



**THE EFFECTS ON THE MONETARY SYSTEM OF
DE-CASHING AND DIGITALIZATION**

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ABSTRACT

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Digitalization of money has accelerated with the initiative of the private sector to issue digital money. This thesis aspires to present potential changes to the monetary system due to the ongoing digital revolution, and the phasing out of cash. Digitalization, denationalization and competition of money were supported by economists in the last century, and have become a key issue, so a comprehensive literature review was conducted on money, the monetary system and the recent developments towards digitalization and de-cashing, in order to achieve the goal of understanding progress in this area. The results suggest that private currencies issued by social networking platforms may shift the current financial service organization, countries open to large digital networks may be vulnerable to digital dollarization, the direct, and the hybrid central bank digital currency (CBDC) models under discussion may be disruptive for fractional reserve banking. The independence of the central bank may be put at risk due to loss of solvency, but the central bank's ability to invigorate the economy may increase with the elimination of the zero lower bound constraint under the existing terms and conditions. However, as might be expected, shifts in money and payment

systems, the decisions to be taken by the authorities, and the steps to be taken by other economic actors should be monitored closely in an attempt to gain a clear overall understanding.

Keywords: cashless economy, de-cashing, digitalization, monetary system, money.



ÖZET

NAKİTİN AŞAMALI OLARAK KALKMASININ VE DİJİTALLEŞMENİN PARASAL SİSTEME ETKİLERİ

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Özel sektörün dijital para çıkarma girişimi ile paranın dijitalleşmesi hızlandı. Bu tez süregelen köklü dijital değişimin ve nakitin aşamalı olarak kalkmasının parasal sistem üzerindeki olası etkilerini sunmayı amaçlamaktadır. Geçen yüzyılda paranın dijitalleşmesi, ulussuzlaşması ve rekabeti konuları ekonomistler tarafından ele alınmış ve günümüzde ise sıcak gündem konusu haline gelmiştir, bu nedenle hedefe ulaşmak için para, parasal sistem ve dijitalleşmeye yönelik son gelişmeler üzerine kapsamlı bir literatür taraması yapılmıştır. Sonuçlar, sosyal ağ platformları tarafından çıkarılmakta olan özel para birimlerinin mevcut finansal servis organizasyonunu değiştirebileceğini, büyük dijital ağlara açık olan ülkelerin dijital dolarizasyona maruz kalabileceğini, görüşülmekte olan direkt ve hibrit merkez bankası dijital parası (CBDC) modellerinin kısmi rezerv bankacılığı için yıkıcı olabileceğini, merkez bankasının bağımsızlığının kendini finanse etme gücünün kaybı nedeniyle riske girebileceğini, fakat merkez bankasının ekonomiyi canlandırma kabiliyetinin, mevcut şartlar ve koşullar altında sıfır alt sınırı sorunun kalkmasıyla artabileceğini göstermektedir. Ancak tahmin edilebileceği gibi, sonuçların netleştirilmesi için para

ve ödeme sistemlerinde sürececek deęişim, resmi merciler tarafından alınacak kararlar ve dięer ekonomik aktörlerin atacağı adımlar yakından takip edilmelidir.

Anahtar Kelimeler: nakitsiz ekonomi, nakitin aşamalı olarak kalkması, dijitalleşme, parasal sistem, para.



To the Decentralized Future



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LIST OF ABBREVIATIONS

ATM:	Automated Teller Machine
BoE:	Bank of England
BoJ:	Bank of Japan
BIS:	Bank for International Settlements
CBDC:	Central Bank Digital Currency
CIC:	Currency in Circulation
DCA:	Digital Currency Area
DCEP:	Digital Currency Electronic Payments
DLT:	Distributed Ledger Technology
ECB:	European Central Bank
ERM II:	Exchange Rate Mechanism 2 (previously ERM)
EU:	European Union
Fed:	Federal Reserve
FinTech:	Financial Technology
G7:	Group of Seven
GDP:	Gross Domestic Product
IOU:	I Owe You (Document)
OCA:	Optimal Currency Area
KYC:	Know Your Customer
P2P:	Peer-to-peer
PBoC:	The People's Bank of China
QE:	Quantitative Easing
RBI:	Reserve Bank of India
sCBDC:	Synthetic Central Bank Digital Currency
SDR:	Special Drawing Rights
SEK, kr:	The Currency Code of the Swedish Krona
SME:	Small and Medium Sized Enterprises
VAT:	Value Added Tax
XDR:	The Currency Code of Special Drawing Rights

CHAPTER 1: INTRODUCTION

Throughout the history, there has been a progress in the form of money from the concrete to the abstract, and parallel changes have been observed on the monetary system. Thanks to digitalization, money is now becoming virtual and digital. Nowadays, due to emerging digital and unregulated virtual currencies, peer-to-peer (P2P) and instant international value transfer are widely available for the first time. Therefore, digitalization could shift the functioning of the monetary system and ongoing developments could lead to the emergence of competitive private currencies as well as radical changes in the role of fiat currency.

Digitalization of money and cashless society concepts are interrelated. However, as there will be an adaptation process and technological asymmetry between countries towards a cashless society, terms such as "de-cashing and less-cash" have come into use. De-cashing, a term coined by Alexei Kireyev, a senior economist at IMF, is defined as:

“de-cashing is defined as the gradual phasing out of currency from circulation and its replacement with convertible deposits” (Kireyev, 2017).

The abolition of money concept is beside the point with this replacement, but rather it is a decrease on the role of cash and lasting increase on the cashless role, a gradual shift from the cash component to cashless component of currency. Today, some steps taken by the monetary authorities towards de-cashing are as follows: demonetization of large notes, establishing working groups on central bank digital currency (CBDC), approval of stablecoin use for chartered commercial banks, limitations of cash on transactions and the carriage.

Considering the numerical data and the recent news flow, it is observed that the importance and use of cash is declining each passing day (Carstens, 2021). The volume of cashless transactions has risen dramatically in recent years due to the use of digital technologies and developments, almost doubling globally from 2014 to 2019. Moreover, demand for online payment systems has increased as online payment service providers have begun to offer a frictionless experience to users during the

recent years. In 2019, cashless transactions reached to 708.5 billion as is seen in Figure 1 and grew more than 14% which is the most in the past decade because of the increase in both supply and demand (Capgemini, 2020).

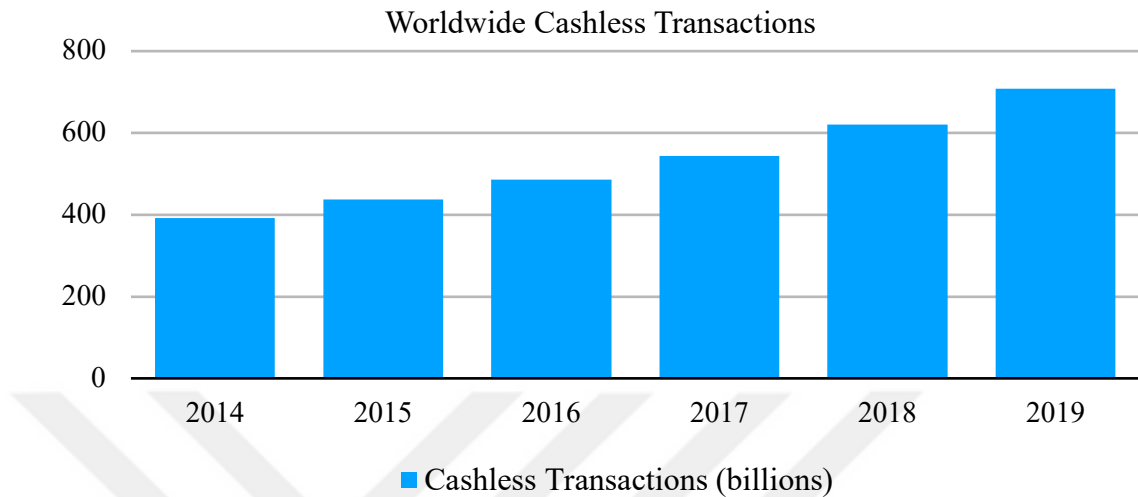


Figure 1. Worldwide cashless transactions, from 2014 to 2019

Increasing cashless payment options and network effects in the digital economy create intense competition among both public and private issuers of digital currency. New players have begun to enter the field, issuing digital currencies; these include issuers of blockchain based cryptocurrencies, J.P. Morgan and Facebook, Inc, etc. In particular, Facebook, Inc. announced launch of its stablecoin project called \approx Libra (renamed to \approx Diem) in June 2019 (Libra Association, 2019). In reaction, G7 set up a working team led by Benoît Cœuré who is currently head of the BIS Innovation Hub to work on stablecoins (Zhang, 2020). Moreover, monetary authorities see the spread of CBDC as an opportunity to switch to a publicly available, and accordingly, more secure alternative to paper currency (Carstens, 2021). Last but not least, since distance has become the key term, people have begun to be interconnected with the digital world more than ever before. The switch to contactless payments has accelerated due to the coronavirus outbreak.

In line with the digitalization and unprecedented events, the rise of cashless society cannot be ignored, and is likely to continue in the future. Although there is a burgeoning literature on the effects of digitalization and de-cashing on the monetary system (Rogoff, 2014; Brunnermeier, James and Landau, 2019; Fiedler, Gern and

Stolzenburn, 2019), to the best of my knowledge, there has been no investigation of the potential effects of alternative monetary structures. In order to clarify the relationship between digitalization of money and its effects on the monetary system, recent developments in digital currencies should be pursued closely because it is still ambiguous whether the digital currency will dominate paper currency and if it does, it is not known which digital currency will dominate. Therefore, there is an ambiguity regarding the structure of the monetary system in the future. Moreover, these alternative models may be affected by individual countries' resistance or support for this technological adoption. Therefore, it is of crucial importance to address the effects of digitalization on different countries.

The ongoing digital revolution could lead to an entirely cashless future and fundamentally change structure of monetary system. In relation to this, this thesis aims to answer the question of "What are the effects of ongoing digital revolution in money and payment systems on the monetary system?" In order to do so, the thesis is structured as indicated below.

Institutions and concept of money are the main topics of Chapters 2, 3 and 4. In Chapter 2, money and monetary system are described and new concepts are explained, such as digital currency area (DCA) and digital dollarization, which digital transformation has just brought into use. Besides, how these new concepts establish currency competition and how this competition differs from the traditional one are discussed. Chapter 3 highlights technical forms and potential emerging models of CBDC which is considered as the next form of fiat currency by consensus. Possible implications of these models on the fractional reserve system are discussed. Chapter 4 investigates how far zero lower bound problem, which is an important constraint in the implementation of monetary policy today, could be overcome within a cashless economy, while drawing the potential direct and indirect implications of the cashless economy for monetary policy undertaken by central banks.

Chapters 5 and 6 discuss implications of less-cash society. Institutions and concept of money come to the fore in the previous chapters, but mainly relevant implications on less-cash society thereafter mentioned. Chapter 5 scrutinizes the potential costs, benefits and concerns that arise from the less-cash economy for society. Chapter 6

examines “how cultural differences put up resistance or give a boost in the adoption of the digital economy” and by way of an answer, compares Germany and Sweden, two European countries that are very different in terms of payment culture. Chapter 7 concludes the thesis with a conclusion summarizing the results.



CHAPTER 2: MONETARY SYSTEM & DIGITAL TRANSFORMATION

2.1 Money

Money is a common reference point within all economic activity in the broadest sense, regardless of what form it takes. It is one of the fundamental social bonds in a society comprised of competing individuals. Besides the general acceptance of money, it requires a social relationship, because money as a representation or as a materialized commodity facilitates possession transfer, and directs the labor of the individuals either directly or indirectly. Furthermore, money brings a new dimension to this aspect when it becomes a liability of an issuer and an asset of a holder; therefore, institutional arrangements for its management are an indispensable part of social regulation to govern the economy (Weber, 2018).

Money is basically defined as anything that can be accepted to pay for goods and services or pay off debts. Paper currency and coins fit the definition of money (Mishkin, 2016). In the next sub-section functions of money will be discussed.

2.1.1 Functions of Money

Money is in use for payments of goods and services, and is primarily known by its three principal functions which together, distinguishing money from other assets. Firstly, money acts as a *medium of exchange* refers to any broadly accepted item that eases the exchange of goods and services. Secondly, it functions as a *unit of account*, the value of goods and services are measured in a specific monetary unit to allow the accurate comparison of values. Finally, it performs as a *store of value* for later use, enables people to extend their purchasing power over a period of time.

Medium of exchange, as the most distinctive function of money, facilitates trade between parties, and eliminates inefficiencies of barter, that is, the inherently restrictive direct exchange of goods and services without any pecuniary mean. Therefore, improved means were necessary in order to facilitate exchange. The

fundamental problem is related to the bartering was *double coincidence of wants*, which is an economic phenomenon where one party has to seek out another with a good or service seeker wants, and is willing to offer the good or service in demand. Besides, the time spent on searching a match is considered as a transaction cost (Mishkin, 2016). Therefore, double coincidence of wants and transaction cost were eliminated through the invention of money.

Money may lose its appeal in an economy if it fails to meet its any of its functions. Thus, it could be replaced by a substitute for the function it does not fulfill. For instance, depending on economic environmental factors, firms, individuals and governments tend to use gold or foreign exchange as store of value while they keep fiat currency or any other commodity as medium of exchange and as unit of account, especially in conditions of high inflation when the instability of the local currency breeds uncertainty.

2.1.2 Brief History of Money

Money is as ancient as the human civilization, and like civilization itself, develop through trade, conflict and discovery. Existing banknotes and coins are simply forms of money in actual use, but money in its present form, is different from the money of the past, and the money of the future.

2.1.2.1 Barter

Since trade between people predates written history, any information about how money firstly developed is based entirely on logical assumption. Barter is the oldest known inherent action of commerce and subject to the relative values affair of negotiation. The direct exchange of goods for mutual benefit is specific to symbiotic relationships between plants, animals, and insects. It is therefore not surprising that barter predates recorded history (Davies, 2002).

2.1.2.2 From Commodity Money to Fiat Money

A commodity is an object that has an intrinsic value as an input to generate goods or services. Commodity money is primarily known as a medium of exchange that can be transformed into a commodity, also and is beneficial in production and consumption. The acceptor can continue using it as a medium of exchange, so does not necessarily need to consume or transform it. For early and primitive societies' general patterns of commerce, it is not easy to characterize these, or specify which particular commodity would be commonly accepted. Nonetheless, a great variety of commodity monies have been reported, such as cowrie shells, cocoa beans, cigarettes, alcohol, wampum, salt, furs, rice and so on (Velde and Weber, 2010). Common features of these items are that they are widely desired, durable, portable, and storable. Money made up of precious metals, such as gold and silver, is relatively advanced commodity money.

In the process of time, money appeared in Mesopotamia during the third millennium B.C. for the first time in written records. In the region, merchants used to exploit silver as a standard of value to balance their accounts, showing that the society had a sophisticated financial structure. However, it is not possible to say that cash was widely used, as it was specific to merchants. In the seventh century B.C., the world's first standardized coin was invented by the Lydian Kingdom in present day Turkey. This standardized metal coin was made of a gold and silver alloy called Electrum. One coin was similar to another. Unlike barter items, these coins did not decay and were much easier to carry around and thus trade flow was facilitated. The kingdoms established the authority of the state by stamping their emblems on the coins they minted just as modern governments do. Other kingdoms adopted Lydia's model, so metal coins began to be found around the Mediterranean region (Surowiecki, 2012). These coins resembled those in circulation today, they are fiat and if the coin is fiat money, it does not retain its value when it is melted down or physically changed, while commodity money retains its value and the precious metal can be applied to non-monetary uses.

