Araştırma Makalesi ● Research Article

Blockchain Based Decentralized Lending Protocols: A Return Analysis Between S&P 500 and DeFi Assets

Blok Zincir Tabanlı Merkeziyetsiz Borç Verme Protokolleri: S&P 500 Endeksi ve DeFi Varlıkları Arasında Bir Getiri Analizi

Betül Kaplan [a, *], Vahit Ferhan Benli [b] & Elçin Aykaç Alp [c]

[a] Graduate Student, Istanbul Ticaret University, Department of International Finance, 34445, İstanbul / Turkiye
ORCID: 0000-0003-3220-0771
[b] Dr.Öğr.Üye., Istanbul Ticaret University, Department of Finance and Banking, 34445, İstanbul / Turkiye
ORCID: 0000-0002-0510-7662
[c] Prof.Dr., Istanbul Ticaret University, Department of Economics, 34445, İstanbul / Turkiye
ORCID: 0000-0001-9076-2102

ÖZ

Bu makale, merkeziyetsiz finansın (DeFi) bankacılık sektöründe finansal faydalarını ve zorluklarını incelemektedir. DeFi, blok zincir teknolojisi ve akıllı sözleşmeler aracılığıyla finansal hizmetlerde devrim yaratarak, aracılar olmadan verimli borç verme ve borç alma olanağı sunmaktadır. Bu makaleS&P 500 ile DeFi varlıkları (MKR, AAVE, COMP) arasındaki ilişkiyi merkezi ve merkeziyetsiz finansı karşılaştırarak analiz eden ampirik bir çalışma sunmaktadır. Bir EGARCH modeli kullanarak varlık oynaklığını tahmin eder ve asimetri ile kaldıraç etkilerini inceler. Sonuçlar, S&P 500 ile MKR ve COMP arasında pozitif bir ilişki olduğunu gösterirken, AAVE'nin anlamlı bir ilişkisi olmadığını göstermektedir. EGARCH varyans denklemi, S&P 500 ve COMP için kaldıraç etkileriyle birlikte, AAVE'nin pozitif bir etkisini ve COMP'un S&P 500 oynaklığı üzerinde negatif bir etkisini ortaya koymaktadır. DeFi, kapsayıcılığı teşvik eden dönüştürücü bir potansiyele sahiptir. Bu makale, alternatif yatırım seçenekleri arayan yatırımcılar için S&P 500 ve DeFi varlıklarının kapsamlı bir getiri analizini sunarak katkıda bulunmayı amaçlamaktadır.

ABSTRACT

This article explores the financial benefits and challenges of decentralized finance (DeFi) in the banking sector. DeFi revolutionizes financial services through blockchain technology and smart contracts, offering efficient lending and borrowing without intermediaries. The article presents an empirical study that analyzes the relationship between S&P 500 and DeFi assets (MKR, AAVE, COMP), comparing centralized and decentralized finance. Using an EGARCH model, it estimates asset volatility and examines asymmetry and leverage effects. The results show a positive relationship between S&P 500 and MKR and COMP, while AAVE has no significant relationship. The EGARCH variance equation reveals a positive effect of AAVE and a negative effect of COMP on S&P 500 volatility, with leverage effects for S&P 500 and COMP. DeFi has transformative potential, fostering inclusivity. This article aims to contribute by providing a comprehensive return analysis of S&P 500 and DeFi assets for investors seeking alternative investment options.

1. Introduction

Traditional finance refers to the conventional financial system that has been in existence for centuries, characterized by centralized institutions such as banks, stock exchanges, and insurance companies. Decentralized finance, on the other hand, is a new and rapidly growing financial paradigm built on blockchain technology that operates on a decentralized network and enables financial transactions without intermediaries. It aims to create a more open,

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transparent, and accessible financial system by leveraging the power of decentralized technology.

In traditional finance, financial services and assets are controlled and managed by a centralized authority, making it susceptible to a single point of failure. Decentralized finance, on the other hand, operates on a trustless network where all transactions are recorded on a public ledger and are secured by cryptography. This eliminates the need for intermediaries and enables users to have full control over their assets, reducing the risk of fraud, hacking, and censorship. Additionally, decentralized finance has the potential to increase financial inclusion by providing financial services to individuals who may not have access to traditional banking services. With the rise of decentralized finance, the financial industry is undergoing a significant transformation and is set to change the way financial transactions are conducted in the future.

While traditional finance has a well-established regulatory framework, decentralized finance operates in a largely unregulated space, leading to a higher degree of risk and uncertainty. However, regulators are beginning to take notice of decentralized finance and are exploring ways to regulate the sector, balancing the need for investor protection with the innovation that decentralized finance brings. Despite its nascent state, decentralized finance has seen a surge in popularity in recent years and is attracting a large number of investors and entrepreneurs looking to tap into the potential of this new financial paradigm. The decentralized finance ecosystem is constantly evolving, with new products and services being developed to address the challenges faced by traditional finance. With the rapid growth of decentralized finance, it is clear that it will play a significant role in shaping the future of finance.

Decentralized finance (DeFi) is a rapidly growing blockchain-based financial infrastructure. In essence, it refers to an open, permissionless, and highly interoperable protocol stack that is built on open smart contract platforms like the Ethereum blockchain (Buterin, 2014). DeFi aims to mimic traditional financial services in a more open and transparent way, without relying on intermediaries or centralized institutions. Instead, it relies on open protocols and decentralized applications (DApps), with code used to enforce agreements and transactions carried out securely and verifiably. Any legitimate state changes are recorded on a public blockchain. Smart contracts can perform most of the functions of traditional finance systems, allowing for the creation of an irreversible and highly interoperable financial system with unparalleled transparency, equal access rights, and little need for custodians, central clearing houses, or trust services.

DeFi already provides a huge selection of applications. For instance, a user could buy U.S. dollar (USD) pegged assets, or stable coins on blockchain platforms, then transfer those assets to a similarly decentralized lending platform to earn interest. Finally, that user could add the interest-bearing instruments to a decentralized liquidity pool or an on-chain investment fund higher than user could get from the banks. Smart contracts are the building blocks of all DeFi protocols and applications. Small algorithms that are performed concurrently by a large number of validators and saved on a blockchain are known as smart contracts. With regard to public blockchains, the network is set up such that every user can take part in any operation and confirm that it was carried out correctly. Smart contracts are therefore less effective than conventional centralized computing. However, their benefit is a high level of security: Smart contracts always execute in accordance with their specifications and enable anybody to independently check the resulting state changes. Smart contracts limit the possibility of manipulation and arbitrary interference when they are implemented securely and offer high levels of transparency.

This study is different from previous studies because it focuses specifically on the relationship between the S&P 500 and DeFi assets. While there have been studies on the relationship between traditional finance and cryptocurrencies, this study takes a more nuanced approach by examining the specific DeFi assets and their relationship to the S&P 500. Additionally, the methodology of this study uses a volatility analysis through the application of an EGARCH model, which allows for a more detailed examination of the potential impact of DeFi assets on the returns of the S&P 500. By using this methodology, the study provides a more comprehensive understanding of the relationship between traditional finance and DeFi, which can have important implications for the future of finance.

DeFi is, at its core, a market of decentralized financial applications that compete for users' business and serve as various financial primitives such as exchange, save, lend, and tokenize. By merging and recombining DeFi products, these applications benefit from the network effects and gain a growing amount of market share from the traditional finance ecosystem. DeFi may become credible in a much wider context, according to the phenomenal rise of these assets and some genuinely novel protocols, which has piqued the interest of legislators, researchers, and financial institutions. This article examines the issues of centralized control, restricted access, inefficiency, lack of interoperability, and opacity that DeFi resolves in traditional financial systems, then describing the current DeFi landscape and outlining the prospects that DeFi will offer in the future. The article is structured as follows: Having introduced the DeFi at Section 1 and the basics of Decentralized finance, it is important to understand the fundamental components and features of this decentralized financial system which will explained in the following paragraphs of the article, Section 2 provides literature review, whereas Section 3 explains the difference between traditional and decentralized financing techniques. Section 4 aims to enlighten of the new lending protocols and solutions that they provide to traditional finance problems. Section 5 creates the data analysis of returns between S&P 500 and DeFi assets with the following findings in Section 6, and finally a concluding section are provided.

1.1. The Basics of Decentralized Finance

One of the main advantages of DeFi is its permissionless nature, which means that anyone can participate in the network without requiring permission or approval from any centralized authority. This makes DeFi accessible to a wide range of users, including those who may be excluded from traditional financial services due to their location, lack of identity, or other factors. Another key feature of DeFi is its interoperability, which allows different applications to communicate and share data with each other. This means that users can access a range of financial services from different providers without needing to switch between different platforms or interfaces. DeFi offers a range of financial products and services, including decentralized exchanges (DEXs), lending and borrowing platforms, stablecoins, prediction markets, and insurance products. These products and services are designed to be flexible, customizable, and accessible to a wide range of users.

Decentralized finance (DeFi) has emerged as a rapidly growing sector within the blockchain and cryptocurrency space. In simple terms, DeFi refers to a new financial system that is powered by blockchain technology and operates on a decentralized network of computers. Unlike traditional finance, DeFi is not controlled by any central authority, but instead, relies on smart contracts, decentralized applications (dApps), and open-source protocols to execute financial transactions. DApps, or decentralized applications, are computer applications that run on a decentralized network. Unlike traditional applications, DApps do not rely on a central authority or intermediary to function. Instead, they are built on blockchain technology, which allows for a distributed network of computers to operate and maintain the application.

