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Part B

The Future of Money and Finance: Blockchain Transformation

Chapter 2

The evolution of money: from scriptural money to digital money

Authored by Tiziano Bussani

The Chapter explores the evolution of (private) money, tracing its transformation from "scriptural money" (bank money) to "electronic money" (e-money) and ultimately, thanks to the advent of blockchain technology, to "digital money" (including cryptocurrencies and stablecoins). The Chapter focuses on the distinguishing features of digital money, as a new form of money that exists as electronic writings encrypted on distributed ledgers, confronting it with scriptural money and electronic money. On these premises, the Chapter investigates the two main categories of digital money: cryptocurrencies and stablecoins. Central Bank Digital Currencies (CBDCs), as digital public money, will be investigated in the next Chapter.

* Tiziano Bussani, University of Milan (tiziano.bussani@unimi.it), Post-doc Research Fellow of Fondazione Fratelli Confalonieri, Ph.D. in International Law, Lawyer in Italy. He is a member of the Scientific Committee of the Chair FUTMOFIN and Curator, Editor, and Author of the Open Knowledge Platform (https://futmofin.unimi.it/openknowledgeplatform/). The supervisor of the Project is the Chair Leader Prof. Giulio Peroni.

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1. General overview

1.1 **The evolution of money has moved from physical commodities like gold and silver coins, to banknotes and paper currencies, and now to electronic and digital formats**. As technology and financial systems advance, so too does the nature and the forms by which money manifest itself, following a process of progressive dematerialization.
In the 20th century, the advent of electronic computers and Internet communications has deeply transformed money and in particular "**scriptural money**" or "bank money", that is the private form of money created by commercial banks through the process of lending and depositing, representing a claim against the issuing institution convertible with state-issued cash on a 1:1 ratio. Indeed, such technological advancements allowed banks and financial institutions to move beyond paper-based ledgers and make use of computers for the automated, digital storage of deposits, which led to more efficient management and transfer of funds and to the **emergence of bank money as the dominant form of money in the global economy**. By the end of the century, further developments in the Internet-based technology have led to the creation of a new form of private money, that is "**electronic money**" or "e-money", which includes electronic means of payment facilitating bank money transactions. E-money is typically issued by a non-bank institution which guarantee its convertibility with bank money on a 1:1 ratio. Like bank money, it is stored and transferred electronically, but, as it relies on more rapid and efficient systems for the transfer of funds, **e-money is emerging as the dominant instrument of payment in worldwide online transactions and e-commerce**.

1.2 **The rise of blockchain has taken this process of digitalization of money to another level,** as it **introduced a brand-new form of money: digital money**, that is money existing as electronic writings encrypted on distributed ledgers. Compared to the other forms of (private) money, digital money has some peculiar characteristics. Technologically speaking, it differs from scriptural money, namely bank money, as the latter exists in the form of electronic writings encrypted on the private ledgers of the issuing commercial bank; moreover, bank money transactions are intermediated by the banking system through a complex process of execution, clearing and settlement, while digital money transactions are operated in decentralized systems through a process where execution, clearing, and settlement take place simultaneously on the blockchain. Digital money also differs from traditional e-money, as it stored on private ledgers of the issuing institutions; still, e-money can become "digital" when issued and traded on blockchain.

1.3 **Digital money includes cryptocurrencies and stablecoins**, the latter being also understood as a sub-category of the former. That of cryptocurrencies is indeed a broad category of currencies that rely on cryptography for security and operate on decentralized networks. Instead, stablecoins are digital monies designed to minimize price volatility by pegging their value to a stable asset, often a fiat currency, or a basket of assets.

2. Scriptural money (bank money) as the dominant form of money

2.1 Scriptural money, often referred to as "bank money", is the dominant form of money in modern economies. Unlike physical currency (coins and banknotes), which are issued by central banks and are not redeemable, **scriptural money is privately created by commercial banks through deposits and lending operations**. Therefore, it is **a private form of money, representing a claim against the issuing institution**, which can be converted in physical currency (legal tender) on 1:1 ratio.

Still, scriptural money is **backed by public-private governance arrangements**, as the ability of commercial banks to create it is influenced both by banking regulations and the central bank's monetary policy; moreover, in advanced economies, bank deposits are guaranteed by the state up to a certain amount, in case of bankruptcy of the issuing bank (in the EU, bank deposits are guaranteed by the state up to EUR 100.000).

