Theoretical and Practical Research in Economic Fields

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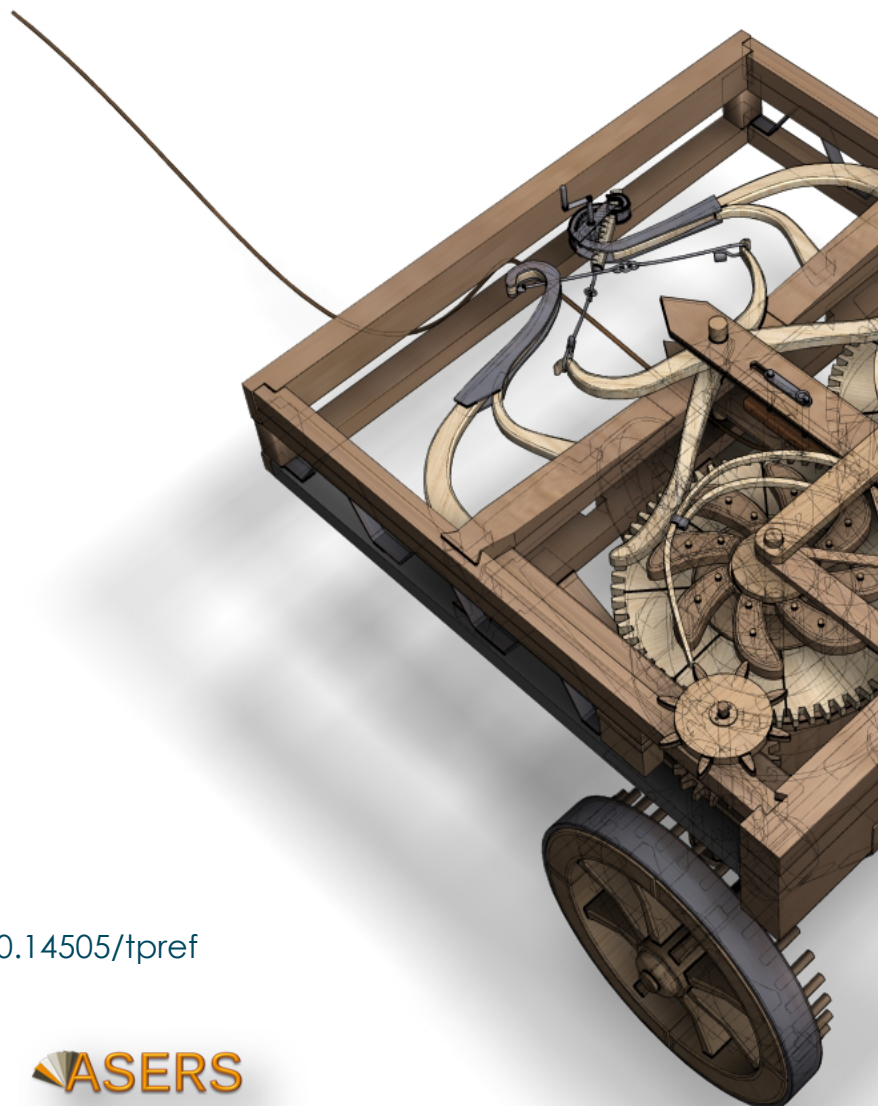Publishing

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Winter Issue
Theoretical and Practical Research in Economic Fields

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Revolutionizing Finance: Decentralized Finance as a Disruptive Challenge to Traditional Finance

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Abstract: This paper examines the emergence and impact of Decentralized Finance (DeFi), between 2019 and 2024, as a disruptive agent opposing traditional finance (TradFi). By using blockchain technology to offer decentralized, open, and readily available financial services, the DeFi industry has seen explosive expansion Emphasizing DeFi's competitive advantage over TradFi, this study aims to investigate notable trends, developments, and market drivers in the toolkit. The main conclusions are the fast and significant rise in Total Value Locked (TVL), the clear increase in user adoption, the expansion in the number of transactions and trading volume on decentralized exchanges (DEXs), and the development of creative financial products. DeFi constantly changes the financial scene despite regulatory oversight and market volatility, so posing major problems and opportunities for established financial institutions.

Keywords: decentralized finance; traditional finance; cryptocurrencies; blockchain; web3.

JEL Classification: G20; G23; O33; K22; E44.

Introduction

Rising as a disruptive and transforming force in the financial sector in recent years, Decentralized Finance (DeFi) challenges the long-standing traditional finance (TradFi) institutions that have dominated for many decades (Hadi *et al.* 2023). Blockchain technology is used by DeFi to offer easily available, transparent, decentralized financial products (Mohd Fairoh *et al.* 2024). This is quite different from the regulated and sometimes vague character of traditional banks and financial institutions. DeFi's obvious difference has made it a well-known agent of financial transformation (Chen Bellavitis, 2022).

TradFi is the provision of services by centralized entities such banks, investment companies, and payment processors. These establishments act as middlemen, enabling financial transactions between consumers and the needed services. Particularly for those in underprivileged banking locations, these institutions control financial transactions, account management, and monetary policies, sometimes leading to outrageous costs, slow transaction speeds, and limited availability (Mishkin, 2004). Moreover, the focused approach of TradFi makes it susceptible to systematic hazards; this is shown by the broad effects of notable bank collapses during financial crises (Bernanke, 2004).

Unlike DeFi, which runs on decentralized networks like Ethereum using smart contracts to automatically and run financial transactions free from middlemen (Alamsyah *et al.* 2024). Among the various advantages of this approach include less transaction costs, faster settlement times, and more inclusiveness. Anyone with an internet connection can access DeFi services, therefore democratizing financial access and empowering individuals all around (Schär, 2021). From roughly 700 million USD in late 2019 to reaching 100 billion USD by mid-2021, the Total Value Locked (TVL) in DeFi protocols has surged remarkably. This shows how quickly these decentralized solutions (DeFi Pulse, 2020; DeFi Llama, 2021) were embraced and with confidence.

Novel financial products and services such yield farming, liquidity mining, and decentralized exchanges (DEXs) have emerged from the developments in DeFi (Ozili, 2022; Makridis *et al.* 2023). These systems have effectively attracted large investments and offer great returns. Platforms including Uniswap, Compound, and Aave saw notable increase in user engagement and transaction volumes over the "DeFi Summer" of 2020; occasionally, they exceeded those of traditional exchanges on particular days (Hayes, 2021). DeFi still has

certain difficulties, nonetheless, even with all the advancement achieved (Turillazzi *et al.* 2023). All of which can affect user confidence and stability is the ecosystem under regulatory scrutiny, technology weaknesses, and market volatility (Gudgeon *et al.* 2020).

Unlike TradFi, decentralized finance, or DeFi, marks a radical shift in the direction of a more inclusive and easily available financial system (Meyer *et al.* 2022). System of centralized control and regulatory scrutiny define TradFi. DeFi offers a decentralized alternative aiming at efficiency, openness, and general accessibility, in comparison. With the possibility to drastically change the future of worldwide banking, the continuous development of DeFi poses both significant challenges and chances for current financial organizations (Meyer *et al.* 2022).

The paper offers comprehensive research on the fast-changing DeFi ecosystem and how it will affect TradFi. By focusing on their fundamental ideas, operating systems, and effects on the global financial scene, it offers a thorough comparison between DeFi and TradFi. The paper advances a better knowledge of how these systems interact and differ by stressing the basic contrasts – such as DeFi's distributed, transparent, and accessible character vs TradFi's centralized, controlled, and occasionally opaque architecture. Capturing the dynamics of a fast-changing sector and its growing impact on the larger financial industry, the paper also follows the evolution of crucial measures inside the DeFi ecosystem, including Total Value Locked (TVL), transaction volumes, user growth, and protocol revenue. Examining how these technologies – which have driven DeFi's rise – smart contracts, yield farming, liquidity mining, and decentralized exchanges (DEXs) – have upended established financial models and opened new prospects for financial services and products, DeFi explores also.

The paper investigates the impact of DeFi on TradFi from 2019, the year before the third bitcoin halving. The paper aims to examine how developments in DeFi – including yield farming, liquidity mining, and decentralized exchanges – may affect the notable rise in user adoption, transaction volumes, and protocol profits. The study intends to examine the efficiency, accessibility, and systemic hazards of DeFi and TradFi in order to evaluate the possibility of DeFi to greatly change and reconstruct the worldwide financial ecosystem.

1. Traditional Finance

TradFi, or traditional finance, is the established financial systems and institutions that have been absolutely vital for generations in worldwide economies. It covers financial institutions with a wide range of financial services including banks, investment firms, insurance companies, and regulatory authorities. Based on relevant research and literature, this review offers a succinct description of the main ideas of TradFi together with their roles, purposes, and challenges.

Conventions and Purpose of Traditional Financial Institutions
Within the traditional financial system, banks and financial intermediaries play several vital responsibilities. Receiving deposits, lending money, and offering payment services help commercial banks – key financial intermediaries – to operate (Mishkin, 2004). These banks, by applying the fractional reserve banking system, play a crucial part in the process of money creation. By means of underwriting, mergers and acquisitions, and advisory services, investment banks help businesses create capital (Fabozzi, 2015). Furthermore, insurance companies manage risks by grouping them and covering a spectrum of possible outcomes (Black and Skipper, 2000).

In order to preserve financial stability, central banks – including the Federal Reserve and the European Central Bank – determine interest rates, monitor the volume of money in circulation, and act as a last source of borrowing (Bernanke, 2004). These organizations use reserve requirements, discount rates, and open market operations – among other tools of monetary policy – to regulate economic activity (Mishkin, 2004).

Financial Markets
Important for the buying and selling of financial securities, capital markets comprise stock and bond markets. Share trading finds venues in stock exchanges as the Nasdaq and the New York Stock Exchange (NYSE). Crucially in the financial ecosystem, these markets help to determine prices and enable the availability of liquid assets, therefore facilitating the process of development (Kurka, 2019). Bond markets let governments and businesses issue and trade debt instruments, therefore helping them to generate necessary money for various uses (Fabozzi, 2015).