DeFi applications are designed to be transparent and open source, which means that anyone can inspect the code and verify that the application is secure and trustworthy. This provides a level of trust and confidence that is often lacking in traditional financial services, which are often opaque and centralized. DeFi offers a range of financial products and services, including decentralized exchanges (DEXs), lending and borrowing platforms, stablecoins, prediction markets, and insurance products. These products and services are designed to be flexible, customizable, and accessible to a wide range of users. Decentralized exchanges are one of the most popular DeFi applications, as they allow users to trade cryptocurrencies without relying on centralized intermediaries. These exchanges are built on top of blockchain technology and use smart contracts to execute trades and manage user funds. Unlike traditional exchanges, DEXs operate on a decentralized network, allowing users to trade cryptocurrencies without the need for a central authority. Some popular DEXs in the DeFi space include Uniswap, Sushiswap, and PancakeSwap.

Smart contracts are the foundation of DeFi which self-executing contracts are coded to enforce the terms of an agreement between two parties without the need for a trusted third party. They enable secure, transparent, and automated transactions and are used in a range of DeFi applications.

In conclusion, DeFi is an exciting and rapidly evolving space within the cryptocurrency industry. It offers a range of financial services that are faster, cheaper, and more accessible than traditional finance. With its focus on transparency, security, and decentralization, DeFi has the potential to revolutionize the financial industry and provide more financial freedom to users worldwide.

The Conceptual Explanations of Decentralized Lending Protocols

It is pertinent to note that the current discourse on decentralized finance (DeFi) includes several conceptual explanations that serve as foundational knowledge for further analysis. These conceptual explanations will be frequently referenced throughout the article, and therefore, it is important to be familiar with them.

Cryptocurrencies have revolutionized the way we think about money and financial transactions. Since the introduction of Bitcoin in 2009, the world has seen the emergence of a new asset class, digital currencies that operate on a decentralized blockchain network. Bitcoin, as the first and most well-known cryptocurrency, has become the benchmark for the entire crypto market, but other cryptocurrencies like Ethereum (Ether or ETH), Maker (MKR), Aave, USDC, USDT, and Compound (COMP) have gained popularity in recent years.

Bitcoin is a peer-to-peer electronic cash system that enables online payments to be sent directly from one party to another without the need for intermediaries such as banks. Its unique features include a decentralized network, limited supply, and a tamper-proof ledger system. Bitcoin has become a popular investment asset due to its scarcity and potential for appreciation over time. Ether, on the other hand, is the native token of the Ethereum blockchain network. Ethereum is a decentralized platform that allows developers to build and deploy decentralized applications (dApps) on top of its blockchain. Ether is used to pay for transaction fees and services on the network and has become the second-largest cryptocurrency by market capitalization (CoinMarketCap, 2023).

Stablecoins are a type of cryptocurrency that aims to maintain a stable value by pegging their value to another asset such as a fiat currency or a commodity. They have gained popularity in the decentralized finance (DeFi) ecosystem due to their ability to provide a stable store of value and a medium of exchange without the volatility associated with other cryptocurrencies such as Bitcoin or Ether. According to Catalini et al. (2021), stablecoins are cryptocurrencies designed to maintain a stable value relative to a specific asset or basket of assets, and they can offer benefits such as price stability and reduced volatility in the crypto market. The examples of stablecoins include USDT, USDC, and Dai, which are all pegged to the US dollar.

USDT, USDC, and DAI are examples of stablecoins, which are cryptocurrencies designed to maintain a stable value relative to an asset or currency. USDT, or Tether, is pegged to the US dollar, while USDC, or USD Coin, is also pegged to the US dollar but is issued by a consortium of companies. Also, USDC was launched by Circle and Coinbase in 2018 (Circle, 2021). USDT is a stablecoin pegged to the US dollar, with each token backed by a corresponding US dollar held in reserve by Tether Limited (Tether, 2014). DAI, on the other hand, is a stablecoin that is pegged to the value of the US dollar which was lauched by MakerDAO (MakerDAO, 2017. DAI is backed by a diversified portfolio of cryptocurrencies rather than a central authority. The use of stablecoins provides users with a more stable store of value and can reduce the volatility associated with traditional cryptocurrencies.

Dapps, or decentralized applications, are software programs that operate on blockchain networks such as Ethereum. They are designed to be open source, decentralized, and autonomous, meaning that they do not rely on a centralized entity for their operation. Dapps use smart contracts to execute the rules and conditions of the application, and transactions are verified and recorded on the blockchain. They are often associated with decentralized finance (DeFi) applications but can also be used for a variety of purposes, including gaming, social media, and file storage.

Lending and borrowing platforms are another popular DeFi application, as they allow users to earn interest on their crypto holdings or borrow funds without relying on banks or other financial institutions. These platforms use smart contracts to manage the lending and borrowing process, ensuring that transactions are transparent and secure. MakerDAO is one of the most well-known DeFi projects that use smart contracts to power its decentralized lending platform. It offers a stablecoin called DAI that is backed by a basket of cryptocurrencies, and users can lock their digital assets as collateral to borrow DAI. This innovative approach to lending allows users to access credit without the need for intermediaries, making it faster and cheaper than traditional lending platforms. AAVE and Compound are two of the most popular DeFi lending protocols. They allow users to earn interest on their digital assets by lending them out to borrowers. These platforms use smart contracts to automate the lending process, reducing the need for intermediaries and lowering transaction costs. One of the most popular metrics used to gauge the success of DeFi is Total Value Locked (TVL). TVL represents the total amount of assets held in DeFi protocols, and as of February 2023, it has surpassed $49 billion (Defi Llama, 2023). This impressive figure highlights the growing demand for decentralized finance solutions and the significant role that DeFi is playing in transforming the financial industry.

MakerDAO, Aave, and Compound are among the leading decentralized finance (DeFi) protocols, each with its native token. These tokens serve different purposes within their respective ecosystems and have become popular investments in the rapidly growing DeFi space. In this following paragraphs, we will explore the native tokens of MakerDAO, Aave, and Compound, their functions, and how they fit into the broader DeFi landscape.

MakerDAO is a DeFi protocol built on the Ethereum blockchain that allows users to issue and trade a stablecoin called Dai. The protocol uses a decentralized governance system to manage the stability of the Dai stablecoin, which is pegged to the US dollar. The MakerDAO ecosystem has its native token called Maker (MKR), which plays a crucial role in governing the protocol (MakerDAO, 2017). MKR token holders have the power to vote on proposals related to the management of the protocol, including setting the stability fee (interest rate) charged on Dai loans and managing the collateralized assets that back the stablecoin. In addition, MKR holders receive a portion of the stability fees paid on loans, creating a mechanism for MKR holders to earn revenue from the protocol's activity.

Multi Collateral Dai (MCD) is the newer and improved version of the original Dai stablecoin, which was launched in 2017 by MakerDAO. MCD is a decentralized cryptocurrency that is backed by a basket of collateral assets, rather than just one asset like the original Dai. MCD is created and managed by the MakerDAO protocol, which is a decentralized autonomous organization (DAO) that operates on the Ethereum blockchain. The protocol uses smart contracts to manage the collateral assets and the issuance of the Dai stablecoin.

The collateral assets used to back MCD include cryptocurrencies such as Ether (ETH), Basic Attention Token (BAT), and others that are approved by the MakerDAO community. The amount of collateral required to create new Dai is determined by a stability fee, which is set by the MakerDAO community and is used to manage the stability of the Dai price. One of the key benefits of MCD is its ability to support a wider range of collateral assets. This makes the stablecoin more flexible and less risky than the original Dai, which was backed only by Ether. MCD also includes additional features such as a Savings Rate, which allows users to earn interest on their Dai holdings, and a Governance Token called MKR, which allows token holders to participate in the governance of the MakerDAO protocol.

MCD is designed to be a stablecoin, which means that its value is pegged to the value of the US dollar. This stability is achieved through the use of smart contracts and the collateral assets that back the stablecoin. If the value of the collateral assets drops, the MakerDAO protocol automatically liquidates some of the assets to maintain the stability of the Dai price. Multi Collateral Dai (MCD) is a newer and improved version of the original Dai stablecoin that is backed by a basket of collateral assets. MCD offers greater flexibility and less risk than the original Dai and includes additional features such as a Savings Rate and a Governance Token. As the decentralized finance (DeFi) space continues to grow, MCD is likely to play a significant role in the development of the DeFi ecosystem.

Aave is a DeFi lending and borrowing protocol built on Ethereum that allows users to lend and borrow cryptocurrencies in a decentralized manner. Aave is a decentralized liquidity market protocol that enables users to participate as lenders or borrowers without relying on custodial services (AAVE,2020). The protocol uses a unique system called "flash loans," allowing users to borrow funds without any collateral for a short period. Aave's native token is AAVE, which is used for governance and fee collection. AAVE token holders can vote on proposals related to the development and management of the protocol, such as introducing new assets to be supported by the protocol, adjusting the interest rates on loans, and changing the distribution of rewards to liquidity providers. Furthermore, AAVE holders can receive a discount on fees for using the Aave protocol (AAVE, 2020).

Compound is a DeFi protocol built on Ethereum that allows users to lend and borrow cryptocurrencies. The protocol uses a unique algorithm that determines the interest rates for each asset supported by the protocol. Compound's native token is COMP, which is used for governance and incentivizing participation in the protocol (Compound, 2019). COMP holders can vote on proposals related to the development and management of the protocol, including introducing new assets, adjusting the interest rates, and changing the distribution of rewards to liquidity providers. Moreover, COMP holders can receive a portion of the protocol's revenue through the distribution of governance tokens. MakerDAO, Aave, and Compound are leading DeFi protocols that offer unique services in the lending and borrowing space. Their native tokens, MKR, AAVE, and COMP, play crucial roles in the governance and incentivization of participation in their respective ecosystems. As the DeFi industry continues to evolve, these tokens will likely remain integral to the growth and sustainability of these protocols.