Paper money was first experimented with in China during the 11th century, and in the 13th century, the visionary emperor Kublai Khan courageously decided that the money would be in a paper form to overcome the problem of the number of different regional

coins in use in the empire. Then, when the Italian merchant Marco Polo visited China, he was amazed at the landscape of people exchanging their labor and goods with pieces of paper created seemingly out of thin air (Surowiecki, 2012). This incident showed that it is not what the form of money is, or even what it is backed by, but that it is sufficient for it to be recognized as money to be under the regulation of an authority, and the authority imposed on the people. The perception also constitutes the basis of the fiat money system that dominates today's monetary system. However, paper money was abolished by the early 15th century due to hyperinflation during the Ming Empire. 700 years after the beginning of this experiment in China, with Marco Polo's introduction of paper money to Europeans, it appeared in Europe for the first time in Sweden. The Bank of Sweden was given the privilege of accepting deposits, providing loans and mortgages and issuing bills of exchange in 1656, so it was also the first public and chartered bank to issue banknote in Europe, which started in 1661 (Davies, 2002). As a result, shift in perspective of money as commodity began with the adoption of paper money across the world.

In 1775, Continental Congress issued 'continentals', referring to paper currency, in order to fund military expenses during the American War of Independence. These notes were backed by gold on paper, but issuance of continentals far exceeded gold reserves, and counterfeiting activity of British agents rapidly devalued them to virtual worthlessness (Glaser, 1968). Consequently, for a while, the use of any currency other than gold and silver coins was prohibited by the U.S. constitution, whereas in 1862, Congress passed the law allowing the government to issue paper currency during the Civil War (Surowiecki, 2012). This legal tender is called 'Greenback', backed by the U.S. government rather than any commodity.

The Bank of England (BoE) adopted the gold standard that also became key criterion for other developed countries in 1821. Until World War I, the world economy was conducted under the gold standard, a monetary system in which most countries' currency is directly convertible to gold at fixed rates, thereby exchange rates between currencies are also fixed. In short, the system was based on converting notes into gold upon demand. Although the gold standard brought stability to prices as intended, its main problem was that monetary policy was heavily influenced by gold supply. In

periods of low gold production and discoveries, it brought uncontrollable deflation, and vice versa (Mishkin, 2016).

From 1918 to 1939 the money standard of the interwar years was vague because there was no consensus across countries. Most governments set aside the gold standard for military spending, so they had simply printed money and caused hyperinflation. The Great Depression shelved this monetary system forever, although some tried to revert to the gold standard (Surowiecki, 2012). In 1944, the Bretton Woods agreement was signed, and this system maintained a variation of the gold standard for a while, but with a difference; all currencies were pegged to the U.S. dollar and the U.S. dollar itself became convertible to gold. However, the amount of dollars in existence increased while the U.S. gold reserve shrank as more countries demanded gold from the U.S. government. The former president of the U.S., Richard Nixon, officially announced that dollar would not be convertible to gold anymore in 1971. Since Nixon decided to unlink the U.S. dollar from gold, a system of fiat money has come to use.

What we predominantly call money today is fiat currency, which means that it is not backed by a physical commodity or convertible foreign exchange, and that, without intrinsic value, it derives its value from the government and people who trust the state. Besides the physical disadvantages of fiat currencies such as the difficulty to store in large amounts and impossibility to transfer it P2P internationally, its one major drawback is that the reliance on fiat currency enables governments to issue unlimited money, giving them enormous power.

2.1.3 Money in a Broader Sense

A relevant distinction is drawn between outside and inside money in monetary economics. Outside money is money that, regardless of whether it is pegged or not, originated outside the private sector, and that is not in zero net supply within the private sector. If fiat currency is picked for outside money example, it is not seen as a liability on balance sheet of any private issuer, so is a net asset for the private sector (Lagos, 2006).

In contrast, inside money is originated in the private sector and represents an asset

and a liability that serves as a medium of exchange. Inside money is in zero net supply within the private sector because it is the liability on balance sheet of issuer, while at the same time, another person's asset (Lagos, 2006). Today, most of the money in circulation is inside money because both hardware and software-based e-money and bank deposits that are issued by private institutions belong to this group. Typically, inside money could be converted to another monetary equivalent upon request, and an inside money bearer obtains a residual claim on the issuer's assets, because inside money represents a claim on a private issuer in case the issuer goes into default.

2.2 The Structure of Monetary Systems

Monetary systems are conventionally built around at least a reference point that might be called a reserve or an anchor, and could be in any form, such as a commodity, commodity backed money or fiat money. Entire instruments of payments are in some way connected to a fixed quantity of the reference point, for example, silver as a commodity money, gold certificates as a commodity backed money, and dollar as a fiat money. Today, the international monetary system is dominated by fiat money that is a government issued currency.

The barter system played an important role in the formation of a monetary system requirement. Barter is based on direct trade of services and resources for mutual benefits and is considered a primitive form of exchange. Therefore, in many ways, history of barter is ancient. Yet, this inherent action still exists (Davies, 2002). Although barter does not have the characteristics of money, purpose of it resembles money in many respects, and is important to mention because it has great impact on evolution of money, and thus, the monetary system.

In addition to facilitating trade off, money requires management. A monetary system is the set of mechanisms usually controlled by a government in order to issue money within a particular economy. The current system is mainly composed of the central bank, commercial banks, and national treasury as well as the mint, an industrial establishment which manufactures coins for current use. As a matter of fact, deposit banks issue the digital money by providing loans. In other words, not only the central bank, but commercial banks can also be said to issue money. Furthermore, a money

hierarchy could be considered when defining monetary systems. There are two extremes, anchor, a reference point that is currently fiat money at the top, and at the bottom, credit. Broadly, in a fiat money system, there is no form of commodity as the basis of anything. Therefore, in the current monetary system, the most valuable thing is base money (also called reserve and high-powered money) directly under the supervision of central bank. The illiquid forms of money, such as bank deposits, is called near money. Even if near money has the same nominal value, base money is at a higher level in money hierarchy.

2.3 Currency Competition

Currency competition sounds new, especially with the advent of cryptocurrencies, but has always existed. In particular, commodities such as gold and silver were in fierce competition with fiat currency as alternative money in the past. Nevertheless, the dominance of fiat currency is unquestionable, and for a long time a competition of fiat currencies has been witnessed, with new competitors tending to join (Raskin and Yermack, 2016).

Recent developments in FinTech (financial technology), a term used to define recent technology that seeks to improve traditional financial methods in the delivery of financial services, are the emergence of blockchain, ongoing projects in decentralized finance, and rise of P2P platforms. These features have brought renewed interest in the topic of currency competition. Moreover, currency competition has become a key issue since 2019, after the reaction of major central banks to announcement of \approx Libra (rebranded to \approx Diem), a blockchain-based stable digital currency planned to be issued by the social media giant with the billions of active users, Facebook.

Even though effectiveness of governments on the money supply is controversial, there has been a consensus over the notion that monetary policy should be controlled by government, and that every single country must constitute own monetary system. Thus, this notion has been brought up to date, both in practice and thought. According to Austrian-British economist and philosopher Hayek (1990), there is no difference between money and other commodities, so it would be better if a competitive environment is created by way of privatization in place of government monopoly for

money supply. Only in this way is the government prevented from manipulating the supply of money, and a step is taken to prevent the instability raised by government-controlled money supply. As a result, currency competition among private and public might encourage the government to issue a “better” currency and ensuring market discipline in monetary policy practices.

Traditional currency competition varies from the current one. Even if a new entrant into the market succeeded as a reliable store of value, it was also required to raise the standards as a unit of account, and be recognized as a medium of exchange at the same time. In traditional currency competition, the system was used to force participants to work with to the principal currency, while the cost of switching was disadvantageous. The major social and commercial digital networks establishing international connections have changed the criteria for fulfilling all the properties of money by succeeding in disseminating information at very low costs. As in the case of Facebook's \approx Diem (formerly \approx Libra), the huge number of users on these platforms allows platforms' managers to introduce their own currency to the market. This situation partially clarifies the reaction of several major central banks to the announcement of Facebook. In today's digital environment, international instant transfer is possible with lower switching cost through P2P networks, mobile devices and interbank models. Therefore, digital developments play an important role in the unbundling of money functions and thus promoting currency competition, e.g., one currency may be stronger in one function over that function of another currency, depending on the situation, one can be preferred to another. (Fiedler, Gern and Stolzenburg, 2019).

2.3.1 The Unbundling of Money Functions

Traditionally, currency competition had been deterred for two main interconnected reasons. The first is due to the presence of strong network externalities, so whereby the value and adoption reason of a specific currency to a user hinges upon how many others regard it similarly. The necessity for a unit of account inherently causes network externalities. In other words, the decision whether to use a specific currency depends on how many other p users there are. Secondly, switching costs can be a reason that also leads to network externalities, the high transaction costs had made it difficult to

switch between different currencies, reducing the appeal of other currencies, it compelled people to make transactions with the currency used in practice within their area. Therefore, currency selection or keeping behavior could not only be explained by subjective factors such as speculation purpose or posing monetary stability, so ignoring the switching cost and network effect previously caused misconceptions. (Dowd and Greenaway, 1993).

For two main reasons as mentioned above, the competitor currencies had to serve three primary functions of money at first. The most critical determinant is to be used as a unit of account by large masses, to be accepted as a medium of exchange in the same direction even if it is a favorable to be kept as a store of value. Furthermore, just because it was extraordinary for users within a currency area or border to adopt a new currency, it would be very difficult to dismiss the existing and adopt the new one, even if the entrant currency was far superior in meeting all functions, so there was no room for any privately issued currency.

The internet provides the infrastructure on which both social digital and commercial networks may be constructed, e.g., Facebook is a social network that has currently over 2.6 billion interconnected active users monthly, and Amazon has an ecosystem where various products are offered for sale. These networks succeed in spreading information global masses almost instantly, at very low cost, which removed borders. Modern technology ensures that information is stored, received and sent, and information is converted into the appropriate form between peers. Given the reduced switching cost and existing network effects, this opportunity contributes to the possible the unbundling of money functions. As currency switching is now easier and its cost is lowering, the requirement to use the same currency to meet all the functions of money has been remarkably reduced. For instance, in this context, a currency can be preferable in the function as unit of account that can be used for general use or for comparing the value of different currencies with each other. At the same time, another currency offers a strong in the role as store of value that makes it preferable, while a currency can be especially favored in its role as a medium of exchange due to its facilitation in a large social or commercial networks. (Fiedler, Gern and Stolzenburg, 2019). Therefore, it is seen that currency competition differs from traditional competition because it takes place in digital networks at the present time, so these

networks have minimized frictions, and this weakened the factors that hinder currency competition. As a result, the unbundling of money functions reduces the dominance of particular currency. Thus, it causes an intense competition between currencies.

Additionally, social and commercial platforms, which have begun to become more prominent in the financial system, hold data and payments, can also lead to shift in the current financial organization, as illustrated in Figure 2. The way consumers store and exchange value through banks, and organize around it, approximately describe how the current financial organization and the financial organization in which banks are located at the center could be shifted when considering a platform-based economy. As the payments may take place on any platform, the contact point of the consumers will be the institution that manages the payment platform, including social networks or e-commerce, etc., instead of a bank. In this type of financial organization, banks may be also replaced by FinTech companies (Brunnermeier, James and Landau, 2019).

Section A: Current Organization

Section B: Developing Organization

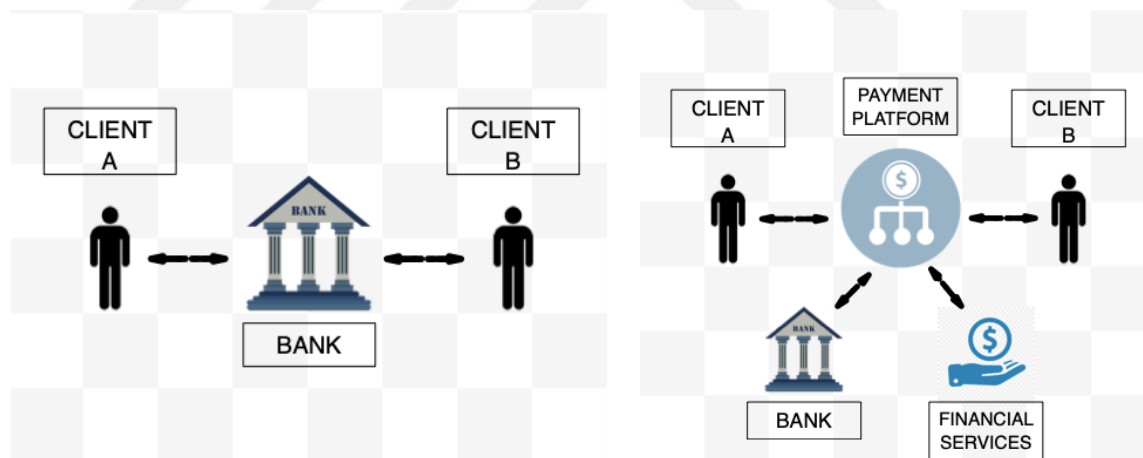


Figure 2. Potential alteration in the financial organization

2.3.2 Digital Currency Areas

New connections and boundaries are created with the payment systems development of transnational commercial and social platforms. Thus, the international monetary system can be redefined by digitalization of payment systems. In addition, digitalization can contribute to the upheaval of new international digital currencies that

are in line with the advantages and requirements of the era. This formation also enables the crossing of the boundaries of traditional optimum currency area (OCA) as it expands the economic interaction networks.

Canadian economist Mundell (1961) developed OCA theory, which stands for a particular area regardless of whether it has national borders or not and the main idea of the theory is that economic efficiency could be increased by using the same currency within this area. The Euro currency used by some EU countries to some extent meets this theory. Thanks to this, it is possible to keep the money on mobile devices and to remit across borders without intermediaries through P2P networks. Because of these developments, barriers that are used to being part of traditional currency area description may vanish.

Digital currency area (DCA) concept has been recently introduced by Brunnermeier, James and Landau (2019). They define it as a network where execution of payments and transactions are made digitally by using money specific to that network. DCA's specific currency can be both an independent currency that provides its own unit of account and a dependent currency that uses fiat or other independent currencies as a unit of account that usually stands out with its medium of exchange feature. For instance, Facebook's \approx Libra's unit of account is derived from a basket of major reserve currencies, and this stable digital currency remains different from each single currency. This approach of \approx Libra's developers is similar to what is used by the IMF in the SDR valuation. On the other hand, as in the case of Ant Financial that is formerly known as Alipay, on this type of network, the currency used by citizens of particular network is limited only to transactions and exchanges within the network.

