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Financial Globalization: The Case of DeFi

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Academic Year 2021/2022

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Introduction

A rising wave of change is influencing and, in some ways, revolutionizing countless aspects of our life. The consequences brought to light by the concept of cryptocurrencies are at the heart of this new digital revolution. The financial world, in particular, has been shaken by the introduction of new and complex systems and structures that developed around the modern cryptocurrencies' architecture.

In recent years, keywords like "bitcoin" and "blockchain" have flooded media channels. However, this field is widely discussed with superficiality and conveyed with triviality and frequently with herd behavior. As a result, numerous misconceptions and biased viewpoints flourished surrounding the topic, hence spreading ignorance. Indeed, only few people are aware of such technologies' actual utility and practical application.

Due to these prejudices and biases that have gathered and are becoming ingrained in everyday culture, it is difficult to establish and develop a critical perspective on the subject. However, this paper aims to renounce at preconceived ideas and plunge deep into a path intended to analyze, explain, and interpret the origin and current maturation of a new phase of human technological development in its most significant features. Namely, blockchain technology and cryptocurrency utility go far beyond the classic assumptions surrounding certain aspects of the subject. The main question this paper will try to assess is whether the novel technological revolution will be as impacting as the advent of the internet or as striking as the tulip bubble.

First, the paper will examine the evolution of traditional finance from a historical viewpoint, focusing on the effects of financial globalization on the national and international economy. Second, the paper will provide a historical and technical overview of cryptocurrencies. Finally, it will discuss decentralized finance: one of the ecosystems that revolve around cryptocurrencies.

Chapter 1 – Financial Globalization

Overview on Financial Globalization

Three decades ago, a firm attempting to create a new factory would have been limited to borrow capital from a domestic bank. Today, globalization has made it possible for that same firm to have the opportunity to choose from a wide range of alternatives. It could browse the world for a lower-interest-rate loan and borrow in foreign currency if foreign-currency loans offered better terms. It could issue stocks or bonds in domestic or international capital markets. It could choose from various financial products to help develop a hedge against potential risks or employ a decentralized approach.

In its purest notion, globalization implies the relentlessly increased involvement on a world scale of trends, ideas, and problems among individuals, regardless of their geography or race. Facing a never-ending contraposition, these trends are simultaneously a source of public enthusiasm and fear, excitement and concern.

In the economic sphere, markets are becoming less segmented by national boundaries due to the gradual loosening of governments' constraints on capital mobility, which integrates a country's domestic financial systems with those of other countries. This framework of liberalization and deregulation of the domestic economic and financial sectors and institutions toward a global system is known as "financial globalization."

The History of Financial Globalization: From the Bretton Woods Agreements

Although Financial Globalization appears to be a novel phenomenon, which origins could be traced back to the Bretton Woods agreements, its roots are much older. Indeed, some scholars trace it back to the early nineteenth century. Both markets for goods and services and markets for assets have historically required a financial bridge. Indeed, trans-country capital movements are centuries old. Scholars argue that what we are experiencing today is a long-standing evolution that only reversed its course due to the outbreak of World War I in 1914 and did not adjust until 1971.

During this period, governments dealt with the economic pressures of the two World Wars and the anguish of the Great Depression. As a result, the sequential chain of these events impeded the progression of financial globalization since governments focused almost exclusively on the reorganization of their domestic economies by imposing significant trade obstacles, depreciating their currencies to compete for export markets, and restricting their citizens' ability to keep foreign cash.

This breakdown in the international monetary cooperation inspired the founders of the International Monetary Fund (IMF)[1] to devise an institution designated for the supervision of the global financial system: a network of exchange rates and international payment methods that allowed nations to purchase goods and services from one another. The new global institution, created with the Bretton Woods agreements in 1944, agreed to assure currency rate stability and urge member nations to remove exchange restrictions that inhibited commerce. It was based on a par value system in which members agreed to bind the value of their currencies, i.e., their exchange rates, to the U.S. dollar. In turn, the latter was secured in respect to gold. The rates could only be adjusted with an IMF ruling aimed at correcting a fundamental disequilibrium in the balance of payments. The Bretton Woods agreements established a system in which asymmetry was key: the dollar in the center and the rest of the currencies on the edges. The U.S. dollar became the worldwide reserve currency: the only one redeemable for gold; serving as gold's de facto substitute in such a system.

After World War II, the Bretton Woods system appeared unstable. The U.S. dollar's credibility as the international monetary system's anchor currency was reliant on its convertibility upon demand in gold at the fixed price of $35 per ounce of gold. However, the continuous injection of dollars into offshore accounts due to the Vietnam war[2] and the "Great Society" social programs[3], along with the lack of a proportionate growth rate in the supply of gold reserves in the United States, resulted in currency inflation, weakening the anchor currency's credibility since the convertibility of dollars into gold was called into question. The Triffin Paradox

[1] The IMF is an international organization whose mission is to encourage global economic growth and financial stability, as well as international trade and poverty reduction.

[2] The Vietnam War was a grueling, expensive, and controversial battle involving North Vietnam's communist government with South Vietnam and its main ally, the United States.

[3]The "Great Society" social programs were an ambitious set of policy measures, laws, and programs aimed at alleviating poverty, decreasing crime, eliminating inequality, and reducing environmental impact in the United States.

depicts this phenomenon: using a global reserve currency can cause conflicts of interest for the issuing country between short-term internal objectives and long-term international ones. Indeed, the country issuing international currency must accept growing current account deficits to meet the world's demand for a reserve currency. At the same time, it must accept growing monetary deficits, weakening the solidity of the national currency used as the international standard of the reserve. In other words, there is a tradeoff between trust and liquidity. Thus, as the U.S. deficit increased, confidence in maintaining a fixed exchange rate between the dollar and gold diminished. Clearly, this system could work only as long as other countries were willing to accept the dollar as it was, without trading it for gold. However, this was not the case.

The system fell apart in 1971 when the United States broke the convertibility link by closing the gold window, indicating that the U.S. dollar could no longer be converted into gold at a fixed price. It could be said that the United States unilaterally abrogated the agreement terms, thereby ending it. The causes of this downfall can thus be summarized in three points. First, the system failed to establish a sufficient adjustment process through which countries could take the required external and internal actions to repair significant imbalances in their balance of payments positions. Second, it failed to provide the long-term growth rate of world monetary reserves required to support an expanding global economy and a largely fixed-rate system. Third, the agreements failed to create mechanisms for dealing with speculative capital flows, which time after time triggered an international monetary crisis.