Short-term debt instruments including Treasury bills, commercial paper, and certificates of deposit define money markets most of all. These tools help businesses to properly control their short-term financial needs and enable the availability of cash and funding for immediate financial demands (Mishkin, 2004).

Legislative System

Financial control is meant to protect consumers, ensure the integrity and stability of the financial system, and maintain market confidence by means of which it is guaranteed (Mishkin, 2004). Several authorities control these activities. While the Basel Committee on Banking Supervision (BCBS) has developed worldwide banking rules known as Basel III to support financial stability, the Securities and Exchange Commission (SEC) is in charge of controlling securities markets in the United States (BCBS, 2011).

A key element of financial control is consumer protection. To protect consumers against bank failures, the Federal Deposit Insurance Corporation (FDIC) and related initiatives grant deposit insurance (Mishkin, 2004). Moreover, rules against discriminating practices in lending under the Equal Credit Opportunity Act (ECOA) and the Fair Housing Act have been adopted to so guarantee fair availability of financial services to all people (Federal Reserve, 2021).

Conundrums in Traditional Banking

Events such as the 2008 global financial crisis exposed structural flaws in the financial system and the interdependence of the worldwide financial system as well as the likelihood of catastrophic collapse (Bernanke, 2004). Moral hazard is a serious threat since insured companies might take more risks knowing they are covered, hence perhaps upsetting the financial system (Mishkin, 2004).

Furthermore, lacking in terms of simplicity and inclusion are traditional financial systems. Strict requirements and high expenses cause financial institutions – especially in underdeveloped areas – to regularly exclude underbanked communities (Demirgüç-Kunt *et al.* 2018; Ryabov *et al.* 2021).

Terms of efficiency and expenditures abound absent in TradFi. The complex and bureaucratic character of traditional financial institutions can lead to higher operational expenses and inefficiencies that are then passed on to consumers as higher fees (Friedman, 1963). Furthermore, complex financial activity and cross-border transactions could be defined by slowness and high expenses resulting from many middlemen and legal responsibilities (Mishkin, 2004).

2. Decentralized Finance

Blockchain-enabled DeFi presents an open and permissionless ecosystem that marks a notable change from established financial institutions (Chen and Bellavitis, 2019; Chohan, 2021). By using decentralized protocols and smart contracts, DeFi systems eliminate the need of middlemen like as banks, hence increasing financial accessibility and lowering transaction costs (Schär, 2021; Aquilina *et al.* 2023). Directly with one another, these sites help consumers to engage in a variety of financial activities like lending, borrowing, trading, and investing. This guarantees openness and helps to reduce the risks related to centralized power.

DeFi stands out for using cryptocurrencies with limited supply, like Bitcoin, instead of fiat money under control by central banks (Makarov and Schoar, 2022). Because their total quantity is often set in advance, cryptocurrencies are naturally deflationary (Nakamoto, 2008). This feature may cause value to rise over time as demand grows, therefore preventing the normal inflation seen in traditional financial systems. Still, the deflationary character of the situation might also hinder economic growth since people might choose to save rather than use their assets (Selgin, 2015).

Smart Contracts and their Effects

Running on blockchain systems like Ethereum, smart contracts – which have the substance of the agreement directly coded – are self-executing contracts. By automatically enforcing and running agreements if particular criteria are met, smart contracts eliminate the need for middlemen and drastically reduce the likelihood of fraud or error (Buterin, 2014; Schueffel, 2020). DeFi's value proposition stems mostly from its capacity to automate and give openness, therefore enabling quick and safe execution of complex financial activities (Christidis and Devetsikiotis, 2016).

From decentralized exchanges (DEXs), lending platforms, and stablecoins to smart contracts provide the basis for many DeFi products (Ozili, 2022). Direct trading of cryptocurrencies between people made possible by decentralized exchanges (DEXs) removes the need for a central regulating agency (Yue *et al.* 2021). This improves the degrees of security and anonymity engaged in the transactions (Hayes, 2021). Lending platforms help users to create interest or borrow against their holdings by lending their assets, so promoting financial inclusion without involving traditional credit evaluations (Gudgeon *et al.* 2020). Linked to solid assets like fiat currencies, stablecoins provide consistency in the erratic bitcoin market and are therefore ideal for frequent transactions and deposits (Mnohoghitnei *et al.* 2022).

Problems and Dangers

DeFi and smart contracts provide a lot of risks and difficulties even if they have several advantages (Didenko, 2022). DeFi's decentralized architecture lacks a central authority to monitor or stabilize the system in times of crisis, therefore causing significant market volatility (Hayes, 2021). Regarding smart contracts, security is a major concern (Li *et al.* 2022). Smart contracts, for all their transparency, remain vulnerable to code errors and abuse, which could cause major financial losses (Gudgeon *et al.* 2020). Furthermore, the legislative scene for DeFi is still unclear since many countries find it difficult to adequately supervise these decentralized networks without stifling creativity (Schär, 2021).

DeFi and smart contract-based financial markets represent, all things considered, a significant development in financial technology that offers several benefits over traditional systems by improving accessibility, transparency, and efficiency. Still, they also bring fresh challenges and hazards that need careful control as ecology develops (Carapella *et al.* 2022).

3. Comparison of Decentralized Finance and Traditional Financial Systems

Examining DeFi from the standpoint of locked volume in US dollars helps one to better understand it than traditional financial systems. Unlike traditional financial organizations, this indication helps one understand the capital allocated and immobilized inside DeFi systems (Qin *et al.* 2021). Reflecting the general well-being and growth of the DeFi ecosystem, the TVL in DeFi is an important indicator of the degree of capital being used in DeFi systems.

Lock Volume and DeFi

In DeFi systems, TVL is the total amount of money currently kept on hand including cryptocurrencies staked in smart contracts for lending, borrowing, and trading (Carre and Gabriel, 2022). A measure of the collateral kept in DeFi systems, TVL, or Total Value Locked, It offers understanding on DeFi services' liquidity and utilization.

Over recent years, the TVL in the DeFi sector has grown significantly. From less than 1 billion USD in early 2020 to more than 100 billion USD by the end of 2021, DeFi Pulse finds that the TVL in DeFi systems rose (DeFi Pulse, 2021). Built on the Ethereum blockchain, Uniswap, MakerDAO, and Aave are somewhat well-known in the DeFi space and account for a sizeable portion of the TVL. Furthermore, mentioned by Hayes in 2021 are Binance Smart Chain (BSC), Solana, and Tron, which have shown notable increase.

DeFi's locked volume is used for stablecoins, lending and borrowing platforms, decentralized exchanges (DEXs), and yield farming among other purposes. Often offering lower rates and more accessibility, these apps give different choices to traditional financial services (Schär, 2021).

Traditional financial systems and locked volume

Furthermore, owning large amounts of capital are traditional financial systems including banks and financial institutions. Still, the capital in TradFi sometimes lacks openness and is under several regulatory systems.

Regulators mandate banks keep reserves. The Federal Reserve mandates banks retain a designated percentage of their deposits as reserves. This criterion affects the amount of money that can be applied for lending and other activities (Mishkin, 2004). Using investment funds, mutual funds, and pension funds, traditional financial institutions supervise significant volumes of assets. The assets are housed in several financial instruments including bonds, real estate, and stocks (Malkiel, 1990).

Concerning stability and protection of investor interests, TradFi operates with a centralized system of control and regulatory monitoring. Still, this concentration of power can lead to inefficiencies and higher costs due of middlemen fees and postponed transaction processes (Friedman, 1963).

Short Analysis of DeFi and Traditional Banking Systems

Public blockchains let DeFi platforms be built with openness and accessibility in mind (Gorkhali and Chowdhury, 2022). Recording all transactions on the blockchain helps to do this and hence improve openness (Patel *et al.* 2022). This openness makes it possible to get current information on the transfer of money and the TVL. DeFi also removes admission barriers, so allowing anyone with internet connection to participate (Gudgeon *et al.* 2020). On the other hand, as they are controlled by centralized entities that control the information distribution, traditional financial systems show less degrees of openness. Geographic distance, regulatory restrictions, and the need of middlemen all regularly impede access to financial services (Mishkin, 2004).

By removing middlemen, DeFi benefits in terms of cost and efficiency by lowering transaction costs and raising effectiveness (Grassi *et al.* 2022). Unlike traditional approaches, smart contracts expedite and cheap

transactions help to simplify procedures (Buterin, 2014). By contrast, TradFi involves many middlemen who each add to the cost and complexity of transactions. Dependency on manual processes and the presence of regulatory compliance criteria help to slow down operations and increase expenses (Malkiel, 1990).

DeFi offers some benefits regarding risk and stability, but it also raises possible issues including weaknesses in smart contracts, lack of government control, and market volatility. While traditional financial systems benefit from regulatory measures designed especially to protect consumers and maintain stability, cybersecurity breaches and illegal activity have caused significant financial losses within the DeFi industry (Li *et al.* 2022; Schär, 2021; Grigo *et al.* 2020). Still, these systems run the danger of bank collapses, financial crises, and systematic dangers (Bernanke, 2004).

4. Comparison of Decentralized Finance and Traditional Banking

Two different approaches to financial services with very different foundations are decentralised finance (DeFi) and traditional banking. These systems are thoroughly analyzed here, with specific focus on critical elements such as accessibility, openness, efficiency, and risk.

Availability and Financial Inclusion

In terms of financial inclusion and accessibility, DeFi and traditional banking show somewhat different disparities. Accessible to everyone with an internet connection and a digital wallet, DeFi platforms provide financial services free from geographical limitations (Schär, 2021). Particularly for those who do not have access to financial services or have limited access to them, this inclusivity removes traditional barriers including minimum account balances, credit scores, and complex documentation so enabling greater involvement (Gudgeon *et al.* 2020).

