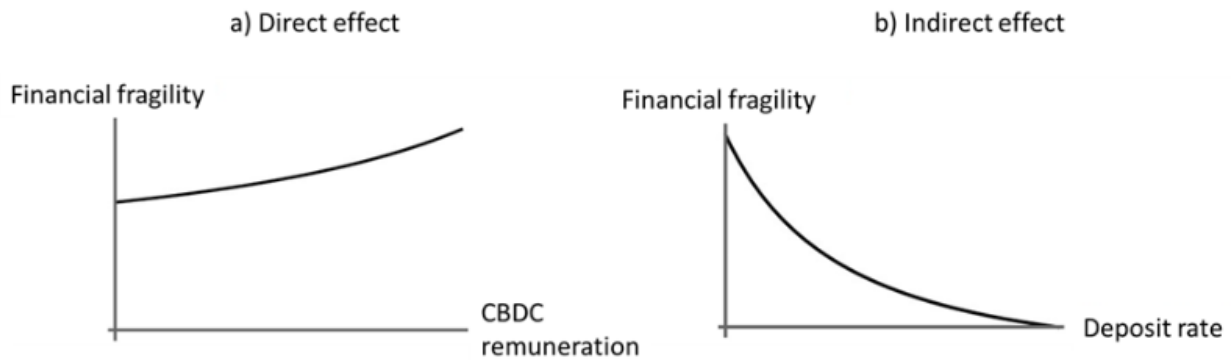
On the liability side, the availability of digital euro could transfer the risk of ruins by withdrawing cash into large amounts of the digital currency. Ahnert et al. (2022) studies about the impact of CBDC remuneration and the possibility of a bank run to be internal, determined by the levels of CBDC remuneration. Depositors could influence the risk of runs through two countervailing economic effects. First, the direct effect is occurred with the remuneration of the CBDC. The digital euro is a secure currency and interest-bearing by ECB. This would work as an incentive for the depositors to withdraw large amounts of cash in digital euro and have an increased consumption in the near future. However, banks in order to come up against with the potential outflow, adapt the deposit contract. In this way, banks reduce the incentive to withdraw early. This is the second indirect effect, which is related with the influence of the digital euro with the interest rates. Commercial bank's reaction may be increase interest rates in order to continue to retain deposits with the issue of the digital euro. This makes the deposits more attractive and thus declines fragility. The total effect of digital euro on bank fragility varies depending on these two effects. With a direct effect, there are higher levels of CBDC remuneration, which reduce the financial fragility and drive to a higher possibility of a bank run. (Lin, 2022). In contrast with the indirect effect, where the levels of CBDC remuneration are lower and there is more economic fragility. In the figure below the two effects are presented:

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**Figure 5: The direct and indirect effect of CBDC remuneration on bank fragility**



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**Notes:** The left chart represents the direct effect of CBDC remuneration on the probability of a bank run, our measure of financial fragility. The right chart illustrates the impact of the bank deposit rate on financial fragility. As bank deposits become more attractive, depositors have fewer incentives to run, decreasing fragility.

In economic theory, there are two explanations of why the “bank runs” may take place in the economy. Firstly, there are the depositors with the notion that all people will react in the same way and the bank will fail, imitate others and withdraw their funds before the completion of their assets (Diamond and Dybvig, 1983). Secondly, regardless of the possibility of an early withdrawal from the depositors, the aggravation of the economic environment in combination with the opportunity of external investment, becomes very important, and may lead to a bank run. (Gorton 1988, Allen and Gale, 1998, 2004). In the CBDC situation, there are many economic theories like the Skeie (2020), where the bank run situation is eliminated by issuing a CBDC. When the depositors have low expectations of the bank system, they transfer their banknotes into CBDC and thus they protect them from a possible bank failure. However, policy makers have already found ways to reduce the run incentives, thanks to the ECB’s ability to honor deposits and issue more and more money, reducing the risk of occurrence. Furthermore, in most of the economies, the trilemma between the efficient allocation of resources, the price stability and



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the traditional role of banks, leading to the possibility of a bank run, is dissolved by the introduction of a CBDC.

### 4.3 CBDC VS Cryptocurrencies

More and more people identify the use of CBDCs with the use of “cryptocurrencies” and believe that, they are the same. Bitcoins, Ethereum, Litecoins and Dogecoins are the most common examples of cryptocurrencies but what they actually are? Before starting to analyze the differences between CBDCs and cryptocurrencies, one must define the nature of cryptocurrencies. Cryptocurrencies are a digital and decentralized token, which is used as a medium of exchange. By the use of cryptocurrencies, people have the ability to buy goods and services and pay the value of them through them and thus they also can use them as a form of investment. According to the historical background, the first well-known cryptocurrency was founded in 2009 by a person with the pseudonym Satoshi Nakamoto and is called Bitcoin. It is titled as “a peer-to-peer Electronic Cash System” and it is recognized as “private” money. Instead of the Euro currency, which is based on trust, the cryptocurrency focused on the cryptographic proof, which is encrypted by the blockchain technology. More specifically, the blockchain (or distributed ledger technology, DLT) is a database, which includes historical records from everything that it was created to store. It is called blockchain due to the fact that, all the information is collected the one on top of the other like a “block”. Adding to the above, the blockchain technology helps cryptocurrencies to record each new “private” money transaction and keep all of them identical and exact. Theoretically, all people, who have the knowledge of blockchain technology are able to mine cryptocurrencies, however in practice it is not so simple, since they require large amounts of energy and computer equipment. People, who want to mine Bitcoins, need nowadays to consume an annual