***De facto*, scriptural money is equated to legal tender** in most jurisdictions, since it is very difficult to imagine that a creditor could legitimately refuse payment offered via bank transfer, that is to say, by bank money instead of coins and banknotes; in many cases, moreover, payments in cash are limited up to certain amounts and can only take place through bank money.

The origins of scriptural money trace back to Middle Ages, but its evolution has been significantly influenced during the modern age and especially, in the last century, by technological advances and changes in legal frameworks. This form of money is "scriptural", as **it exists as a record in the commercial bank's account books**, which, as of now, are no longer paper-based but are maintained through centralized electronic ledgers.

2.2 The concept of scriptural money began around the XII-XIII century, with the emergence of banking institutions in Italy and other parts of Europe. Before the development of banks, the use of physical currency was the primary means of conducting transactions. However, with the rise of trade, merchants required a more efficient method to transfer and store value, leading to the creation of **promissory notes** (written guarantees that a person or institution would pay a certain amount of money or precious metals on demand) and **deposit certificates** (documents representing a claim to physical currency or precious metals stored in vaults at the issuing bank), which eventually have become more and more used in trade as means of payment instead of the underlying coin or metals. Italian bankers in the XIV century, particularly in Florence, Venice, and Genoa, issued the first **private banknotes**, that could be used as a form of credit to settle debts and conduct trade across long distances. These early forms of scriptural money allowed for the easier movement of funds and played a key role in enabling long-distance trade. As a result, the reliance on physical currency diminished, and the use of written instruments for transferring value became increasingly prevalent in medieval European economies. This marked the beginning of a significant shift towards the modern monetary system, where money could be represented not just by physical coins but also by abstract forms of credit and written commitments.

2.3 By the 16th century, particularly in England with the establishment of the Bank of England (1694), private banknotes evolved into official, **government-backed paper currency**. The bank was authorized to manage public debt and issue banknotes, which were initially backed by gold, but it soon became clear that only a fraction of the banknotes issued would be redeemed for physical gold at any given time. This created the modern **fractional reserve banking system**, where the bank issues more money than it holds in actual gold and banknotes reserves, relying on the fact that not all depositors will demand their funds simultaneously. Modern banknotes became a substitute for precious metals like gold and silver, and they were no longer just promissory notes but rather official government-issued medium of exchange (legal tender). **On this bases, commercial banks went on issuing promissory notes or deposit receipts**, which entitled the holder the right to redeem them at the issuing bank for official banknotes, **converting these ancient forms of scriptural money for legal tender**.

The modern banking system expanded significantly in the XIX century with the growth of commercial banks, especially under the "**gold standard**", where the ability of commercial banks to issue scriptural money was linked to the gold reserves they held. During the XX century, the end of the "**gold exchange standard**", the international monetary regime (1945-1971) under which USA guaranteed the convertibility of dollar banknotes with a fixed amount of gold, while dollar banknotes were used as a global reserve currency, marked a significant shift in the global monetary system: the 1971 Nixon declaration of "closing the gold window" definitively disanchored the creation of money, both public (banknotes) and private (scriptural money), from gold reserves and gave rise to the current **fiat money system**, where money is not tied to physical commodities like gold but derives its value from trust in the issuing authorities.

2.4 In the contemporary age, **the advent of electronic computers and Internet communications** has deeply transformed bank money, by allowing commercial banks to substitute paper-based ledgers with digital records and electronic databases, enabling faster, more efficient transactions and real-time updates of account balances. Moreover, the development of automated clearing house systems facilitated the electronic transfer of funds between banks, both domestically and internationally, replacing paper-based check systems and improving the efficiency of financial transactions. **This led to the consolidation of scriptural money in the global financial system and the use of bank transfer as instruments of payment to regulate transactions** instead of the material exchange of official banknotes.

To date, many factors influence the ability of commercial banks to create new bank money through lending operations: apart from market factors, such as demand for credit and creditworthiness of borrowers, these include regulatory constraints such as **capital requirements**, which impose banks to hold a certain amount of capital to absorb potential losses, and **reserve requirements**, which dictate the proportion of deposits that commercial banks must hold in central bank reserve and cannot lend out, and monetary policy tools such as **interest rate manipulation**. Central bank reserve means the public

form of money that is issued by central banks and distributed to banks and financial institutions only, to serve as official means of payment for wholesale transactions.