On the other hand, traditional banks have certain criteria for clients, including the providing of identity, the maintenance of minimum balances, and the passing of credit checks (Mishkin, 2004), and are subject to rigorous rules as well. Policies that preclude some people from obtaining financial services, poor infrastructure, and high regulatory standards can limit banking services in underdeveloped areas (Demirgüç-Kunt, 2018.). The all-encompassing and global character of DeFi platforms contrasts sharply with the regulated access and limited scope of these platforms.

Openness and Faith

By means of a publicly available ledger where transactions are recorded on public blockchains, DeFi systems offer transparency and let anyone examine them (Nakamoto, 2008; Lu *et al.* 2021). They also rely on smart contracts, autonomous agreements with terms specifically included in computer programming language. This reduces the need of middlemen and lowers the possibility of dishonest behavior (Buterin, 2014).

On the other hand, traditional banking systems are generally opaque since transaction details usually only affect the parties engaged and the bank. For confidence, customers rely on the integrity and regulatory control of the bank (Mishkin, 2004). Furthermore, acting as mediators, banks handle fund movement and custody on behalf of their clients. The centralizing process could lead to lower speed of transactions and higher costs (Friedman, 1963).

Cost and efficiency

DeFi saves money by cutting middlemen, therefore lowering administrative costs and transaction fees (Habib *et al.* 2022). Furthermore, ensures quick settlement times by using blockchain technology (Hayes, 2021). Furthermore, smart contracts simplify many financial processes therefore reducing the need for human involvement and improving operational efficiency (Schär, 2021).

On the other hand, traditional banking involves higher fees since banks charge for multiple services like account maintenance, transactions, and overseas transfers, which could be rather expensive (Mishkin, 2004). Furthermore, because of the involvement of intermediate institutions and regulatory verifications, traditional banking transactions – especially cross-border transfers – can take several days to complete (Friedman, 1963).

Danger and Consistency

DeFi platforms run many hazards, including smart contract issues that unscrupulous people could manipulate and cause significant financial losses (Gudgeon *et al.* 2020; Piñeiro-Chousa *et al.* 2023). Furthermore, DeFi's asset volatility puts major hazards to customers and investors (Hayes, 2021). The rather unstructured DeFi terrain could lead to issues with fraud, security breaches, and insufficient consumer protection (Schär, 2021).

Conversely, traditional banking operations inside a framework of strict regulatory control seeks to ensure stability, protect consumers, and discourage dishonest behavior by means of rigorous control of their operations (Kaur *et al.* 2023). This control includes capital needs, deposit insurance, and regular audits among other aspects (Bernanke, 2004). Because they have regulatory support and have been established in the financial system for a long period, traditional banks are usually considered as steadier and more trustworthy (Mishkin, 2004). Still, traditional banks are vulnerable to systematic hazards even with these measures in place. Financial crises clearly show this; as Bernanke pointed out in 2004, the failure of banks can have broad effects.

5. Comparison of "Monetary Policy" in Traditional Finance and Decentralized Finance

TradFi, or traditional finance
Inflation and Central Banking
Through their regulation of the money supply and interest rates, central banks – like the Federal Reserve in the United States – play a vital part in traditional banking. To control economic stability and development, they apply instruments including reserve requirements, discount rates, and open market activities.

Through monetary policy, central banks try to lower inflation; but too much money production can cause inflation, so diminishing the value of fiat currencies (Fisher, 1911). Fiat currencies depend on confidence in the issuing government; they are not supported by actual commodities. Bad fiscal policies can destroy this confidence, which would cause hyperinflation like what Zimbabwe and Venezuela experience (Hanke and Krus, 2013).

Furthermore, affecting investments is inflation since it reduces actual returns. To fight inflation, TradFi provides bonds, equities, and derivatives among other tools. Still, these devices are sometimes complicated and call for intermediate services (Mishkin, 2004).

DeFi, or decentralized finance
Limited supply and deflationary nature
Operating on blockchain technology, DeFi makes use of often limited supply coins. With a fixed cap of 21 million coins, for instance, Bitcoin naturally tends to lose value over time.

The limited supply of many cryptocurrencies causes a deflationary impact, whereby as demand rises the value of the currency usually rises rather than falls. This deflationary quality can give people an incentive to save their assets rather than quickly consume them (Nakamoto, 2008). Built on publicly available blockchains, DeFi systems provide unlimited access to financial services free from middlemen's need (Pal *et al.* 2021). This degree of transparency reduces costs and improves openness (Schär, 2021). Automated and enforceable financial agreements with conditions buried straight into code are smart contracts (Kumar *et al.* 2020). This reduces the need for traditional legal systems and middlemen, therefore streamlining financial transactions (Buterin, 2014).

Comparative Study
Monetary Policy
By using a variety of policy tools, central banks in traditional banking control the money supply and influence inflation. Still, these policies could sometimes have unanticipated financial effects like asset bubbles or economic downturns (Bernanke, 2004). By contrast, DeFi runs on coins with decentralized control and set supply limits (Zetzsche *et al.* 2020). This arrangement could lead to more predictable financial effects. Still, the lack of a central authority produces the absence of an organization able to provide economic stabilization during crises (Hayes, 2021).

Inflation versus deflation
In the field of TradFi, inflation is a major issue that drives central banks to usually target a specific inflation rate. Too much inflation can progressively reduce the value of savings and deter investment activity (Friedman, 1963). On the other hand, the deflationary feature of many cryptocurrencies in DeFi can encourage the behavior of saving instead of consumption. While asset holders could gain from this, it can also have the negative impact of slowing down economic growth if people postpone their consumption (Selgin, 2015).

Availability and Investment
Although TradFi presents a wide spectrum of investment choices, these usually entail middlemen, which raises costs and limits access for the ordinary person. Although they protect investors, regulatory systems can sometimes create challenges for new market players (Malkiel, 1990). On the other hand, DeFi offers investment opportunities that are more readily available, with less barriers to access and less expenses as a result of middlemen removed. Still, without control, fraud and security lapses become more likely (Gudgeon *et al.* 2020; Raffaele *et al.* 2023).

6. Integration of Decentralized Finance and Traditional Finance

Combining TradFi with DeFi marks the meeting of modern blockchain technology with tried-through financial systems (Rajput *et al.* 2019). By using the stability and regulatory systems of TradFi, this cooperation aims to increase the effectiveness, availability, and openness of financial services.

Tokenizing Traditional Assets
Defi
DeFi systems allow traditional financial assets such stocks, bonds, and real estate to be tokenized so that they may be traded on blockchain networks (Naggar, 2023). For these assets, this procedure results in digital representations – known as tokens. Then these tokens can be traded on decentralized exchanges (DEXs) (Buterin, 2014; Karim *et al.* 2022). Tokenizing helps assets be more liquid and streamlines the purchase and selling procedure for fractional shares of valuable assets for investors (Laurent *et al.* 2018). Tokenized assets have lately started to be included into Synthetix and MakerDAO systems (Schär, 2021).

TradFi
Traditional banking institutions are starting to welcome tokenization as a way to streamline settling processes and cut costs. Using asset tokenization, JPMorgan's Onyx platform improves the trading and settlement process efficiency (JP Morgan, 2020). Furthermore integrating decentralized and traditional systems is banks and financial organizations who offer custody solutions and guarantee adherence to rules for tokenized assets (PwC, 2020).

Central Banks Digital Currencies (CBDCs)
DeFi
Central bank digital currencies (CBDCs) can be included into DeFi platforms to provide a safe and dependable digital money alternative approved by the government. Including this link helps to simplify transactions and reduce the normal volatility connected with cryptocurrencies (Auer and Böhme, 2020). Moreover, DeFi systems could use central bank digital currencies (CBDCs) as a means of decentralized payment solutions, therefore enhancing the efficiency and speed of global transactions (Nakamoto, 2008).

TradFi
To modernize and improve the financial system, central banks all around are actively looking at and implementing Central Bank Digital Currencies (CBDCs.). Prominent examples of actively advancing the evolution of their digital currencies include the European Central Bank (ECB) and the People's Bank of China (PBOC). CBDCs offer the regulatory oversight and stability of traditional fiat currencies while leveraging the technological advancements of blockchain (PwC, 2020).

Hybrid Financial Products
DeFi
Modern financial ideas such yield farming, liquidity mining, and decentralized insurance are offered by DeFi systems. These products can be mixed with traditional financial services to present new investment opportunities (Hayes, 2021). Furthermore, smart contracts allow the conditions of hybrid financial instruments to be automated and enforced, thereby reducing the need for middlemen and improving general efficiency (Buterin, 2014).

TradFi
DeFi products have the potential to be included into traditional financial institutions' offerings to appeal to consumers who are tech-savvy and provide a larger spectrum of investing options. Currently looking at the possibilities of DeFi ETFs and other investment products grounded on blockchain technology is Goldman Sachs (Goldman Sachs, 2021). Furthermore, these organizations can apply their expertise and abilities in risk management to develop hybrid financial products complying with laws and safe (Mishkin, 2004).

Compliance with Rules and Regulations
DeFi
Self-regulating systems and best practices followed by DeFi platforms help to strengthen security and protect users. For governance, this entails doing extensive code audits and building decentralized autonomous organizations (DAOs) (Schär, 2021; Aiden and Werbach, 2022; Sims, 2019). DeFi platforms are also gradually working with regulators to ensure adherence to anti-money laundering (AML) and know-your-customer (KYC) rules, therefore facilitating smooth connection with traditional financial systems (Gudgeon *et al.* 2020).

TradFi

With an eye toward protecting consumer interests and preserving market stability, authorities and regulatory bodies are developing frameworks to monitor the convergence of DeFi and traditional financial systems. For supervising virtual assets and service providers, the Financial Action Task Force (FATF, 2021) presents legislative guidelines. Establishing common protocols and guaranteeing safe and compliant operations depend much on the cooperation between DeFi platforms and established financial institutions (PwC, 2020).

