Cryptocurrency, Decentralized Finance Blockchains and Robust Trading Strategies

Cryptocurrency, Decentralized Finance Blockchains and Robust Trading Strategies

By

Yosef Bonaparte

Cambridge Scholars Publishing

Cryptocurrency, Decentralized Finance Blockchains and Robust Trading Strategies

By Yosef Bonaparte

This book first published 2022

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-5275-8932-3
ISBN (13): 978-1-5275-8932-2

TABLE OF CONTENTS

PREFACE

Yosef Bonaparte is an associate professor in finance at the Business School of the University of Colorado, in Denver, and the director for external affairs in finance. He has a PhD in economics from the University of Texas and has taught in several institutions and universities in the United States and Canada. His research has focused on **household finance**, asset pricing and political finance. Specifically, Professor Bonaparte analyses how political climate and political affiliation influence key household financial decisions, such as the level of risk tolerance and participation in the stock market.

Professor Bonaparte has been active in the cryptocurrency and blockchain field since 2019, ranging from conducting research at the academic level and publishing in journals, participating and presenting at conferences and seminars, and conducting feasibility studies to institutional investment companies to form a new cryptocurrency, named *Generation Coin* (*G-Coin*). He has also provided advice to policy makers, especially to the state senator of Colorado. Some chapters of the book have been presented at several major universities and institutions, including the University of Miami, the University of Colorado, at Boulder, and the University of Denver. Professor Bonaparte also completed MIT's Open Course Ware *Blockchain and Money* course by Professor Gary Gensler. Professor Bonaparte is currently teaching a course on cryptocurrency and blockchain at the University of Colorado at Denver Business School.

Professor Bonaparte's research has been published in top financial and economics journals, his work has been featured in major newspaper and magazines, including the *New York Times*, *Wall Street Journal*, *Market Watch*, *The Denver Post*, Yahoo finance and MSN, and he has been featured on several TV networks including ABC and Fox News.

INTRODUCTION

The goal of this book is to conduct a 360 review of the most important elements that one needs to know about cryptocurrency, decentralized finance (DeFi) and blockchain. This material is very important, since there has been a **major shift in global payments methods**, including a shift away from the use of credit cards for business payments from 29 %, in 2016, to 15 %, in 2021, and a shift towards digital wallet payments, rising to 46 % of payments, in 2021, from only 18 %, in 2016 (see Table P1 below). Given the dramatic changes in the nature of global payments, knowledge of emerging blockchain technology, with DeFi emerging as a payment system, is crucial.

This book can be used by practitioners as well as for teaching. Professor Bonaparte uses many elements of this book in his cryptocurrency and DeFi blockchain classes that he teaches at the University of Colorado, at Denver, and the University of Miami. The book can also be used for policy makers: when a state or city decide to issue token bonds, such as for the State of Colorado token bond bill, **SB 22025, where Professor Bonaparte served as an expert witness, in 2022**.

The book is structured in three main themes. The first theme, presented in Chapter 1, is an introduction to the origin of money with historical background that also reviews key developments and, in Chapter 2, an introduction of the role of finance, in general, and, specifically, facilitating transactions. The first theme is necessary to understand the origin and the foundation of cryptocurrency and DeFi blockchain, which paves the way to second theme. The second theme is blockchain technology and how it operates, in Chapter 3, including introducing key terminologies, and how blockchain paves the way for the innovation of cryptocurrency. Specifically, Chapter 3 presents the new DeFi Blockchain technology and how the new blockchain technology facilitates new approaches for direct **peer-to-peer transactions.** Chapter 4 continues this discussion, including the use of blockchain technology across different sectors, including Bitcoin, non-fungible tokens (NFT) and initial coin offerings (ICO), among others.

The third theme of the book is about the story concerning the present and the future of cryptocurrency, discussed in Chapters 5 and 6. In particular, in

Chapter 5, the definition of cryptocurrency and why it exists is followed by an analysis concerning who and why people own cryptocurrency and how they use it, including key financial statistics about crypto holders. Most importantly, in this book, the possible future paths of cryptocurrency and blockchain are portrayed, and key recommendations are provided that have implications for the functioning of financial markets.