3. Electronic money (e-money) as an emerging instrument of payment

3.1 Electronic money, or "e-money," represents one of the most significant innovations in the payment systems landscape over the last few decades, representing a further step in the digitalization of money. In the last two decades, it has emerged as the **dominant instrument of payment in e-commerce and online transactions**. Examples include **credit and debit cards** and **app-based payment systems**.

Unlike bank money, which is created by commercial banks only**, e-money is typically created outside traditional banking by financial institutions offering a payment circuit to consumers and enterprises for electronic transactions** denominated in official currencies. Similar to bank money, e-money **exists as a record in the issuer's account books**.

In most jurisdictions, e-money is created on a 1:1 ratio with bank money and is denominated in an official currency. When the user deposits funds into the issuer's bank account, the issuer credits the same amount of electronic money to the user's e-money account, enabling the user to carry out electronic transactions within the circuit. At the end of the process, e-money account balances can be liquidated into bank money for the same amount. In such cases, the **issuer**, which is **the sole responsible for the electronic/scriptural money conversion**, transfers bank money from its own bank account to that of the user and resets the e-money account balance accordingly. Therefore, as the e-money account balance originally created is eventually reset, the e-money issued cannot further circulate.

As e-money creation follows the 1:1 ratio with bank money, its use does not expand, by itself, the monetary aggregates. However, it can influence market liquidity. For this reason, electronic money is considered private "money" as it is a private **payment instrument**, but it holds a **completely different legal status and governance structure compared to scriptural money**. Scriptural money, in contrast, is *de facto* equated to legal tenders and are backed by complex public-private governance arrangements, particularly through banking regulations and central bank monetary policy and oversight.

3.2 In the European Union, the regulation of e-money is governed by the **Electronic Money Directive (2009/110/EC)**, which sets the legal framework for institutions wishing to issue e-money. This regulation requires that e-money issuers obtain a license from the relevant national authority, adhere to strict capital requirements, and implement measures to safeguard customer funds. The Directive also ensures that e-money institutions comply with anti-money laundering and counter-terrorism financing rules. In addition, the EU requires e-money issuers to offer a high level of transparency and to provide customers with clear information about the terms and conditions of their e-money accounts.

3.3 The rapid growth of e-money worldwide has also led to **several challenges**, linked to the growth of non-bank e-money providers, such as tech companies and digital platforms, and introduced new complexities in terms of regulatory oversight, as these institutions are not subject to the same scrutiny as traditional financial institutions and are often based in other jurisdictions. Hence, e-money can undermine monetary sovereignty by reducing central banks' control over the money supply and can lead to currency substitution, where people use foreign currency denominated e-money instead of bank transfer in local currency.

4. Digital money (cryptocurrency and stablecoins) as a new form of money based on distributed ledgers

4.1 Digital money represents a further step in the digitalization of money and payments, introducing a **new paradigm based on decentralized technologies**. As **money existing as electronic writings encrypted on distributed ledgers**, it has specific technological features. Unlike traditional bank money or electronic money, digital money operates without a central intermediary, leveraging the security and transparency provided by blockchain and distributed ledger technologies and enabling peer-to-peer tamper-resistant transactions that are recorded and verified through cryptographic processes.

The core characteristic that distinguishes digital money from earlier forms is its reliance on distributed ledger systems, which **decentralize the process of money creation and transaction verification**. In a traditional banking system, money creation and transactions are managed by central authorities such as commercial banks and central banks, relying on centralized record-keeping and oversight; hence, bank money transactions are intermediated by the banking system through a complex process of execution, clearing and settlement. In contrast, digital money operates on a distributed ledger, which is maintained across a network of computers, allowing for decentralized validation of transactions and the creation of new digital assets. This system is highly resistant to tampering, as each transaction is recorded in a way that is publicly accessible and immutable, ensuring the integrity of digital money systems. Moreover, the **execution, clearing, and settlement of digital money transactions take place simultaneously on the blockchain** thanks to cryptographic algorithms operated by decentralized networks.

Digital money includes cryptocurrencies and stablecoins.

⇒ SATOSHI NAKAMOTO, Bitcoin: A Peer-to-Peer Electronic Cash System. Whitepaper, 2008

4.2 **Cryptocurrencies** are typically volatile and are used for various purposes, including investment, remittances, and as a **medium of exchange in certain ecosystems**. Cryptocurrencies are digital assets that exist outside traditional monetary systems and are **not universally defined or regulated**. Jurisdictions vary in how they classify cryptocurrencies, with some treating them as property, others as securities, and some recognizing them as means of payment. The decentralized nature of cryptocurrencies

complicates regulation, with some countries imposing strict regulations, while others promote innovation. The legal treatment of different types of cryptocurrencies often depends on their function.