Cross-platform financial services
DeFi

DeFi systems are developing interoperable solutions to let seamless connection with traditional financial systems possible. Projects include Polkadot and Cosmos aim to create a linked chain of blockchains (Hayes, 2021). Moreover, decentralized exchanges (DEXs) can work with traditional exchanges, therefore broadening the range of trading possibilities and financial services. Increasing market liquidity and higher user satisfaction follow from this cooperation (Schär, 2021; Bartoletti *et al.* 2022).

TradFi

TradFi: Decentralized lending and borrowing, among other DeFi services, can be included into platforms of traditional banks. For handling their financial matters, this would provide consumers with more options (Goldman Sachs, 2021; Pham and Trinh, 2022). Moreover, financial institutions can build relationships with DeFi systems by means of application programming interfaces (APIs). This improves the efficiency of service delivery and lets the real-time data flow unhindered (PwC, 2020).

7. Impact of Decentralized Finance on Global Finance

By providing creative ideas challenging the established financial systems, DeFi is transforming the worldwide financial sector. One may see the impact of this in many spheres, including financial inclusion, openness, accessibility, and efficiency. These effects are carefully discussed in this part.

Accessibility and Financial Inclusion

DeFi removes traditional barriers including regional limitations, lack of banking infrastructure, and strict regulatory prerequisites therefore enabling equal access to financial services. Without a regular bank account, those who have both an online connection and a digital wallet can participate in DeFi events like lending, borrowing, trading, and investing.

DeFi systems give global access, so allowing the availability of financial services from any place around the world. Those who lack access to banking services or have restricted access to banking services in underdeveloped countries or otherwise lack this benefit notably (Schär, 2021). Moreover, DeFi promotes inclusion by allowing people to participate in the global economy regardless of their socio-economic level by means of previously unavailability financial instruments and services (Gudgeon *et al.* 2020).

Cost-effective efficiency

DeFi uses smart contracts and blockchain technology to improve the efficiency of financial transactions by automating processes and so removing the need for middlemen (Trivedi *et al.* 2021). This speeds up the application of financial services and reduces the transaction costs.

DeFi removes middlemen, therefore minimising the connected costs associated with wire transfers, loan processing, and currency swaps when compared to traditional financial services (Hayes, 201). Furthermore, unlike in TradFi, which might span several days, transactions on DeFi networks are instantly finalized (Buterin, 2014).

Openness and Faith

Operating on public blockchains, DeFi systems record all transactions and make them accessible to the public (Truchet, 2022). This degree of openness builds trust and reduces the possibility of manipulation and dishonest behavior.

DeFi assures that all transactions are immutable and can be verified by using blockchain technology, therefore creating an easily available and clear financial system (Nakamoto, 2008). Furthermore, open source, the smart contracts used in DeFi let anyone check and validate the code. This helps to reduce the possibility of hidden diseases or evil deeds (Schär, 2021).

Creativeness and Novel Financial Products

DeFi is a hive of creative ideas constantly producing unique financial goods and services unaffordable in TradFi (Weingärtner *et al.* 2023). These pursuits cover synthetic assets, decentralized insurance, yield farming, and liquidity mining.

By providing liquidity to DeFi networks – a notion lacking a direct counterpart in traditional financial systems – yield farming helps users create profits (Xu, J. and Feng, 2022). Moreover, DeFi platforms like Synthetix let users create and trade synthetic assets that reflect the value of real assets, therefore offering fresh investment opportunities and risk reducing potential (Gudgeon *et al.* 2020).

Obstacles and Dangers

DeFi offers many advantages, but it also carries significant risks and challenges that need to be addressed if we are to guarantee its long-term acceptance and growth (Werner *et al.* 2022).

Because of flaws in smart contracts and blockchain technology, DeFi systems run security risks (Schär, 2021). Furthermore, the legislative environment for DeFi is still changing since many governments struggle to create systems that protect consumers while simultaneously encouraging invention (Hayes, 2021). Moreover, the assets inside the DeFi ecosystem can show notable volatility, thereby posing possible risks to consumers as well as investors (Buterin, 2014).

8. Applications of Decentralized Finance

DeFi is a broad spectrum of financial apps and services built on blockchain technology and run distributedly. These applications provide financial services free from the requirement for traditional middlemen by use of smart contracts, which enable decentralized functioning. The main DeFi use cases are listed here.

Decentralized Exchanges (DEXs)

Decentralized exchanges let consumers straight trade cryptocurrencies with one another, therefore removing the need for a centralized body to monitor the transactions. These transactions use smart contracts to execute deals, therefore offering more security and anonymity than centralized exchanges.

On the Ethereum blockchain, notables decentralized exchanges (DEXs) include Balancer, SushiSwap, and Uniswap. Decentralized exchanges (DEXs) enable users with improved fund management, help to reduce the vulnerability to hacks usually connected with centralized exchanges, and guarantee a higher level of anonymity (Hayes, 2021).

Lending and borrowing sites

DeFi lending systems let users borrow assets by offering collateral or lend their assets to others and get interest (Yan and Zhou, 2023). These systems run under smart contracts, which enforce loan rules and automate lending.

Among the notable lending and borrowing sites available in the DeFi domain are MakerDAO, Aave, and Compound. Usually without the necessity for credit checks or thorough documentation, these sites provide more easily available lending and borrowing tools. Moreover, they give lenders more interest rates than traditional savings accounts (Schär, 2021).

Stablecoins

Made to offer a continuous value by being connected to a reserve asset, such a fiat money (like USD) or a commodity (like gold), stablecoins are digital currencies. In the very erratic bitcoin market, cryptocurrencies provide a safe approach to store assets and a consistent means of exchange.

Mostly used stablecoins are DAI, USD Coin (USDC), and Tether (USDT). Stablecoins let consumers make daily purchases, remittances, and savings free from the notable price swings usually connected with other cryptocurrencies (Gudgeon *et al.* 2020).

Liquidity mining and yield farming

Usually in the form of more tokens, yield farming is providing liquidity to DeFi platforms in exchange for benefits. A particular feature of yield farming, liquidity mining is when users receive tokens unique to the network in return for supplying liquidity.

By means of yield farming and liquidity mining initiatives, platforms like Yearn.Finance and SushiSwap inspire consumers to contribute liquidity. These activities give customers the possibility to receive more returns on their money than with other investment choices. Hayes, 2021 is the source's cited year.

Insurance

DeFi insurance solutions address many risks in the DeFi ecosystem, including protocol problems, hacks, and smart contract failures. These systems cover claims and use decentralized pools of capital.

Notable DeFi insurers include Cover Protocol and Nexus Mutual. DeFi insurance protects users from possible financial losses resulting from unanticipated events, therefore improving the security and dependability of DeFi systems. (Schär, 2021)

Synthetic assets

Synthetic assets are virtual copies of real-world objects including stocks, goods, or fiat money. They let users access these assets without actually owning the tangible underlying good.

One well-known platform focused in the design and trading of synthetic assets is Synthetix. Synthetic assets enable simple worldwide trading (Gudgeon *et al.* 2020) and give investors more choices of investment options.

Markets of Prediction

Prediction markets let consumers stake money on the outcome of upcoming events including financial markets, sporting contests, or elections. These markets precisely predict the results of events by using the collective intelligence of a big population.

Popular systems for prediction markets are augur and gnosis. By means of market-driven forecasting, these prediction markets offer a fresh approach for reducing risks and acquiring understanding of future events. The reference is Hayes (2021).

9. Key Indicators of Decentralized Finance Activity

Different important indicators can be used to evaluate the degree of activity in DeFi, therefore providing insightful data on the growth, use, and overall welfare of the DeFi ecosystem. Policymakers, developers, and investors all need these measures to understand the complexities of DeFi markets. Here are some of the primary indicators. Based on important 2019 data, which corresponds to the year before the third bitcoin halving event, we give a quick summary of the DeFi sector.

Total Value Lock (TVL)

In the subject of DeFi, TVL is a frequently used statistic that measures the total value of bitcoin deposited under DeFi systems. It shows the degree of financial resources and confidence paid to the DeFi ecosystem.

Under DeFi systems, TVL measures the financial value of every item deposited, lent, or used in any other capacity. A reliable gauge of the liquidity, use, and confidence in DeFi systems is a larger TVL. It immediately shows the capital level actively engaged in the DeFi ecosystem (Schär, 2021). Many DeFi analytics products, notably DeFi Pulse and DeFiLlama (DeFi Pulse, 2021), allow one to access TVL data.

DeFi Pulse tracks many DeFi systems on the Ethereum blockchain's TVL. For many DeFi platforms on multiple blockchains, DeFi Llama offers TVL data.

With leading platforms like MakerDAO, Compound, and Uniswap leading the way in the DeFi space, it was still in its early years in 2019. By year's end, the TVL in DeFi systems showed a modest rise from over 300 million USD to over 700 million USD. Mostly driven by people who were enthusiastic about blockchain technology and among the first to investigate decentralized financial services, the user base comprised In 2020, the period known as "DeFi Summer" saw notable rise in capital as well as curiosity. From less than 1 billion USD at the start of the year to more than 15 billion USD at the end, the TVL – total value locked – gushed. Platforms like Uniswap, Aave, and Yearn Finance, which saw significant increase in TVL due of their innovative products and appealing yields on assets staked, drove the fast expansion (DeFi Pulse, 2020). By the middle of the year, the TVL in 2021 exceeded 100 billion USD, signifying a continuous expansion tendency. The growing interest of institutional investors helped to highlight this expansion even further. Layer 2 scaling solutions – such as Optimism and Arbitrum – resulted in lower transaction fees and higher transaction speeds, which in turn helped TVL to expand. DeFi Llama, 2021's higher involvement of institutions and their link with established financial systems increased the credibility and TVL of DeFi platforms. Though the DeFi market saw swings and changes between the years 2022 and 2023, overall TVL stayed hopeful. The smooth flow of assets between many blockchains made possible by improvements in cross-chain interoperability produced a very integrated and strong DeFi ecosystem. Notwithstanding more government scrutiny, efforts to create DeFi platforms following rules have effectively drawn more money into the ecosystem.