An Initial Coin Offering (ICO) is a type of fundraising mechanism that allows companies or projects to raise capital by issuing and selling digital tokens or coins to investors. The tokens or coins are created and stored on a blockchain network, which is a decentralized ledger that is maintained by a network of computers around the world. ICOs have become a popular way for startups and blockchain projects to raise capital because they offer a way to access a large pool of potential investors who are interested in investing in blockchain projects. ICOs also provide a way for investors to participate in the growth of a project or company by purchasing tokens or coins that may increase in value over time. ICOs typically begin with the issuance of a whitepaper, which outlines the details of the project or company and how the funds raised from the ICO will be used. The whitepaper will also include information on the total number of tokens or coins that will be created and sold, the price of each token or coin, and the timeframe for the ICO. Investors can participate in an ICO by purchasing the tokens or coins with cryptocurrency such as Bitcoin or Ethereum. The tokens or coins are usually sold at a discounted price during the ICO

period, and the price may increase once the tokens or coins are listed on a cryptocurrency exchange.

In conclusion, a basic understanding of the conceptual explanations of decentralized finance, such as blockchain technology, smart contracts, and dApps, is crucial to comprehend the functioning of DeFi protocols and their significance in the financial industry. As we have seen, DeFi applications such as lending and borrowing platforms, stablecoins, and decentralized exchanges offer new and innovative solutions to long-standing problems in the traditional financial system.

1.2. Definition of the Problem

Traditional finance is a system that has long relied on intermediaries and centralized institutions to facilitate transactions and lending. While this system has worked for centuries, it is not without its problems. These problems range from high fees to slow transaction times, and most importantly, the exclusion of certain groups from access to finance. Decentralized finance (DeFi) is a blockchain-based financial infrastructure that offers solutions to many of these issues. This essay will explore the problems with traditional finance and how DeFi, specifically lending platforms, can provide solutions. Additionally, we will analyze the returns of the S&P 500 compared to the DeFi assets Maker (MKR), Aave (AAVE), and Compound (COMP). While DeFi lending platforms offer solutions to the problems of traditional finance, it is also important to consider their potential for return on investment. To do this, we will compare the returns of the S&P 500 to the DeFi assets MKR, AAVE, and COMP.

Traditional finance has several problems that have led to the rise of DeFi lending platforms. One of the biggest issues with traditional finance is the high cost of intermediaries. Banks, for example, charge high fees for services like loans, which can be a significant burden for individuals or small businesses. Moreover, the centralized nature of traditional finance means that these intermediaries can exercise significant power over their clients, leading to unfair practices. Another issue with traditional finance is the slow transaction times. While banks offer convenience in terms of access to funds, it can take days or even weeks for transactions to be completed. This delay can be especially problematic for small businesses that need funds quickly to maintain operations. Finally, traditional finance has historically excluded certain groups from access to finance. This includes individuals with low credit scores or those in underbanked areas. These exclusions can exacerbate wealth inequality and make it difficult for some to achieve financial stability.

DeFi lending platforms offer several solutions to the problems of traditional finance. Firstly, they are open and transparent, meaning that fees are often significantly lower than those charged by traditional intermediaries. Additionally, the decentralized nature of these platforms means that there is no central authority that can exercise

undue power over clients. Another advantage of DeFi lending platforms is the speed of transactions. Because these platforms are built on blockchain technology, transactions are completed almost instantly. This can be especially beneficial for small businesses that need access to funds quickly.

Finally, DeFi lending platforms can provide access to finance for those who have been historically excluded from traditional finance. Because these platforms are built on open protocols and decentralized applications, there are fewer barriers to entry. This means that individuals with low credit scores or those in underbanked areas can access funds that they would not be able to through traditional finance.

2. Literature Review

The majority of scientific literature on blockchain focuses on its technical aspects of blockhain and its usage in business and technical fields. This paper aims to contribute to the growing field of blockchain and Decentralized Finance (DeFi). Nakamoto (2008) introduced the first consensus-driven, decentralized blockchain, the Bitcoin blockchain, to eliminate the need for financial intermediaries and create a transparent financial system based on code-based, peer-to-peer transactions. For 15 years, Bitcoin has enhanced the security and affordability of payments, exemplifying the capabilities of decentralized blockchains. Its achievements include providing a safer and more economical method for creating and accepting payments. However, the true significance of Bitcoin lies in its demonstration of the immense power of decentralized blockchains. Bitcoin operates through a network of separate but interconnected clients that validate its blockchain.

Buterin (2013) significantly advanced the concept and presented the first use case for smart contracts (i.e., code-based agreements executed without human intervention) with the Turing-complete script language of the Ethereum blockchain, laying the technical groundwork for Decentralized Finance (DeFi)—a financial ecosystem that enables complex financial products and transactions in a borderless and trustless manner (e.g., lending/borrowing, derivatives). DeFi has the potential to revolutionize the financial industry by providing more accessibility, choice, and control to individuals and institutions. However, it also raises new challenges and risks, including regulatory uncertainty and potential security vulnerabilities (Dirk A. Zetzsche et. al. 2020). Blockchain technology holds good promise for the fintech sector. Blockchain holds great promise for fintech, providing business solutions through its decentralized structure and immutable public ledger (Aitken, 2018).

There has been significant research conducted on the workings of DeFi lending protocols, which is an emerging field. Numerous studies have been carried out to explain how DeFi lending works, including works by Bartoletti et al. (2020), Gudgeon et al. (2020), Perez et al. (2020), and Kozhan and Viswanath-Natraj (2021). Perez et al. (2020)

specifically focused on analyzing the workings of "Compound". Saengchote et al. (2021) illustrated how Compound works, who its users are, and how they interact with the pool. In addition, Catalini et al. (2021) pointed out that collateralized lending platforms allow users to deposit one token in exchange for interest and borrow another token using the original one as collateral, which is similar to traditional lending practices. One example is, "MakerDAO (MakerDAO is a decentralized autonomous organization founded in 2014 that functions as an open-source project on the Ethereum blockchain (MakerDAO, 2017)) " which permits users to lock up value to issue the "Dai stablecoin". Moreover, Ben Charoenwong et al. (2022) investigated the possibility of creating a decentralized and capital-efficient stablecoin using smart contracts that algorithmically trade to maintain stability. The study explored the new functionalities decentralized stablecoins offer and addressed several outstanding conjectures in the space. This current study differs from the existing literature as it focuses on the relationship between DeFi assets and traditional finance assets and seeks to test hypotheses regarding their correlation using volatility models.

Token deposits on lending platforms play a dual role of incentivizing borrowers to repay their loans while also providing liquidity for other users to borrow. For instance, on Compound and Aave, users can deposit Ethereum (ETH or Ether) and USDC, respectively, and then the Ether depositor can borrow USDC while the USDC depositor can borrow Ether. The lending platform enforces over-collateralization ratios based on the quality and volatility of the collateral provided (Catalini et al., 2021). This transaction type is renamed as "back-to-back loans" in traditional banking.

Bartoletti et al. (2020) and Cousaert et al. (2021) conducted 'Systemizations of Knowledge (SoKs)' for two subspaces of DeFi, namely lending protocols and yield aggregators. They employed a mixed approach of synthesizing academic literature and conducting their own subspace analyses. Meanwhile, Werner et al. (2021) also conducted a "SoK" for the entire DeFi space, but with a focus on security challenges, which they categorized as either technical or economic.

In broadest sense, decentralized finance is an emerging open-source financial infrastructure that relies on blockchain technology and smart contracts to create innovative open protocols and decentralized applications (dApps). Its ultimate goal is often to remove traditional intermediaries from the financial value chain and democratize access to finance (Bollaert et al., 2021; Chen and Bellavitis, 2020; Fisch et al., 2020; Zetzsche et al., 2020). DeFi is largely based on distributed ledger technology (DLT) which was created by Nakamoto (2008) by combining blockchain technology with a proof-of-work consensus mechanism that prevents the creation of perfect copies of digital assets, thus eliminating the need for trust in DeFi markets. One notable example of DeFi is the market

for token offerings or initial coin offerings (ICOs) (An initial coin offering (ICO) is the initial public offering of the cryptocurrency world. An ICO can be launched by a business to generate money for the development of a new coin, app, or service (Investopedia, 2022)) for startups, which has been well-documented (Bellavitis et al., 2021; Catalini and Gans, 2018; Fisch, 2019; Howell et al., 2020; Lee et al., 2022; Li and Mann, 2018; Momtaz, 2020a).

Decentralized finance has yet to address several novel and idiosyncratic risks that fall broadly into two categories: "intra-protocol" and "inter-protocol" risks. Intra-protocol risks include consensus failures, such as 51% attacks on Proof-of-Work (PoW) blockchains and validator cartels on Proof-of-Stake (PoS) (The Proof-of-work (POW) consensus process, which was first used to validate a blockchain and add new blocks, was replaced with Proof-of-stake (POS). The quantity of staked coins is used by proof-of-stake (POS) cryptocurrency owners to verify block transactions (Investopedia, 2022)) blockchains, as well as intra-protocol arbitrage on automated market maker (AMM) exchanges (AMMs are decentralized exchanges that employ algorithmic "money robots" to supply liquidity for traders buying and selling crypto assets (Chainlink, 2022)), known as maximum extracted value (MEV) (The term "maximum extractable value" (MEV) describes the amount of value that may be obtained from the generation of blocks that is more than the usual block reward and gas costs by including, omitting, and rearranging the transactions in a block (Ethereum, 2022)) (Daian et al., 2020). Inter-protocol risks include so-called "oracle attacks", in which biased or fake outside information is fed into smart contracts, and "flash loans" that pave the way for inter-contract arbitrage (Wang et al., 2021a). The technical vulnerabilities that both intra- and inter-protocol hazards represent are extremely challenging for individual platform users to find or even comprehend. These dangers set decentralized finance apart from intermediary financial markets. The effects of these risks might be particularly noticeable in crowdfunding marketplaces, like the initial coin offering market, where individual backers might lack the technical expertise to fully assess the unique protocol hazards.