DCAs are similar to OCAs in terms of increasing trade by facilitating it, but they are fundamentally different from each other. An OCA is often related to geographic proximity and the economic actors in the OCA leave the exchange rate as a means of adjustment. In response, that means the ability to move sufficient factors of production and coalition of macroeconomic shocks. OCA architecture is focused on the power of a monetary authority to soften shocks in the market. In contrast, digital mutual attachment holds DCA's together. Even though the issuer of particular DCA's currency is under the surveillance of regulatory authority, the main attention is not the role of

the monetary authority. DCAs' target is to get the edge on complementary activities and data connections that occur in the ecosystem of a digital network. Strong monetary connections improve, when economic actors use the same form of currency, whether it is independent or not. Depending on the structure of DCA, conversion to other payment instruments may be less possible or technically impossible. Price transparency and discovery are relatively better within the network because these strong monetary connections encourage users to voluntarily keep to the network's currency (Brunnermeier, James and Landau, 2019).

The regulatory framework and privacy issues come to the fore when the competition is considered linked to DCA. Firstly, the activities of networks could be limited by unlike regulatory frameworks because the approach of each country differs, so unfair competition could occur on DCAs. Nevertheless, anonymity and unmediated P2P transactions on digital networks increase day by day, that is to say, somehow the prohibitor feature of regulatory frameworks diminishes with reduced adherence to them. Secondly, DCA's currencies can position themselves differently based on how their network users manage their data. Some networks give importance to protecting the privacy of their users, while others choose to use or even sell their users' data. This is often related to network externalities, large networks usually cooperate with governments and tend to exploit user data, whereas small networks tend to attract users by positioning themselves differently about privacy.

2.3.3 Digital Dollarization

The adoption of the currency and exchange rate target of another economy is called dollarization in the most general sense. Dollarization is also a different type of fixed exchange rate regime, but differently, there is a stronger commitment mechanism than that provided by a currency board that is a monetary authority which is responsible to retain a fixed exchange rate with a foreign currency. The currency board can be removed, and the value of the local currency can be changed, but it is impossible to change the value with dollarization because value of foreign currency is the same regardless of where it is circulated (Mishkin, 2016).

This phenomenon could occur in different ways, for example, using the domestic

money as a medium of exchange while keeping foreign currency as store of value and unit of account is one option. Constant rise in inflation rate could be given as a reason because decrease in purchasing power push households, firms and even governments to use foreign currency as a store of value. This phenomenon is typical in developing and least developed inflationist countries in some cases. After the devaluation of the Brazilian Real in the late 90s, the issue of the adoption of another economy's currency by the Argentine authorities was discussed, and in 2000 the dollar was adopted by Ecuador. The most obvious advantage of dollarization is the elimination of any attack on the domestic currency. Dollarization may seem as an attractive monetary regime at first considering the financial turmoil in emerging market economies, but there are costs besides the benefits. This also means giving up seigniorage rights because a country that uses foreign currency as legal tender gives up the right to issue its own legal tender, which would benefit its monetary authority. Thus, the country is deprived of seigniorage income, which might be used to indirectly purchase income generating assets such as bonds. In addition, the ability of its monetary authority to respond to economic shocks substantially decreases because the conduct of an independent monetary policy would be lost (Berg and Borensztein, 2000).

The phenomenon of dollarization takes on a new dimension when it comes together with the digitalization of money. Today, there are new strategies in order for a currency to become an international reserve currency and to gain use. Economists attribute the current dominant position of the U.S. dollar to its volume, its full and unconditional capital convertibility and depth and liquidity of the U.S. financial markets. The idea that transnational reserve currency status could be obtained through commerce suggests that digital networks can be another tool to internationalize a currency. The idea emphasizes entirety in the invoicing patterns, since traders purchases are invoiced in one currency, they also want to invoice in the same currency to maintain their purchases frictionlessly. Therefore, exporters and importers are attracted to invoice their sales in the currency they trade in order to facilitate funding. Moreover, one of the main reasons for the very large volume of the dollar invoicing is the growing demand for seeking safe deposits in international trade (Gopinath and Stein, 2018).

Digital networks are good at developing an international exchange environment, providing new possibilities and augmenting an international means of payment. In a

platform-based economy, invoicing in the currency of the platform is attractive similar to the international trade example above. Countries that adopt DCA integration can increase the international acceptance of their currencies and so that large platforms and their home countries would take an advantage in this regard. On the other hand, other countries may face more intense currency competition from foreign currencies through cross-border payment networks. Domestic currency is used both as a medium of exchange and as a unit of account in cross-border systems at the present time, but this situation might change. In particular, an independent DCA specific currency (such as \approx Diem) can provide a special unit of account for people in many different countries. Moreover, it might increasingly penetrate to economies where significant numbers of users are located when supported by a strong network. Small economies with high and unstable inflation that are prone to dollarization and that are open to large digital networks will be vulnerable to digital dollarization. (Brunnermeier, James and Landau, 2019).

CHAPTER 3: IMPLICATIONS OF CBDC FOR FRACTIONAL RESERVE BANKING

3.1 Central Bank Digital Currency

Changes in economic activity have been observed in all areas of life by digital transformation. Nowadays, people also expect efficiency and convenience in financial services, and mainly private companies have taken the first steps to satisfy this expectation. The use of cash decreases with each passing day, with the increase of innovative payment systems. Many central banks and other monetary authorities responsible for monetary policy are currently focused on a new digital currency, named central bank digital currency (CBDC), to meet to these expectations and to maintain monetary autonomy.

CBDC is used for expressing various concepts, but in fact it does not have a satisfactory definition by virtue of its uncertainty. Nevertheless, the general view is that CBDC is the new, digital, form of fiat money. CBDC is a liability of the central bank, so it is obligated to meet the functions of existing fiat money if challenges are left aside (Ward and Rochemont, 2019). As of 2020, the Central Bank of the Bahamas became the first in this respect and issued the digital Sand Dollar, and no other CBDC has been launched on a large scale yet. CBDCs have been analyzed for its pros and cons by academicians, staff of central banks and monetary reformers because cash gradually disappears, and authorities are under the threat of a comprehensive loss of monetary control (Bindseil, 2020).

Cash is defined as legitimate circulating banknotes and coins that can be accessed by all economic actors in the economy. Bank account money is defined as electronically recorded deposit account liabilities in the books of commercial banks, accessible by all money users who have bank accounts. Reserve currency is defined as electronically recorded current account liabilities in the books of central banks that accessible only by users who have central bank accounts (Bjerg, 2017).

Bjerg (2017) defines CBDC in relation to three kinds of money: cash, reserve

currency, and bank account money, that together constitute the current monetary system. As is seen in Figure 3 (the Venn diagram), CBDC has three common characteristics: it is central bank issued, globally accessible and electronic. First, cash and bank account money have global accessibility, but reserve currency does not. Second, both cash and reserve currency are issued by the central bank, but the creation of bank account money is not in this group. Lastly, while reserve money and bank account money are electronic, cash is not. In this regard, CBDC is described as central bank issued digital currency; it might be accessed more extensively than reserve currency, it might have much more functionality than cash for retail transactions, it might also have a different operational structure than the conventional central bank currencies, and distinctly, it might be both positive and negative interest bearing (Kumhof and Noone, 2018).

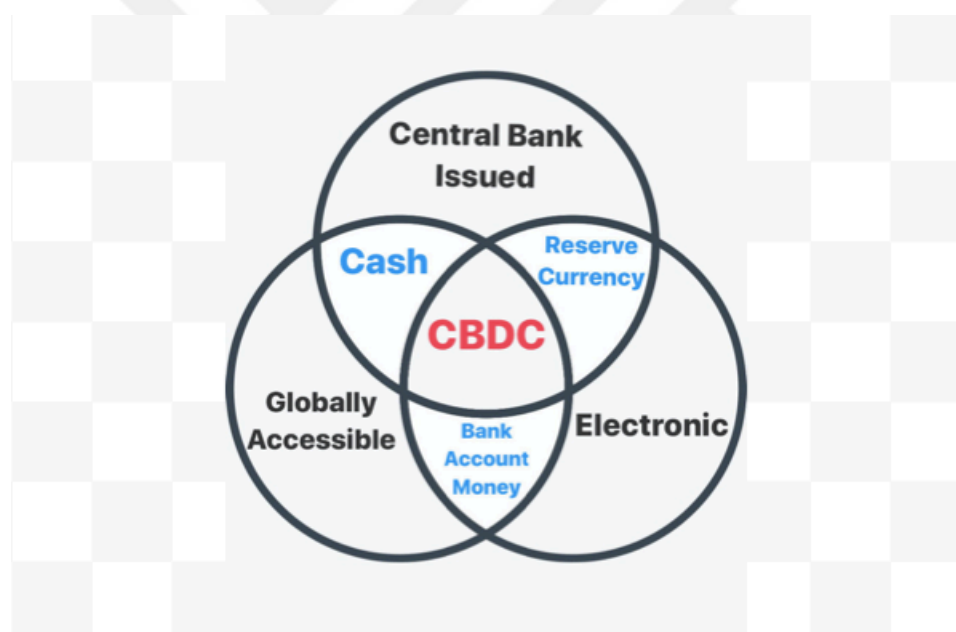


Figure 3. A taxonomy of currency

Digital currencies that close a significant gap have become a subject closely followed by central banks and governments. Therefore, central banks started to deal with the digital versions of their physical fiat money. The former managing director of the IMF and the current President of the European Central Bank (ECB) Christine Lagarde stated that considering the recent developments we have seen, we see those works on stablecoin projects, which are unlike the Bitcoin segment, and it would be better if we

were beyond of this era because

“there is clearly a demand out there that we have to respond to.” (Twitter, 2019).

It is apparent that not only the ECB, but also others, mainly the Riksbank, and the People’s Bank of China (PBoC), are closely interested in digital currency projects. However, none of the major central banks have put their digital currencies into circulation yet. Scheduled CBDCs to be issued are currently on the research agenda or on the pilot phase.

3.1.1 Potential Technical Forms of CBDC

In the recent decades of old monetary system, the currency issued by the central bank is offered as either cash or reserve. However, a new dimension might be added when a potential digital currency is offered by a monetary authority. CBDC might be implemented in two technical forms: as account based, and as token based. The main distinctions between these are the verification process and the degree of anonymity. Existing bank deposits and reserve balances are account based, whereas e-money, banknotes, coins and cryptocurrencies are examples of token-based form.

One option is for the central bank to issue account-based currency that would be in digital form. In this choice, funds of both corporations and individuals would be kept in CBDC accounts at the central bank and the depository institutions. The central bank or empowered intermediary institution would carry out the transactions by debiting the payer's account and crediting the payee’s account, so it has a centralized structure in Figure 4; except for the cost of initial each CBDC account creation and maintenance fees, this choice would be cost-efficient. This approach is relatively secure because suspicious financial transactions or unusual activities could be easily monitored by a monetary authority. However, this approach could lead to privacy concerns because to reveal identity of both payer and payee in order to authenticate a transaction is required (Bordo and Levin, 2017).

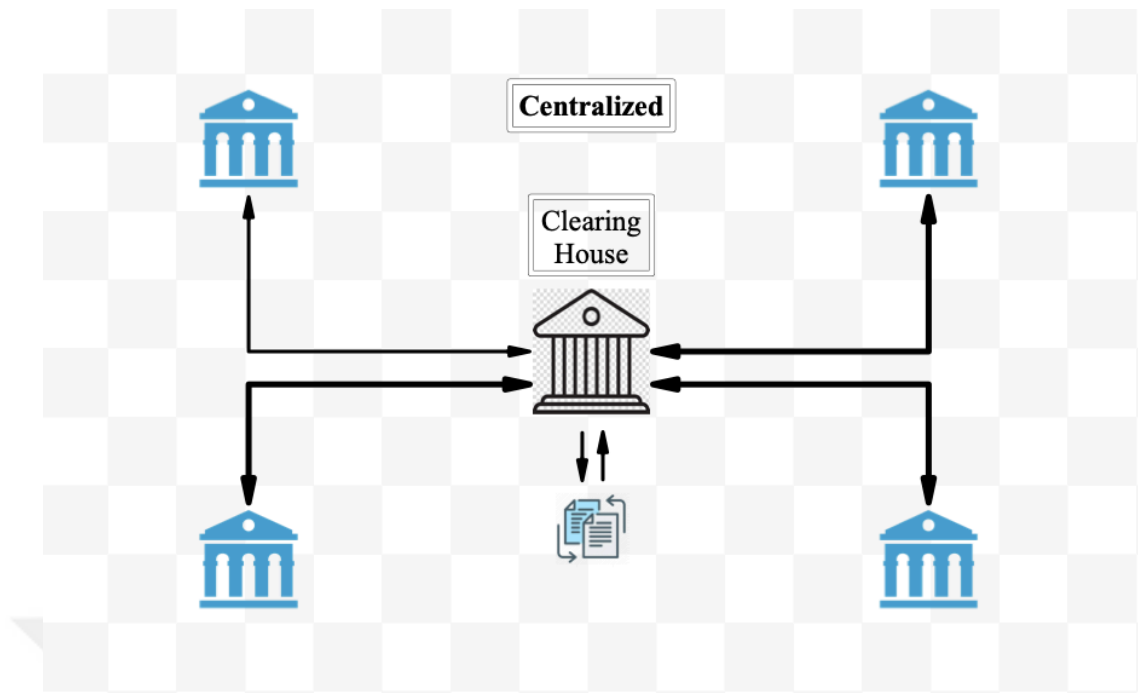


Figure 4. Centralized model

Another option is for the central bank to issue token-based currency, which would serve as legal tender and circulate in an untraceable or semi-traceable manner. It might be occasionally redeposited at the central bank or to intermediary institutions for some purposes such as charging interest and exchanging foreign currency, etc. This option would benefit from a kind of encrypted distributed ledger technology (DLT) that is decentralized, as shown in figure 5, because verification and authentication by a central institution are not required as in the case of blockchain technology. Token based currency would have anonymous features just as in the case of paper currency because it is not required to reveal identity of both payer and payee for authenticating a transaction. Nevertheless, implementation of transparent procedures to the DLT for traceability in former digital currencies has proven to be unsuccessful (Bordo and Levin, 2017).