Driven by invention, profitable returns, and increasing acceptability, The Rise of DeFi's total value currently held has been exponential since 2019. The DeFi industry continues in its expansion and integration with

traditional financial systems despite the occurrence of market corrections and the presence of regulatory challenges, therefore showing a good and motivating future view.

The key trends in the evolution of TVL over the investigated period are summed up in Figures 1, Figure 2, and Figure 3.

Figure 1. Total Value Locked - All Chains (2020 - 2024) (bil. USD)

Source: DefiLama
Note: TVL excluding staking, Pool2, government tokens, borrows, double count, liquid staking, vesting.

Figure 2. Total Value Locked - All Chains (July 2024 (left), 2020 - 2024 (right))
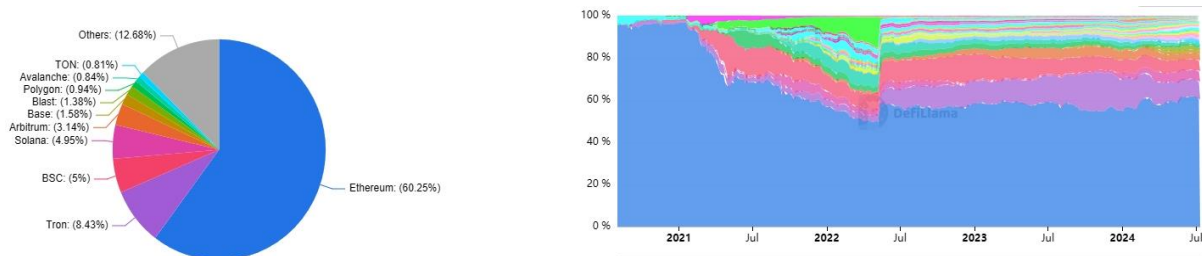
Source: DefiLama

Figure 3. Total Value Locked - Protocol Categories (2020 - 2024) (bil. USD)
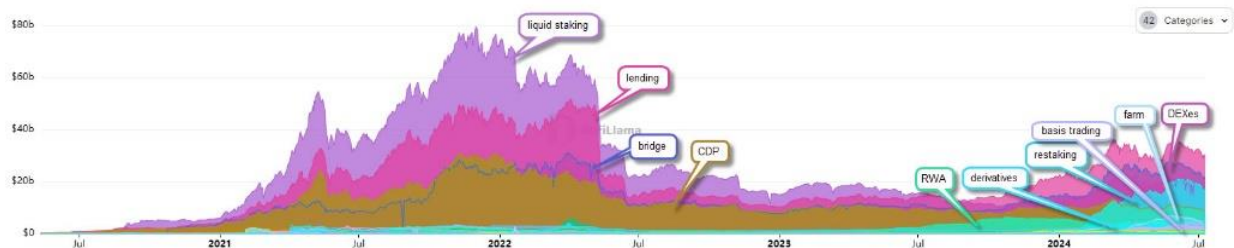
Source: Authors processing based on data from DefiLama
Note:
Top ten protocol categories:
Liquid staking – Protocols that enable you to earn staking rewards on your tokens while also providing s tradable and liquid receipt for your staked position
Restaking – protocols that allows you to stake the same ETH natively and in other protocols
Lending – protocols that allow you to borrow and lend assets
CDP – protocols that mint its own stablecoins using collateralized lending
Bridge –
RWA – protocols that involve Real World Assets, such as house tokenization
Derivatives – protocols for betting with a leverage
Basis trading – projects simultaneously buying and selling crypto futures to profit from price differences between the spot and futures markets
Farm – protocols that allow users to lock money in exchange for a protocol token
Dexes – protocols where you can swap / trade cryptocurrencies

Number of Unique Users

Another important statistic is the total number of different users or addresses interacting with DeFi systems. This survey provides insightful data on the degree of DeFi application acceptability and degree of usage.

The count of distinct users shows the total number of individual wallets addresses that have interacted with DeFi systems over a designated period. The increasing number of different users indicates a boom in interest and adoption of DeFi services among a larger spectrum of customers (Hayes, 2021).

Configurable dashboards provided by Dune Analytics let users track unique user stats on many DeFi systems.

One interesting indicator of the popularity and spread of DeFi platforms over time is the number of different users in this field. Emphasizing notable trends and critical benchmarks, this paper offers a succinct summary of the expansion of DeFi user counts from 2019 onward. DeFi became somewhat well-known in 2019 mostly among people who were enthusiastic about blockchain technology and those who embraced fresh ideas right away. With the growing number of unique users, platforms including MakerDAO, Compound, and Uniswap have been becoming more and more well-known. Most of the platforms had at the end of the year - less than 100,000 unique users - indicating the quite small user base during that time.

DeFi involvement peaked in the summer of 2020, sometimes referred to as "DeFi Summer." Using yield farming and liquidity mining produced a notable rise in the total number of different DeFi users on platforms. Platforms like Uniswap claimed a user base of about 500,000 people at the end of 2020. Retail investors and traders among other more diverse groups began to show interest in the enticing returns produced by DeFi systems. The momentum created in 2020 continued into 2021 since DeFi platforms showed continuous expansion in the total count of unique users. The user base grew to include a more diversified mix of normal investors, professional traders, and institutional investors among other players. The overall count of unique users on all DeFi platforms as of mid-2021 exceeded two million (Dune Analytics, 2021). Although the DeFi market saw swings and changes between the years 2022 and 2023, user expansion stayed constant. Layer 2 solutions and cross-chain interoperability have been very important in the continual rise in user numbers by lowering transaction costs and improving user access. Dune Analytics projects that there will be more than 4 million different users on DeFi systems in 2023.

Advances, attractive returns, and a growing level of interest from both the general public and institutional investors have driven exponential expansion of the number of unique people using DeFi platforms since 2019. Though the sector has seen swings, generally the trend in user growth is positive, implying that more people are adopting and using DeFi products.

Figure 4 gives a general picture of the key trends in the evolution of distinct addresses utilized during the investigated period.

Figure 4. Unique Addresses Used (2020 - 2024) (number of addresses)
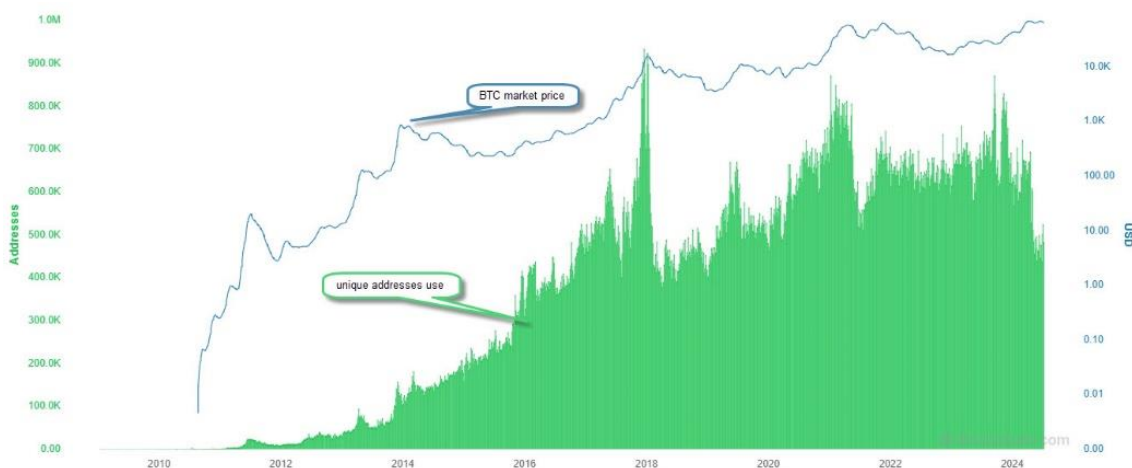
Source: Authors processing based on data from blockchain.com
Note: The total number of unique addresses used on the blockchain (30 day average).

Transaction Volume

Transaction volume measures the total value of all the DeFi platform-mediated transactions. Together with other financial activities, this includes loans and repayments performed on lending platforms as well as transactions done on decentralized exchanges (DEXs).

The whole value of all the DeFi-mediated transactions is known as transaction volume. High transaction volumes point to a notable degree of liquidity and use, which implies active market participation and great user involvement (Gudgeon *et al.* 2020).

For DeFi services developed on the Ethereum blockchain, Etherscan offers thorough transaction data. Glassnode provides for multiple blockchain networks on-chain data analytics including transaction volumes.

Since 2019, the number of transactions on DeFi platforms has exhibited notable rise, signifying the quick acceptance and evolution of DeFi systems. The important trends and noteworthy events in the evolution of DeFi transaction volumes are succinctly summarized in this overview. Those who were fast to adopt new technologies and very interested in blockchain drove much of DeFi's expansion in 2019. Notable sites including MakerDAO, Compound, and Uniswap began to acquire popularity at this period. The transaction volumes were somewhat modest during this period; monthly values ranged from a few hundred million USD. DeFi participation surged noticeably in the summer of 2020, sometimes referred to as "DeFi Summer." Innovations like liquidity mining and yield farming attracted large sums of money that raised transaction volumes. The monthly transaction volumes rose significantly by the end of 2020 and now stand at several billion USD. Prominent DeFi platforms as Uniswap, Compound, and Aave had notable trading volumes; Uniswap sometimes ranked first among the transaction volumes of big, centralized exchanges (Hayes, 2021). As the transaction volumes in the DeFi industry showed consistent rise all year long, the momentum created in 2020 stayed with us into 2021. As new platforms and Layer 2 solutions like Optimism and Arbitrum surfaced, the ecosystem saw a boost in diversity and lower prices and better throughput followed. Additionally contributing to the surge in transaction volumes and improved liquidity in DeFi markets was the increased attention institutional investors paid. DeFi Pulse (2021) claims that the monthly transaction volumes as of mid-2021 exceed tens of billions of USD. Although the DeFi market had swings and changes over the years 2022 and 2023, overall, the direction stayed positive. Improvements in cross-chain interoperability enabled seamless transactions between several blockchain systems, hence raising transaction volumes. Increased regulatory scrutiny and attempts to combine with TradFi drove the transaction volumes and platform operations.