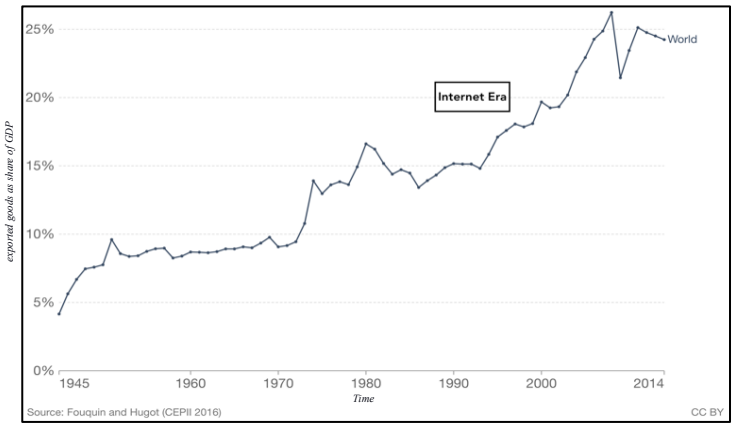
The Bretton Woods agreement's demise exposed most industrialized countries to the realities of floating currencies: the exchange rate increased or decreased in response to market demand. Thus, their value was determined solely by the public’s trust. The regime that emerged was based on managed, flexible exchange rates. Countries gained the freedom to choose any form of exchange arrangement. They could let their currency float freely, adopt another country's currency, or peg it to another currency or a basket of currencies. In other words, as a result of the downfall of the Bretton Woods system, economies were able to open and approach greater capital mobility while retaining monetary policy autonomy.

Furthermore, with the subsequent oil shock[4], which provided international banks with funds, a new wave of globalization began.

The leading agent that marked this new trail was the advancement and refinement in technology. Just like the Industrial Revolution carried the world towards modernity, the technological advancements, tied with the internet's emergence, acted as a catalyst in the equation of global progress toward contemporary society. Indeed, if we refer to economic globalization as a firm's ability to seek value outside of its native nation, a relevant benchmark of this process would be the historical change in global export value as a percentage of the Gross Domestic Product (GPD). When we compare it to the growing number of people who have turned to the internet and the subsequent creation of social media, which allowed individuals to consume information and entertainment, and the creation of business prospects through digital media, we can observe a catalyst reaction (Figure 1-2): prior the global internet era[5], it took 50 years, from 1945 to 1995, for global exports to increase by roughly the same percentage as 1995 to 2014.

Figure 1

Value of exported goods as share of GDP, 1945 and 2014

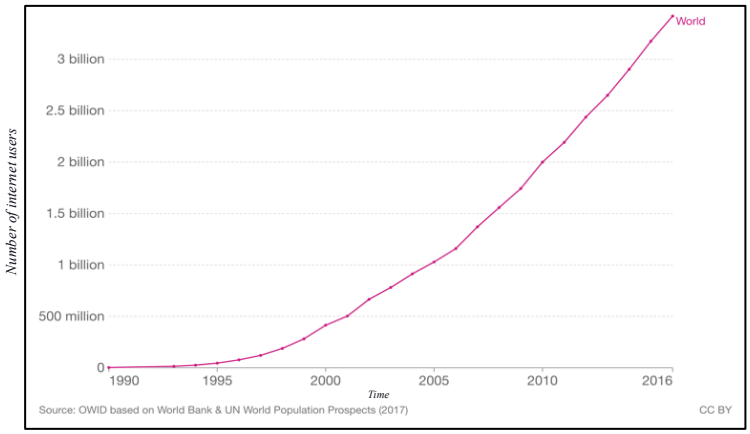


[4] In 1973 oil embargoes were imposed on countries that supported Israel during the Yom Kippur War. It halted U.S. oil imports from OAPEC members and initiated a sequence of production cuts that nearly quadrupled the global oil price.

[5] Period of internet evolution and expansion started in 1995 with the creation of Java and the advent of Windows 95, Amazon, and Internet Explorer.

Figure 2

Number of internet users



Evolution of Financial Globalization

Hence, advances in information and internet-based computer technologies have allowed market participants and national governments to acquire and process data faster and more accurately, creating a chain reaction. First, the global commitment of national economies, which developed considerably as underlying economic activity, expanded across multiple nations and areas. Then, the liberalization of national financial and capital markets and the rapid development of information technology fostered financial innovation and increased cross-border capital flows. Lastly, due to technological advancements and financial deregulation, competition among suppliers of intermediate services intensified.

These dynamics, in turn, resulted in significant structural changes in domestic and international capital markets. First, the banking system went through a process of disintermediation. It can be described as a change of financial intermediation from bank loans and deposits to tradable securities. Indeed, banks have increasingly moved financial risks away from their balance sheets and into securities markets. A second dynamic that developed is related to cross-border financial activity. Indeed, it has considerably increased. Investors are striving to improve their risk-adjusted returns by diversifying their portfolios abroad. They explore the best investment prospects across various sectors, nations, and currencies. National financial markets have grown progressively while bounding into a unified global financial system at the wholesale

level. Today, the world's largest financial hubs[6] support borrowers and investors from all over the world. Third, nonbank financial organizations, such as venture capitalists, began to compete with banks in national and international markets, lowering financial instruments prices.

Benefits and Risks of Financial Globalization

Nonetheless, banks have diversified their activities beyond conventional deposit-taking and lending. Commercial banks have been allowed to enter into investment banking, wealth management, and even insurance in some jurisdictions, allowing them to diversify their income streams and corporate strategies' risks. Banks are increasingly turning to capital markets to finance their investment operations. They rely on decentralized markets where derivatives such as currency and interest rate swaps are privately exchanged, often between two parties, to control risks and simplify intermediation. Nevertheless, financial globalization carries embedded risks, which, although counterintuitively, are the proof of the growth and evolution of this phenomenon. Indeed, when economies open, problems are likely to arise in the short run. One well-known risk is that of a financial crisis. Thus, by examining it from a different perspective, financial crises serve as a critical testing ground for the financial globalization model. Indeed, the Asian and Russian crises of 1997-98, Turkey and Argentina in 2001, and the 2008 housing market bubble, which led to the financial crisis, are symptoms of an ongoing living cycle with technological advancement at its core.

[6] A financial hub is a city or area that is home to a significant number of diverse financial services organizations. The expression hub refers to a wheel with a hub and spokes, which is a metaphor for the ramification of the financial services business.

Chapter 2 – The Blockchain

The birth of cryptocurrency

The Economic Crisis: The Loss of Trust

The housing market bubble that began to grow in 2007 in the United States acted as the foundation for the global financial meltdown. Banks and lending agencies offered cheap mortgage interest rates, encouraging many homeowners to take out loans they could not sustain. Banks began to lend dangerously and irresponsibly to families and people who lacked the creditworthiness for their mortgages. Such high-risk subprime loans[7] were unavoidably compounded. As the volume of subprime mortgage packages increased to an alarming level, with a substantial percentage of them defaulting, lending institutions suffered financial difficulties, leading to the 2008-2009 financial crisis. When the notorious US investment firm Lehman Brothers Holdings Inc. declared bankruptcy in 2008, it undermined people's trust in banks so severely that it triggered the birth of a new asset class.