Ugolini A. et al. (2023) highlights the interconnections between different asset classes, including DeFi assets, cryptocurrencies, stock markets, and safe haven assets. Their findings suggest that DeFi assets and cryptocurrencies exhibit the highest spillovers among all asset classes, with external factors impacting net spillover size within each asset class. Yousaf I. et al. (2022) further examines the dynamic connectedness between DeFi assets and sector stock markets during the COVID-19 pandemic, providing valuable insights for investors and portfolio managers seeking to manage risk and optimize portfolios during economic uncertainty. The study by Yousaf I. et al. (2022) further examines the dynamic connectedness between DeFi assets and sector stock markets during the COVID-19 pandemic, providing valuable insights for investors and portfolio managers seeking to manage risk and optimize

portfolios during economic uncertainty. Piñeiro-Chousa et al. (2022) find that VIX inversely influences DeFi, while the gold index acts as a safe haven, and Telegram chats influence DeFi, but Twitter activity does not. The authors recommend future research to examine the post-pandemic period, include variations in sentiment variables, and analyze longer time-series data, as the DeFi landscape of projects and their behavior as a category of crypto assets are rising and may change significantly in the future.

The review of literature and empirical studies have shed light on the significant potential of DeFi in enhancing financial inclusion, efficiency, and innovation, while also acknowledging the challenges and risks it entails. To ensure the responsible and sustainable growth of DeFi, all stakeholders must collaborate to balance innovation with safety, privacy, and transparency. This necessitates the continuous pursuit of research, education, dialogue, and collaboration among academia, industry, and regulatory bodies, as well as the active participation and empowerment of users and communities. By adopting the appropriate approach and mindset, DeFi has the potential to unlock the full benefits of decentralized technologies in building a more inclusive, equitable, and resilient financial system for all.

3. Traditional Finance vs. Decentralized Finance

In traditional finance, a network of intermediaries connects various parties. A network of intermediaries that connect various parties is the basis of market-based finance. Financial organizations and intermediaries which act on infrastructures such as stock market are the classic intermediaries. These conduits engage a variety of financial market participants, especially those who have financial resources (such savers, lenders, and investors) and others who are in need of financial resources (borrowers, entrepreneurs etc). When breaking down market-based financial systems into its conventional divisions like corporate banking, investment banking, retail banking etc., we frequently consider the intermediaries to be the focal point. Major intermediaries that centralize tasks and financial resources are thus what we define as traditional finance. In this regard we distinguish between the market based and bank based financial systems (Hardie&Howarth, 2013).

In existing capitalist economies, the two-tier banking system plays a crucial role in creating the money supply, which leads to a centralized, profit-seeking authority acting as the credit allocator, renamed after "central bank". In general, the transmission of "money" created inside a financial system transmissioned to the real sector occurs preferably with the help of a private sector which is fortified with burdensome capital standards. They have to allocate capital and deposits inform of credit facilities to ultimate borrowers within the boundries of capital restrictions and under severe competitive pressures. This allocation process should yield risk adjusted returns and generate enough value for preserving capital, where the capital allocation takes place

according to the risk appetite of the related management of financial institutions. The risk appetite is mainly driven by eagerness for the related credit rating of the financial institution if it wants to stay competitive enough within the competitive circumstances. Under this competitive capital and rating contingencies, the allocation problem becomes more severe when it comes to the lending to small and medium-sized businesses (SMEs) and peaks up in jurisdictions where the banking industry has already consolidated.

In contrast, large financial institutions frequently favor complex, expensive transactions that provide economies of scale and breadth. These speculative loans are frequently used to fund share buybacks, mergers and acquisitions, trading of secondary market assets, and other related activities. Small and medium-sized firms are less likely to receive these loans than bigger clients do (SMEs). As a result of the expansion of credit to offset a stagnant supply of goods and services, asset price inflation is therefore caused. The owners of financial assets stand to prosper, whereas small enterprises may have difficulty raising capital. A variety of financial exclusions might follow from this. A sizable portion of the world's population also doesn't have access to banking since it's kept out of their reach. Also, a relatively large section of the world lacks access to banking that is kept out of access to financial services by a variety of barriers, whether they need it or not. Customer due diligence is frequently required in traditional finance, but DeFi is attempting to steer clear of giving that authority to an unelected group of bankers. Around the world, 40% of people lack access to financial services. It is true that a big section of this population is denied access to banking because of their welfare status or geography, but it is also true that the most reputable financial services corporations are not urged to establish themselves in the world's less developed regions (Financial Times Adviser, 2021). DeFi has the potential to provide access to financial services for anyone with internet access. This opens up opportunities for people who may not have previously had access to traditional financial services, increasing financial inclusion and empowerment. DeFi's borderless and trustless nature also means that people from around the world can participate in financial activities without the limitations imposed by geographical borders or traditional intermediaries.

The financial industry, particularly lending, has become slow and inefficient due to its size and outdated decision-making and operating processes. The concept of banking has existed for thousands of years, with the first recorded bank dating back to ancient Babylon in 2000 BC (Mishkin, 2018). However, the modern banking system as we know it today began to emerge in the 16th and 17th centuries, with the development of central banks and the issuance of paper money (Mishkin, 2018). Technologically, they have old architectural structures that were established many years ago and are far from meeting today's needs. On a worldwide scale, every bank has set up its own mechanism for making decisions and paying out money with the old competitive

understanding and closed it to the outside world. Neither system of them speaks to each other due to the fact that every lending institution has a unique credit management and risk analysis procedure. The current technology enables strangers to reach consensus with each other without recourse to a central authority (Scott, 2016). According to Harvey. C.R et. al. (2021) decentralized finance offers considerable potential for solving problems associated with centralized finance: centralized control, limited access, inefficiency, lack of inoperability, and opacity as explained below.

Centralized Control: There are numerous levels of centralization. The majority of customers and businesses work with a single, regional bank that set the interest rates and fees. One authority tries to control the short-term interest rates and the inflation rate in a centralized banking system.

Limited Access: The fact that 38% of people in the world do not have bank accounts makes it incredibly difficult for them to get loans and participate in online commerce. Additionally, a lot of consumers turn to payday lending services to make up for liquidity shortfalls. However, having a bank account does not ensure access. Borrowing ability and eligibility is required by banks to be able to take a credit.

Inefficiency: There are numerous inefficiencies in a centralized financial system. The interchange rate for credit cards, which drives up interest rates for individuals and small companies, is possibly the most glaring example. Additionally, the two business days it takes to settle a stock transaction (officially transfer ownership) are wasted time. The value date problem at the swift based transfers is another case in point which is the issue of delays and discrepancies in the processing of these types of transactions. This seems completely absurd in the era of the Internet. Many of these inefficiencies are not immediately apparent to users because banks must pay for their physical infrastructure, deposit interest rates are still relatively low, and loan interest rates are high in the current banking system. Other inefficiencies include the expensive and slowly moving of cash, the direct and indirect brokerage costs, the lack of security, and the impossibility of carrying out microtransactions.

Lack of Interoperability: Businesses and consumers interact with financial institutions in a siloed environment. The U.S. financial system is well-known for being compartmentalized and built to withstand significant switching costs. Transferring money between institutions can be excessively time-consuming and difficult. For instance, wire transfer might take two to three business days to complete (SmartAsset, 2022), and depending on the currency type, SWIFT transfer could take up to more business days to complete which could delay the time to get the service or product in the needed time because of transfer time and value date problems occur in international transfers.

Opacity: The current financial structure lacks transparency.

Bank customers have limited understanding of the state of their bank's finances and are forced to rely on the insufficient government insurance provided by the banks for the security of their money after the 2008 financial crisis. They also struggle to determine whether the interest rate on a loan that they are provided is reasonable or not. As previously stated, the government's strategies for "pump-priming" attempts through state-owned banks to stimulate the economy are as opaque as possible. In this ambivalence, the state may play a remarkable role in the production of money and credit while also becoming a sizable net debtor and increasing the opaqueness of the debt-capital markets (Baumgartner et. al., 1986).

Expanding on these issues could result in a lengthy list of significant issues that are inherent to our existing system of centralized banking. Our financial infrastructure in which we live has not entirely adapted the digital era. New possibilities are provided by decentralized finance, and lending protocols serve as banks and financial intermediaries. Although the technology is still in its infancy, the benefits could be revolutionary.

4. Blockchain Based Lending Protocols

Lending protocols are a revolutionary new technology that is transforming the way people borrow and lend money. These protocols use blockchain technology to facilitate peer-to-peer lending, allowing individuals and institutions to lend and borrow digital assets directly from one another without the need for a central authority or intermediary. One of the key benefits of lending protocols is their ability to reduce transaction fees while eliminating intermediaries in between the transaction. Traditional financial institutions often charge high fees for processing loans, which can make borrowing expensive for individuals and small businesses. With lending protocols, however, borrowers and lenders can transact directly with one another, eliminating the need for intermediaries and the fees they charge. This can make borrowing more affordable and accessible, particularly for those who may not have access to credit through traditional channels. Another benefit of lending protocols is their ability to increase liquidity. By allowing individuals and institutions to lend and borrow directly from one another, these protocols create new sources of liquidity that can be used to finance a wide range of activities. This can help to stimulate economic growth and development, as more capital is available to support new ventures and investments.