Since 2019, the transaction volume in the DeFi market has surged fast and significantly. New financial instruments, more acceptability and use, as well as institutional investor growing interest could all help explain this increase. Though the market is always changing, and laws provide challenges, overall transaction volume is always rising. This shows how DeFi is developing and finding a place in the larger financial system.

Figures 5 and 6 give a general picture of the key trends in the evolution of confirmed daily transactions and projected transaction value over the investigated period.
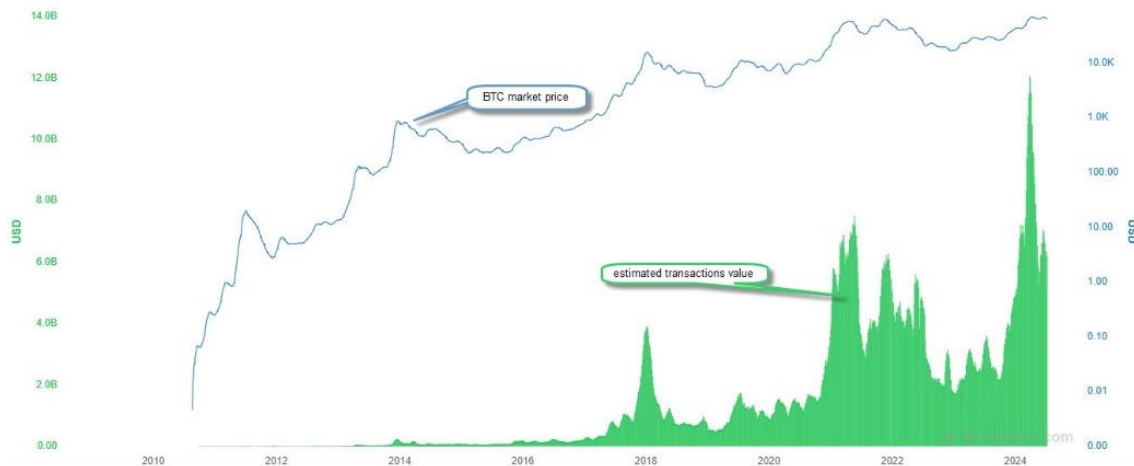
Figure 5. Confirmed Transactions Per Day (2020 - 2024) (number of transactions)
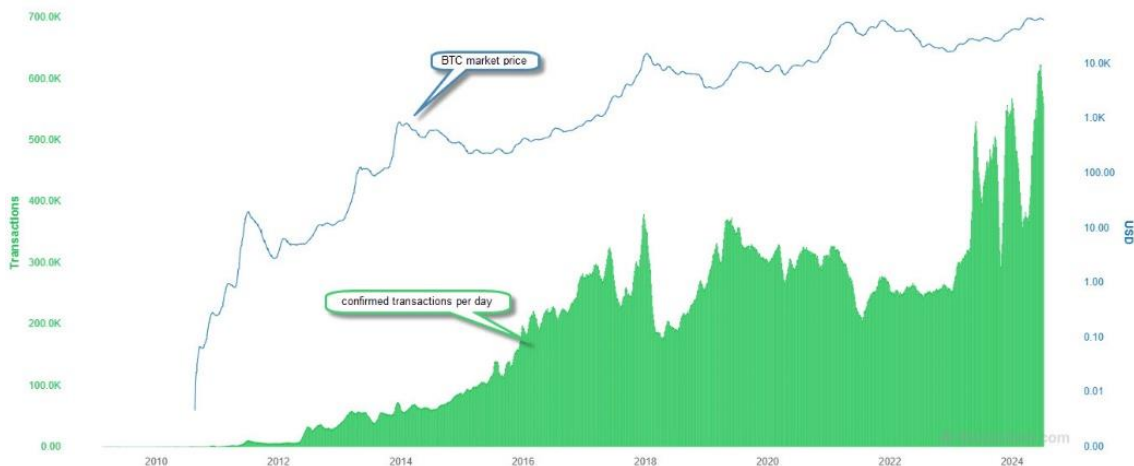
Source: Authors processing based on data from blockchain.com
Note: The total number of confirmed transactions per day (30 day average).

Figure 6. Estimated Transaction Value (2020 - 2024) (bil. USD)

Source: Authors processing based on data from blockchain.com
Note: The total estimated value in USD of transactions on the blockchain (30 day average). This does not include coins returned as change.

Trading Volume on Decentralized Exchanges (DEXs)

A separate subset of transaction traffic, DEX trading volume is the total value of transactions made on decentralized trading systems.

The total value of purchase and sale events conducted on decentralized exchanges (DEXs) is trading volume. Important trading volumes on decentralized exchanges (DEXs) point to active market participation and liquidity, which are absolutely vital for the process of price determination and guarantee of effective markets (Buterin, 2014).

Up-to- current data on the trading volume of the Uniswap decentralized exchange (DEX) is available from Uniswap Info. Multiple dashboards housed by Dune Analytics track trading volumes on several decentralized exchanges (DEXs).

The growth of DeFi has been much aided by decentralized exchanges (DEXs). Thanks to increased acceptance, developments, and more knowledge of DeFi systems, the trade volume on decentralized exchanges (DEXs) has seen a notable rise since 2019. With systems like Uniswap, Kyber Network, and Bancor leading the way as early adopters, decentralized exchanges (DEXs) began to gather very significant popularity in 2019. Usually ranging in tens of millions of USD every month, the trade volumes were somewhat low. This represents the early stage of user adoption and the developing character of decentralized trading. Referred to as "DeFi Summer," the summer 2020 saw notable increase in growth for decentralized exchanges (DEXs). The adoption of creative ideas like liquidity mining and yield farming brought about a significant cash flow into platforms. From roughly 1 billion USD at the beginning of 2020 to surpass 20 billion USD by the year's conclusion, the monthly trade volumes on decentralized exchanges (DEXs) saw a notable surge. Leading the way in this development, Uniswap and Sushiswap drew a varied clientele comprising institutional participants as well as private traders (Hayes, 2021). Following the pattern from 2020, by middle of the year the trading volumes in 2021 usually exceeded 50 billion USD per month. By means of Layer 2 scaling techniques including Optimism and Arbitrum, transaction costs have been efficiently lowered and processing capacity has been improved, therefore fostering trade activity. Larger trading volumes followed from institutions' growing interest in DeFi since more institutional capital was poured into decentralized exchanges (DEXs). With Uniswap alone managing more than 100 billion USD in trade volume during months, Uniswap V3, Sushiswap, and Curve had high degrees of trading activity (DeFi Pulse, 2021). Although the DeFi market saw swings and shifts between the years 2022 and 2023, trade volumes on decentralized exchanges (DEXs) stayed robust. Consistent trade activity resulted from easier asset exchange across several blockchains made possible by improvements in cross-chain interoperability. Trade volumes and platform operations were affected by growing regulatory control and the necessity to include DeFi into current financial systems. The overall direction of trading volumes stayed positive despite market volatility, which emphasizes the dependability and adaptability of decentralized exchanges (DEXs).

Since 2019, the trading volume on decentralized exchanges (DEXs) has surged rapidly and significantly mostly due to technological developments, wider acceptance and use, and increasing interest from institutional investors. The general trend of trading volume shows growth despite the erratic fluctuations in the market and the

challenges presented by legislation, therefore showing the resilience and opportunities of decentralized exchanges (DEXs) in the always shifting DeFi environment.

The Figures 7 give a general picture of the key trends in the volume of DEXs development during the investigated period.

Figure 7. DEXs volume (protocol breakdown) (2020 - 2024) (bil. USD)
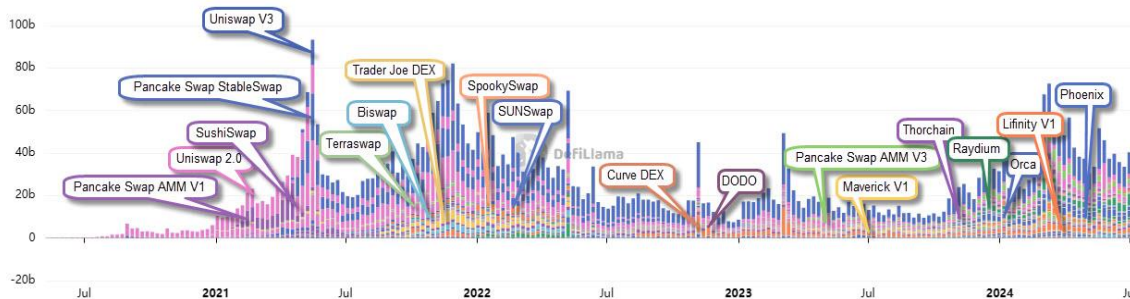
Source: Authors processing based on data from DefiLama

Total Borrowed and Total Supplied

The metrics of total borrowed and total provided inside DeFi lending platforms respectively measure the quantity of cryptocurrencies borrowed and the overall amount deposited for loan.

Whereas total offered denotes the whole value of assets that are accessible for loan, total borrowed is the total value of assets that are presently being borrowed from lending platforms. These factors, which reflect both loan demand and capital availability, help to indicate the activity of the lending market (Schär, 2021).