In 2008 an anonymous individual or group of individuals, under the pseudonym Satoshi Nakamoto, published a whitepaper[8] describing a new Peer-to-Peer Electronic Cash System as a countercultural initiative. Nakamoto (2008) stated that "commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust-based model." He continued expressing his dissatisfaction with central banks and banks. These institutions had frequently violated the trust of those who deposited money, remarking that "the root problem with conventional currency is all the trust that's required to make it work." Soon after, in January 2009, the Peer-to-Peer Electronic Cash System was launched under the name of Bitcoin (BTC), which relies on a technology known as the blockchain.

[7] Subprime loans feature interest rates that are greater than the prime rate. Subprime borrowers typically have poor credit scores or are considered to be at risk of loan default.

[8] A whitepaper is a report that informs readers concisely about an issue or project and presents the issuing body's philosophy on the matter.

Blockchain Technology and the Case of Rai Stones

The blockchain is a shared public ledger that stores every validated transaction in the network. It can be described as a contemporary version of rai stones: the traditional currency on Yap[9]. Yapese villagers' economy was based on the shared memory of past payments by remembering the ownership of each stone and by keeping a mental log of past transactions.
Like bitcoin, rai stones were an intangible asset as the physical location and movement of the stones were irrelevant to the economic activity. Moreover, it was a democratic system: an individual owned a stone as long as most of his fellows agreed he was owner, just like what happens on the blockchain.

Indeed, on the blockchain, every transaction is organized in a series of blocks "chained" together, creating a permanent record. Each block contains data from multiple transactions. However, for the block to be officially recorded on the blockchain, and thus, for the transactions to be executed, the block must be validated.

The validation occurs through a consensus process known as "proof of work" ("PoW"). PoW is a piece of data that is extremely challenging to produce yet simple to verify by others. Producing a proof of work is a random and low-probability operation, which requires numerous trials and errors before producing a valid set of data. It was first designed to solve the double-spending problem[10].The core of this system is based on cryptography to ensure the integrity and chronological order of the blockchain.

Users known as "miners" execute PoW through a process called "mining." Crypto miners employ extremely powerful computers programmed to solve complex arbitrary mathematical equations generated by the bitcoin code in the form of cryptographic hashes[11]. Once solved, hashes are used as the digital signature of the mined block and, thus, as proof of work. The

[9] Yap is a small group of islands in Micronesia.

[10] The double-spending problem occurs when a single coin is spent more than once at the same time. As a result, there is a discrepancy between the spending history and the number of coins available.

[11] A complex cryptographic mathematical problem delivers a string of letters and numbers as an output. one-way function

cryptographic string obtained from solving the hash function is what makes each block unique. It represents the block's digital signature. This system creates an unbroken chain of blocks that leads back to the first block, creating the "avalanche effect": little changes to any part of the original data will result in an entirely unrecognizable hash, thus preventing users from creating a fake transaction and avoid double-spending.

In this system, crypto miners compete against each other to solve the hash function. Mining cryptocurrencies is analogous to the mining of precious metals. Like gold miners mine gold, crypto miners will trigger the creation of new cryptocurrencies into circulation. The first miner to guess the correct code, corresponding to the yet unvalidated block, receives a reward and adds the block to the ledger. In the bitcoin ecosystem, in exchange for the work done for the validation, miners are rewarded with bitcoins, which are then released in circulation.

As miners deploy increasingly powerful equipment to solve the functions, the network's equations become more complex to solve. At the same time, competition among miners intensifies, increasing the cryptocurrency's scarcity.

This system prevents hacker attacks since if some of the records are changed, the computed hash will no longer match the original hash, and the attack will fail as long as the malicious user does not acquire control of 51% of a blockchain's mining capabilities, thus taking control of more than half of the validation authority. Nevertheless, this is almost impossible to achieve since the computational power required would be immense.

However, recent developments led numerous countries to ban PoW mining. To solve hash functions, an enormous amount of computational power is needed. This power is often obtained by using a vast number of GPUs[12] or ASICs[13]. The University of Cambridge (2022) estimates that Bitcoin alone generates 132.48 terawatt-hours (TWh) annually, which, if put into perspective, is more than the annual electricity usage of Finland and Norway, resulting in 95 megatons of carbon dioxide (de Vries et al., 2022). For this reason, environmental concerns began to develop, with countries such as Pakistan, Egypt, Morocco, China, Algeria, and

[12] GPUs: Graphics processing units

[13] ASICs: Application-specific integrated circuits

Morocco implementing a ban on crypto mining. Nevertheless, miners began to apply more eco-friendly approaches, and new validation methods began to develop, such as "proof of stake" or "proof of burn."

Under a different perspective, it could be said that Nakamoto devised a creative game-theoretic solution to the traditional Byzantine Generals' Problem, which involves providing the generals a wage as long as they operate honestly but garnishing that money if they are detected trying to cheat. Notably, the security of Bitcoin does not rely on any "Homo Economicus" notion that people are ruthless optimizers and ultra-rational. Instead, even if individuals are lethargic and malevolent alliances develop, the system will remain safe.

Thus, under a general perspective, it should be said that Bitcoin is not money. The blockchain is not a currency system. It is a platform of trust. You are not signing up for a product or a service. It is not a company. "Bitcoin is the concept of decentralization applied to the human value transmission mechanism," said Andreas Antonopoulos[14]. Bitcoin provided a platform on which currency can be managed as an application on a network without central control points, a fully decentralized system similar to the Internet itself. It is not money for the Internet, but the money of the Internet.

Nonetheless, money itself is nothing more than a language employed to convey value to each other. Bitcoin pioneered the notion of decentralized computation securities. This enables replacing a security model based on concentric circles of access and control with an institution at the center, with an open security model accessible by everyone from the inside out, based on market forces in game theory. It is the first market-based security mall where a sequence of incentives and penalties assures the end outcome. In other words, it revolutionized the concept of trust.

As the popularity of Bitcoin grew, so did the concept of encrypted digital assets that could be used as currency. Soon, the first alternative cryptocurrencies appeared. These are referred to as “altcoins”. Their goal is to improve the original Bitcoin architecture limitations by providing increased transaction speed and scalability or developing other utilities.

[14] Andreas Antonopoulos is currently one of the most notable Bitcoin information providers, having published numerous notorious books on blockchain, Bitcoin, and Ethereum.