The fourth and final theme of the book is about crypto regulation sentiments and robust trading strategy. We map key regulation problems that the crypto field faces and then analyze key trading strategies that one can utilize to trade cryptocurrency. Specifically, in Chapter 6, we study the regulation issues and how they impact prices and volatility, and then, in Chapter 7, we present an explanation for why people trade and map for key trading strategies, including suggestions for entries and exits for trading strategies. It is important to understand the key difference between crypto asset classes and other asset classes, like equity. Crypto is more of a speculative asset, whereas equity is largely a productive asset with an increasing trend overtime.

The book is structured with eight chapters, where each chapter is a sum of sections. In some chapters, an appendix is included at the end of the chapter. The appendices mainly present key figures and pictures. Collectively, this book discusses the origin of money, the role of finance, technologies that offer possibilities, and the present and the future of cryptocurrency and Defi blockchain.

Table P1: Global Payment System Usage between 2016 and 2021

	2016	2021
Credit Card	29 %	15 %
e-Wallet	18 %	46 %
Bank Transfer	17 %	16 %
Debit Card	13 %	8 %
Cash on Delivery	9 %	7 %
Charge & Deferred Debit Card	6 %	3 %
Pre-Paid	3 %	3 %
PostPay	2 %	1 %
PrePay	2 %	1 %
Other	1 %	0 %

Source: Worldpay Report; MIT Crypto and Blockchain class. https://ocw.mit.edu/help/faq-fair-use/.

SECTION I:

THE ORIGIN AND THE ROLE OF FINANCE

CHAPTER 1

THE ORIGIN

Chapter Review

This chapter focuses on the origin of money and reviews the history, from the origin of bartering and commodity money to the current digital form of money. After reviewing the history of money, the role of money is discussed in depth, from store of value, unit of account, and medium of exchange. The chapter then includes an analysis of the emerging differences between medium and method of exchange. With technological development, these terms (e.g., medium and method) start to become to be different. For example, if you buy a grocery basket, the medium of exchange can be the basket versus dollars; yet, the method of exchange varies between cash, check or credit card. In addition, this chapter analyzes the key characteristics of money, for example, digital versus physical as well as the design of money.

The second part of this chapter discusses the history of ledger and payment systems, which is critical for understanding the current blockchain revolution. The chapter then presents a comparison of self-governing by technology for money supply versus the current control of the money supply by the Federal Reserve and other central banks. This is critical because it has implications on the financial market's stability. The Federal Reserve, as are central banks in other countries, are in charge of monetary policy, while, in the US, for instance, Congress and the government are in charge of the fiscal policy. With a self-governance based on technology for the money supply, it follows that the transaction volume and financial activities for the money supply are reflected in the number of blocks generated.

The approach for each section of the chapter is to provide details and key information, as well as figures that reflect real world documents. These figures, many of which are historical and taken from several different places and resources, are presented towards the end of each chapter (for this chapter they are in the Appendix for Chapter 1).

1.1 The History of Money

This subsection reviews the history of money, from barter to commodity money up to the current digital form of money and digital wallet. The subsection closes with the role of money and how it facilitates transactions.

The History of Money

The word money was introduced, first, from the **Latin word *moneta*** that means **"coin" or the French *monnaie***. Some believe that moneta originated from the temple of Juno, which is on one of Rome's seven hills; Juno was associated with money, as derived from the name of the Etruscan goddess Uni, meaning a "unit" or "the one." According to *Merriam-Webster*, the meaning of the word "money" is "something generally accepted as a medium of exchange, a measure of value, or a means of payment."

The history of money went through five main steps, discussed below:

Step 1: Barter System

The term *barter* is derived from the old French *barater*, "to barter, cheat, deceive, haggle," or *baretor*, in Romania, and some suggest that the barter system may date back to at least one hundred thousand years ago. Barter is a system of exchange where participants, or parties, in a transaction directly exchange goods or services for other goods or services. This is slightly different from gift economies, and often features immediate reciprocal exchange, not one delayed in time. Barter usually takes place on a bilateral basis and occurs often between either complete strangers or potential enemies.

Step 2: Commodity Money

Commodity money is an object, like shells (of the cowry Cypraea *moneta* L. or C. annulus L.), gold and silver, that is used for trading. The first usage of commodity money came from Mesopotamia, circa 3000 BC, and some (according to Herodotus) argue that the Lydians were the first nation to present the use of gold and silver coins.