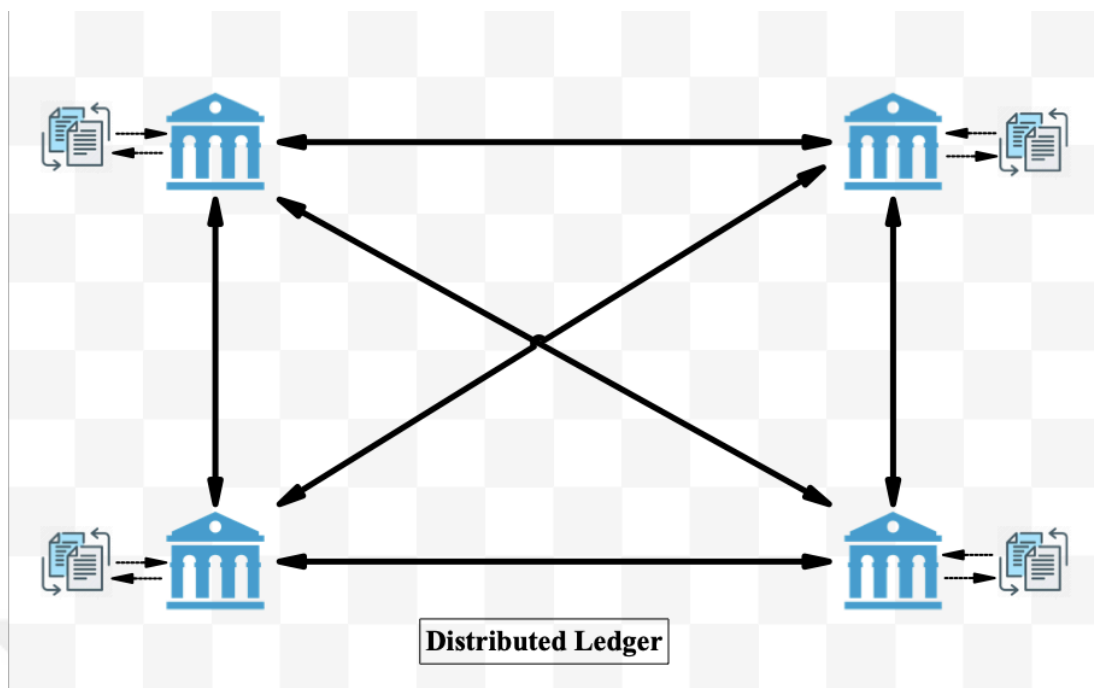


Figure 5. Distributed ledger

Parallel to the increasing interest of central banks' digital currency issuance, the Bank for International Settlements (BIS) conducted research in late of 2019 and in first quarter of 2020 on how CBDC will be implemented under current conditions. Researchers have mainly focused on how the central bank might manage its operations and technological design of CBDC. As a result, inferences have been made on three potential CBDC structures: direct, indirect and hybrid. These are based on two technological experiences: wholesale and retail. In this context, retail and wholesale experiences as their name implies, vary in the distribution of CBDC. The distribution of wholesale CBDC is relatively limited because it is likely to be accessible only to commercial banks, clearing houses and other intermediary institutions similar to the current traditional relationship. The existing circulating e-money represents a claim on an intermediary institution, so it cannot be regarded as the equivalent of cash. The distribution of retail CBDC is likely to reach a larger community, and might include individuals, small & medium sized enterprises, and corporations. In the case of this type of distribution, it will represent a claim on a central bank, as with today's banknotes.

Based on the two experiences stated above, these three potential CBDC structures are issued and redeemed only by the central bank. Additionally, all might be run on either

account or token-based infrastructures. The fundamental differences are the statutory claims and the registries kept by the central bank. The direct CBDC model gets its name from the representing the direct claim on the central bank that keeps a registry of entire balances and keep them up to date with every transaction. In the indirect CBDC model, the central bank solely tracks wholesale accounts, so consumers have a claim on intermediary institutions. The hybrid CBDC model stands for an intermediary solution that allows intermediary institutions to facilitate and manage transactions while users have direct claims on the central bank (Auer and Böhme, 2020).

All three approaches have their own advantages and disadvantages. Firstly, the direct one may initially seem advantageous because of its non-complicated architecture. However, this system's velocity and efficiency are reduced because it eliminates dependence on intermediaries. General acceptance assumes that it will be better if the technical capacity of such a large scale is built and run by the private sector, as experienced in today's electronic banking system. More crucially, customer relationship and assessment is subject to *know your customer* (KYC), which is very distinct from the current operations of the central bank, has an important role on the credit cycle that is an indispensable part of the existing system. According to Carstens (2021), the central bank is unlikely to mediate savings while such events of the real economy need to be managed. Furthermore, even if the central bank overcomes the difficulties of technical issues, it seems very difficult to offer such a service for a non-private institution, and also any malfunction, glitch or cyber attack experienced by the central bank can put the central bank's reputation at risk. Therefore, the probability of developing this direct model is low. Secondly, the indirect one offers workableness similar to current mediational system and relieves the central bank with intermediary institutions taking responsibilities such as dispute resolution, KYC and relevant services. However, the disadvantage is that the central bank cannot keep a registry of individual claims, because in this model the central banks only keep wholesale registries. Therefore, the ability of the central bank to receive information from the individual depends on the intermediary institution's policy and legal legislation. Another disadvantage is that, probably only a portion of deposits will still be guaranteed by deposit insurance scheme of the central bank, as it is seen today. Finally, the hybrid one may seem complicated, but it is easier to manage than direct one. Even though users have direct claims on the central bank, it does not interact directly with

users. Therefore, the central bank focuses only on its core operations and thus intermediary institutions will continue to conduct the services it provides. Indeed, this structure might be more resilient than the indirect one, but it is clear that it would be costly and complicated to run such an infrastructure for the central bank alone (Auer and Böhme, 2020).

In today's conditions, CBDC will not be a monopoly on the market because other cryptocurrencies and e-money platforms have already been released by private entities and have been developed day by day. Frankly, in CBDC's absence, several private institutions are closely involved in developing DLT based tools and solutions. Nevertheless, credibility of central bank is unarguable, so when the time comes, it might provide a competitive advantage. However, unaccompanied competitive advantage would not guarantee convenient, user friendly and advanced digital products, etc. Much better results can be obtained by the cooperation of the public and private sector. Furthermore, it is clear that risky trials and unregulated products are not responsible policy; therefore, if central banks attempt to have a part in DCA, they have a responsibility to ensure issuing of high-quality products.

3.1.2 The Current Landscape of CBDC

CBDC projects have been accelerated on a large scale since formal announcement of Facebook Inc's private stablecoin project on June 18, 2019, because its plan has forced governments into focusing on a public digital currency. This announcement made policy makers and regulators take action, and the G7 large economies group set up a working team led by Benoît Cœuré who is former member of the ECB's Executive Board, and who became the head of BIS innovation hub for this reason. Additionally, this group firstly focused on Facebook's and other so called stablecoin projects, and published a report under the heading "Investigating the Impact of Global Stablecoins" in October 2019 (Zhang, 2020). Therefore, if a structural change in the monetary system is witnessed, Facebook Inc's role in that change is an indirect, as a catalyst.

Research that has been carried out on CBDC and how close each government might be to issuing such currencies differ from country to country. Certain countries focus on this issue to a large extent, while it is not even a priority for others. Recently, a

group of countries have launched pilots to catch potential issues, assess viability and develop experience with CBDC. The resources allocated to FinTech research have been increased, and central banks received consultancy from the private sector advisors when it is necessary in order to get better outcomes. In addition, legal regulations are both reviewed and rearranged to prevent legal problems that may occur if CBDC is put into circulation. Another group of countries have focused on enhancing established payment arrangements and strengthening existing regulations without a preparation for issuing their own CBDC. Simultaneously, with the emergence of the synthetic CBDC idea, it is also considered how the demanded amount of convenience might be achieved without issuing the true CBDC to the market (Zhang, 2020).

Sveriges Riksbank announced a pilot called e-krona, a digital version of the existing currency for retail use in 2018, but this was not on the agenda in 2017. The central bank reported that access to the e-krona could be in two ways: account-based and value based (tokenized), so it might be either held in an account at the Riksbank or be kept in a local method by way of card or in an application (Sveriges Riksbank, 2018). Therefore, the Swedish way to digital transactions will potentially be traceable and based on the direct CBDC model.

Some central banks will be under the pressure of digitalization and will need to offer services and products that meet the requirements of the era and they might relieve themselves by partnering with e-money providers. In order to identify this type of digital currency, which is issued by private providers instead of central banks, IMF researchers coined a term called synthetic CBDC (sCBDC) in 2019 (Tobias and Griffoli, 2019). Although the central bank would solely back stablecoins with its reserves and deliver settlement services, this complex type of sCBDC has substantial costs and risks because sCBDC as an inside money represents a claim on an intermediary institution because it is not a liability of the central bank. However, there are three main reasons why sCBDC would be favorable for central banks. Firstly, sCBDC has low cost of startup and maintenance. Secondly, it allows them to keep private issuers under regulation. Thirdly, it retains the reputation of central banks by maintaining their institutions' distance from public (Kriwoluzky and Kim, 2019). This type of a modern technical solution is also called indirect CBDC model.

There are also many central banks that aspire to cooperation with the private sector. For instance, the BoE currently focuses on an approach that is called platform (centralized) model. This model solely allows the central bank to issue or remove tokens, but hands over responsibility of user interactions and KYC checks to payment interface providers (PIPs). Not only the BoE but also the PBoC also focus on the hybrid CBDC model, the PBoC has consulted experts for a model that it would issue and redeem retail CBDC through the medium of commercial banks' networks (Calle and Eidan, 2020).

PBoC runs a system of China's digital currency electronic payments (DCEP) that is classified as the retail form of CBDC (Tong and Jiayou, 2021). DCEP is a stablecoin backed 1:1 with Chinese Yuan (CNY), renminbi (RMB) and is a claim on the PBoC, but intermediaries such as Tencent, Alibaba, Union Pay and retail banks handle retail payments. Therefore, China has adopted a hybrid CBDC model as it takes a two-tiered approach (Xu and Prud'homme, 2020).

It has to be noted that most of the major economies are currently looking for the idea of issuing digital currencies, but China has already reached the stage of releasing pilot programs for citizens in Shenzhen, Chengdu, Suzhou and Xiong'an to transact in digital Yuan. Moreover, multinational companies across China such as Starbucks, McDonald's and Subway have already signed up for joining the digital currency pilot. The two main reasons behind this success are the massive Chinese population who rapidly embraces new digital technologies, and highly competitive companies that rapidly adapt to changing technological paradigms and regulatory framework that enforces businesses in China to accept institutional experiment (Xu and Prud'homme, 2020).

3.2 Fractional Reserve Banking

Fractional reserve banking is the most commonly practiced system and fiat is the legal tender today. In this system, banks keep only a fraction of the deposits as reserves and the amount of reserve to be kept is determined in proportion to an amount, this amount is called reserve ratio. Central banks set a reserve requirement, which is a minimum amount of reserve for banks. The system allows banks to make loans and invest the

amount after reserving the reserve requirement. Additionally, banks generally keep reserves above the minimum level (reserve requirement) in order to avoid a shortage of cash. The difference between reserve requirement and the actual reserves is called excess reserves (Mankiw, 2017).

Reserve ratio is the fraction of deposits that banks keep as cash in their vaults (reserves). Money multiplier determines the quantity of money that banks could create with each fiat currency of reserves and its formula is $1/\text{reserve ratio}$. For instance, 100 units of deposits could create up to 1000 units of money when the reserve ratio is 10 percent. That is to say, 1000 units of money is backed by 100 units of vault cash in total. Therefore, money created by banks rather than a monetary authority, which has many implications for inequality and financial instability. In sum, fiat currency is created by credit-debt cycle and its production out of thin air because it is not backed by any commodity within the system.

In cases of economic disruptions, many people could be skeptical that insolvent banks would not be able to give back their demand deposits, or meet their financial obligations; in this instance, there may be a run on the bank. Thus, many people may want to move their money elsewhere or withdraw their money and cause a snowball effect. For this reason, governments, central banks and commercial banks must restore trust and financial stability. Otherwise, overall system would collapse or regulatory bodies would have to impose capital controls, which would be an undesirable option. In fact, currency is created by credit and backed by debt in the fractional reserve banking, so the current system may be more fragile than expected.

3.2.1 Potential Alterations on the Fractional Reserve Banking

In modern banking system, although the currency offered by the central bank is in tangible (cash) or in intangible form (digital), non-banks can only have access to the cash form without a commercial bank intermediation. Intermediation of commercial banks through deposits is required to access to the digital form. In fact, banks deposits are inside money, so they do not directly represent central bank reserves. They are the promise of commercial banks to pay out currency or to meet obligations so that bank deposits are not risk-free. Furthermore, in case a commercial bank fails to pay out,

deposit insurance is applied in different amounts by different national central banks in order to compensate a fraction of deposits., e.g., in the Eurosystem in keeping with deposit guarantee scheme €100.000 per depositor is preserved at present (ECB, 2018).

With the release of CBDC, non-banks (households and businesses) will be able to use intangible form of currency and reach straight claims toward the central bank without commercial bank intermediation and therefore radical changes will occur in the system. However, it might occur if certain central banks decide to adopt the direct or the hybrid model. If the indirect model is adopted, there will be no difference in this regard.

Narrow money might be affected significantly from the release of CBDC. By definition, narrow money is together the narrowest one M0, that is limited to cash, and M1, that is the sum of cash and demand deposits. Liquidity is mostly kept in the form of demand deposits by non-banks. Deposits have a crucial role for commercial banks to finance their businesses because their business model is based on maturity transformation that means collecting short term deposits but crediting long term. The central bank issues cash and reserves and these are liabilities of the central bank. The sum of cash and reserves constitute base money M0 in a balance sheet presentation. On the other side, commercial banks must hold a fraction of deposits as required reserves and provide deposit money to facilitate retail payments and to keep currencies for short term. In other words, M1 is comprised of cash held by non-banks, and demand deposits in banks as is illustrated in Figure 6.

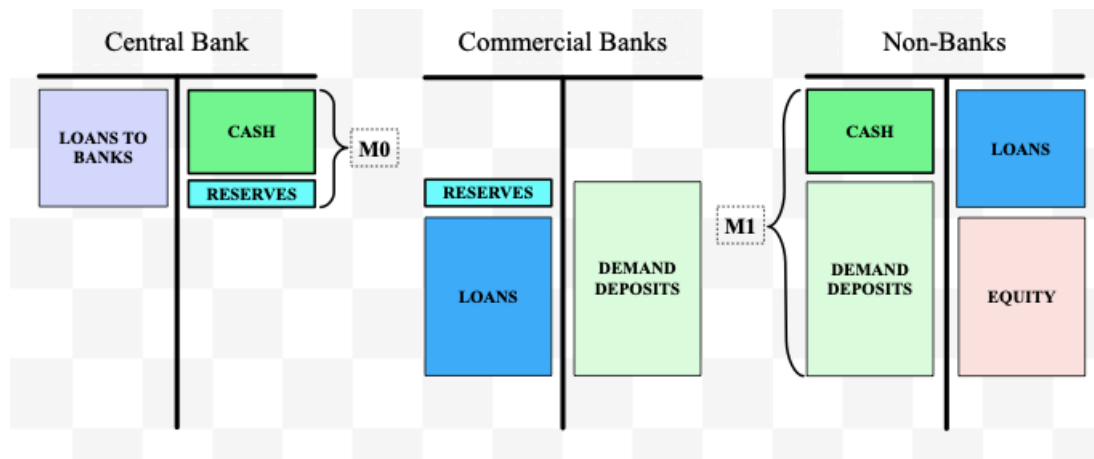


Figure 6. Current fractional reserve banking model

CBDC is different from the current system because of its obvious superiority and common availability as a "flight to safety" vehicle (Andolfatto, 2020). Under potential direct and hybrid models, CBDC will compete directly with bank deposits, and it would probably be the first choice for payments and short-term holding because CBDC as a legal tender is not exposed to bank run risks that commercial banks are exposed to. Therefore, a sizable portion of commercial banks' demand deposits would shift to the central bank as shown in Figure 7, leading to a radical change in the functioning of the fractional reserve banking. Consequently, commercial banks will need to find new sources of funding to maintain bank loans that are supplied and financed by existing deposits (Fiedler, Gern and Stolzenburg, 2019).