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rate of 127 tera watthours (TWh), which equals with the annual electricity consumption of Norway in total. Other people, who want only to use cryptocurrencies for their daily transactions need only to buy them from a brokerage platform and add them to their digital wallet. However, the value of one cryptocurrency like the Bitcoin changes each day and it depends on its demand and supply in the market system. As a result, there is extreme price volatility and thus the value of people's digital wallet changes daily. Some advantages of the use of cryptocurrencies are the decentralization ability. Cryptocurrencies are not incurred from any government control or law. There is not any authority to dictate rules to cryptocurrency owners and thus cryptocurrencies come against the monopoly of currencies. Cryptocurrencies have both a high-level security system and anonymity to their transactions. Blockchain technology with their advanced encryption techniques ensure money transactions. Furthermore, people have access to their crypto-wallet for twenty-four-hours without the need to be online. There are no limits to the transaction, people can transfer their money everywhere at any time without the need of a server, since there is a peer-to-peer network to support it.

The reason behind the confusion between the CBDCs and cryptocurrencies is their similar digital structure. Both of them, are created by blockchain technology. This technology gives the ability to store large amounts of data and it is also a significant tool for digital tokens such as the digital currency. However, cryptocurrencies and CBDCs are not the same medium of exchange. Some of the appreciable differences between them are:

- I. Centralization: Cryptocurrencies are centralized currencies without any eligible legal term and there is not any regulatory agency to control their circulatory number within the economy, the security of money transactions and to set its value. In order to be a successful digital currency cryptocurrency, need to be trustworthy. The lack of a

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regulatory system also increases the incentives for illegal activities such as the black-market activity. In contrast with the CBDCs like the digital Euro, which are issued and totally controlled by the European Central Bank. Digital Euro guarantees that there is trust and translucence. In this way there are no anonymous transactions.

- II. Purpose of creation: CBDCs are only a digital version of current fiat currencies, which depend on the monetary policy decisions and are created in order to make digital money transactions easier, while cryptocurrencies are a new currency investment, which could work both as a financial asset such as shares and as a medium of exchange.
- III. Volatility levels: Cryptocurrencies are characterized by their extreme volatility. The value of cryptocurrencies is not stable but occurs through the demand of its exchange. For this reason, many people characterize them as a financial “bubble”, which no one can predict when it falls or rises. However, the value of CBDCs is linked with the current value of fiat currencies in each country. For example, E-Yuan’s value equals with the value of Chinese yuan renminbi (CNY).
- IV. Anonymity: Cryptocurrency’s users are anonymous, since nobody knows with whom is he transacting with, but also which was the number of transactions or other specific details, which make the transaction distinct. On the other side, the digital Euro is controlled by the central bank, which has the total control and knowledge for all money transactions.

Nowadays, cryptocurrencies have become more and more popular to people and more specifically to those who have speculative perspectives and want “fast earnings”. However, cryptocurrencies are not so useful as a medium of

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exchange. According to statistics, the number of daily bitcoin transactions in January 2021 was only 400,000 and Ethereum transactions was more than 1,1 million per day until July 2021. In contrast with the visa transactions, which has an average of 150 million per day. These statistics prove that there is an extremely lower number of money transactions through cryptocurrencies. As a result, issuing a digital euro under the ECB authority could help for faster money transactions, without the need of financial institutions and added transfer costs.

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### Conclusion

Throughout history, currencies played a crucial role in the economy's functions. From the barter system until to the fiat currencies and now to the digital currencies, history showed that, there was an extremely important evolution. The increasing development of technology in combination with the innovation of the internet drove a dramatic change in the way, which people do their daily money transactions. The prospect for the central bank to issue digital currencies, available around the world as an alternative way of transaction, urged the European Central Bank to follow the trend and started considering issuing a digital currency in Europe, which is called Digital Euro. Before the 17<sup>th</sup> century, all exchanges were performed through the exchange of goods like gold, rings and stones. However, this way of exchange was completely impractical, which prompted the creation of currencies. In the 20<sup>th</sup> century, all people had already started using the popular electronic methods like Paypal, Visa and others in order to perform faster and easier money transactions. However, technological innovations did not stop there. In the 21<sup>st</sup> century, the blockchain technology helped for the creation of cryptocurrencies. An anonymous way of transactions without the need of any authority, which worked as an investment. European Central Bank catering the European citizen's needs for a digital medium of exchange, has started the process of issuing the digital euro four years ago (2018). ECB has examined the difficulties, the possible benefits and some alternative scenarios, which are related with the circulation of a common digital currency in Eurozone. After the implementation of digital Euro, European citizens will have the ability to perform safe transactions without additional cost. To conclude, digital euro is a significant development, which will radically change the future of currency exchange around the world.

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