Additionally, lending protocols can improve access to credit for borrowers. Traditional financial institutions often have strict lending criteria that can exclude many people from accessing credit. With lending protocols in decentralized finance, however, individuals and small businesses can access a wider range of lenders, potentially increasing their chances of obtaining a loan. This can help to promote financial inclusion and empower those who may have been previously excluded from the traditional financial system. Overall, lending protocols are a powerful new technology

that has the potential to revolutionize the way we borrow and lend money. By reducing transaction fees, increasing liquidity, and improving access to credit, these protocols have the potential to create a more equitable and efficient financial system. DeFi has the potential to revolutionize the financial industry by providing more accessibility, choice, and control to individuals and institutions. However, it also raises new challenges and risks, including regulatory uncertainty and potential security vulnerabilities (Dirk A. Zetzsche et. al. 2020). Loans are an essential part of the decentralized finance ecosystem. There are a large variety of protocols that allow people to lend and borrow crypto assets. Decentralized loan platforms are unique in the sense that they require neither the borrower nor the lender to identify themselves. Everyone has access to the platform and can potentially borrow money or provide liquidity to earn interest. As such, DeFi loans are completely permissionless and not reliant on trusted relationships.

The ecosystem of decentralized finance cannot function without loans. Users can lend and borrow cryptocurrencies using a wide range of methods. Decentralized loan systems are distinctive in that neither the lender nor the borrower must provide their identities. Everyone has access to the platform and may be able to give liquidity to earn interest or borrow money. DeFi loans are therefore totally permissionless and unreliant on established connections. Borrowers could run away with the funds, and lender must protect itself to prevent these situations. First, credit can be granted with the requirement that the loans are returned atomically which means that borrower must get the money, and use it, and the return it all in one blockchain transaction. In this regard, Aave (Aave is a decentralised non-custodial liquidity market protocol where users can participate as suppliers or borrowers. Suppliers provide liquidity to the market to earn a passive income, while borrowers are able to borrow in an overcollateralised (perpetually) or undercollateralised (one-block liquidity) fashion (Aave, 2020)) is the first lending protocol that introduced "flash loans which allows you to borrow whatever amount of assets that are accessible without posting any kind of security, as long as the liquidity is returned to the protocol in a single block transaction. The working mechanism behind the flash loan is the borrower has not paid back the money (plus interest) after the transaction's execution cycle (Aave, 2020). In this scenario, the transaction will be meaningless and any outcomes, including the loan itself, will be undone. Flash loans are a useful new tool for arbitrage and portfolio restructuring, even if they can only be used in applications that are resolved atomically and totally on-chain. They become a crucial component of DeFi lending.

Loans in DeFi lending protocols can be fully secured with collateral, which is locked in a smart contract until the debt is repaid. There are three types of collateralized loans: collateralized debt positions, pooled collateralized debt markets, and peer-to-peer collateralized debt markets. Collateralized debt positions use newly created tokens, while debt markets use existing tokens and require a match

between a borrower and a lender. There are different type of decentralized lending platform which offers different type of DeFi products. In DeFi lending protocols, users are allowed to lend and borrow cryptocurrencies. A DeFi lending protocol facilitates peer-to-peer lending among network members and removes the requirement for third parties, in contrast to traditional systems that are platforms that lend money to borrowers.

Table 1. Lending Protocols and Key Metrics

Name	Description	Availability on Chains	Total Locked Value in USD
AAVE V2	Open Source Liquidity Protocol	Ethereum, Avalanche, Polygon	4,820,000,000
Benqi Lending	Decentralized borrowing/lending platform	Avalanche	229,250,000
Compound Finance	Decentralized borrowing/lending platform	Ethereum	1,940,000,000
MakerDAO	An Unbiased Global Financial System	Ethereum	7,240,000,000
JustLend	Decentralized finance algorithmic market protocol	Tron	3,460,000,000
Venus	Decentralized stablecoin borrowing/lending platform	BSC	832,780,000

Source: Defi Llama Protocols, 2023

Lenders can get a DeFi yield by engaging a platform for DeFi lending. For cryptocurrency owners who want to lend their crypto assets to the platform can earn a passive income. Additionally, the platform gives long-term investors the opportunity to earn high interest rates than traditional finance. Both lenders and borrowers can profit from DeFi lending protocols. In above Table 1, there is a list of some most known lending protocols and key metrics by the time of writing this article (February, 2023). Users have a few different options for decentralized lending and borrowing through lending protocols built on Etherum. The most popular lending platforms are MakerDAO, Compound, and Aave V2.

Overall, DeFi lending platforms offer a promising alternative to traditional finance lending and borrowing. By leveraging blockchain technology and smart contracts, DeFi lending protocols provide a transparent, secure, and flexible lending and borrowing experience that can benefit both lenders and borrowers. As the DeFi ecosystem continues to grow and mature, it is likely that we will see more innovative lending protocols and products that will further expand the DeFi lending market.

4.1. An Unbiased Global Financial System: MakerDAO

MakerDAO, which arrived on the scene in 2017 and attracted a significant user base, is one of the oldest initiatives with a decentralized autonomous management system and is still going strong today. The MakerDAO platform promises a mechanism where users may borrow cryptocurrency as collateral rather than fiat money and make extra money by lending. The project's ability to function with user community and smart contract contributions is also critical in terms of decentralization and security.

MakerDAO is frequently held up as an example of DeFi. The creation of a stablecoin with cryptocollateral that is pegged to USD is the main value-add of MakerDAO. This means that the stablecoin may be backed, vaulted, and audited entirely within the Ethereum blockchain without the need for external centralized institutions. In the MakerDAO there are two-token architecture, the governance token MKR provides platform voting rights and takes part in improving business performance. The second token is a DAI stablecoin, a key component of the DeFi ecosystem into which numerous protocols can be included.

It is just a collateralized debt position, which is the fundamental concept behind the DAI mechanism. For instance, a homeowner in need of some liquidity may utilize their home as collateral when applying for a mortgage loan from a bank in order to secure a loan that includes a cash takeout. Given that ETH's price volatility is substantially higher than that of a home, the collateralization ratios for the ETH-DAI contract are higher than those for a conventional mortgage. Additionally, as everything takes place on the Ethereum blockchain, there is no need for any centralized institutions.

DAI must continue to be pegged 1:1 to the USD for the MakerDAO ecosystem to stay effective. To encourage supply and demand and move the price closer to the peg, several mechanisms are in place. The debt cap, stability fee, and DAI savings rate serve as the fundamental pillars for preserving the peg. Owners of MakerDAO governance tokens (MKR) have power over these parameters. MakerDAO is managed through the use of the MKR token. By allowing additional collateral kinds and adjusting factors like collateralization ratios, token holders have the ability to vote on protocol changes. Owners of MKR are expected to act in the platform's best interests financially. The locked dollar amount associated with the unique address for MakerDAO constitutes most of all unique addresses and associated dollar amount of DeFi transactions (Kaal W.A. 2020).

MakerDAO offers several products, including the Dai stablecoin and the Maker platform. Its flagship product is

the Dai stablecoin, which is designed to maintain a stable value relative to the US dollar. Dai allows users to transact in a currency with a stable value, providing stability in a highly volatile cryptocurrency market. In addition to Dai, MakerDAO also offers multi-collateral Dai (MCD), which allows users to use a wider range of digital assets as collateral for their loans. MakerDAO also offers the Dai Credit System, which allows users to access loans with Dai as collateral and provides a transparent and decentralized alternative to traditional lending practices.

There are several key differences between MakerDAO and traditional finance. Firstly, MakerDAO is decentralized, meaning that it is not controlled by any single entity. Instead, it is governed by the community of users who participate in the network. This decentralization gives users more control over their financial assets and reduces the risk of censorship or interference by external parties. Secondly, as mentioned above, MakerDAO uses a unique system called a collateralized debt position (CDP) to create and manage Dai stablecoin. In this lending protocol, users can create Dai by collateralizing their Ethereum (ETH) holdings, and they can manage the value of their Dai by adjusting the amount of collateral they hold. This allows users to access short-term liquidity without having to sell their ETH holdings. In contrast, traditional finance often requires users to sell their assets to access liquidity, which can be costly and time-consuming.

Third, MakerDAO offers a stablecoin that is pegged to the value of the US dollar. The stablecoin of MakerDAO is called as DAI. This provides users with a more stable and predictable store of value compared to cryptocurrencies like ETH, which are subject to significant price volatility. In contrast, traditional finance often uses fiat currencies, which are subject to inflation and other risks.

In conclusion, MakerDAO is a powerful and innovative platform that is helping to drive the growth of the DeFi ecosystem. With its user-governed structure, strong security model, and range of financial products and services, it provides users with a comprehensive and accessible tool for accessing financial services within the DeFi space. Additionally, its focus on stability and sustainability, and its active promotion of the DeFi ecosystem, make it an exciting platform to watch in the coming years.

4.2. The Money Market Protocol: Compound Finance

Compound Finance is a decentralized finance (DeFi) protocol that enables users to earn interest on their cryptocurrency deposits and borrow cryptocurrency from the network. The protocol is built on the Ethereum blockchain and uses smart contracts to facilitate these financial transactions. As DeFi is an emergent field, there is extant research on the issue, particularly on lending. Several papers explain how DeFi lending protocols work (Bartoletti et al., 2020; Gudgeon et al., 2020; Perez et al., 2020; Kozhan and Viswanath-Natraj; 2021), with Perez et al. (2020) who specifically investigated Compound.

One of the key features of Compound is its use of a transparent, algorithmically determined interest rate for each supported cryptocurrency. These rates are determined by the supply and demand for each asset on the platform, and they are updated continuously in real time. This means that users can easily track the current interest rate for their deposits and make informed decisions about their investments. Compound operates as a decentralized, automated money market, where users can supply their crypto assets to the market and earn interest on them or borrow assets from the market and use their own assets as collateral. This allows users to earn interest on their crypto holdings, while also providing liquidity to the market. The platform is based on the Ethereum blockchain and uses smart contracts to manage all transactions and interactions between users.

One of the key features of Compound is its unique interest rate model, which is based on an algorithm that adjusts the interest rate dynamically based on supply and demand. This ensures that users always receive a competitive interest rate on their deposits, while also allowing the platform to maintain a stable and efficient market. In addition to earning interest on their deposits, users can also borrow cryptocurrency from the Compound protocol. The interest rates for borrowing are also algorithmically determined, and they are based on the supply and demand for each asset on the platform. This allows users to access short-term liquidity without having to sell their cryptocurrency holdings.