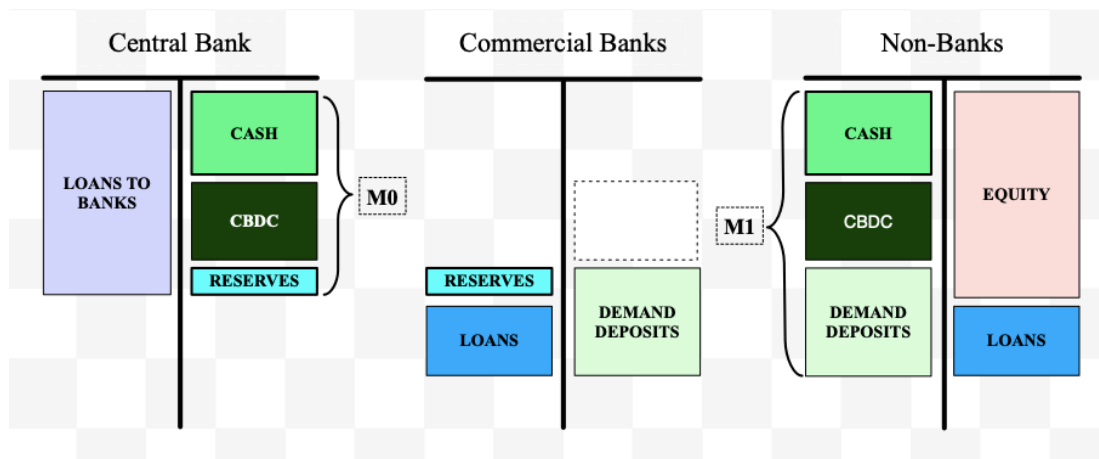


Figure 7. Potential banking model towards a CBDC

After the introduction of CBDC, commercial banks may attract deposit accounts in three ways. Firstly, they may improve their payment system and make it convenient, user-friendly and superior. Secondly, they may link deposit accounts to essential financial services. Finally, they may charge higher interest rates than the rates applied on CBDC accounts; this also means that the interest rate applied to CBDC accounts is the lower bound for bank deposits. Commercial banks will have to offer higher interest rates to compensate for the above-mentioned risks. As the banks have different degrees of credit rating, it is natural for them to offer different interest rates. The gap between interest rate charged to CBDC accounts and interest rate applied to bank accounts will be near zero under normal circumstances, but this gap will widen at the time of economic difficulties. Although commercial banks succeed in attracting some deposit accounts, their existing traditional business models would still be disturbed by the release of CBDC (Fiedler, Gern and Stolzenburg, 2019).

One of the greatest concerns regarding CBDC model is a sudden mass migration from bank deposits to CBDC, in the face of such a situation this mass migration will have the same impact on the financial sector as a bank run, but there would be no restrictions, as people would not need to queue for ATMs. It is worth noting that that a bank run is already a threat for banking system because it is the main problem of bank money creation based on fractional reserve system. However, the current system will continue to be the trigger of instability due to the method of bank money creation. Inherent monetary erosion and the associated susceptibility to crisis might be significantly reduced with CBDC, but it alone cannot prevent these factors, because

neither the central bank nor the banks are able to determine alone how much money can be created in the fractional reserve banking. Furthermore, in case economic actors transfer funds from commercial banks to CBDCs during a cascading failure, the central bank may redirect liquidity back to commercial banks when it sees appropriate to protect banking sector as is currently the case with open market operations in order to sustain existing system (Carstens, 2021). Therefore, in case issuance of CBDC leads to flight to safety vehicle and disrupt the fractional reserve system to an extent, the central bank could take many measures to maintain the current system.

Both cash and bank money have coexisted for over three hundred years. At first, banknotes coexisted in the market with precious metals and then with bank money and if CBDC continues to coexist with bank money as is intended in the indirect model, it will not be much different concordantly (Huber, 2019). Furthermore, also, the central bank may face with a bank run-like situation because currency competition will possibly be fiercer. Especially central banks will be under threat of this situation when they impose negative interest rates or be in a state of stress.

CHAPTER 4: IMPLICATIONS OF CASHLESS ECONOMY FOR MONETARY POLICY

4.1 Independence of Central Bank

Elimination of paper currency might put the independence of the central bank at risk because it can lose its power to finance itself by falling income that is acquired from interest on the money it lends, or profit from the assets it obtains. Although budgets of central banks are generally under the supervision of government, ability to self-funding power makes central banks privileged financial institutions. A central bank's profitability allows it to identify necessary or unnecessary expenses by itself, and remit the remainder of the generated income to the country's treasury. Therefore, maintaining independence is crucial because it helps central banks to manage crisis processes better by establishing a staff of expert economists. For certain reasons, the continuation of the central bank as a profitable institution reinforces its operational independence (Rogoff, 2014).

Central bank independence has been developed more since the collapse of the Bretton Woods system, which was a regulated system of fixed exchange rates in 1971. In addition, not only the U.S. economy, but also other major industrial economies had to struggle with periods of high inflation during the 1970s, e.g., expected inflation rate increased steadily from around 4% in 1970 to 12% in 1979 in the U.S. (Davis, 2012). Therefore, central banks made structural changes to regain their credibility as institutions that are supposed to ensure financial stability. In order to do so, they had to resist any political pressure. The research of Alesina and Summer (1993) indicates that central bank independence promotes price stability, which is a goal of monetary and fiscal policy, but it has no measurable effect on real economic performance. Especially, De Nederlandsche Bank and Deutsche Bundesbank managed to keep inflation low by fulfilling their responsibility, and also achieved increased output with lower unemployment. However, Switzerland, which has also a very independent central bank, managed to keep inflation low, but growth was slower and less stable compared to Germany and the Netherlands.

Nevertheless, independence of central bank has become an indispensable part of the healthy economy and this change is seen as one of the strongest changes in monetary policy and these events between 1970s and early 1980s forced economists to review macroeconomic models. Today, many central banks have considerably greater independence compared to 40 years ago while De Nederlandsche Bank and Deutsche Bundesbank were the central banks with the highest independence in the past.

The level of independence of the central bank of each country differs for many reasons. One of these is the idea of being completely independent, which has been discussed, because of the accountability of the central bank, which is another reason (Walsh, 2010). Furthermore, there are obstacles to the freedom of the central banks, but at the same time, it is difficult to defend this independence because they provide a financing tool that may facilitate criminal activities in the world (Rogoff, 2016). Central banks are unelected and also stronger when they are independent, but can only maintain their true effectiveness within a public accountability mechanism.

Instrument independence is central bank's ability to determine monetary policy instruments, and goal independence is central bank's ability to determine the goals of monetary policy (Mishkin, 2016). Elimination of paper currency will have an impact on both goal and instrument independence.

4.1.1 Goal Independence

Goal independence is defined as the ability of the central bank to determine the final goals of monetary policy without the direct intervention of any fiscal or political authority. For instance, ECB has goal independence because it has full power to maintain price stability. On the other hand, the BoE lacks goal independence because the inflation target is determined by the government not by the BoE. The Fed has a higher level of goal independence than BoE because the Fed's goals are set in its charter, and it is Fed's responsibility to turn the goals into practice (Walsh, 2010). That means, in brief, that goal independence is the determination of the inflation target by the central bank, not by public officials or other bodies.

Paper currency can be spent at its nominal value and has almost no cost besides its printing costs, and the governments' monopoly role on paper currency allows it to make significant profits. When new currency is printed, the value of currency in the circulation falls, leading to inflation. This phenomenon is also known as inflation tax that governments savor (Rogoff, 2016). Thus, conflicts occur between the interests of the government and the goals of the central bank.

4.1.1.1 Inflation Targeting

Expectations and credibility play a significant role in modern central banking and central banks use various new methods to keep inflation expectations under control (Rogoff, 2016). They are important components of modern economic theories and have important effects on policy planning and implementation. However, it is a fact that not only the long term future, but also the short term can only be predicted with uncertainty regarding economic stability, which hinges on many factors, and also many of the economic decisions of an organization depend on the behavior and future expectations of other institutions (González-Páramo, 2007).

One of the primary objectives of the central bank is to achieve and maintain price stability that requires avoiding both sustained inflation or deflation. There are two different potential scenarios related to inflation that digitalization could cause. The worst-case scenario for the central bank may be experienced when digital dollarization or private digital currency gains weight in currency competition so that the inflation power of the central bank will decrease, because people will tend to switch to rival currencies when inflation diminishes the value of currency in circulation (CIC). Consequently, private digital currency could discipline monetary policy as long as private digital currency floats like an alternative currency (Raskin, Fahad and Yermack, 2019). Nevertheless, the best-case scenario for the central bank might also be acquired when CBDC is likely to replace the existing currency, so the central bank's ability to spur inflation will increase (Fiedler, Gern and Stolzenburg, 2019).

Inflation targeting is not only important in maintaining economic stability, but also a social task so that inflation has a direct link with the purchasing power because inflation diminishes the value of CIC. Furthermore, inflation targeting can only affect

the real economy in the short run and it should be supported by other macroeconomic goals in order to affect the real economy in the long run as well. Achieving the determined or optimal inflation rate goal that depends on economic conditions is important for society's welfare, although it does not benefit every segment of society.

4.1.2 Instrument Independence

Instrument independence is the ability of the central bank to set up policy tools independently for monitoring the targets of the monetary policy. For example, the BoE can adjust its policy tools without the intervention of the government, although it lacks goal independence. In contrast, the Fed and the ECB have full instrument independence (Walsh, 2010). In sum, instrument independence ensures that the inflation rate, whether or not it is determined by other bodies, is followed consistently over time by the central bank.

Instrument independence enables the central bank to reach its objectives and to achieve the objectives it determines the monetary policy to be applied and the instruments to be used at its own discretion. It should not be correlated with low or reasonable inflation rate, because unlike goal independence, the central bank cannot determine the target, but it is the independence of using the policy tools of monetary policy to achieve the determined target. Therefore, without goal independence, the central bank cannot directly influence real GDP and unemployment.

All in all, electronic reserves will continue to generate more than sufficient income to bear the bank's operational costs in most cases, and as long as they remain an actual accounting unit and intermediary for the solution of interbank financial transactions, central banks will be able to maintain their self-funding feature and thereby, independence (Rogoff, 2016). However, when factors such as digital dollarization, currency competition public and private occur, many central banks will potentially face the threat of independence loss, but therewithal central banks which managed to put their digital currency into circulation and provide it as a de facto unit of account, will continue to enjoy their profitability by having an advantage over the competition. Furthermore, CBDC projects must also be supported by governments to sustain

monetary independence because potential loss of seigniorage income also adversely affects the state's treasury.

4.2 Overcoming Zero Lower Bound Constraint

Policy rate set by the central bank is one of the main tools of traditional monetary policy. There is a considerable disproportion in the implementation of monetary policy, some theoretical plans may not be applied in practice. Therefore, central banks are significantly constrained as the nominal interest rates cannot be negative. This is called zero lower bound. The central bank can raise the short-term nominal interest rates to the level it considers necessary when the economy is expanding at an unsustainable rate (overheated) and inflation threatens to rise to undesirable levels. However, amid economic downturns, when aggregate demand falls below aggregate supply and under the threat of deflation, the policy rate cannot be cut down to below zero (Buiter, 2009).

One of the main reasons for the zero lower bound, which is a macroeconomic problem, is that interest rates reach a certain level and the other is the existence of physical currency because when short term nominal interest rate touches zero, people begin to hoard cash, limiting capacity by causing liquidity trap, even though it is naturally risky and inconvenient. It should be noted that, in a cashless environment, negative nominal interest rates would encourage spending by making cash positions costly. Therefore, in this context, nominal policy interest rates may be negative in theory, but not in practice due to presence of the cash. It often results in central banks seeking unconventional methods, such as quantitative easing (QE), to increase money supply and boost the central bank's balance sheet in an economy with longer term assets purchases of central banks in order to stimulate the economy by encouraging investment and lending.

Zero lower bound constraint is also the problem of many of today's major central banks because overall interest rates are suppressed by low and stable inflation rates. While the ECB and the Bank of Japan (BOJ)'s main policy rates had already touched zero bound, the Federal Open Market Committee (FOMC) and monetary policy

committee of the BoE have had to pull official policy rates to zero bound simultaneously due to the COVID-19 outbreak as indicated in Figure 8.

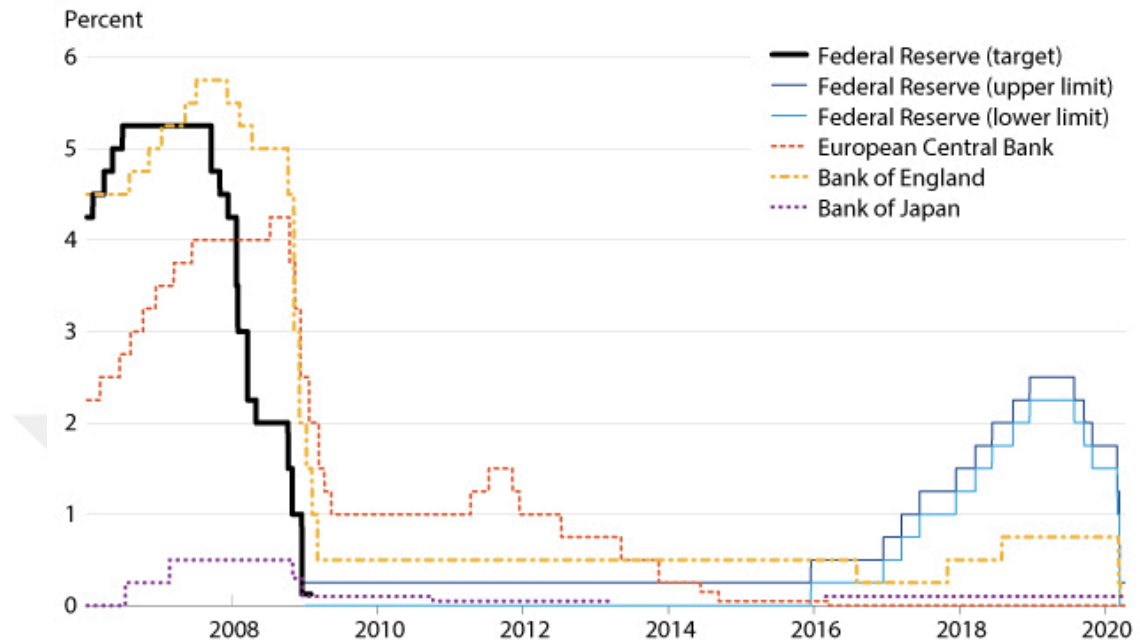


Figure 8. Policy rates, from 2006 to 2020 (Source: Haas and Neely, 2020)

In times of economic downturns and near zero interest rates, central banks usually implement QE by purchasing government bonds and financial assets from financial institutions in order to stimulate economy. The rates before the 2008 crisis were far above the levels before 2020. They were able to lower their policy rates as well as QE to overcome the 2008 crisis. However, since nominal interest rates are almost zero, and could not be negative, they have resorted to QE to overcome the ongoing crisis. As the short term policy rates decreased and were at zero lower bound, central banks expanded their balance sheets at a record level with QE as seen in Figure 9 (Haas and Neely, 2020).