The Development of Blockchains: Ethereum and Smart Contracts

Based on Bitcoin innovation, in 2015 a new cryptocurrency was created called Ethereum (ETH): a decentralized global software platform powered by blockchain technology.
Both allow the use of electronic currency without the involvement of intermediaries. However, the main difference is that Ethereum is programmable using the native Solidity scripting language and the Ethereum Virtual Machine (EVM), which is comparable to a cloud computing engine that works like a decentralized computer with millions of nodes operating. Bitcoin allowed transactions and trust to become decentralized. Ethereum allowed the decentralization of contracts in what are known as smart contracts. They are algorithmic software programs recorded on the blockchain that allow regular contracts to be converted into digital equivalents. Smart contracts are logical because they follow an "if this then that" structure, operating exactly as designed and cannot be modified once executed. They are the fundamental building blocks of decentralized applications (DAPPs), which utility scopes from games to autonomous decentralized organizations (DAOs), art (NFTs), or financial services (DeFi). One of the most significant problems with a traditional contract is the requirement for trustworthy individuals to carry out the contract's agreements. Instead, smart contracts automate agreements by converting the terms of a contract into computer code that runs automatically when the contract requirements are fulfilled. Vending machines provide a simple metaphor for smart contracts because the inputs guarantee agreed-upon consequences. Thus, after all the prerequisites are delivered, the vending machine will dispense the selected item. However, the vending machine will not provide the product if the item is not selected or if not enough money is provided. To summarize, smart contracts operate on three main pillars: automatic execution, predictable outcomes, and public records stored on the blockchain, ensuring privacy protection and visible terms.

Blockchain Utility

Differences between coins and tokens

Since Ethereum has a programmable layer, developers can use it to create their cryptocurrency projects. These altcoins, however, operate on Ethereum's blockchain rather than their own, making them known as “crypto tokens”. In other words, tokens allow developers to build, issue, and manage derivatives of primary blockchains. In general, to lower development expenses,

developers "rent" a preexisting blockchain to serve as the backbone of their project instead of creating a new one from scratch. Tokens have a distinct niche in the cryptocurrency industry, serving as "utility" within an application's ecosystem.

To better understand the role of a token, consider an institution going through a voting procedure. The institution wishes to ensure that no fraudulent behavior occurs. It decides to implement smart contracts because a centralized voting mechanism has difficulties tracking votes and could experience counting mistakes. As a result, a specific amount of tokens are created and distributed to voters. No voter may vote using a digital identity that is not his or her own. After obtaining the token, voters can send tokens to only one of the candidates' wallets, which have been set for the election. The person who received the most tokens at the end of the voting period will be declared the winner. All transactions are recorded in the blockchain, and the counting is done automatically, with no third-party interference or reliance on a manual process. Furthermore, to maintain privacy, the token might first pass via an encryption pool to secure the sender's identity before arriving in the final wallet.

Tokens can also be used for a variety of other different ends. They can take the form of governance tokens, which function similarly to stock shares in a public company. They give the holder the right to vote on initiatives that shape the future of that specific project. The more tokens you possess, the more voting power you have. Another design is non-fungible tokens (NFTs), which represent ownership of a digital asset. The blockchain stores the ownership information. NFTs can be used to determine who owns a one-of-a-kind digital property. Decentralized finance is another infrastructure. Instead of obtaining a loan from a lender, you might use crypto tokens as collateral and obtain one through a DeFi platform.

Private Blockchains: The Walmart Case Study

In parallel to the development of decentralized public blockchains, such as Ethereum and Bitcoin, businesses and institutions started understanding the potential of blockchain technology, creating private blockchains. In other words, they created closed private systems in which they have control over the transactions added to the chain, helping to optimize the flow of information through processes they control. Walmart, for example, developed a food traceability system based on Hyperledger Fabric with its technology partner IBM. Its goal was to track mangos sold in Walmart stores all-around the United States and pork sold in Walmart

stores in China. The blockchain-based system was successful. It enabled the uploading of certificates of authenticity to the blockchain for pork in China, providing increased trust to a system where trust was historically a significant concern. Instead, the time required to trace the provenance of mangoes in the United States was reduced from seven days to 2.2 seconds, enhancing efficiency considerably. The company intends to expand the system to new products and categories in the foreseeable future.

Public Blockchain: The UN World Food Program Case Study

Another meaningful instance of public blockchain adoption can be observed through a 2017 example. The UN was in a crisis due to Syria's civil war. The UN World Food Program (WFP) had built up stores in refugee camps where refugees could purchase food. However, to trace the food, they needed to offer refugees money to purchase supplies. However, the issue was that handing prepaid cards to refugees would not work. In fact, a previous case study showed that handing prepaid cards to refugees would create extorsions within the refugees. Moreover, this strategy had previously cost the WFP millions of dollars in transaction costs and the requirement to form agreements with local banks, resulting in millions of dollars lost, all of which might have gone toward millions of meals. Thus, the World Food Programme turned to blockchain to tackle the problem. Indeed, each immigrant's "account" was credited with money, and when a refugee went to a business, their identities were verified. Thus, the World Food Programme turned to blockchain to tackle the problem. Each refugee was credited with funds in an account. An iris scanner was implemented in stores to verify their identities. Refugees were then allowed to redeem the credits for supplies. All the information was stored on a blockchain. The idea cut money-transfer fees by 98%, decreased fraud, and significantly streamlined the assistance system. Soon after, the UN swiftly expanded the operation to cover over 100,000 refugees.

The Public's Response: A Behavioral Perspective

It is clear that blockchain technology and cryptocurrencies are not yet completely understood. Nevertheless, they have found wide applications in several distinct industries and

revolutionized part of them. However, although the potential is substantial, so is the uncertainty.

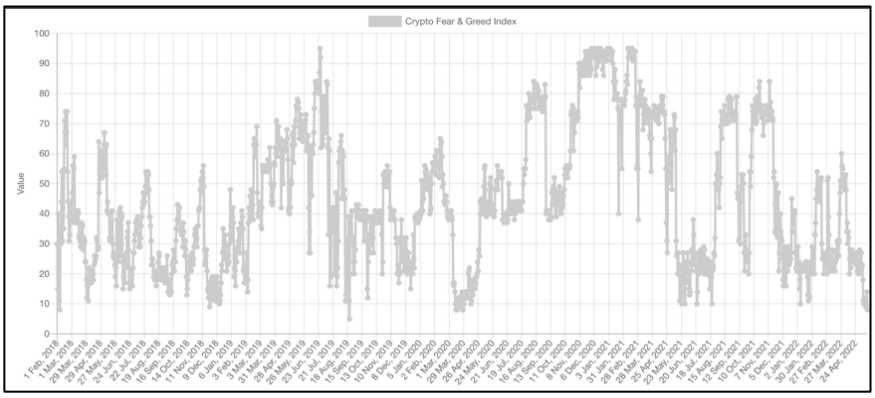
The partial understanding caused by the novelty of the asset is the driving reason for the extreme volatility cryptocurrencies experience in the market. Indeed, significant price movements in crypto and traditional markets are usually fueled by news and speculation. However, their impact is magnified in crypto markets because they possess less liquidity compared to traditional financial markets. Thus, higher capital operations tend to make the price move significantly. Nevertheless, there are signs that cryptocurrency market volatility is diminishing. The confidence in the new asset class is increasingly improving, with both institutional investors and trading companies constantly getting more involved in this ambit.