Step 3: Representative Money

After banks were introduced and growing rapidly, around the seventh century, banks begin to issue receipts to their depositors—redeemable for the commodity money deposited; this is the representative money system.

Ultimately, these receipts became generally accepted as a method of exchange and payment, and were used as money. These banknotes, known as *jiaozi*, did not relocate commodity money and were used beside coins.

Step 3: Paper Money

The growing use of paper money occurred during the thirteenth century, especially, in Europe, through the accounts of travelers. Stockholm's Banco was among the first to issue banknotes, in 1661, and these were used together with coins.

Step 4: The Gold Standard

The gold standard is a monetary system for which paper notes were a medium of exchange and were convertible into pre-set, fixed quantities of gold. It substituted the use of gold coins as currency between the seventeenth and nineteenth centuries in Europe. Toward the beginning of the twentieth century, most countries adopted the gold standard, backing their legal tender notes with given quantities of gold.

Step 5: Fiat Money Post WWII

At the Bretton Woods Conference, at the end of World War II, the majority of the countries at the conference adopted fiat currencies, which were exchanged relative to the US dollar as a global currency, since the US held significant gold reserves and had emerged as an economic power in the post-war period. The International Monetary Fund (IMF) and the World Bank were created to assist in monitoring the new system. The conversion into gold was set at a fixed rate, maintained by central bank interventions. With problems with the gold standard, including lack of control of the money supply with gold production and hoarding affecting it, and with high inflation in the US in the 1970s, the fixed rate for the US dollar's value remained high, when its market value should have fallen. The US made a decision to reprice the US dollar, but this policy led to a run on gold reserves. By 1971, under President Nixon, the US decided to abandon the gold standard and change to a floating rate system, allowing the US dollar to change relative to other currencies, beginning in 1972. IMF countries were allowed to choose to allow their currencies to float with the US dollar, or be fixed (pegged relative to another currency or a basket of currencies or adopt another country's currency, or participate in a currency block as part of a monetary unit). Then, many currencies in other countries became backed by US dollar or by an index of currencies. Hence, new foreign exchange systems emerged including, in addition to fixed and pegged rate

system, floating rates, and managed float, where central banks intervened when currencies got too out of line by buying and selling foreign reserves, and the IMF provides international reserves for emergency situations.

The Role of Money and Key Characteristics

Next, we turn to analyze the role of money and its key features. There are several roles for money, such as store of value and unit of accounts; it is important to mention that the store of value has to do with stable and limited supply. However, the greater role is as a medium of exchange between two parties who are interested in conducting a transaction or a trade. The key characteristics of money are that it is durable, whether paper or coin money, portable (easy to carry), divisible, uniform, rigid to counterfeit, and acceptable.

The design of money is critical, and presents some advantages. In fact, there are different approaches used to design money. For instance, the design of money can be token versus account-based and physical versus digital. Furthermore, the design of money can be wholesale or broadly accessible and central banks versus private banks.

1.2 Medium vs. Method of Exchange: The Emerging Difference

Often, when we ask researchers about the role of money, they would say, for instance, that it is a **medium of exchange,** and others would say it is a **method of exchange**. In part, perhaps both of these definitions seem the same, yet, with recent technological development, these terms, e.g., medium and method, start to become to be different. For example, if we buy a grocery basket from Whole Foods, the medium of exchange can be the basket versus US dollars; yet, the method of exchange varies between cash or credit card.

This is important to distinguish because cryptocurrency replaces both the medium and method of exchange, which is distinct from other payment systems. Therefore, we can define three categories of medium and method of exchanges. The first category is **dollar centralized medium and method of exchange**, which means using the dollar as the medium of exchange and centralized finance, such as Visa or MasterCard, and as the method of exchange. The second category is **dollar decentralized medium and method of exchange**, which means using the dollar as the medium of

exchange and paying cash directly—decentralized finance peer-to-peer. It is important to mention that both the PayPal and Venmo payment systems use the dollar as the medium of exchange, and the method of exchange, and the money or fund transfer is decentralized finance, hence, peer-to-peer. Venmo is still a centralized payment system, yet it performs as a peer-to-peer money transfer.

The third and most importantly category for the scope of this book is **cryptocurrency as a decentralized medium and method of exchange**, which means using a cryptocurrency, such as Bitcoin, as the medium of exchange and the method of exchange, and that it is peer-to-peer decentralized finance. Therefore, what distinguishes the three currencies is the medium, hence, the dollar versus cryptocurrency, and a centralized versus decentralized method of exchange.