Overall, Compound Finance provides a valuable service for users looking to earn interest on their cryptocurrency holdings and access short-term liquidity without having to go through a traditional financial institution. Its transparent, algorithmically determined interest rates make it a compelling option for those looking to maximize their returns on cryptocurrency investments. These products in Compound provide a valuable service for users looking to earn interest on their cryptocurrency holdings and access short-term liquidity without having to go through a traditional financial institution.

There are several key differences between Compound Finance and traditional finance. First, Compound is decentralized, meaning that it is not controlled by any single entity. Instead, it is governed by the community of users who participate in the network. This decentralization gives users more control over their financial assets and reduces the risk of censorship or interference by external parties.

Second, Compound uses transparent, algorithmically determined interest rates for each supported cryptocurrency. These rates are determined by the supply and demand for each asset on the platform, and they are updated continuously in real time. This allows users to easily track the current interest rates and make informed decisions about their investments. In contrast, traditional finance often uses opaque interest rates that are determined by banks and other financial institutions.

Third, Compound allows users to access short-term liquidity

without having to go through a traditional financial institution. This can be useful for those who want to access funds quickly or who do not have access to traditional financial services. In contrast, traditional finance often requires users to go through a bank or other financial institution to access short-term liquidity, which can be time-consuming and difficult for some individuals. Lastly, the main difference between Compound Finance and traditional finance is that Compound is decentralized, transparent, and accessible, while traditional finance is centralized, opaque, and controlled by financial institutions.

Compound also offers a number of different assets for lending and borrowing, including popular cryptocurrencies like Ethereum and Bitcoin, as well as stablecoins like USDC and DAI. This provides users with a wide range of options for earning interest on their assets or securing loans and helps to ensure that the platform is accessible to a large number of users. Additionally, Compound is constantly adding new assets to its platform, providing users with access to a growing pool of liquidity.

Another key feature of Compound is its security measures. The platform uses a combination of smart contract auditing, user-controlled key management, and multi-sig technology to ensure that users' assets are safe and secure at all times. This is in contrast to traditional centralized lending platforms, which can be vulnerable to hacking and other security breaches.

Furthermore, Compound Finance is a powerful and innovative platform that is helping to drive the growth of the DeFi ecosystem. With its unique interest rate model, wide range of assets, and strong security measures, it provides users with a powerful financial tool that is helping to democratize access to financial services. Additionally, its developer-friendly approach and growing ecosystem of apps and tools are helping to drive innovation and creativity within the DeFi space, making it an exciting platform to watch in the coming years.

In conclusion, Compound Finance is a leading decentralized finance protocol that enables lending and borrowing of various crypto assets in a trustless and transparent manner. It has a user-friendly interface and offers attractive interest rates for both lenders and borrowers. The platform has gained significant popularity in the DeFi space and has seen significant growth in its Total Value Locked. With the launch of Compound Chain and other upcoming developments, the platform is poised to continue innovating and offering new opportunities for its users. As DeFi continues to disrupt traditional finance, Compound Finance is a promising example of how decentralized lending and borrowing protocols can create a more open, accessible, and efficient financial system. The platform also offers a governance token, COMP, that allows holders to participate in the decision-making process for protocol upgrades and changes. This decentralized governance model is a significant innovation in the traditional finance world, where decisions are typically made by a centralized authority.

Compound Finance has established itself as one of the leader in the DeFi space, offering a compelling alternative to traditional financial institutions. Its success has inspired numerous other lending platforms to emerge in the DeFi ecosystem, creating a vibrant and dynamic space that is driving innovation and change in the finance industry.

4.3. Open-Source Liquidity Protocol: AAVE V2

Aave, a lending market protocol like Compound that was established in 2017, provides several improved features. Beyond what Compound provides, Aave offers a large number of extra tokens for supply and borrowing. Aave V2 is the latest version of the Aave protocol, which introduces several new features and improvements compared to the original Aave protocol. One of the main differences between Aave V2 and the original Aave protocol is the introduction of flash loans. Flash loans are a type of short-term loan that allows users to borrow a large amount of cryptocurrency without providing any collateral. This can be useful for users who want to access liquidity quickly or who do not have any collateral to provide.

A flash loan in Aave is a kind of short-term loan that enables customers to borrow a sizable quantity of cryptocurrency without offering any collateral. Users that need quick access to money or don't have any available collateral may find this beneficial. Flash loan is what differs Aave from other protocols. Since they must be fully returned in one transaction, flash loans are special. This means that before taking out a loan, borrowers must have a strategy in place to finance required to pay it back. The transaction will be immediately cancelled, and the user will not get the borrowed funds if the loan is not fully paid within the allotted time frame.

Users must first authorize the Aave contract to transfer the required amount of cryptocurrency from their account in order to take out a flash loan. The selected quantity of cryptocurrencies will subsequently be transferred to their account when they are using the flash loan function. The user is then required to pay back the loan in full, along with any compounded interest, in the same transaction. Flash loans can be helpful for a number of things, including arbitrage, providing liquidity, and transferring assets. However, because the loan must be repaid in full in a single transaction, they are regarded as high-risk. They might not be appropriate for all users as a result.

Aave is also known for its use of non-custodial lending. This means that users retain control of their assets at all times, and do not have to deposit them into a centralized platform for safekeeping. Instead, users can lend and borrow directly from each other, and the platform provides the infrastructure for this to happen. This is in contrast to traditional centralized lending platforms, where users must trust the platform to hold their assets and manage the loan process.

Another key difference is the use of a new interest rate model called the liquidity-based interest rate model. This

model allows users to earn a higher interest rate on their deposits by providing liquidity to the Aave V2 market. It also allows users to borrow at a lower interest rate by taking liquidity from the market. The interest rates for each supported cryptocurrency are algorithmically determined based on the supply and demand for the asset on the platform. Additionally, Aave V2 introduces the concept of Aave pools, which are pools of liquidity that are managed by the Aave community. Users can earn a share of the interest earned on the pool by providing liquidity to it.

Aave also offers a number of different assets for lending and borrowing, including popular cryptocurrencies like Ethereum and Bitcoin, as well as stablecoins like USDC and DAI. This provides users with a wide range of options for earning interest on their assets or securing loans, and helps to ensure that the platform is accessible to a large number of users. Additionally, Aave is constantly adding new assets to its platform, providing users with access to a growing pool of liquidity. The platform also has a number of different revenue streams, including interest from loans and fees from flash loans and token swaps. This helps to ensure the long-term viability of the platform, as well as providing a steady stream of income for users who participate in the platform. Additionally, Aave has implemented a governance system that allows users to vote on changes to the platform and determine its future direction.

In conclusion, Aave V2 is a cutting-edge decentralized finance protocol that has revolutionized lending and borrowing in the crypto space. The platform offers a wide range of crypto assets for both borrowing and lending, with an innovative system of reserves that ensures stability and security for users. Aave V2 also offers attractive interest rates for lenders and flexible terms for borrowers, making it an ideal choice for both short-term and long-term investors. Additionally, Aave V2 is highly customizable and adaptable, allowing users to create their own unique lending and borrowing strategies. With the launch of Aave Pro and other upcoming developments, the platform is well-positioned to continue innovating and driving growth in the DeFi space. Aave V2 is a significant example of how decentralized finance can create a more open, accessible, and efficient financial system, offering new opportunities for both individual investors and institutional players. The growth of decentralized finance has been driven by the increasing demand for alternative financial services that are more efficient, accessible, and transparent than traditional finance. Lending platforms like Aave V2 has emerged as key players in the DeFi ecosystem, offering a wide range of services that cater to the needs of different users. The potential of DeFi lending platforms is enormous, and it is likely that we will see more innovative protocols and applications in the near future. With the growth of DeFi, the financial world is experiencing a major paradigm shift, and Aave V2 is at the forefront of this revolution.

5. Data & Methodology

5.1. Data and Variables Definition

This study is based on daily S&P 500 Index, MKR, COMP, AAVE token data for the period September 2020 to December 2022, via investing.com. Since, the S&P 500 is a stock market index that measures the stock performance of 500 large-cap companies. It is one of the most widely followed indexes in the world and is considered a leading indicator of the overall performance of the stock market. The companies included in the index are selected by a committee based on a variety of factors, such as market capitalization, liquidity, and industry representation. The index is weighted by market capitalization, meaning that the larger companies have a greater impact on the index's performance. The S&P 500 Index is used as a benchmark by investors to gauge the performance of their investments against the broader market. DeFi platforms are decentralized networks that use blockchain technology to offer financial services such as lending, borrowing, trading, and payments. DeFi tokens are often used as a means of exchange or to access certain features on DeFi platforms. MakerDAO's governance token MKR, Compound Finance's governance token COMP, AAVE's governance token AAVE is examined in the study.