However, the returns of such high volatility assets push individuals into wild, irrational speculation practices, usually driven by the fear of missing out ("Fomo"). Moreover, this attitude is boosted by globalization: in most developed countries, anyone with internet access can operate in financial markets, making the volume of potential investor significant. Moreover, the expectations and behaviors of others readily influence noise traders[15]. This inclination leads to "herd behavior," in which judgments are largely made based on heuristics rather than genuine evaluations (Jalal, Sargiacomo & Fayyaz, 2020). For this reason, the market experiences "hype cycles," which range from inflated positive expectations to disillusionment. An excellent graphical representation of this phenomenon can be observed in the "Fear and Greed" index shown below (Figure 3).

[15] Noise traders trade on signals they believe will provide higher returns than random returns, although this notion is unfounded.

Figure 3

Crypto Fear and Greed Index Overtime



Source: https://alternative.me/crypto/fear-and-greed-index/

Nonetheless, blockchains and tokens are in constant growth, even when "fear" is the dominant sentiment. Indeed, modern developments helped create even more sophisticated decentralized applications (DApps) allowing developers to build decentralized financial ecosystems on their top. Yet unknown to most, DeFi addresses the same issues for crypto users as traditional financial institutions address for the fiat-based economy.

Chapter 3 – Decentralized Finance

The Infrastructure of Decentralized Finance

A comparison between DeFi and Traditional Finance

Finance refers to the process of making, managing, and investing money. The traditional financial system has at its heart financial institutions, such as banks and market providers. The scope of financial institutions can be outlined under three central notions. First is in-sourcing, which refers to the process of bringing together participants with financial resources, such as lenders, savers, and investors. The second is outsourcing, which refers to supplying those seeking financial resources, such as borrowers. Lastly, off-shoring, which is vital for cross-border transactions. This architecture shaped the hub-and-spoke model: a system that arranges service delivery into a network of leading anchor establishments, i.e., the hubs**,** complemented by secondary establishments: the spokes. The primary distinguishing feature is that dominant intermediaries concentrate operations and financial resources. This results in a centralized operational system. However, the functioning of these financial nodes is dependent on trust and confidence in the intermediaries. Nonetheless, financial systems are generally considered fundamentally unstable, with regulations addressing instability and backing trust; although not consistently successful. Traditional finance has layers of inefficiency that deprive the general consumer of value. For example, some individuals are denied the right to open a bank account or utilize certain specific financial services. Individuals without access to these services may struggle to find a job. Financial services may prevent you from receiving payments. Moreover, personal information is a hidden expense of financial services. Governments and centralized institutions can shut down markets, and trading hours are frequently restricted to specific time zones' business hours.

The Evolution of Decentralized Finance

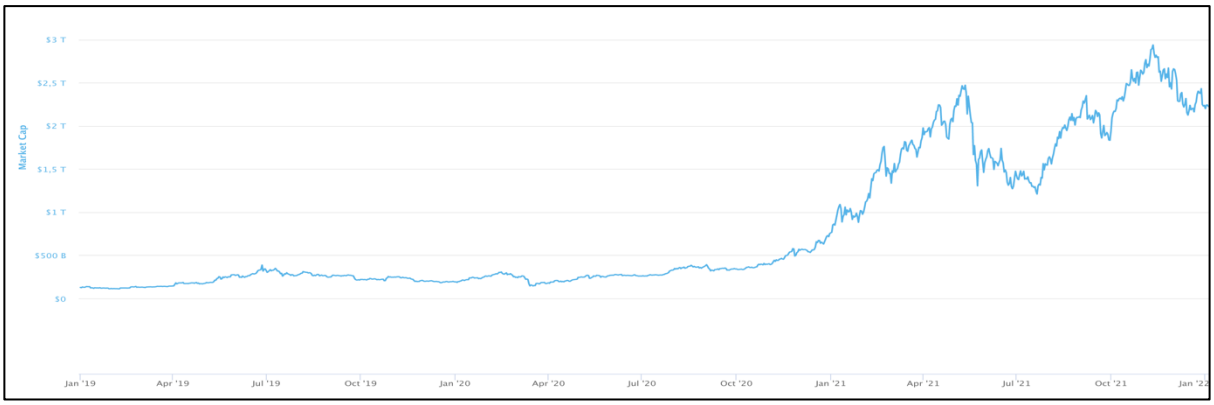
It is within these shortcomings that DeFi's techno-utopian vision of finance developed. Unlike traditional centralized finance, DeFi possesses three distinct features: transparency, control, and accessibility. Indeed, every user can examine the specific rules that govern the functioning of the financial assets in DeFi. By removing private agreements, back-deals, and centralization,

all of which are significant barriers to CeFi[16] transparency, the individual obtains complete control of the agreement. Furthermore, DeFi empowers its consumers by allowing them to keep absolute and exclusive control of their assets. No institution may utilize, censor, or relocate the user's resources without permission. Finally, anyone with an internet-connected device may use DeFi protocols and services, helping individuals threatened by hostile governments and irresponsible monetary inflation policies. In these regards, some scholars argue that DeFi provides governance mechanisms that are seen as 'democratizing' finance, although incumbents may see such arrangements as "anarchy."

Although DeFi is still a new technology, a combination of macroeconomic implications and technological factors contributed to the exponential expansion of the cryptocurrency market (Figure 4). As a result, Decentralized Finance protocols gained traction, hosting a total value-locked economy worth over $100 billion (Figure 5).