1.3 Ledgers and Payment Systems

A financial ledger is the backbone of any corporation and financial institution. Ledgers act as a means of recording financial data to make sure all profits and expenses are properly recorded for both peace of mind as well as for when tax time arrives.

A ledger has three main principles. The most common ledger utilizes what is known as a **double entry** accounting system. What this implies is that for any debit that may occur there is a credit that also occurs. For example, say the company ABC buys materials for $1,000. A debit of $1,000 is recorded to the cash account, and a credit of $1,000 is recorded to the inventory account. **Balance** is a key principle that is created from this system. As, when it comes time to analyze the accounting ledger, if the amount of credits does not match the amount of debits, then something has gone wrong. This directly ties into the third principle of security and **accountability**. Because ledgers are broken down and categorized into many sub-ledgers, in which credits and debits must be equal to each other, it is very easy to see and track if a mistake has happened, or if assets went missing. This creates honesty and integrity in the system.

Ledgers are used everywhere, from small companies to large companies, and are even used in the circumstances of recording economic activity and financial relationships between countries. Because the scope of use cases is so broad, there are many different types of ledgers that have evolved. The most commonly known ledger is known as the **general ledger**; the general ledger acts as a parent for all **sub-ledgers**. Sub-ledgers are a method of

categorizing accounting data so that the seemingly endless amount of transactions can be better navigated and accounted for. The double entry ledger system is not the only ledger system. Another ledger method is known as the **single-entry** system, in which, unlike the double entry system instead of always recording both a debit and a credit, only one part of the transaction is recorded. This is not an efficient system. This system is not proper for taxes, and one cannot accurately test to see if all transactions have been properly accounted for, as there is no balance being shown between debits and credits for each entry.

Financial data is a very red tape heavy issue. Since the ledger is the backbone supporting this issue, all ledgers must have the proper characteristics in order to ensure integrity. One of the key factors of a good ledger is **immutability**. Immutability ensures that once a transaction has been recorded, the transaction will forever stay the same. This evokes **consistency** in the ledger by ensuring that no transactions are tampered with after recording, as well as being always consistent to the **timestamp** of which the transaction occurred to ensure **accuracy**. Well-built ledgers also incorporate a sense of **ownership** in each transaction. This is done by creating a **comprehensive description** of each transaction for the purpose of the transaction to be better understood later on.

Ledgers can also work as means of **payment systems**, which is a system used to settle financial transactions via the transmission of monetary value, and used for cash or monetary value transfer in domestic and international transactions. Automated teller machine (ATM) networks and the Society for Worldwide Interbank Financial Telecommunication (SWIFT), are examples of payment systems that have become globally available. The ATM is a local payment system while the SWIFT is a cooperative society that assists as an intermediary and initiator of financial transactions between banks worldwide

The parties involved in a payment system include the institutions, instruments, individuals and procedures that use the centralized finance technologies to execute the exchange possible. One of the most common types of payment systems often links bank accounts and provides for monetary exchange using bank deposits, and is named operational network. Some payment systems also include credit mechanisms, which are essentially a different aspect of payment.

Companies like Visa and MasterCard are essentially giant ledgers and use a payment system. When a person spends money with a Visa card, what

happens is Visa first checks if the individual has enough money in their account for the debit, by looking up the individual in their ledger. If the individual does indeed have enough money for the debit, the amount of the transaction is then recorded as a debit to the buyer's account and the money is then credited to the seller's account and recorded to the ledger once complete. This form of transaction takes advantage of the double accounting system as for every debit the individual incurs another individual or entity is receiving that credit.

1.4 Money Supply: Self-Govern vs. Federal Reserve / Human

The Federal Reserve, as the Central Bank of the US, is in charge of its monetary policy, while the congress and the government are in charge of the fiscal policy. The Federal Reserve, also known as the Fed, was created to be independent in order to avoid political pressures that could be put on its operations, such as pressures for loose money policies that could create inflation. This split in power between the Federal Reserve and the government means that the Federal Reserve is in charge of the money supply, although the US President appoints the chairman of the Federal Reserve, which must be approved by Congress, and the chairman of the Federal Reserve is required to submit their Monetary Policy Report semiannually to the Senate Committee on Banking and to report to Congress. The Federal Reserve chair appointment must be approved by the Senate for four-year terms, and the Board of Governors of the Federal Reserve includes seven members also nominated by the president and confirmed by the Senate for four-year terms (Board of Governors 2015a). Thus, removing a sitting Federal Reserve chairman requires a large majority in Congress.