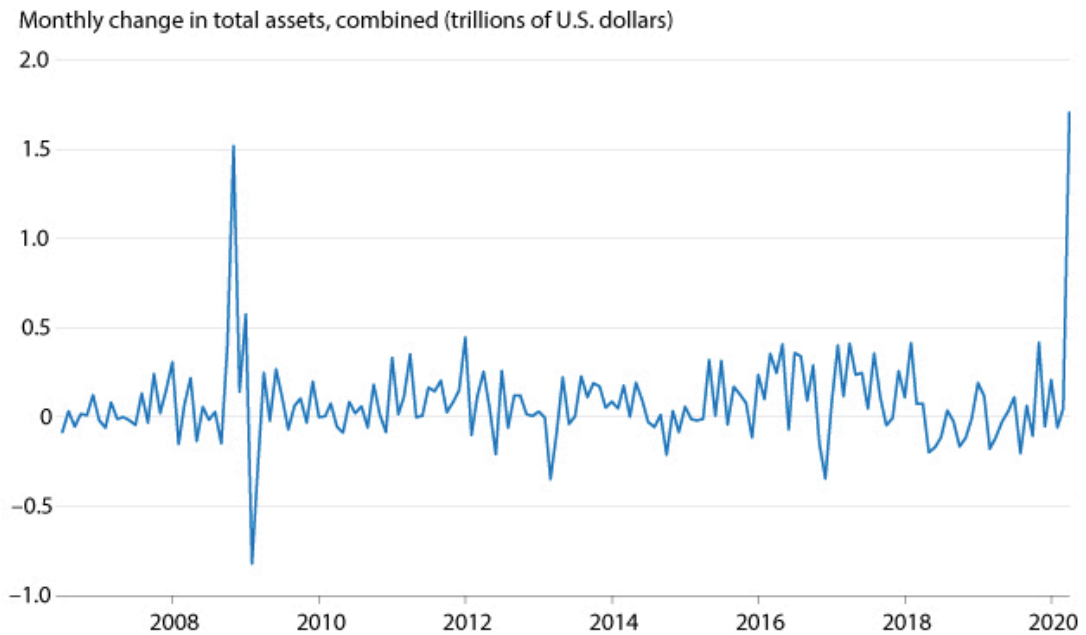


Figure 9. Total assets of the four major central banks, March 2006 to March 2020 (Source: Haas and Neely, 2020)

As it is a fact that people withdraw cash under the pressure of receiving a zero or negative nominal return, so central banks are contingent upon an effective zero lower bound. Since the current rates are near or at the zero lower bound, there is an intense discussion on how paper currency use can be deterred or abolished. The idea of paying a negative interest to currency may be cruel, but it is less cruel than inflation, which undeniably reduces purchasing power in a similar way (Rogoff, 2014). If the paper currency is abolished, and the central bank-derived digital currency is released and accepted simultaneously, there will be no way out of the banking system so that people will have to accept negative interest rates. In those days, central banks will be able to impose negative interest rates as well as positive interest rates (Rogoff, 2016). Therefore, in an economy where cash use is significantly reduced or simply abolished, central banks will be able to stimulate economic activity even in low interest environments.

Helicopter money should be underlined in this context because it is another way to cope with deflation independent from policy rate. Helicopter money, i.e. helicopter drop, has a metaphorical meaning and was coined by Milton Friedman. It is an unconventional monetary policy tool to stimulate the economy. The central bank issues large amount of money on behalf of government to raise citizens' income level.

Under standard assumption reducing short term interest rates is sufficient to stimulate the economy, but as mentioned above, in such economies interest rates already touch to zero and due to shortage in demand those economies face liquidity trap.

In today's financial world, not only cash handouts, but also extraordinary tax cuts, issuing extra money to the economy could be shown as equivalent to helicopter money. However, monetary policy may be implemented by way of direct CBDC distribution "helicopter drops" after transition to cashless economy is completed as all citizens within an economy will have official digital wallets connected to the central bank, so the government may inject digital currency into those wallets in an efficient way and without intermediation. Therefore, a central bank may benefit from such measures to avoid liquidity trap, thereby significantly reducing deflationary risks (Prasad,2018).

In a cashless economy, issuing CBDC would relax the zero lower bound with improved ability of the central bank. In such an environment, negative interest rates logically trigger economic actors to spend money instantly, or deposit it into savings accounts. However, digital fiat currency could lose its function of being a store of value as negative interest rates will undeniably lower the value of CBDC. Therefore, currency competition should be taken into consideration because CBDC will be vulnerable to those currencies that maintain their value. The central bank derived currency must be protected by regulations in order to be effective in policy implementation (Fiedler, Gern, and Stolzenburg, 2019).

CHAPTER 5: PROS & CONS OF LESS-CASH SOCIETY

5.1 Potential Benefits

There is no doubt that cashless economy will make the lives of all economic actors easier with increased efficiency, and with the collapse of international barriers, it will ensure financial inclusion even in places where there is no banking. Furthermore, illicit activities can be largely prevented by retiring or phasing out of the use of paper currency, which facilitates the financing of these activities by formalizing the transactions. However, it is important not to be complacent because as the monopoly of the fiat currency is threatened by developing FinTech, alternatives have arisen to facilitate these activities.

5.1.1 Financial Inclusion

Financial inclusion seeks to remove barriers that prevent people from joining the financial sector and using financial products to enhance their lives. In addition to making financial services accessible and affordable to all companies and individuals, irrespective of their financial conditions, it also signifies the inclusion of vulnerable groups that cannot access banking services into the system.

Primarily, less cash society could lead to either greater financial exclusion or inclusion. However, it is assumed that policy makers, developers and economists cooperate and act rationally, and that they will eliminate the disadvantages of the current system and lead it to inclusion. Otherwise, if vulnerable groups such as, aged, illegal migrants, homeless people and web-disabled, etc. are ignored, becoming cashless might cause polarization and might also cause financial exclusion. Moreover, international trade and remittance could be facilitated by policy makers taking into account unbanked or underserved populations.

In a less cash environment, transition to digital would require at least debit accounts with intermediaries; therefore, gradual phasing out of currency might support financial inclusion. Furthermore, users new to digitalization might gain an easy-to-access and reliable payment instrument, and increase the profitability of small businesses that

keep up with digital trends (Kireyev, 2017).

5.1.2 Reduction in Illegal Activities

The money left behind unrecorded is untraceable, and called ‘black money’. These anonymous features of paper money inherently facilitate tax evasion, fraud, counterfeiting, bribery, crime, money laundering, and so on. In a sense, high-valued fiat currencies are used as an anonymous store of value that subsidizes the criminal activities and are minted by the government. In addition to this, it would be very unlikely that large denominations in circulation are hoarded by low and middle income households (Buiters, 2009).

Studies and thoughts in recent years assert that giving up physical money and replacing it with digital alternative may help to reduce these kinds of illegal activities markedly, or lead to a shift in the type of law breaking. Even though some policy makers, governments and organizations have tried to curb these illicit activities without issuing a digital currency, no perfect solution has been found.

Both Indian Government and EU made provision for cutting down of untraceable money caused illegal activities over the last years. In a night, Reserve Bank of India made a shock announcement of ₹500 and ₹1,000 demonetization on November 8, 2016, and these notes lost their legal tender feature, but were able to be deposited and exchanged till December 30, 2016. According to statement of the Reserve Bank of India (RBI), this move was required to restrict counterfeiting, inhibit illegal hoarded cash holdings and restrain the finance of terrorism (RBI, 2016). It might also be noted that ₹500 was replaced by new series of ₹500 and also ₹2000 was released in a complex process on November 8, 2016. However, printing of ₹2000 paused for during the latest fiscal year because hoarding and evasion was suspected, almost for the same reasons, because of the ill-planned decision and also there occurred several deaths due to shortage of cash, and panicked note exchange (Vij, 2016).

The ECB exhibited relatively a soft attitude in contrast to Government of India and announced on May 4, 2016 and decided to stop issuing €500 banknote permanently by the end of 2018 (ECB, 2016) and distribution and printing of the banknote stopped by

central banks of Euro system at the beginning of 2019. However, it keeps it legal tender and maintains its value, in other words €500 banknote retains its medium of exchange and store of value functions. Thus, the bank did not cause shortage of cash, long queues and deaths, and this movement seems a more orderly transition in contrast to India. This note was one of the highest value printed currencies, that worth about 415 XDR and its value is main reason behind this abolition because it enables large amount of easily portable, stackable and storable money. Therefore, €500 banknote is nicknamed *Bin Laden* because it is substantially favored by criminals.

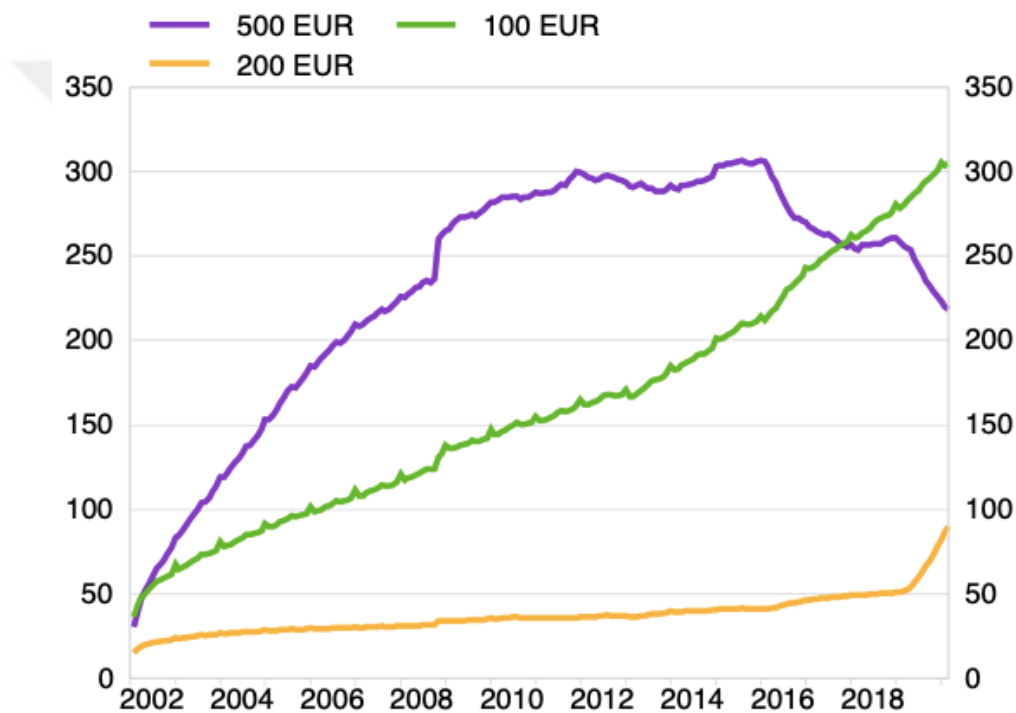


Figure 10. Circulation of high denomination banknotes (Source: ECB, 2020)

In Figure 10, between the years 2012 to 2016 issuing €500 had been controlled until announcement. Besides, it is clearly visible that there is a dramatic rise in €200 in parallel to rapid decline in €500 due to their value in circulation from the beginning of 2019 which is the date when issuing €500 permanently stopped. This appeared to be caused by substitution, €200 has come into use instead of €500, even though, of course, values are different. Also, this brings to mind that compared to its closest equivalents €200 is still a high valued currency. For instance, €200 values about to 160 XDR, while its closest rival \$100 is approximately 70 XDR. Moreover, under the normal

conditions steady increase is expected to be seen for all denominations because of outstanding amount's accrued interest.

Consequently, the underground economy also includes daily labor such as cleaning services, and baby-sitting for working informally or avoid paying VAT. Yet, it is not easy to measure magnitude of expectative growth in tax collection because the paucity of VAT analysis cannot be ignored, especially in developing countries. These attempts aim to diminish high volume illegal activities to a certain extent by eliminating high valued currencies. Nonetheless, it may only lead a shift in a type of activity or cause slipping in methods of finding or holding money, elimination of high valued currencies does not offer a permanent solution at all. Many different options exist for hiding wealth, but these methods do not offer liquidity like currency does. The money that remains outside of financial institutions is anonymous, which obstructs implementation of laws, so paper currency is a problem on its own.

5.1.2.1 Re-Conception with an Alternative Virtual Currency

Virtual currency is not in the highly liquid asset class often associated with money and it was defined by the European Central Bank as follows,

“a digital representation of value, not issued by a central bank, credit or e-money institution, which, in some circumstances, can be used as an alternative to money” (ECB, 2015).

A virtual currency that is secured by strong cryptography in the validation of transactions is called cryptocurrency. Cryptocurrencies can be either centralized or decentralized. They are mainly based on blockchain technology that inhibits double spending and counterfeiting.

Thousands of cryptocurrencies have appeared since Bitcoin, the first cryptocurrency, was launched in 2009 and even private companies such as Facebook and JP Morgan Chase have planned to venture into this market. Shortly, virtual currency of Facebook, INC is named \approx Libra and pegged to basket of major reserve currencies announced in 2019, but has not been transferred into practice yet. JPM coin was launched in 2019

as stable cryptocurrency that is pegged 1:1, representative and used for facilitating exchange. However, access to JPM coin is subject to some permissions and being used only by institutional clients (J.P. Morgan, 2019). Therefore, it is not clear whether or not the JPM coin is a cryptocurrency because normally cryptocurrencies are accessible to all without permission.

Nowadays, cryptocurrencies are mostly used for speculative or adapting to technology trends purposes and also some are able to fuel the shadow economy. Even though the cryptocurrencies developed so far could technically fulfill medium of exchange function, they fall short of becoming efficient currencies just because of their extreme volatility and unpredictable transaction costs. However, Bitcoin plays a critical role when it comes to the store of value function because it is pioneer, credible, limited and decentralized. In addition, Bitcoin is widely utilized as unit of account within the crypto world, but when it comes to the fueling shadow economy, Bitcoin is considered as the least suitable cryptocurrency because each confirmed transaction is included in the blockchain, not to be removed, so it is trackable (Nakamoto, 2009). However, untraceable cryptocurrencies, based on anonymity and privacy, have been developed in recent years.

Some employers would tend to employ fewer illegal immigrants with minimal CIC, because non-anonymous money system would give them away and leave no other option of payment, so informal employment could be blocked in this way (Kireyev, 2017). Nonetheless, in parallel to favorable developments by policy makers, rise of cryptocurrencies are non-ignorable, and such coins as Monero, which are private, untraceable and fungible (What is Monero (XMR), 2020), are accused for facilitating illegality, and expectedly, unfavorable for low income groups due to convertibility barriers. It must be emphasized that such privacy-oriented cryptocurrencies have disturbed the authorities, the Internal Revenue Service (IRS) has offered a bounty program of up to \$625K for anyone who can crack privacy of primarily Monero and other privacy-driven cryptocurrencies as well as lightning network that operates blockchain based cryptocurrencies (IRS, 2020). Even if it is possible to minimize illegality in working area with traceable currency, in today's world, the ones who push their luck will be able to find a way.

5.1.3 Welfare Improvement

The potential dominance of any private digital currency attracts citizens in an inflationary country with financial instability and could undermine the influence of monetary policy. Besides, private digital currency that is supposed to be competitor of local fiat currency could lead to monetary authorities to lose a set of monetary policy tools. Therefore, the competition disciplines monetary authorities to offer non-depreciative currency in order to pull citizenry towards legal tender and thus maintain their authority.

The proliferation of digital currencies, including private and decentralized digital currencies such as \approx Diem and Bitcoin as the most distinct examples, has favorable welfare implications. Private digital currencies may create prosperity as they discipline monetary authorities by putting them at risk of reputational loss, resulting in balanced inflation. Thus, balanced inflation maintains the purchasing power of citizens, and encourages local investment, as it reduces uncertainty and enables higher returns. This shows that the government may profit through taxation by allowing private digital currency to circulate within the economy just because more local investment brings higher tax revenue for governments that adopt a tolerant regulatory policy (Raskin, Fahad and Yermack, 2019). However, acceptance of an alternative digital currency could also mean a reduction in seigniorage income and hidden tax that arises from inflation, but this situation concerns the sovereign.