Figure 4

Cryptocurrency Market Cap

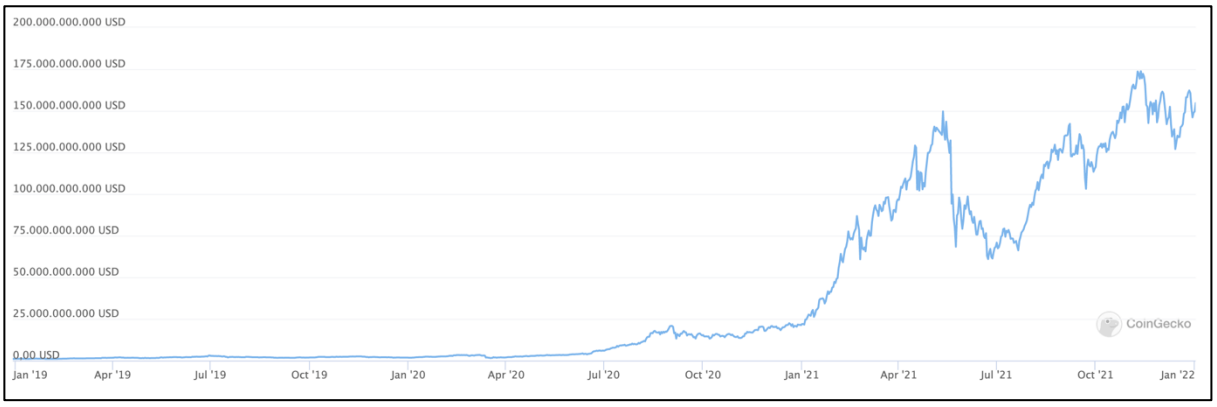


Source: hhtp://www.coingecko.com

[16] CeFi: Centralized Finance

Figure 5

Total Value Locked in DeFi



Source: hhtp://www.coingecko.com

The Impact of Blockchain Technology on Finance: A Catalyst for Change

DeFi from a Technical Perspective

From a technical perspective, DeFi originates from two key patterns in technology evolution: Moore's law and Kryder's law. The former states that the amount of data processing power rises overtime at an exponential rate. The latter holds the same for data storage capacity. The combination of increased processing power and data storage capacity resulted in hardware virtualization. It is a network that enables turning physical desktops and operating systems into virtual equivalents using a "hypervisor": a virtual machine management organism (VMM) that provides simulated digital hardware to numerous guest-operating-systems. With ever-lower prices and ever-powerful computational power, hardware virtualization became more accessible, enabling service-oriented architectures to be constructed and implemented.

In essence, DeFi protocols are Decentralized applications (DApps) designed explicitly for financial purposes on top of a blockchain, which combine smart contracts to ensure compliance with the operations and a front-end interface to connect users directly. However, one significant issue with blockchain protocols is the detachment from the outside world. For example, the Ethereum blockchain only has authoritative knowledge of what is happening within its blockchain, not, for instance, the Nasdaq price-level. This constraint confines the applications

to the blockchain's native contracts, diminishing the smart contract platform's value. This issue is known as the "oracle problem". In the context of smart contract platforms, an oracle is any data source that reports information from outside the blockchain. To overcome this limitation, developers created third-party services such as Chainlink[17], which allow blockchain smart contracts to access external, real-world data. The oracle allows the smart contract to access information not stored on the blockchain, such as the real-time prices of assets. By doing so, DeFi allows for the emulation of standard financial products while also allowing for unique financial primitives, which provide fascinating new security features, such as trading, lending, derivatives, asset management and insurance services.

DeFi's Financial Services

Decentralized exchanges ("DEXs") were among the first infrastructures to be developed. DEXs are peer-to-peer platforms where crypto token transactions occur directly between crypto traders and are not overseen by banks, brokers, or any other third party, but rather by smart contracts. For the transactions to occur, a mechanism that crosses supply and demand is needed to allow the purchase order and the proposed price to meet. The transaction is successful when the system finds compatibility. In order-book trading, there are generally two categories of traders. First, the takers: those who accept the price decided by the bid/ask mechanism already in place. Second, the market-makers: traders who place orders at prices not currently obtainable on order books. They provide liquidity, allowing traders to deal without waiting for another buyer or seller to arrive. However, while this type of trading works well when there is a lot of demand and liquidity, it may not be the best choice for newly developed tokens that are low on liquidity due to low excitement or reduced volumes. As a result, tokens characterized by high volatility and limited trading are less likely to be adopted, making it difficult for new projects to grow. As a solution, developers integrated liquidity pools, which are financial instruments in which investors, known as liquidity providers ("LPs"), lock on a smart contract an equivalent value of two different tokens in order to create a market between the two pairs, like what happens in forex trading. As a result, the investor provides liquidity and, in turn, earns trading fees from all transactions carried out in the pool proportional to his percentage share of the total liquidity provided for that pair.

[17] Chainlink (LINK) is a cryptocurrency and technology platform that operate as an oracle network.

Liquidity mining or yield farming is the first fascinating use case developed from liquidity pools. As we said, in exchange for the liquidity provided to the pool, LPs receive a reward, which can be composed of commissions generated by the underlying DeFi platform or from other sources. Some liquidity pools distribute the rewards in different tokens compared to the input. These received tokens can be deposited in other liquidity pools to earn fees from there as well, and so on.

Around this central concept, incredibly complex, but extremely profitable strategies emerged. Yields from yield farming are calculated on an annual basis. The estimates obtained represent the profits generated over a year. Some commonly used parameters are the annual percentage rate ("APR") and the annual percentage yield ("APY"). The difference between the two is that the APR does not consider the effects of compound interest. In these regards, some of these complex strategies could earn around 1% daily APR. However, they are extremely risky and require elaborate risk management to deal with the volatility and impermanent losses[18]. Nonetheless, the expected returns, if executed correctly, are incredibly high. An example of a yield farm is shown in the figure below (Figure 6).

Figure 6

Yield Farm Protocol Example

Source: http://www.francium.io

[18] Liquidity pool impermanent loss occurs when the price of a token rises or falls after depositing it in a liquidity pool. This is deemed a loss when the dollar value of your token at the moment of withdrawal is lower than the amount deposited.

Recently DEXs developed synthetic tokens that use smart contracts and oracles to follow the price of actual financial assets. This quality enables synthetic tokens to provide exposure without having to buy the underlying assets directly. Instead, to successfully take a short position on an asset, traders can generate "inverse synthesizers."

Another application of DeFi is lending and borrowing protocols. They address one party lending a financial asset to another in exchange for interest. The lender party shall deposit their tokens into a "money market" created by the agreement to a set of smart contracts, after which the coins become available for borrowing by other individuals. The smart contract delivers interest tokens to the user automatically and not when the borrower pays its debt. This is possible since almost all the loans made with native tokens are over-collateralized, meaning that users who wish to borrow must supply collateral worth more than the loan amount. While this may appear illogical because the user could sell their assets to obtain the funds, there are plenty reasons why DeFi's over-collateralized borrowing makes sense. To begin with, investors may want to keep the collateralized asset in the long run and need another kind of asset in the short term. Second, individuals might potentially postpone paying capital gains taxes on their digital tokens by borrowing using DeFi protocols. Finally, people can use borrowing to boost leverage on particular trading positions.

DeFi implementation example: Pseudo-delta-neutral Strategy

The combination of yield farming, synthetic tokens, and borrowing and lending protocols can be employed to achieve a pseudo-delta-neutral strategy. This approach involves creating multiple farming positions with balanced positive and negative deltas so that the assets' overall delta is zero. For example, start by investing $400 in a liquidity pool pair with two low volatility assets, such as Ethereum (ETH) and a stablecoin[19] (USDC). First, take a $100 3x leverage position on ETH/USDC (borrowing USDC). In this way, the investor has deposited $100 and borrowed $200. The total position value is $300. Since it is a 50%-50% position setting, the investor will have a $150 cost ETH long exposure. Second, taking a $100 3x leverage short

[19] A stablecoin is any token that is engineered to have a steady price, either by being pegged to a commodity or currency. Usually this is implemented by managing the supply through an algorithm. Examples are: Tether, USDC and BUSD.

position on ETH/USDC (borrowing ETH). Indeed, the investor has deposited $300 and borrowed $600 equivalent ETH. The total position value is $900. Since it is a 50%-50% position setting, you will have a $600 - $450 = $150 cost ETH short exposure. When the two strategies are combined, it will allow ETH to move between -35% and +50% to maintain a neutral stance. If the asset moves more than that, the user will take a loss. If the price ranges between the above values, the market exposure will be zero. However, since the user acts as a liquidity provider, he will earn interest. Thus, the longer the investor's money is deposited, the wider the margin of safety with positive earnings is.