Two well-known sites that provide complete information on the total borrowed and delivered number of compounds and Aave are While Aave also provides significant market statistics, such the overall amounts borrowed and supplied, Compound's market website allows in-depth study of these criteria.

Since 2019, the lending platforms in the field of DeFi have shown notable rise in both the overall amount borrowed and the overall amount issued. These metrics show the increasing use of DeFi for lending and borrowing, therefore reflecting the greater adoption and evolution of DeFi protocols (Metelski and Sobieraj, 2022). Beginning in 2019, DeFi lending platforms such MakerDAO, Compound, and Aave began to draw interest and popularity. During this first phase of growth, the total borrowed and given amounts were somewhat small. Compound had borrowed 20 million USD overall and added about 100 million USD by the end of 2019. Early adopters – mostly crypto enthusiasts and early DeFi users – were investigating the sites most of all. DeFi participation surged in 2020 under the moniker "DeFi Summer," as liquidity mining and yield farming significantly raised the total values of assets supplied and borrowed. By the end of 2020, compound's overall supply had grown to more than 2 billion USD; the total borrowed amount above 1 billion USD (DeFi Pulse, 2020). Attractive high yields and incentives drove a notable rise in capital for the DeFi lending systems. Following the encouraging trend from 2020, 2021 saw a considerable increase in the total amount borrowed as well as supplied. By use of Layer 2 solutions like Optimism and Arbitrum, transaction costs were lowered, which in turn encouraged lending and borrowing behavior. Rising institutional interest produced a boom in trading volume. Platforms like Aave and Compound have amassed by mid-2021 over 10 billion USD in total money given and several billion in total loans borrowed (DeFi Llama, 2021). Though market corrections in 2023 and 2022, the fundamental trend stayed positive. The simple transfer of assets between different blockchains made possible by developments in cross-chain technologies helped to promote and increase lending and borrowing operations. Rising regulatory scrutiny and more attempts to interact with TradFi drove the lending and borrowing volumes. DeFi Pulse estimates that the combined supply on top of the main DeFi platforms in 2023 exceeded 50 billion USD and that the overall borrowed amounts also showed notable increase.

Since 2019, the total sums of money borrowed and given on DeFi platforms have seen a fast and notable rise largely due to technological developments, tempting rewards, and a rising interest from mainstream and institutional participants. Though market corrections and legal challenges are inevitable, the general trend is still positive, implying a bright future for DeFi lending and borrowing.

Figure 8 give a general picture of the key trends in the growth of outstanding debt on DeFi over the investigated period.

Figure 8. DeFi outstanding debt – Compound (2020 – 2024) (left), Aave (2020 – 2024) (right))
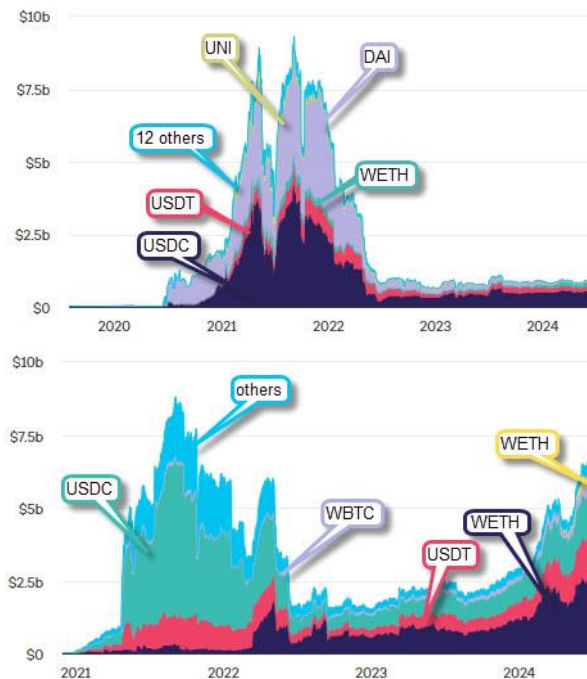
Source: Authors processing based on data from theblock.co

Note: Lending Platforms / protocols:

Aave is a lending protocol where users can borrow and lend assets. Interest rates are determined algorithmically. AAVE token holders govern the Aave protocol.

Compound is a money market protocol where users can borrow and lend assets. Interest rates are determined algorithmically. COMP token holders govern the Compound protocol.

Yield Rates

Important markers of the profits users can get from engaging in DeFi activities are yield rates—that is, interest rates provided by DeFi protocols for lending and staking.

For staking, lending, or providing liquidity, yield rates are the interest rates charged to consumers. While also showing the risk and return profile of DeFi investments, high yield rates can draw additional users and capital into the DeFi ecosystem (Hayes, 2021).

Zapper lets customers control their DeFi portfolios and collects yield rates for several DeFi platforms.

Since 2019, the yield rates on DeFi platforms have changed significantly. Showcasing the changing dynamics and appeal of DeFi as an investment choice, these rates indicate the earnings users may get by lending, staking, or providing liquidity on DeFi platforms. The early growth of DeFi platforms such Compound, MakerDAO, and Aave in 2019 helped to produce quite moderate yield rates. Early adopters, ranging from 2% to 5%, primarily affected the first yield rates for lending stablecoins and cryptocurrencies. Often referred to as "DeFi Summer," the summer of 2020 saw notable increase in growth for the DeFi industry. Using yield farming and liquidity mining methods produced remarkable rise in yield rates; some platforms provide annual percentage yields (APYs) exceeding 1000% at the greatest periods. Attractive profits on platforms including Yearn Finance, Compound, and Uniswap helped them to become well-known. For instance, the COMP token incentives given by Compound significantly raised the effective APY (Annual Percentage Yield) for lenders and borrowers respectively. When the very high returns of DeFi Summer dropped in 2021, the interest rates remained somewhat attractive. For notable cryptocurrencies and stablecoins, the average annual percentage yields (APYs) ranged from 5% to 20%. Using Layer 2 scaling techniques like Optimism and Arbitrum has helped to lower gas prices, therefore indirectly improving net yields for consumers. Better institutional players produced better stability and predictability of yield rates. This resulted from the notable cash flow, which enhanced the trading venues and raised liquidity. Market corrections caused variations in the DeFi yield rates between 2022 and 2023, although generally the direction stayed positive. Competitive yields have come from newly emerging technologies such cross-chain yield farming and automated yield optimization. For those looking for yield, the rather low-risk potential presented by stablecoin deposits remained enticing, generally falling between the range of 5% to 15%.

Advances like yield farming and liquidity mining, market pressures, and increasing institutional interest have prompted significant changes in the yield rates on DeFi platforms from 2019. DeFi still offers attractive returns, especially for stablecoins and well-known cryptocurrencies, even if the very huge gains of DeFi Summer have become more consistent.

The figures 9 give a general picture of the key trends in the evolution of the Median APY trend on all monitored pools over the investigated period.

Figure 9. Median APY trend (2022 - 2024) (%)
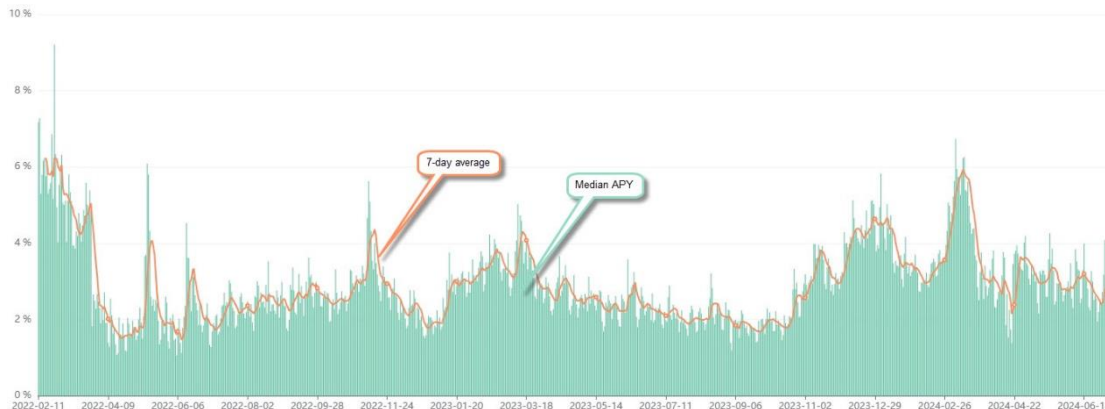
Source: Authors processing based on data from DefiLama
Note: APY (annual percentage yield) calculated over all tracked pools on given day

Protocol Revenue

Protocol income includes DeFi protocol charges from numerous operations - including trading, lending, and staking.

Protocol revenue is the total charges a DeFi protocol generates from its running operations. Higher protocol revenue indicates not only the capacity of the protocol to generate stable money but also its effective acceptance and consumption (Gudgeon *et al.* 2020).

Token Terminal provides thorough financial data including protocol income for DeFi systems. Monitoring daily fees generated by multiple DeFi platforms, CryptoFees provides insightful analysis of protocol earnings.