The US Federal Reserve has a so-called **dual mandate**: "Promote effectively the goals of maximum employment, stable prices, and moderate long term interest rates." The Federal Reserve has many tools in its arsenal, including determining interest rate and the money supply. The Federal Reserve operates in many dimensions to determine the level of money supply. One of these dimensions is the bond market, where the Federal Reserve increased the bond holdings on its balance-sheet by purchasing bonds from the public. Another dimension is putting deposits in the commercial bank accounts, increasing the money supply, and providing deposits for banks to lend out as loans, injecting liquidity into financial markets and with a rise in the money supply reducing the real equilibrium

interest rate in the US economy, as well as encouraging greater borrowing by governments and businesses further stimulating the economy. Of course, when the Federal Reserve, instead, sells bonds to the public, this reduces the buyers' deposits, and the money supply shrinks in the financial markets, this open market operation, in turn, increases the real equilibrium interest rate, under a contractionary open market policy.

What are the key factors that the Federal Reserve considers to determine the supply of money? Key roles of the Federal Reserve are to maintain low inflation, at 2 % to 2.5 %, and to hold low unemployment at a level between 3 % and 4.5 %; these are the main objectives that the Federal Reserve considers when making monetary decisions. A high money supply contributes to inflation because it increases the supply curve for loanable funds, which shifts out intersecting the demand curve for loanable funds at a lower real interest rate, which, with more money circulating, increases the cost for goods and services, but, as an expansionary policy, has a positive effect on lowering the unemployment rate. Since the level of money supply influences these two goals but in different directions, the Federal Reserve has to optimize the level of money supply, so not to have a high inflation and not to have high unemployment.

An optimization process was developed, historically, whereby the Federal Reserve's open market operations are decided on by its Federal Open Market Committee (FOMC) at FOMC meetings. At these meetings, the FOMC uses a wide range of economic information on the current and future economic outlook including indicators of economic activity and employment strength, inflation, energy prices, trends in the money supply, and regional economic information, along with events (such as the pandemic and the invasion of the Ukraine by Russia, creating greater human and economic hardship with implications for the US economy), in making its decisions (see, for example, its recent FOMC statement on March 16, 2022, https://www.federalreserve.gov/newsevents/pressreleases/monetary20220316a.htm). The FOMC consists of "twelve members—the seven members of the Board of Governors of the Federal Reserve System; the president of the Federal Reserve Bank of New York; and four of the remaining eleven Reserve Bank presidents, who serve one-year terms on a rotating basis."

On the other hand, cryptocurrency coin supply is driven via a self-governing technology. For instance, Bitcoin issues a new supply of coin every ten minutes, which is distributed to miners who verify transactions, in a lottery fashion. The reason we say self-governing technology is because the supply of coin is not made by a decision but rather by a formula based on the

demand and supply for Bitcoin for speculative or transaction purposes. Since there are fixed amounts, just like mining gold, the value of Bitcoin can rise or fall, based on supply and demand factors, with a ceiling for how much can be mined.

The number of bitcoins that can be created is set at twenty-one million, and there are currently 18,844,906 bitcoins in existence today (January 2022). Only 2.8 million new bitcoins can be created between now and 2140, the year when the last bitcoin will be created. A limited supply means that bitcoin cannot be inflated. Therefore, some view Bitcoin as a good hedge against inflation. The cryptocurrency approach for the supply of money is more limited in terms of supply, given the limits on Bitcoins, and follows a self-govern technology.