4.3 **Cryptocurrencies, while sharing some characteristics with money, are not fully classified as "money"**. Indeed, they can be used as a medium of exchange in certain contexts, but their acceptance is very limited; moreover, their high volatility makes them keen to perform store-of-value and unit-of-account functions. Therefore, while they exhibit some features of money, they are **more accurately categorized as digital assets** or alternative currencies, which may evolve into money over time.

4.4 Cryptocurrencies can be broadly classified into two categories: coins and tokens.
The former, such as **Bitcoin**, **Ethereum**, **Ripple**, **BNB**, **Solana**, to name those with the higher market capitalization, are the **native digital currency of the relevant blockchain platforms** that primarily serve to operate the network.
Tokens, on the other hand, can represent a wide variety of digital assets that can be created on blockchain platforms, through smart contracts, to **perform many different functions**. Indeed, digital tokens can be classified into several categories based on their purpose, such as: **Payment Tokens**, performing as a medium of exchange; **Utility Tokens**, designed to provide access to services and products on specific platforms; **Security Tokens**, representing ownership or a stake in a real world asset, such as shares, bonds, real estate, and other assets to be used to represent ownership on securities; and more.

⇒ OKP, Part B, Chapter 1, Fundamentals of Blockchain and Distributed Ledger Technologies
⇒ Coinmarketcap.com – Website
⇒ Ethereum – Website
⇒ Ripple – Website
⇒ BNB – Website
⇒ Solana – Website

4.5 **Stablecoins**, on the other hand, are digital assets **designed to maintain a stable value by being pegged to a reserve asset, such as an official currency or a basket of commodities**. Despite being considered as a specific type of cryptocurrencies, stablecoins must be considered apart from the latter, as they are designed to avoid volatility and be suitable for everyday transactions and as a store of value. In general, **stablecoins can compete with electronic money for online transactions, while USD-pegged stablecoins have already emerged as the dominant means of payment in crypto trading and De-Fi ecosystems**.
Stablecoins are issued by private entities which are responsible for maintaining the reserve backing that ensures stability of the stablecoin's value. Under certain circumstances, stablecoins may be considered as electronic money operating on blockchain platforms.

4.6 There are three main types of stablecoins, namely fiat-collateralized, crypto-collateralized, and algorithmic stablecoins.

Fiat-collateralized stablecoins are backed by a reserve of fiat currency, such as US dollars or euros, held by a central authority. The reserve ensures that for every unit of stablecoin issued, an equivalent amount of fiat currency is held in reserve. Popular examples of fiat-collateralized stablecoins include **Tether** (USDT) and **Circle** (USDC). These stablecoins are typically redeemable on a 1:1 basis with the underlying fiat currency, making them a reliable store of value and medium of exchange in the crypto ecosystem.

Crypto-collateralized stablecoins are pegged to a fiat currency, but backed by a reserve of other cryptocurrencies, such as Ethereum or Bitcoin. These stablecoins are designed to be over-collateralized, meaning the value of the collateral exceeds the value of the stablecoins issued. This is done to account for the volatility of the underlying crypto assets. Examples of crypto-collateralized stablecoins include **Dai** from MakerDAO and **USDe** from Ethena. These stablecoins are often governed by decentralized organizations that automatically adjust collateral requirements and liquidate assets to maintain stability.

Algorithmic stablecoins are not backed by any collateral. Instead, their value is maintained through a series of algorithms and smart contracts that automatically increase or decrease the supply of the stablecoin based on market conditions. The idea is to use market incentives to ensure that the price of the stablecoin remains stable, much like central banks control the money supply of fiat currencies. **Ampleforth** is an example of an algorithmic stablecoin.

⇒ Tether – Website
⇒ Circle – Website
⇒ MakerDAO – Website
⇒ Ethena– Website
⇒ Ampleforth – Website

4.7 Unlike volatile cryptocurrencies, therefore, stablecoins are more suitable for everyday transactions and serve as a reliable store of value. They are increasingly used in decentralized finance (DeFi), facilitating cross-border payments, trading, and lending. However, their decentralized nature and reliance on reserve assets or algorithms raise **regulatory concerns**, particularly regarding monetary sovereignty, financial stability and consumer protection. Stablecoins' future depends on regulatory clarity, technological advancements, and effective risk management, potentially transforming digital payments and financial systems globally.