In contrast, in a cashless economy where only CBDC and fiat-collateralized stablecoins are in circulation by reason of a monopoly privilege, the government's ability to inflate increases and thus the purchasing power of citizens decreases because in such a restricted economy, it is not possible to switch local currency into independent currency that is denominated in its own unit of account. Such a situation possible because of legal tender laws barrier to private digital currencies because it uncloses how public digital currency may take the place of private ones. This brings to mind monetary principle of Gresham's Law statement, as follows "bad (abundant and overvalued) money drives out good (scarce and undervalued) money," defines how the law promotes bad money in circulation and obligators would rather to pay in depreciating currency (Raskin and Yermack, 2016).

As mentioned above, the presence of private digital currencies has welfare effects, but there are important issues that could increase the instability of emerging market economies. Systems of these private digital currencies could be subject to breakdowns in technological infrastructure and may cause confidence crisis due to lack of official reserve backing (Prasad, 2018). In addition, centralized private digital currency holders could be exposed to counterparty risk because of the paucity of appropriate auditing, especially during economic downturns.

In conclusion Raskin Fahad and Yermack (2019) imply that competitive private digital currency where one function as a complement rather than a substitute could enhance welfare for both citizenry and emerging market government, as long the government adopts a permissive regulatory policy. Nevertheless, there are also significant barriers to entry in currency market that could also cause hardship.

5.2 Potential Costs

The majority of individuals who are interested in the cashless society tend to overstate its positive aspects, frequently ignoring the negative aspects, either intentionally or unintentionally. Cashless payment methods leave digital trails and supply information flow to issuers and intermediaries, and the probable manipulation of this will limit protection of human rights. Furthermore, as is widely predicted, production, distribution, withdrawal and replacement costs associated with currency management will be notably reduced, while primarily the costs of preventing cyber attacks, researching and developing digital currencies will increase. However, parallel to the decrease in the costs related to the management of currency, it does not mean the increase of seigniorage income obtained by the central banks and the government, and it is complicated and potential causes of seigniorage loss will indirectly lower the inflation tax, also known as hidden tax.

5.2.1 Human Rights

Besides the negative aspects of anonymous cash, anonymity is also crucial for human rights and liberties. Opportunities to monitor the identity of the participants in the

cashless society bring great risks. Financial institutions and governments that are able to track participants activities will increase the risk of moral hazard if they abuse the big data and their advantageous position for their own interests, and the tendency to act immorally increases due to lower probability of punishment.

According to Rogoff (2014), regulations on government's use of information flow should be introduced to alleviate this important problem, and if small denominations remain in circulation, this problem might be tolerated. Nevertheless, large private companies that issue digital currencies offering, presumably, a medium of exchange, must also be taken into account, as far as the cashless economy is concerned. These companies may become a monopoly in some fields, with their user masses and early adoption of technology, so that they can reach and put up for sale the information flow of their users, thanks to the failure of users to read contracts, due to human nature. Therefore, overall arrangements should be brought not only to the governments, but also to these companies on behalf of human rights.

5.2.2 Potential Loss of Seigniorage Revenue

Seigniorage is a key issue when cashless economy is discussed. The notion of moving away from paper currency brings to mind its revenue that is derived from physical money creation. In general, central banks earn seigniorage revenues via lending the money for getting interest or reacquire from the securities they obtain. Any digital payment alternative not affiliated with the central and commercial banks to some extent reduce seigniorage revenue. In order not to lose this income, central banks are motivated to replace their existing physical currency with its digital equivalent and thus, they might recapture the seigniorage revenue that is accrued indirectly to the banking sector (Dyson and Hodgson, 2016).

The difference between face value of fiat money and the cost of produce to distribution is called seigniorage. As is seen in Table 1, it cost 19.6 cents to produce a \$100 in 2020. Seigniorage is one of the most important revenues of governments to fund portions of their expenditures without taxation. The revenue is increased by supplying currencies in the form of paper and metallic in order to purchase goods and services from the private sector, just as occurs with taxes. The best way to calculate

this revenue for cross country comparison, besides flow of seigniorage, flow of GDP should be considered to measure the quantity of goods and services that the government can purchase by printing fiat currency irrespective of opportunity cost of printing fiat currency (Frenkel and Goldstein, 1996).

Table 1. Printing costs of US dollar denominations (Source: FED, 2020)

Denomination	Printing Costs
\$1 and \$2	7.7 cents per note
\$5	15.5 cents per note
\$10	15.9 cents per note
\$20	16.1 cents per note
\$50	16.1 cents per note
\$100	19.6 cents per note

In today's economic environment, seigniorage is not the government's printing of currency for direct purchase. Rogoff (2016) explicitly stated that there are three phases of seigniorage. In the first phase, the government tries to close the budget deficit by issuing interest bearing debt instruments to the market, because government expenditures usually exceed tax revenues. In the second phase, the central bank issues cash equivalent electronic bank reserves, and thus allocates resources to purchase government debt. Central banks are not designed to make a profit, but generally bring profit because the longer-term debts generally generate higher interest income than the central bank reserves over the long run. In the last phase, the central bank transfers any earnings exceeding its expenses to the government. In other words, this indirect seigniorage revenue works in effectively the same way as the government directly purchasing services and goods.

According to Rogoff (2014), there would be no significant loss as long as demand is constant if foreseen digital currencies are issued by central bank as CBDC, instead of private institutions. In fact, *ceteris paribus*, emergence of CBDC could increase seigniorage revenues because the cost of printing and the low durability of paper currency directly reduce profitability, and even this is considered as a motivation to issue CBDC for the central banks. At the same time, despite the spread of alternative

transaction systems, the decline in both inflation rates and interest rates in recent decades have been important factors in increasing demand for paper currency. However, there would be a significant reduction in demand if current currency is replaced with traceable digital currency, because of the high demand for anonymous paper from the underground economy. Although governments would compensate a fraction of this loss by adding reacquired taxes from shadow economy and diminished law enforcement costs, central banks might have to reduce reliance on seigniorage revenue or will not be able to make up and this possibility puts the independence of central banks at risk because it will be difficult for them to finance themselves. Briefly, with the elimination of paper currency, the central bank will be the only one to lose its seigniorage revenue, while it is almost revenue neutral for the government.

EU countries issue money as a representative of the ECB and cash in circulation is roughly 8 percent with regards to value. The ECB gains the revenue from this percentile. Seigniorage revenue has already fallen for a dozen years due to the lower interest rates in euro area, diminishing demand for cash and the demonetization of €500 (ECB, 2017). However, loss of banknote income increases the importance of income sources, such as open market operations or interest income earned by lending or borrowing via CBDC, *ceteris paribus*, if central banks issues CBDC in parallel to stop issuing paper currency.

Eventually, digitalization could be a loss for one side, and a gain for the other when it comes to seigniorage revenue. The consequence will mostly be determined by digital developments and the competition. In any case, this revenue is not important for most central banks, but the revenues are substantial, especially for central banks such as Fed, ECB and BoJ which issue global currencies (Prasad, 2018).

5.2.2.1 Inflation Tax

Seigniorage as a form of inflation tax that is levied by governments by issuing more money than the economy requires, so that they cause inflation and devalue money (also bonds) in circulation. (Rogoff, 2016). In normal conditions, both inflation and tax are poles apart because inflation represents a natural rise in prices, while tax is legislation. However, they both intentionally increase inflation by printing redundant

money for various reasons.

Firstly, those who preempt the cash have the superiority just because they have the power to buy before the general price levels rise. Secondly, most countries are very indebted, and debtors benefit from inflation because it makes it easy to repay because there is a great deal of money in the market, but this is a kind of punishment for cash holders, because it reduces purchasing power.

Seigniorage income is desired by governments because it lets them exchange fiat currency with a commodity, and overprinted money could cause undesired inflation hence their dilemma. In addition to this, Nobel laureate economist Milton Friedman said that inflation is taxation without legislation. Inflation has hidden tax because it does not require legislative proposal, and imposing taxes is seen as political suicide, thereby inflation allures sovereigns, so creating inflation by raising the money base is one of the ways that motivates them (Friedman, 1974). Therefore, if paper currency is eliminated, unnecessary inflation that arises from inflation tax will be prevented.

As a result, although the loss of seigniorage income through digitalization may first affect governments and the independence of central banks, there would be a beneficial situation against exercise of dishonest sovereigns.

5.3 Concerns

There are countless concerns rising with the idea of a cashless economy. Most prominent is the issue of privacy, which is data-associated. With the transformation of money from concrete to more abstract form, and because this abstract money (digital) is difficult to manage and so requires more financial literacy, overspending comes to the fore. Furthermore, since the voluminous data will help big companies redesign their products and services, small businesses will be disadvantaged, so the power disparity will increase even more.

5.3.1 Privacy

Privacy plays a crucial role in protecting human autonomy and dignity. It protects us from unjustified use of third parties and allows us to plan what can be known about us. Privacy is recognized as fundamental human right by United Nations (UN, 2015). Notwithstanding the article of human rights, invasion of privacy is common and especially violated by governments and businesses. Unfortunately, digitalization facilitates surveillance compared to the past because users supply information in opposition to their desire, and a considerable number of them are deceived due to asymmetric information.

The attraction of digitalization is very clear because of its advantages, usefulness and efficiency, but if this digital richness means sacrificing privacy, users will not fully embrace digitization. Nonetheless, governments and business might be forced to take people into the world of surveillance by invading privacy for their own interests, including monitoring financial activity of their citizenry and customers when the time comes. Therefore, there are several requirements for privacy in the optimal cashless society. Primarily, individual privacy should be protected. The government's permission to access confidentiality should be subject to certain standards. Access by third parties such as interest groups, should be precluded and if necessary accessibility rights should be rearranged (Downey, 1996). Otherwise, if measures are not taken and privacy is not taken into consideration, digitalization might become a cost besides its attractiveness.

On the other hand, internet users remain anonymous in non interventional environments, and complete anonymity could carry encountered cash problems to digital money. Eliminating anonymity may cause users financial records to be accessed, and used by others involuntarily. However, complete anonymity also ties law enforcement agency's hands, and thus criminal activities cannot be prevented to a great extent. Therefore, balance between protection of privacy and anonymity is essential.

5.3.2 Overspending

Our way of paying for goods and services gradually shift and cashless payment methods diversify. Therefore, as the structure of money change, prominent differences also arise in spending behavior because cash is tangible form of money and require less effort to manage, while intangibility of digital money makes it difficult to manage, and even may require relatively more financial literacy. Furthermore, there are studies indicating that cashless payment methods cause irrationality on spending behavior.

In addition to changing the form of money, it is another problem to pay with the money it is not possessed and increases the risk of overspending and indebtedness. Credit cards provide cashless transactions, these are different than cash in terms of fundamental aspects. Moreover, willingness to purchase of customers is increased for the same product when credit cards are used instead of cash (Prelec and Simester, 2001).

In a cashless context, it makes more sense to compare cash with debit cards, which are similar, rather than credit cards. Debit cards are appropriate to substitute for cash because debits, just as cash, supply instant and ubiquitous transactions, and debit cards are currently as common as cash. It is even more used in certain countries, such as the U.S. in share of payment usage (Kumar and O'Brien, 2019). Research findings of (Runnemark, Hedman and Xiao, 2015) show that the form of the underlying payment instrument is important for willingness to pay for identical products, and consumers tend to pay more often with debits. Nevertheless, in the same study, participants were given the option to pay with PayPal, but no difference was observed in the willingness for payment due to earmarking effect. The cost of going to the ATM is not ignorable because participants who do not carry enough money want to avoid this cost by keeping their valuation low.

According to Holkar (2018), although the convenience of digital transactions is unquestionable, contactless payers can spend involuntary excess by experiencing impulsivity and memory problems. The author suggests three solutions for less exposure to such problems. First, access to cash should be maintained until the

precautions are taken. Second, tools should be developed to control digital spending. Last, strong regulations should be designed to reassure consumers.

As a result, consumers might lose control on spending as means of payment become intangible and they might face more risk of spending than they planned with the ongoing revolution in payment methods. As expected, large-scale profit-oriented institutions will encourage cashless payments by the spread of alternative methods. However, if necessary measures are taken, spending imbalances in a cashless society could also be significantly mitigated.

5.3.3 Power Disparity

Cashless transactions inherently leave digital trails and thus create voluminous records. Especially inside money can provide information flow to large companies, thereby causing disruptions in the balance of power. This situation will cause monopolistic competition by causing SMEs to disappear or lose their market power and share significantly. Reaching voluminous data and using it competitively will not be affordable for SMEs, without sufficient expertise. However, this system will give great opportunities for some entrepreneurs, so also might support rapid growth in the same time. In contrast large companies act upon consumer behavior, habits, activities, and lifestyle, thus they would redesign the goods, services and marketing and have the upper hand (Sajter, 2013).

Consequently, small entrepreneurship activities will be discouraged, while multinational and large company actions will strengthen. Even though the rise of cashless payments will to some extent provide an advantage to large companies, it will also become problematic by decreasing social diversity and heterogeneity in the long term. Apart from the social problem, since the variety of products and services will be reduced, quality problems will also emerge with a uniformity on a large scale. Although these scenarios may seem farfetched, they are among the risk probabilities that would be created by the cashless society and should be evaluated from the point of risk management.

CHAPTER 6: A COMPARATIVE CASE FOR TWO EUROPEAN COUNTRIES

Sweden and Germany are worlds apart in terms of payment culture. Cash is gradually disappearing with the wide adoption of FinTech within the borders of Sweden, while its neighbors, the Germans, are still strongly reliant on cash, despite all the technological advances. Therefore, Germany and Sweden are two extreme points in the European economy from the point of cash usage. Although these two countries are neighbors, Sweden is closer than ever to be a cashless society, while Germany has a more conservative attitude towards cash. Most probably, you need more cash in Berlin as a tourist because you might encounter some cafes and small businesses that only accept cash, while it is possible that your cash may not be accepted in some places in Stockholm.

Even though Germany and Sweden both are EU members, Sweden is not in the euro area; the monetary unit is the Swedish Krona, and adopted the floating exchange rate regime, while Germany is part of the Euro area because it has adopted the Euro as its legal tender. Therefore, Germany is Euro area member since 1999, but Sweden took the decision to stay out of the ERM II through a referendum held in 2003. Furthermore, Sweden, with its sound economy, has always been able to meet other whole convergence criteria, except stage three of the Economic and Monetary Union (EMU). Although this is a dilemma, it is considered to have a binding right because the intention behind the economic framework and the promises Sweden gave initially made have been followed (Amttenbrink and Herrmann, 2020). The Euro is sole single currency within the ERM II, so other EU members outside of the Euro area have to protect their exchange rates from excessive fluctuations against the Euro.

6.1 Status Quo

By the end of year 2018, the total volume of Euro currency in circulation about €1,230 billion and €690 billion (56.1 percent) of total issuance were issued only by the Bundesbank as is shown in Figure 11. It is estimated that two-thirds of the banknotes issued by the Bundesbank are kept abroad, so approximately €230 billion cash

circulates in Germany (Deutsche Bundesbank, 2019). Considering the fact that the Euro zone consists of 19 countries, and also the Euro is a reserve currency, one-fifth of the total cash supply volume in circulation is in Germany, indicating that a huge ongoing demand for cash. Furthermore, according to a study by Esselink and Hernández (2017), German consumers have on an average of €103 in their wallets. This figure is the highest in the Euro area, as well as nearly two times more than the average of Euro area consumers (€65) carry.