The way of distributing the new supply of money has financial inclusion issues. The Federal Reserve approach may increase inequality at times, because when the Federal Reserve targets lower interest rates, this has a positive effect on real estate prices by increasing real estate valuations and increasing the demand for home loans, which may become too high for less wealthy consumers, and may also inflate rental prices. It may also have a positive effect on stock market prices with wealthier consumers having greater opportunities to invest, while, in cryptocurrency, the money supply increases based on millions of investors acting as miners or as transaction verifiers. It is important to mention that we are not including cryptocurrency investors, who may be wealthier individuals. One problem with crypto, just as in using gold, is that its price depends on supply and demand factors, and, with limited amounts, this could result in a contraction of an economy if a nation takes on a crypto currency as its sole currency without adequate operational and regulatory frameworks, and inadequate reserves and disclosure and investor protections (see IMF report, “The Crypto Ecosystem and Financial Stability Challenges.”).

Table 1.1: The Comparison in the Money Supply between Federal Reserve and Cryptocurrency

Item	Federal Reserve	Cryptocurrency
Money supply	FOMC	Self-govern technology
Receivers of money supply	Banks and Federal government	Miners and transaction verifiers
Financial inclusion	Lower	Depends affordable price for crypto
Goal for the supply	Lower inflation and unemployment	Rewarding those who verify the transactions (miners)
Uncertainty	High	Limited by Bitcoin ceiling & supply/demand
Store of value	Less risky	Risky
Financial stability	Many crises	Not enough history; only a few previous crises

Bitcoin self-govern money supply or the "monetary policies" as follows:

- Creation originally 50 bitcoin per block
- Reward halves (1/2) every 210,000 blocks
- Currently 12.5 BTC created per block—thus "inflation" at 4.1 %
- Currently 17.3 million BTC; capping at 21 million BTC in 2040
- Market-based transaction fee mechanism also provided for in Bitcoin Core

Ethereum self-govern money supply or the "monetary policies" as follows:

- Three ETH per block, therefore, "inflation" at 7.4 %
- Fresh proposal to decline to two ETH per block in 11/18
- Fees paid in Gas (10 Gas per ETH) for computation and attributed to miners

Appendix: Images of Historical Money and Coins

This appendix displays some historical figures related to money, coins, ledgers, and others.

Song Dynasty Jiaozi, the Image by Bertramz on Wikimedia. World's earliest paper money License: CC BY

Salt Bars—Ethiopia

Image in the public domain by Gary Todd. Image by Sandstein on Wikimedia.

Cowrie Shells Tally Sticks Non-metal money

Image by Yusuke Kawasaki on Wikimedia. License: CC BY © Chuy1530 on Wikipedia. Image by Mary Harrsch on flickr

Rai Stones—Yap Bronze Aes Rude—Rome Bronze Spade—China

Non-metal money Metal money Metal money

© StAnselm on Wikipedia. Image by Scott Semans World Coins.Image by Daderot on Wikimedia

Cooper Plate—Sweden Bronze Yuan—China Silver Dekadrachm—Greece

Metal money Minted money Minted money

Images are of the public domain

Jiaozi Promissory Note—China Five Pound Note—England Continental Note—US

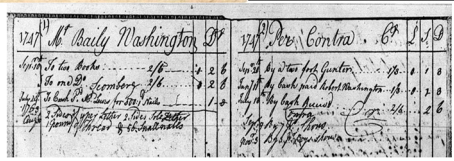
Paper money

Images are in the public domain

Australia United States

Canada

Private bank notes



Images are in the public domain
England Proto Cuneiform Personal Ledger George Uruk, ca 3000 B.C Washington 1747

Private bank notes Ledger Ledger

Images are in the public domain

Deposits and negotiable orders

CHAPTER 2

THE ROLE OF THE FINANCIAL MARKET

Chapter Review

In this chapter, we analyze the role of the financial market, in particular, how the financial markets facilitate moving, allocating and pricing assets (including money) and the corresponding risk. This is critical because the financial market aims to lower the uncertainty that households face, and smooth the lifecycle consumption path that households need, especially as they are ageing and labor income risk changes overtime.

The next section maps the financial institution and its roles in our economy, especially the monetary side to facilitate transactions, including deposits, loans, investments, and currency exchange. We will review key financial markets and the primary financial institutions in the US, based on size and importance, particularly the Federal Reserve and commercial banks. We, then, turn to discuss contemporary fiat money, and the role of the central bank and centralized finance, hence, the credit card.

The following section analyzes the association between the financial sector and technology. In particular, we will focus on the issues that the finance sector have with blockchain technology. There are several issues that we discuss, ranging from **scalability and efficiency** to **security and privacy**, namely to what extend the blockchain is secure, and **public policy and legal structures**.