Figure 1. Movements of S&P 500, MKR, AAVE, COMP, Returns
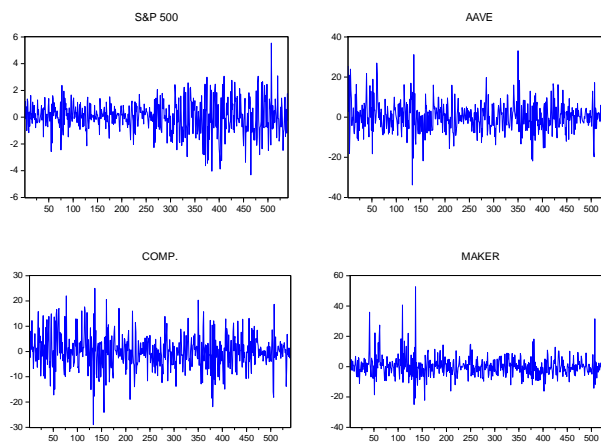
Source : Authors calculations

In Figure 1, the S&P 500 Index returns, MakerDAO's token of MKR, AAVE V2's token of AAVE, Compound Finance's token of COMP returns are shown above. As we can see from Figure 1, the S&P 500 Index had higher returns compared to the DeFi assets in the recent months of 2022. In terms of specific DeFi assets, MakerDAO's token of MKR experienced a sharp rise in price in the first half of 2022, but its returns have been decreasing in recent months. This may be due to various factors, such as changes in market sentiment, the supply and demand of the token, and the performance of the MakerDAO platform. On the other hand, Compound Finance's token of COMP and AAVE V2's token of AAVE have shown more fluctuating returns

compared to MKR. This may be due to the fact that both COMP and AAVE are well-established DeFi lending protocols with a large user base, which provides a more stable foundation for their respective tokens. It is important to analyze the performance of each asset on its own merits and consider the unique factors that may affect its returns. As the DeFi ecosystem continues to evolve and mature, we can expect to see more nuanced and sophisticated analyses of the relationship between DeFi assets and traditional financial assets like the S&P 500 Index.

5.2. Hypothesis Definition

This empirical study aims to investigate the relationship between the returns of S&P 500 and DeFi assets listed on Investing.com. The study tests two hypotheses. Hypothesis 1 (H_1) posits that DeFi assets have a statistically significant effect on S&P 500 returns. On the other hand, Hypothesis 2 (H2) argues that DeFi assets do not have a statistically significant effect on S&P 500 returns. The study seeks to prove H_1 relevant and material by using volatility models. The outcome of this study will provide insights into the relationship between traditional financial assets and DeFi assets, which is becoming increasingly important in the rapidly evolving world of finance.

H_1: DeFi assets have a statistically significant effect on S&P 500 returns.

H_2: DeFi assets do not have a statistically significant effect on S&P 500 returns.

The study will examine the volatility of the returns of S&P 500 and DeFi assets. The volatility of the returns is an important measure of risk and can provide insights into the relationship between the two types of assets. A higher level of volatility in the returns of DeFi assets compared to the returns of S&P 500 may indicate a higher level of risk in investing in DeFi assets. This study aims to provide insights into the relationship between traditional financial assets and DeFi assets. By testing the hypotheses using statistical tools such as EGARCH model, the study will provide evidence to accept or reject the hypotheses. The findings of this study may have implications for investors and financial regulators who are interested in understanding the potential impact of DeFi assets on the broader financial markets.

5.3. Econometric Methodology

In the study, return series were calculated for all variables. Based on the data obtained, it was concluded that the data is level stationary by applying unit root analysis. In the second stage, ARCH/GARCH family models were set up to examine the impact of returns on DeFi assets on the returns of S&P 500. It was determined that the meaningful model is the EGARCH model.

The theoretical structure of the EGARCH model from the ARCH/GARCH family models is explained below.

The first model among variance models is the Autoregressive Conditional Heteroskedasticity (ARCH) model introduced by Engle (1982). In this model, the conditional variance is dependent on the absolute or squared values of the error terms and the lagged standard deviations or variances. $\{\varepsilon_1\}$

$$\varepsilon_t = Z_t \sqrt{h_t} \tag{1}$$

and there is no correlation between the elements of this process. Here $Z_t \approx N(0,1)$ known as white noise, h_t is the conditional varienace of $\{\varepsilon_t\}$. h_t can vary over time. The conditional variance at period t, h_t, is expressed as a constant number and the squared lagged error terms from previous periods. An ARCH(q) process contains q lagged error terms. An ARCH(q) model is in the form of below equation 2.

$$h_t = C + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 \tag{2}$$

Here, C > O and a_i > 0 are. The sum of the coefficients must be less than 1 to ensure stationarity.

The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is used. The GARCH model assumes that the variance of returns has a predictable process. The conditional variance is dependent on the observed latest return as well as the previous conditional variance. GARCH(p,q) process is;

$$h_t = C + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_j h_{t-j} \tag{3}$$

For the stationarity of the model, the stability parameters ($\alpha_1 + \beta$) must be less than 1. As a result, a model that fits the data quite well with a small number of parameters is produced.

The ability to systematically set forth the volatility set has been the biggest support for GARCH models in the analysis of financial time series. It has been indicated that many studies have applied GARCH models in the analysis of stock returns, interest rates, and foreign exchange data (Bildirici et al., 2010).

Also, it may not be suitable in cases where asymmetrical reactions are revealed, especially in the stock market, due to the independence of the sign of a shock. The stock return volatility may increase after a sharp price drop, while the same amount of price increase may result in a lower volatility. To address such problems, the Log-Normalized Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model has been developed to model the variance.

In the study by Nelson (1991) where the Exponential GARCH (EGARCH) model was introduced, the conditional variance is expressed as follows:

$$\boldsymbol{logh_t} = \boldsymbol{\alpha_0} + \sum_{i=1}^{p} a_i \frac{u_{t-i}}{\sqrt{h_{t-i}}} + \sum_{i=1}^{p} \gamma_i logh_{t-i} +$$

$$\sum_{i=1}^{m} \delta_i \left(\frac{|u_{t-i}|}{\sqrt{h_{t-i}}} - \sqrt{\frac{2}{\pi}} \right) \qquad (4)$$

If the coefficient a_i is significantly negative in the equation, it shows that negative shocks will cause more volatility than positive shocks. In other words, it indicates that negative shock increases volatility more than positive shock.

If $\gamma_i < 1$, the stationarity condition is satisfied. $\frac{u_{t-i}}{\sqrt{h_{t-i}}} > 0$ the effect of shocks on conditional variance $a_i + \delta_i$, $\frac{u_{t-i}}{\sqrt{h_{t-i}}} < 0$ the effect of arrows on the conditional variance will be up $-a_i + \delta_i$.

5.4. Econometric Results

In the study, firstly, return data was generated for S&P 500 and DeFi assets. Unit root analysis tests was conducted for the 4 variables. After all the variables were found to be stationary, the most appropriate ARMA model was created. The heteroscedasticity was analyzed on the created ARMA model, and the existence of ARCH effect was confirmed. Finally, the relationship between S&P 500 and DeFi assets was modelled using ARCH family models. The appropriate ARCH model was determined to be the EGARCH model. The summary results are as follows.

Unit Root Test Results

As seen in Table 2, all the variables were tested using ADF (Augmented Dickey Fuller), PP (Phillips Perron), and KPSS (Kwiatkowski-Phillips-Schmidt-Shin) unit root tests and it was found that they were at level stationarity.

Table 2. Unit Root Test Results

Variable / Unit Root Test	ADF	Philips-Perron	KPSS
S&P 500 Return	-23.445	-23.538	0.293
AAVE Return	-8.377	-23.884	0.303
Comp Return	-24.804	-24.804	0.442
Maker Return	-16.283	-26.206	0.433
Critical Values	ADF-PP Tests		KPSS Test
1% level	-3.442		0.739
5% level	-2.867		0.463
10% level	-2.570		0.347

In the process of determining the appropriate ARMA model for the DeFi assets and S&P 500 variables, various alternatives were tested. It was observed that the MKR and COMP have an effect on the returns of S&P 500, whereas the returns of AAVE did not have any impact. Hence, MKR and COMP were included in the ARMA model which would form the basis of the average equation. However, the effect of the AAVE return variable on the variance was analysed in the EGARCH model. The resulting ARMA model is as follows.

SP

$500_t=0.021+0.0288*MKR_t+0.0415*COMP_t+1.355*AR(1)$
$-1.294*AR(2)+ \qquad 0.868*AR(3)- \qquad 1.373*MA(1)+$
$1.277*MA(2)-0.868*MA(3)+u_t \qquad (5)$

The coefficients of the obtained ARMA model, excluding the constant term, are statistically significant at the 1% level of significance.

As a result of ARCH-LM test applied based on the model obtained, F-statistic: 5.641180, N*R-squared critical values were calculated as 27.08384 and ARCH effect was determined. The EGARCH model, one of the ARCH/GARCH family models established after this stage, is presented below.

Table 3. EGARCH Model Result for S&P 500

Variable	Coeff.	Std. Err.	z-Stat.	Prob.
C	-0.062	0.032	-1.955	0.051
MAKER	0.020	0.006	3.341	0.001
COMP	0.021	0.006	3.742	0.000
AR(1)	1.112	1.40E-101	8.00E+100	0.000
AR(2)	0.601	0.000	85028.040	0.000
AR(3)	-0.744	0.000	-499673.000	0.000
MA(1)	-1.122	1.40E-101	-8.00E+100	0.000
MA(2)	-0.614	9.10E-104	-6.80E+102	0.000
MA(3)	0.775	1.34E-05	58012.320	0.000
Variance Equation				
C(10)= α_0	0.071	0.017	4.240	0.000
C(11)= δ_i	-0.076	0.022	-3.376	0.001
C(12)= a_i	-0.180	0.022	-8.126	0.000
C(13)= γ_i	0.976	0.000	122792.200	0.000
C(14)=AAVE	0.005	0.003	1.967	0.049
C(15)=COMP	-0.008	0.003	-2.921	0.004

In line with the results presented in Table 3, it is seen that the MKR and COMP returns have a statistically significant and positive effect on the S&P 500 returns. Based on the EGARCH model variance equation, it is seen that AAVE returns have a positive and significant effect on the volatility of S&P500 returns, while COMP returns have a negative and significant effect on volatility.

Another information obtained from the EGARCH model is the existence of an asymmetric effect of positive and negative shocks. The a_i coefficient indicates the presence of leverage effect. It shows that the effects of positive shocks and negative shocks are asymmetrical, and the effects of negative shocks are greater than positive shocks. Since the γ_i coefficient is less than one, the stability condition is provided in the established model.