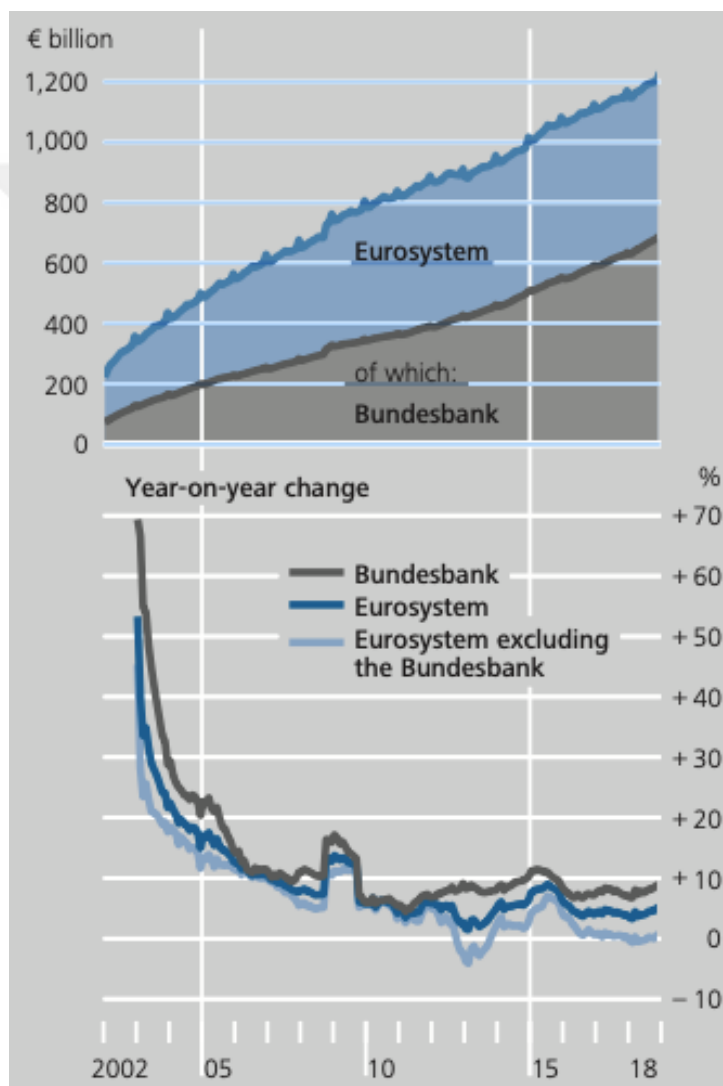


Figure 11. Volume of euro currency in circulation (Source: Deutsche Bundesbank, 2019)

On the other hand, there has been a noticeable decline in cash issuance in Sweden over the past decade. The average value of cash in circulation in the SEK dropped approximately 40 percent from 2010 to 2019, peaked in 2010, and the fell to its lowest

in 2017, as illustrated in Figure 12. Today, the SEK's average value of cash in circulation is roughly 63.5 billion kr, currently about to \$7.45 billion. However, the rise in the past two years is partly due to technical reasons; the Riksbank has carried out a comprehensive interchange of cash, so there was a currency revision in which old notes and coins were replaced with new ones. Moreover, Swedish officials lately recommended citizens to hoard some cash in such cases of data center malfunction or a cyber attack cause payment systems to go offline, so that citizens could partially minimize the risk (Swedish Civil Contingencies Agency, 2018). Cash use statistic of Sweden confirms this because it is in constant decline.

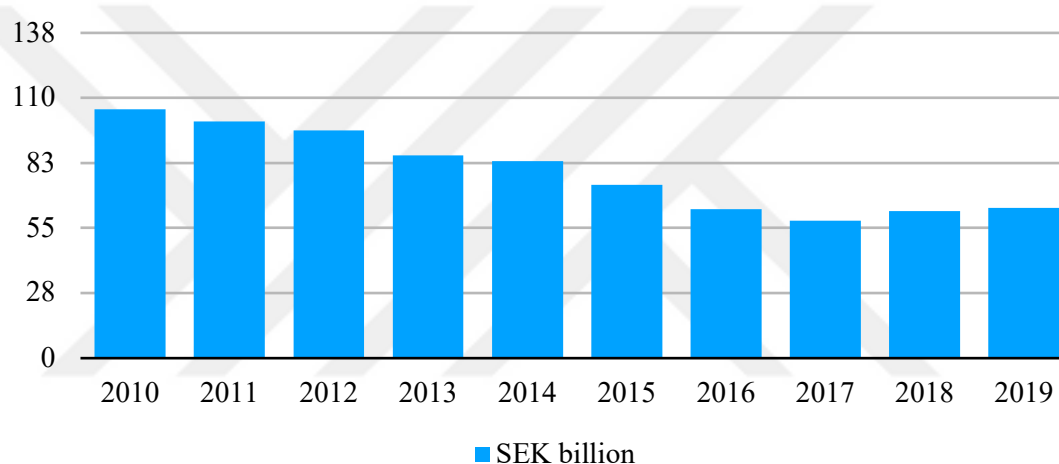


Figure 12. Average value of the SEK banknotes and coins in circulation

It may be remarked that available data of Sweden on the monetary system enables to interpret subject of cash more precisely, because the SEK is not a reserve currency, and also sole users of it are mainly in Sweden. However, since cash is anonymous, it is difficult to trace the cash in circulation. Therefore, the same conditions do not apply to a common and reserve currency adopter country, whereas more information is available for Germany, which is also part of the Euro area because, inherently, the Euro area has a larger group of researchers.

The most common, but not necessarily the best way to calculate cash use is CIC/GDP ratio, which is expected to roughly mirror it within a country, because the required data relatively accessible. This is seen for two countries in the Table 2, the result also indicates that cash is more used in Germany than Sweden. Nevertheless, due to the

anonymity of cash transactions, consumer goods and services purchased with cash or cash substitutes cannot be taken in calculation precisely, so this ratio fails to reflect exact retail payments.

Table 2. Currency in circulation to GDP, 2019

	CIC	GDP	CIC/GDP
Sweden	\$7,45 billion	\$530.89 billion	1.4%
Germany	\$363 billion	\$3.861 trillion	9.4%

According to the Bundesbank (2018) and the Riksbank (2019) statistics, in Germany, which is known as one of the countries where cash transactions dominate, 74 % of consumer transactions were made with cash in 2017, and the cash usage rate from 2008 to 2017 declined by almost 11 percent. By contrast, in Sweden, which is expected to be the world's first cashless society, in 2018, only 13% of transactions were made with cash, and cash usage fell by almost 67 percent from 2010 to 2018. Instant mobile payments, such as Swish, are the most popular mobile payment system founded by six large Swedish banks in cooperation with the Riksbank, and other new technologies, have become more prominent than ever. It is worth noting that payment diary studies have been carried out by central banks, for particular years only, but these statistics are critical because the CIC/GDP ratio supplies insufficient information. Although the use of cash in transactions of each country is in a downtrend, as is shown in Table 3, the attitude of German and Swedish citizens regarding its utilization considerably varies. It is clear that Germany is slow on the global road to a cashless society, unlike Sweden.

Table 3. Comparative consumer cash usage

	SWEDEN Share of Cash (percent)	GERMANY Share of Cash (percent)
2008	na	83
2010	39	na
2011	na	82
2012	33	na
2014	23	79
2016	15	na
2017	na	74
2018	13	na

6.2 The Determinants Behind the Cash Usage Difference

Data privacy vs convenience: Germany and Sweden stand at two extremes between data privacy and convenience balance. Concerns about privacy, particularly among elderly consumers, come into prominence in Germany. Cash aids have been made available to decelerate the increasing information asymmetry among citizens, firms and governments, because these provide a high level of privacy in transactions. It plays an important role in protecting individuals from organizations, as the knowledge gained about the counter party also means power (Mai, 2019). Bundesbank (2018) reported that 94% of respondents stated that privacy is an essential feature of payment instruments, and cash remains the payment instrument that best meets this criterion.

Conversely, today, besides the relatively low cash usage ratio, over five thousand of people have had RFID (radio-frequency identification) chips and NFC (near-field communication) implanted under their skin in Sweden in order to facilitate everyday

activities such as making a payment or entering a facility. The New York Post reported quote of British science communicator Ben Libberton:

“It’s not just about the chip, but integration with other systems and data sharing. People have shown they’re happy to give up privacy for convenience” (Libberton, 2019).

The biggest drawback with these trends is sacrificing privacy because the implanted device could be tracked without any pre-authorization approval, so many Swedes prefer convenience over privacy.

Disparity in median age: Use of cash varies depending on socio-demographic factors. It decreases as income and education levels rise, but diverges across age categories. The role of age difference is important because this can be attributed to the habit continuation of using cash. It is a fact that the median age difference has an effect on cash usage, even though it does not have a great role in opening this adoption difference. As is seen in Table 4, Germany is the country with the highest median age among the members of the EU, while Sweden is one of the countries with the youngest population. Therewithal, millennials, also called generation Y, are associated with the tech savvy, while baby boomers have a conservative attitude towards FinTech, or struggle to keep up with it when different generations are compared. However, even if the Germans in general are reluctant to give up physical currency, the younger generation has the potential to shift this situation. According to the Bundesbank survey (2018), use of cash ratio inherently lowers in the younger generation, so they are more likely to adopt digital alternatives. Consequently, Sweden’s relatively young population has a greater tendency to adopt cashless payment products.

Table 4. The 27 member countries of the EU by median age

Countries	Median Age	Countries	Median Age
1. Germany	47.8	15. Finland	42.8
2. Italy	46.5	16. Netherlands	42.8
3. Greece	45.3	17. Romania	42.5
4. Slovenia	44.9	18. Malta	42.3
5. Portugal	44.6	19. Denmark	42
6. Austria	44.5	20. Poland	41.9
7. Lithuania	44.5	21. Slovakia	41.8
8. Latvia	44.4	22. France	41.7
9. Croatia	43.9	23. Belgium	41.6
10. Spain	43.9	24. Sweden	41.1
11. Bulgaria	43.7	25. Luxembourg	39.5
12. Estonia	43.7	26. Cyprus	37.9
13. Hungary	43.6	27. Ireland	37.8
14. Czechia	43.3		

Cultural background and signs: The first banknote in Europe was introduced in Sweden in 1661, and the country's monetary system shifted. Therefore, Sweden has always embraced new technologies, and it would not be surprising if it becomes a first country to eliminate paper currency, and in the current climate Sweden is close to becoming a cashless society (Ott, 2018). On the other hand, for German citizens, physical currency usage is not only an individual choice but also a cultural value. Robert Muschalla, curator of the exhibition “Saving – History of a German Virtue” stated that

“[long-standing cash preference] is based on an underlying preference for the

supposedly concrete versus the abstract” (Youtube, 2018).

The idea of this ideology goes back to the 18th century, Germans used to give priority to having a tangible result in return for their labor, rather than receiving more abstract items such as IOUs in the progress of economy (Arneson, 2020). Furthermore, the German word *Schuld* means debt and guilt at the same time. Debt and cashless payments do not have a direct connection, but it is obvious that debt is remote from cash, and Germans have a strict financial attitude that arises from the nation’s roots.

Common action of economic agents: Sweden has an unstoppable acceleration towards becoming a cashless society because of solidarity across economic agents including commercial banks, the central bank, the government, corporations and citizens. Firstly, the Riksbank is conducting a pilot project, the digital version of the existing currency, namely, e-Krona. Secondly, Commercial banks have restricted cash withdrawals and deposits at most of their branches and taken ATMs out of service across Sweden. Thirdly, Swish is the foremost mobile payment system, 70 percent of Swedes use this application established by Sweden's six large banks in cooperation with the Riksbank (Sveriges Riksbank, 2017). In contrast, in Germany, there is no specific practice restricting cash use as is implemented in Sweden or development for cashless payment products. Policy makers have an attitude that leaves the choice of payment methods to the consumer decision. Parallel to this, privacy supporters are doubtful about the abolition of cash, but if this happens, they think that it should occur naturally as a result of supply and demand.

CHAPTER 7: CONCLUSION

This thesis aimed to identify potential alterations on the monetary system caused by ongoing digital revolution in money and payment systems. In order to achieve this objective, an extensive literature review of money, monetary system and recent developments towards digitalization and de-cashing was conducted. The results indicate that the structure of the monetary system may be reshaped, as described below.

Decreasing switching cost of digital currencies may lead to an unbundling of money functions, and fierce competition among public and private currencies. Social and commercial platforms may have an impact on shifting the current financial service organization as long as they are able to hold data and associated with digital currencies, so they will be more prominent in the financial system. Furthermore, predominance of these systemically important platforms may also cause emergence of digital currency areas that makes the world smaller and demolish barriers of optimum currency area theory. Both emerging and advanced countries that are socially and digitally open to large digital networks may be prone and vulnerable to digital dollarization, in which the national currency might be replaced by the currency of digital platforms.

In the case that direct CBDC model is adopted, it may be disruptive for the fractional reserve banking because it may be possible to straight claims against the central bank without commercial bank intermediation. Due to seigniorage revenue loss, abolition of paper currency might put independence of the central bank at risk due to loss of self-financing power. If the central bank is vulnerable to digital dollarization and currency competition, as people tend to switch to rival currencies, particularly when inflation threatens their purchasing power, then the central bank's ability to curb inflation or deflation will diminish, so its goal independence may also be at risk. However, in case the central bank will be able to replace the existing fiat currency with its own digital currency that is favored by people, ability to spur inflation will increase, because the zero lower bound constraint will be eliminated by closing the way out of the banking system, and thus central banks will be able to impose negative interest rates freely.

Transitioning to a digital world might support financial inclusion, slow down the funding of illegal activities, combat tax evasion, improve welfare and inhibit the exercise of dishonest sovereigns, so a less-cash or cashless economy may benefit society. Nevertheless, privacy, overspending and power disparity concerns arise, because digital payment methods leave digital trails and supply voluminous information flow to its issuers, intermediaries and multinational companies in consequence of monopolistic competition, and because a more abstract form of money causes irrational spending behavior.

Cultural factors play an important role in the adoption of cashless payment methods, as seen in Germany and Sweden, which are the two extreme points towards a cashless economy in the European economy. Our study indicates that while most Germans attach importance to data privacy, most Swedes prefer convenience. Looking back into history, Sweden has always been a pioneer in the adoption of innovations, while it is a priority for German citizens to have tangible results in return for their labor; this explains to some extent the Germans' longstanding cash preference. The German authorities do not impose a specific policy on the use of cash, whereas the economic agents of Sweden, including citizens, are in solidarity and take action in the same direction towards reducing cash usage. Therefore, in countries such as Sweden, the transition to a cashless society may be completed in the upcoming years.

The structure of the future society will be influenced by the underlying digitalization trend and correspondingly the ongoing evolution of money, payment systems and the accompanying reactions of economic actors, such as corporations and organizations, are likely to continue in the forthcoming years. Therefore, based on this conclusion, researchers should closely monitor recent advancements and developments.

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