The chapter closes by pointing out and emphasizing the riddle that is still existing, and persisting: specifically, how to move value (money or coins), with a peer-to-peer approach and without any trusted central intermediary. In the Chapter 2 Appendix there are several pictures of historical credit cards and processing machines that have been used.

2.1 Pricing Money and Risk

One of the key roles of the financial markets is to **facilitate** the **moving**, **allocation** and **pricing** of assets (including money) and the corresponding **risk**.

The word **facilitate,** or financial facilitation, means that the financial market provides a place where buyers and sellers can meet; the place can be a fiscal place or virtual via the net. The place is critical because buyers need to find the seller and not to go randomly asking for counterparts for the purpose of transaction.

The concept of **moving**, can mean many things, such as moving commodities like corn, oil, wheat, etc., from the farmer or the producer to the interested buyer. The financial market can facilitate moves, via the supply chain and financial market, that aid, to contract, any transaction. Moving also can be a rotation from one asset class to the other, such as from value stocks to growth stocks, or from stocks to bonds, and vice versa.

The next topic to focus on is the **allocation,** and how important it is. Given the wide range of financial opportunities, where each asset exhibits return and risk (we will explain later in this section the risk and return trade off), the allocation across these assets is critical as these investment opportunities, across assets, can compete and complement each other, and the level of desired risk for a given risk varies across investors. As such, allocation across these financial assets is critical, and the financial markets facilitate via moving and allocation of money and liquid assets.

It is important to understand the terms **pricing** and **risk**. Each valuable asset should have a listed price, based on its market value, that it is traded on. The asset can be stock equity, bonds, wheat or a bushel of corn, etc. The listed price reflects the available information at the moment, and the valuation of the asset based on several aspects, especially demand and supply, cost, competition, etc. Yet, with 24/7 news cycles, it is hard to predict the future of such an asset, given the uncertainty in the economy. The future prediction for an asset, in addition to supply and demand, is the risk premium that is included in the price; with higher risk assets expected to have higher returns. Otherwise, investors would not want to invest in a risky asset if it had a lower return that did not compensate the investor for the risk taken on.

There are different reasons for risk and uncertainty, which are many and critical and reflect financial sector challenges. First, there is the risk of crises and instability in the financial market. Second, there is risk associated with

fiat money instabilities connected with instability in monetary and fiscal policies, particularly during times of crisis. Third, is the risk of financial inclusion, where market factors may enhance the wealthy versus the poor and create inequality within a society.

2.2 Financial Institutions

A financial institution is engaged in a business that deals with financial and monetary transactions including deposits, loans, investments, and currency exchange. They are unique as well by holding primarily financial assets and are financed by financial liabilities. This results in financial institutions taking on different risks including interest rate, liquidity, credit, and capital risks. Financial institutions encompass a large array of business transactions in the financial sector. There are several different types of financial institutions that operate in financial markets, discussed below, based on their size and importance.

The biggest financial institution in the US is the **Federal Reserve Bank**, which operates as the central bank of the US and has the following primary goals: (1) to keep inflation around low (today a goal of about 2.5 %); and (2) to maintain unemployment at a low rate (today at about 3.5 % and 4 %). One of the many toolboxes that the Federal Reserve possesses is to control the money supply using its operational goal of achieving target key interest rates. The Federal Reserve controls the money supply primarily by engaging in Federal Open Market Committee operations to purchase bonds from the public to increase seller deposits to increase the money supply and to sell bonds to the public to reduce buyer deposits to reduce the money supply. These tools are very effective to engage in expansionary and contractionary policies to provide or reduce liquidity in financial markets in order to achieve the desired interest rate, and the inflation and unemployment level targets. The key problem that the Federal Reserve faces is that if the Federal Reserve increases the money supply, and lowers market interest rates, there is a trade-off with the potential for higher inflation. This means that the Federal Reserve has difficulties meeting both goals. Thus, the Federal Reserve has to optimize its policy between the optimum money supply level to reduce inflation, and the target interest rate level that is optimal. The Federal Reserve is also constrained by other factors, such as supply chain issues and consumer demand for goods that also contribute to inflation. In summary, in addition, the Federal Reserve, or central bank, goals and objectives are to **oversee the fractional banking system,** via providing reserves, supervising the banking system via regulation and audits; enhance