6. Findings

One of the first decentralized finance usage is to give special attention was lending and borrowing. Decentralized lending and borrowing are just exchanges of cryptocurrencies with fixed or variable interest rates for the purpose of transferring and returning them. Users interact with the designated protocols, which are interfaces at the first or second layers of a blockchain, through typical Web 2.0 interfaces. There is no central authority that decides who participates in and mediates the entire lifecycle of loan and borrowing since decentralized finance is open, public, and permissionless. Credit history or other financial records are not required because loans are either granted with excessive collateral or in a method that ensures repayment. Anyone can take in a borrowing against their assets to earn interest or put a collateral to secure a loan. To increase efficiency and cut costs, decentralized lending and borrowing aims to eliminate middlemen from the money markets.

The S&P 500 is a stock market index that represents the performance of the 500 largest publicly traded companies in the United States. It is widely considered as a benchmark for the overall health of the stock market and the US economy. Historically, the S&P 500 has provided strong returns for investors over the long term. On the other hand, DeFi (Decentralized Finance) has emerged as a new frontier in finance and has generated significant returns for investors in recent years. DeFi projects typically operate on blockchain technology and offer financial services such as lending, borrowing, and trading that are based on decentralized protocols. These protocols are transparent, secure, and accessible to anyone with an internet connection, enabling DeFi to offer attractive returns to investors. However, DeFi investments are also riskier and more volatile compared to traditional investments, and the industry is still in its early stages of development. Nevertheless, DeFi represents a unique opportunity for investors to participate in the growth of a new financial ecosystem and potentially generate higher returns.

According to data analysis, there is positive relation between the S&P 500 and MKR. Also, a value of 0.02 indicates that there is a positive correlation between the S&P 500 and COMP. Relationship between S&P 500 and AAVE do not sign a significant relationship in mean equation. The EGARCH variance equation results indicates that there is a positive effect of AAVE and negative effect of COMP on the volatility of S&P 500 returns. Also, the EGARCH results shows the leverage effect for S&P 500 returns that gives information about the asymmetry of positive and negative shocks. The recent study on the impact of decentralized finance (DeFi) assets on stock market returns has resulted in a significant finding. The hypothesis 1 that DeFi assets have a statistically significant effect on S&P 500 returns has been accepted. This suggests that there is a clear connection between the growth of DeFi and the performance of the traditional stock market, implying that the DeFi market has a substantial influence on the wider financial ecosystem.

The study adds to the growing body of evidence that DeFi is a force to be reckoned with in the world of finance and investment.

The recent findings on the impact of DeFi assets on stock market returns have added to the growing evidence that DeFi is becoming an increasingly important player in the financial world. While traditional finance has long dominated the market, the rapid growth and acceptance of DeFi has demonstrated that decentralized finance is a force to be reckoned with. The fact that DeFi assets have a statistically significant effect on the returns of the S&P 500 further supports the idea that DeFi and traditional finance are becoming more intertwined. As the DeFi market continues to grow and evolve, it will be interesting to see how it continues to impact the traditional financial world and shape the future of finance.

The analysis of the relationship between the returns of S&P 500 and DeFi assets can provide valuable insights into the potential of decentralized finance as a complementary or alternative investment option to traditional finance. By understanding the correlation between these assets, investors can make informed decisions about diversifying their portfolios to include DeFi assets, which can potentially provide higher returns and lower risk.

Furthermore, this analysis can also contribute to the development of new financial products and services that incorporate DeFi assets. For example, it could lead to the creation of new index funds that combine both traditional finance assets and DeFi assets, providing investors with a diversified portfolio that includes exposure to the potential benefits of DeFi. It could also lead to the development of new lending and borrowing platforms that incorporate DeFi assets, providing borrowers with access to more flexible and potentially cheaper financing options. Overall, this analysis can help bridge the gap between traditional finance and decentralized finance, creating a more integrated and comprehensive financial ecosystem that benefits investors, borrowers, and the overall economy.

Traditional finance refers to the traditional financial system that is centralized and controlled by banks and other financial institutions. This system is often opaque and can be difficult for some individuals to access. Decentralized finance (DeFi) refers to the use of blockchain technology and smart contracts to create decentralized financial applications and services. Decentralized finance is transparent, accessible, and decentralized, which makes it potentially more inclusive and trustworthy than traditional finance.

There are several key differences between traditional finance and decentralized finance. First, traditional finance is centralized, while decentralized finance is decentralized. This means that traditional finance is controlled by a small group of financial institutions, while decentralized finance is governed by the community of users who participate in the network. Second, traditional finance is often opaque,

while decentralized finance is transparent. This means that traditional finance can be difficult for users to understand and track, while decentralized finance is transparent and easy for users to see exactly how their funds are being used and how the system is being governed. Third, traditional finance can be difficult for some individuals to access, while decentralized finance is accessible to anyone with an internet connection. This means that traditional finance can exclude certain individuals, such as those who are unbanked or live in underbanked regions, while decentralized finance can provide financial services to anyone with an internet connection, regardless of their location or financial history. Decentralized finance differs from traditional finance in that it is decentralized, transparent, and open to anybody with an internet connection, whereas traditional finance is centralized, opaque, and difficult for some people to access.

In conclusion, the key differences between traditional finance and decentralized finance lie in their centralization, transparency, and accessibility, with DeFi offering a decentralized, transparent, and accessible alternative to traditional finance. However, it is worth noting that DeFi is still a relatively new and evolving industry, and there are still challenges and risks that need to be addressed. Despite this, the potential benefits of DeFi are significant and have the potential to bring about major changes in the way financial services are delivered, making it an exciting and rapidly growing area to watch in the coming years. Furthermore, the decentralized and community-driven nature of DeFi presents a unique opportunity for individuals to have more control over their own financial future, by allowing them to participate in the financial system in a way that was previously not possible. The development of DeFi is still in its early stages and there is much more room for growth and innovation, but it is clear that it has the potential to disrupt traditional finance and bring about a more inclusive, transparent, and accessible financial system. With the increasing popularity and adoption of DeFi, it is likely to play a significant role in shaping the future of finance.

7. Conclusion

Decentralized finance, or DeFi, offers a revolutionary approach to financial services that is decentralized, transparent, and accessible to everyone with an internet connection. The DeFi lending and borrowing process eliminates the need for intermediaries, reduces transaction costs, and provides a more inclusive and trustworthy financial system. Both decentralized finance and traditional finance have their own advantages and disadvantages, and the choice between the two depends on individual needs and priorities. As technology and financial systems continue to evolve, it is likely that we will see a convergence between these two approaches. The potential of DeFi to disrupt traditional financial institutions and change the way financial services are provided is significant. Furthermore, recent data analysis has indicated positive correlations between some DeFi assets, such as MKR and COMP, and the S&P 500, highlighting the potential impact that DeFi

could have on the broader financial market. The relationship between the S&P 500 and the selected cryptocurrencies was analyzed using the EGARCH model. The EGARCH model is a popular econometric model used to analyze financial time series data that captures the asymmetric effects of positive and negative shocks on the volatility of asset returns. The EGARCH variance equation results indicated that there is a positive effect of AAVE and a negative effect of COMP on the volatility of S&P 500 returns. The EGARCH results also showed the leverage effect for S&P 500 and COMP. The use of the EGARCH model allowed for a more nuanced analysis of the relationship between the S&P 500 and the selected DeFi assets. As the DeFi ecosystem continues to grow and evolve, it will be interesting to see how it interacts with traditional finance and how both systems will adapt to these changes.

As Piñeiro-Chousa, J. et al (2022), mentioned defi assets are used to hedge for portfolio diversification. In existing studies in literature VAR models are generally used. In our study, by using the EGARCH model, the opportunity to explore the relationship between the variables and the volatility relationship are given. In all studies, there is a relationship between DeFi assets and S&P 500 return. The portfolio makes a demand for these assets for diversity and protection on a particular level of knowledge. As a way, COMP, and MKR are positively related in this context. However, unlike other studies, the existence of leverage between DeFi assets and S&P 500 return has been proved in this study, so investors are sensitive to the positive and negative news in the market, but the volatility caused by negative news is higher. Parallel with these result, Ugolini A., et. al. (2023) findings suggest that each asset class is primarily affected by its own shocks, but DeFi assets and cryptocurrencies exhibit the highest spillovers among all asset classes.

As Ugolini A., et. al. (2023), Yousaf I. et al. (2022), Piñeiro-Chousa et al. (2022) provided in their studies, DeFi assets are used as a method for investors to hedge themselves against the market risks. With similar consequences regarding to exonomic uncertainity period like the Covid-19 pandemic period. Yousaf I. et al. (2022) found that optimal hedge ratios revealed similar levels of coverage for all periods, wşth slight upturns in costs during the pandemic. The results provide valuable insights for investors and portfolio managers seeking to manage risk and optimize portfolios during economic uncertainty.

In another study highlighting the relationship of risk and deficit by Piñeiro-Chousa et al. (2022) found that VIX inversely influences DeFi, gold index influences it as a safe haven, and Telegram chats influence DeFi, but Twitter activity does not.

In conclusion, decentralized finance (DeFi) has emerged as a transformative force in the financial sector, offering new opportunities for financial inclusion, efficiency, and innovation. DeFi has attracted considerable attention from investors, entrepreneurs, and policymakers, as evidenced by

the growing number of DeFi projects, users, and transactions. However, DeFi also poses significant challenges and risks, such as regulatory uncertainty, market volatility, security vulnerabilities, and systemic effects. Therefore, it is important for all stakeholders to work together to foster a responsible and sustainable DeFi ecosystem that balances innovation with safety, privacy, and transparency. This requires continuous research, education, dialogue, and collaboration among academia, industry, and regulators, as well as the active participation and empowerment of users and communities. With the right approach and mindset, DeFi can unlock the full potential of decentralized technologies to create a more inclusive, equitable, and resilient financial system for all.

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