Benefits and Criticisms of DeFi

However, due to its novelty, the dimension of DeFi is still embedded with a skeuomorphic design, which entails maintaining the shadow of the traditional format in the novel system, overlooking the new dimension. For example, when the first cars were developed, they had leather straps that when pulled left or right would make the car steer. The manufacturers brought to a new class of object a previous design, which was used to ride horses. Thus, like horse reigns used to conduct horses, so did DeFi protocols with traditional financial services. The only limit to design and functionality is the ability to develop a DApp that executes the given commands.

Among the dimensions of decentralization, access, efficiency, interoperability, and transparency, DeFi offers compelling advantages over traditional finance. Decentralization allows the community to jointly own financial goods without top-down control, which could be risky to the average consumer. The open nature of DeFi fosters confidence and security where previously was opacity. To encourage its growth, DeFi is directly providing value to users with services such as yield farming, which has attracted significant capital to the DeFi ecosystem in a concise amount of time. Moreover, DApps can be engineered so that their token economics (“tokenomics”) is designed to reward their innovation while fostering a long-term sustainable protocol and community. DeFi aims to create systems that employ technology to eliminate borders, jurisdiction, and the need for centralized authority. As we have seen, DeFi in its purist form poses a range of difficulties, particularly in terms of state sovereignty and technology dependence. While these factors are likely to prevent the ideal from becoming a reality, the underlying technologies revolutionize real-world sectors. As a result, DeFi is

gradually being integrated into traditional finance rather than challenging it. Moreover, in the policy and regulation framework, the question of how to balance the challenges with the opportunities arises. Indeed, the regulations that should govern DeFi must be entrenched in the system for them to work. The policies must adjust to meet the demands of DeFi. Tools should include those designed to improve cooperation among competent authorities and improve tech risk management. These technologies may necessitate the government performing a prominent role in monitoring and possibly managing the central underlying systems: ironically, the DeFi dream may require government action.

Conclusion

Following the ending of the Bretton Woods agreements, markets became less segmented by national boundaries due to the loosening of governments' constraints on capital mobility. This framework of liberalization and deregulation of the domestic economies, known as financial globalization, gave birth to the global commitment of national financial and capital markets to expand across multiple nations and areas. Rapid technological improvement appears to be the driving force behind this trend. First, with the advent of the internet and mass media communication. Now, with the emergence of blockchain technology and cryptocurrencies.

The blockchain is a distributed, permanent ledger that allows recording transactions and tracking assets. Blockchain technology appears to have the potential to revolutionize systems that maintain track of the history of products through a substantially enhanced, transparent ledger system and improve tasks in present industries. A blockchain network can track and can be used to trade virtually anything of value. Moreover, digital assets, such as Bitcoin and other tokens, began to spread by employing blockchain as the backbone. Additionally, the decentralized distribution of financial and investment services to a wide range of consumers began as a result of the broadening adoption of cryptocurrencies.

Indeed, Decentralized Finance has inspired a new wave of innovation by setting, on the one hand, "trustless" versions of established financial systems and, on the other hand, innovative solutions that would be unattainable to implement without the blockchain.

However, as with any new technology, the underpinnings are not well understood, and for that reason, it is difficult to say how widely adopted the technology will be. Often due to the immaturity of the sector, certain risks plague all of DeFi, and overcoming them is crucial for DeFi to achieve mainstream adoption. Among all, scaling risk and a lack of regulation are two crucial areas that need to be addressed. If the underlying technology cannot scale to service the entire population, the benefits of DeFi will be limited to just the prosperous parties. Inevitably, scaling solutions will come at the expense of some of the advantages of a "pure" DeFi approach. Nonetheless, scalability will improve over time by virtue of development. Moreover, DeFi could be vulnerable to criminal activities and market manipulation due to the insufficient application of anti-money laundering and know-your-customer (“AML/KYC”) rules and

transaction anonymity. Hence, regulation must be implemented, although this would slightly "detach" from the purist philosophy of decentralization.

However, DeFi is currently adopted mainly on crypto-asset speculation, investment, and arbitrage rather than real-economy use cases. Nonetheless, history has proven that the early development of novel technologies is generally followed by bubbles and a loss of market integrity, even while developing solutions that may be of significant use in the future. Just think about the dot.com bubble during the internet's dawn.

Undoubtedly, seeing the exponential adoption both in the private and public sphere and the extensive mass adoption use of cryptocurrencies and DApps, with breakthroughs in blockchain scalability and effective legislation establishing safeguards and enhancing confidence, DeFi will play a major role in the financial system maybe not against CeFi but alongside it.

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Riassunto

Dopo l'avvento di internet, una innovativa tecnologia - la blockchain - ed un concetto inedito - le criptovalute - hanno generato una nuova rivoluzione digitale, che sta trasformando, in modo particolare, il mondo della finanza. Nelle reti di informazione, ricorrono sempre più spesso i termini blockchain e bitcoin, senza che, tuttavia, il fenomeno sia compreso appieno. Nonostante l'enorme potenziale dei due citati strumenti, la complessità degli stessi determina lo scetticismo degli operatori meno tecnologicamente avanzati. Peraltro, va anche rilevato che la elevata volatilità dei rendimenti di questi asset invoglia pratiche speculative selvagge e irrazionali, di solito guidate dal timore di perdere l'occasione. Questo atteggiamento è favorito dal fenomeno della globalizzazione: nella maggior parte dei Paesi sviluppati, infatti, chiunque abbia accesso a Internet può operare sui mercati finanziari, rendendo significativo il volume dei potenziali investitori.

L'insieme di questi fattori - ed in particolar modo, la ampia disinformazione dovuta alla difficoltà tecnica degli strumenti - ha indotto gli investitori ad approcciarsi a questo mondo seguendo il "comportamento del gregge", ossia tenendo condotte in gran parte determinate dalla rassicurante omogeneizzazione a quelle della massa, in assenza di preventive, approfondite e razionali, valutazioni tecniche e strategiche.

Tanto considerato, il presente scritto, al fine di dipanare alcuni radicati luoghi comuni sull'argomento, intende:

- Sintetizzare l'evoluzione storica della finanza tradizionale, concentrandosi sugli effetti della globalizzazione finanziaria sull'economia nazionale e internazionale;
- Fornire una panoramica storica e tecnica delle criptovalute;
- Approfondire il concetto di finanza decentralizzata, con le sue prospettive di sviluppo.