Revenue from the DeFi systems comes from fees and extra charges paid by DeFi platforms. This data provides insightful analysis on the financial situation and growth of DeFi systems. The evolution of protocol income on DeFi platforms from 2019 forward is succinctly summarized below. DeFi systems were in their early years in 2019, and income generation was rather modest. Starting to establish themselves were MakerDAO, Compound, and Uniswap. Mostly through transaction fees, loan interest, and trading fees on decentralized exchanges (DEXs), the protocol produced small income. DeFi participation increased significantly during the period sometimes referred to as the "DeFi Summer" in 2020, which clearly affected protocol income. Innovations in yield farming and liquidity mining have drawn a sizable number of users, which has clearly increased transaction volumes and fee generating. Leading DeFi protocols such Uniswap, Aave, and Compound saw a notable rise in monthly income from a few hundred thousand dollars to several million dollars by the end of 2020, according DeFi Pulse (2020). As protocol income reached hitherto unheard-of heights in 2021, the impetus created in 2020 continued in that direction. DeFi platforms have diversified and increased their income sources by adding fresh financial products and services, therefore broadening their offers. As these companies poured significant funds into the DeFi ecosystem, institutional involvement increased, and revenues followed. By mid-2021, notable platforms including Uniswap and Aave produced monthly sales exceeding 50 million USD, via DeFi Llama (2021). The DeFi market saw swings and changes between 2022 and 2023 that affected protocol revenues. Still, the general trend stayed hopeful. The developments in cross-chain technology helped to enable seamless transactions between several blockchains, hence supporting ongoing income growth. Increased regulatory scrutiny and the effort to link DeFi with existing financial systems changed income sources. The aggregate monthly income of well-known DeFi platforms has steadily shown great increase as of early 2023, therefore proving the adaptability and endurance of DeFi systems (CryptoFees, 2023).

Since 2019, the income brought in by DeFi platforms' protocols has been quite notable and fast rise. Innovations, more acceptance, and more institutional investor interest help to explain this development. The basic

direction of protocol income is still positive even if the market may fluctuate and rules create challenges. This underlines the financial viability and opportunities for DeFi protocol expansion.

The numbers 10 give a general picture of the primary trends in the monthly DeFi income growth during the examined period.

Figure 10. Monthly DeFi revenue (protocol breakdown) (2020 - 2024) (mil. USD)
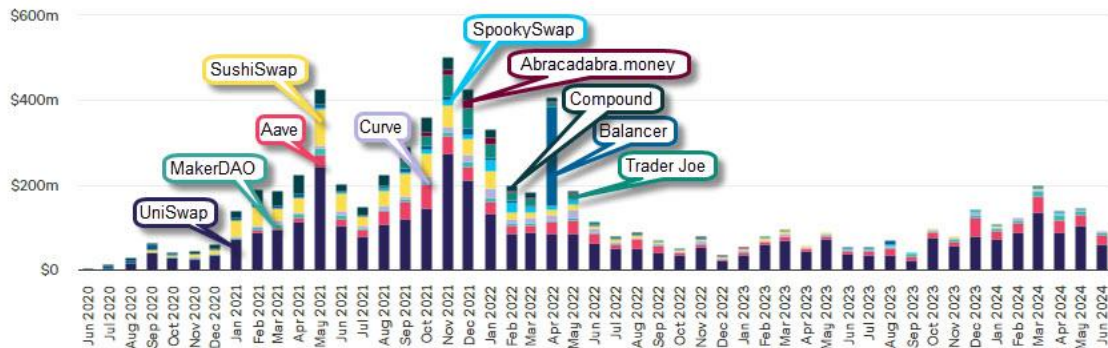
Source: Authors processing based on data from theblock.co

Conclusion

Over the past four years, DeFi has drastically changed the finance sector and presented both clear opportunities and challenges to the TradFi systems. Originating from blockchain technology and smart contracts, DeFi offers decentralized, transparent, and readily available financial services that significantly deviate from the centralized and sometimes confusing character of traditional banking and financial institutions (Buterin, 2014; Nakamoto, 2008).

Emphasizing the importance of a balanced approach to control that can reduce risks without limiting innovation, the paper emphasizes the regulatory problems and hazards connected with DeFi, including smart contract vulnerabilities, market volatility, and lack of regulatory monitoring. Key areas of the research are also represented by the growing interest from institutional investors and the possible integration of DeFi into conventional financial systems, exploring the possibility for DeFi to go from a niche market to a mainstream financial system, and, as a result, profoundly influencing traditional finance. Based on both the chances for additional innovation and expansion as well as the issues that must be resolved to guarantee the stability and sustainability of the ecosystem, the paper emphasizes the future direction of DeFi. Highlighting DeFi's ability to transform the worldwide financial system, it is a vital tool for academics, legislators, and business leaders interested in the junction of technology and money.

TradFi is in great part dependent on established financial institutions including banks, investment businesses, and insurance organizations. They guarantee monetary stability, provide vital financial services, and help to foster economic development. Still, it runs against major challenges like operational inefficiencies, financial exclusion, and structural risks (Mishkin, 2004; Bernanke, 2004). The 2008 financial crisis revealed flaws in TradFi, therefore highlighting the likelihood of broad repercussions should major institutions fail (Bernanke, 2004). Furthermore underlined by the high costs and slow processing times of traditional financial systems are the need of more simplified and efficient substitutes (Friedman, 1963).

DeFi uses blockchain technology to cut middlemen, lower transaction costs, and increase openness, therefore addressing these challenges. Rising from over 700 million USD in late 2019 to more than 100 billion USD by mid-2021, the exponential rise in Total Valuelocked (TVL) in DeFi protocols emphasizes the quick adoption and confidence in these decentralized systems (DeFi Pulse, 2020; DeFi Llama, 2021). Attractive to both personal and institutional investors, yield farming and liquidity mining have resulted in significant increase in user involvement and transaction volumes (Hayes, 2021).

Still, DeFi has hazards as well. The decentralized character of DeFi raises fresh systemic questions like market volatility and smart contract susceptibilities (Gudgeon *et al.* 2020; Hayes, 2021). Furthermore, the legislative environment for DeFi is still unclear since increased scrutiny can hinder its growth and inclusion into TradFi (Schär, 2021). Notwithstanding these risks, DeFi is clearly able to democratize money, improve efficiency, and inspire creativity.

In essence, the interaction between TradFi and DeFi marks a major and transforming transformation in the financial sector. DeFi's inventions challenge accepted wisdom in traditional banking by offering a decentralized substitute with guaranteed improved access, efficiency, and openness. The global financial ecosystem might be

greatly disrupted and changed as DeFi grows. For established financial institutions, this offers opportunities as well as challenges (Buterin, 2014; Demirgüç-Kunt *et al.* 2018). For people and companies engaged in the financial sector navigating this dynamic and fast changing terrain, a thorough awareness of the influence and possibilities of DeFi is very necessary.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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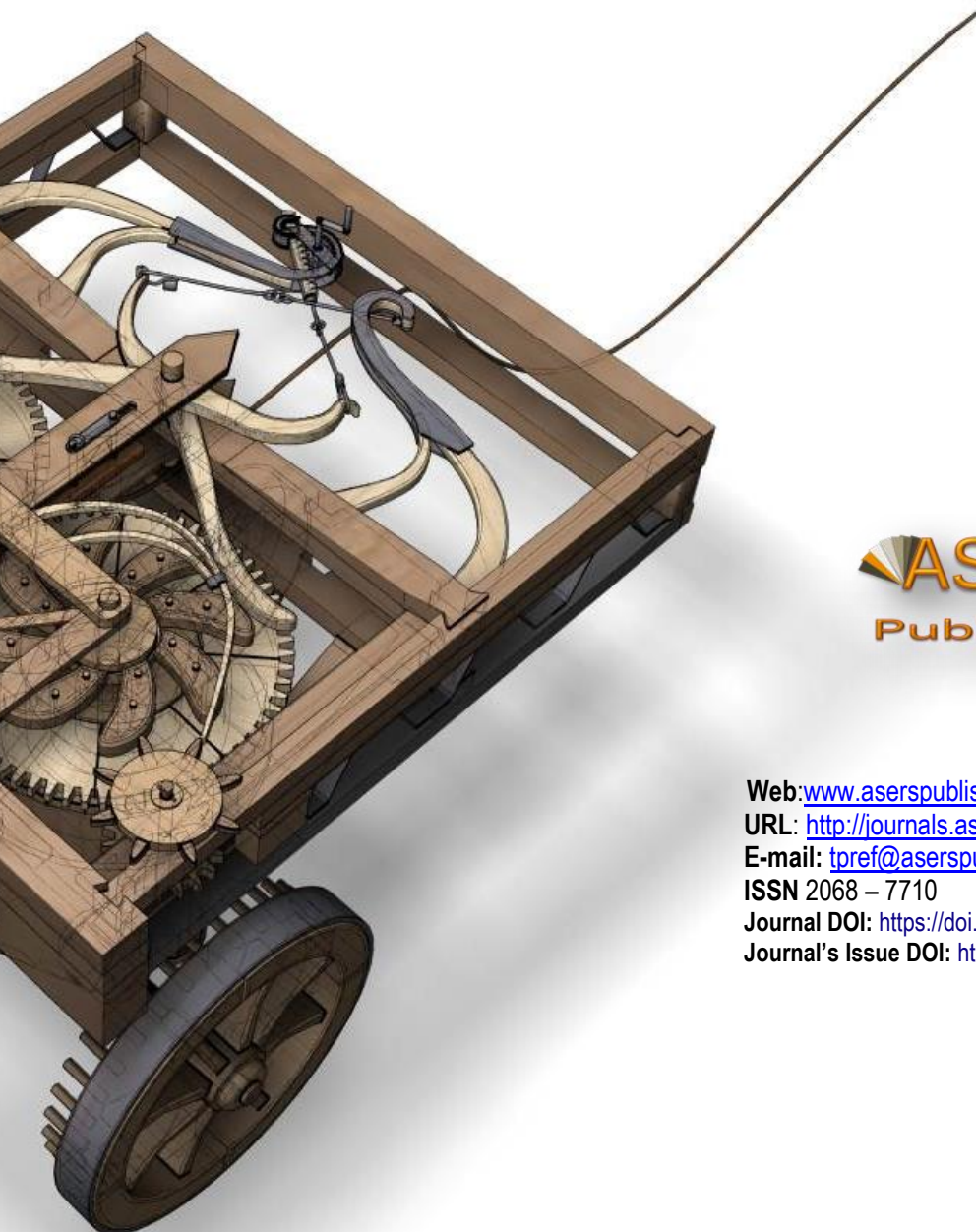[20] Friedman, M. (1963). *Inflation: Causes and Consequences*. Asia Publishing House.

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