Dopo gli accordi di Bretton Woods, l'allentamento dei vincoli imposti dai governi alla mobilità dei capitali ebbe come conseguenza la riduzione della segmentazione dei mercati, fino ad allora prevalentemente caratterizzati da operatività circoscritta entro confini nazionali.

La crescente liberalizzazione e deregolamentazione dei mercati finanziari nazionali -fenomeno noto anche come globalizzazione finanziaria – unitamente al parallelo, repentino progresso

tecnologico, generò l'espansione dei mercati finanziari e l'investimento dei capitali oltre i confini nazionali, verso approdi internazionali e mondiali. Peraltro, la globalizzazione finanziaria reca rischi endemici, direttamente proporzionali allo sviluppo del fenomeno. L'apertura dei mercati, nel breve periodo, può, infatti, generare crisi finanziarie, che, tuttavia, in qualche modo, fungono da banco di prova del modello stesso. La crisi asiatica e russa del 1997-98, quella turca e argentina del 2001 e la bolla del mercato immobiliare del 2008 ne sono i sintomi.

Può leggersi in questa prospettiva anche la pubblicazione, dopo la crisi finanziaria del 2008, di un "whitepaper" ad iniziativa di un individuo o un gruppo anonimo di individui, noto/i con lo pseudonimo di Satoshi Nakamoto. Il documento conteneva la descrizione di un nuovo sistema di denaro elettronico, c.d. "Peer-to-Peer". Nakamoto, individuato il limite dei mercati finanziari tradizionali nell'affidamento di cui devono godere le banche perché funzioni l'intero sistema, riteneva che il rimedio potesse rinvenirsi in un nuovo programma, denominato "Bitcoin", basato su un sistema di denaro elettronico "Peer-to-Peer", sviluppato sulla base della tecnologia "blockchain" e lanciato nel gennaio 2009, La anzidetta tecnologia "blockchain" si fonda sulla esistenza di un registro ramificato e permanente, che consente di registrare le transazioni e di tracciare i beni in modo immodificabile.

La tecnologia "blockchain" sembra potenzialmente idonea a rivoluzionare i sistemi che conservano traccia della storia dei prodotti, attraverso l'utilizzo di un libro mastro tecnologicamente avanzato e trasparente, destinato a migliorare e semplificare le attività delle industrie attuali. Una rete blockchain, infatti, può essere utilizzata per tracciare e scambiare praticamente qualsiasi cosa.

In linea generale, occorre comunque precisare che il "Bitcoin" non può definirsi propriamente denaro. La "blockchain" non è un sistema valutario, ma è una piattaforma fiduciaria.
Non si sta sottoscrivendo un prodotto o un servizio finanziario. Non è il prodotto rappresentativo di un valore aziendale. Il Bitcoin applica il concetto di decentralizzazione al meccanismo di trasmissione di valori, fornendo una piattaforma su cui la moneta può essere gestita come un'applicazione su una rete, senza punti di controllo centrali; un sistema completamente decentralizzato, simile a Internet stesso. Non è denaro «per» Internet, ma il denaro «di» Internet. Il denaro stesso, d'altro canto, non è che una convenzione utilizzata per trasmettere valore agli altri.

In questo contesto, quindi, il Bitcoin si pone quale pioniere della nozione di sicurezza computazionale decentralizzata, consentendo di sostituire ad un modello di sicurezza basato su cerchi concentrici di accesso controllato da un'istituzione centralizzata, un modello di sicurezza aperto e accessibile a tutti dall'interno, basato sulle forze di mercato della teoria dei giochi.
È paragonabile ad un primo centro commerciale di sicurezza, basato sul mercato, in cui una sequenza di incentivi e sanzioni assicura il risultato finale, così rivoluzionando il concetto di fiducia.

Sulla base dei concetti esposti, si è sviluppata la concezione della finanza decentralizzata (DeFi). A differenza della finanza centralizzata tradizionale, la DeFi è connotata da tre caratteristiche distinte: trasparenza, controllo e accessibilità. Ogni utente, infatti, può esaminare le regole specifiche che governano il funzionamento degli asset finanziari della DeFi ed eliminando gli accordi privati, i back-deal e la centralizzazione - tutti ostacoli significativi alla trasparenza della DeFi – il soggetto operatore ottiene il controllo completo dell'accordo. Inoltre, la DeFi conferisce agli utilizzatori il potere di mantenere il controllo assoluto ed esclusivo dei propri beni. Nessuna istituzione può utilizzare, contestare o spostare le risorse dell'utente, senza autorizzazione.

Infine, chiunque abbia un dispositivo connesso a Internet può utilizzare i protocolli e i servizi della DeFi e ciò consente di operare anche a soggetti che agiscono nell’ambito di territori caratterizzati da governi che adottano politiche restrittive o politiche di inflazione monetaria irresponsabili. A questo proposito, alcuni studiosi hanno sostenuto che la DeFi fornisce meccanismi di *governance* tendenti ad una "democratizzazione" della finanza, che, peraltro, gli operatori storici considerano "anarchica".

In sostanza, i protocolli DeFi sono applicazioni decentralizzate (DApp), progettate esplicitamente per scopi finanziari in cima a una blockchain, che combinano smart contracts, per garantire il rispetto delle operazioni, e un'interfaccia front-end per connettere direttamente gli utenti. La DeFi consente, quindi, l'emulazione di prodotti finanziari standard e, allo stesso tempo, permette primitive finanziarie uniche, che forniscono nuovi livelli di sicurezza, come il trading, i prestiti, i derivati, la gestione patrimoniale e i servizi assicurativi.

Come inizialmente accennato, peraltro, a DeFi possiede una serie di problematiche, soprattutto in termini di relazioni con la sovranità statale e di dipendenza dalla tecnologia. Se da un lato, questi fattori, probabilmente, impediscono all'ideale di diventare realtà, dall'altro le tecnologie sottostanti rivoluzionano i settori del mondo reale.

Di conseguenza, la DeFi si sta gradualmente integrando nella finanza tradizionale piuttosto che sfidarla. Inoltre, nel quadro delle politiche e delle normative, si pone la questione di come bilanciare le sfide con le opportunità. Infatti, le norme che dovrebbero disciplinare la DeFi devono essere radicate nel sistema per poter funzionare. Le politiche devono adattarsi alle esigenze della DeFi. Gli strumenti dovrebbero includere quelli progettati per migliorare la cooperazione tra le autorità competenti e migliorare la gestione del rischio tecnologico. Queste tecnologie potrebbero richiedere che il governo svolga un ruolo di primo piano nel monitoraggio ed eventualmente nella gestione dei sistemi centrali sottostanti: ironicamente, il sogno della DeFi potrebbe richiedere l'azione del governo.