

Research on Decentralized Finance Lending Protocols: A Case Study of Compound

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Abstract: Decentralised finance (DeFi) is a decentralised peer-to-peer system based on blockchain technology that facilitates lending and borrowing through smart contract code and lending protocols replacing traditional financial activities that typically require trusted intermediaries such as brokers or banks. In this essay, the four factors of collateral presentation, borrowing rate, lending relationship, and subject of legal connection are compared between decentralized and centralized financial lending models. This paper illustrates the entire DeFi lending model using Compound as a real-world example. The borrowing interest rate is decided in real time by Compound's smart contract according to the supply and demand of funds in the market, so the borrower does not need to bargain with the lender. The smart contract will automatically match the money market. Additionally introduced are the DeFi innovation's concept and features. The paper concludes by discussing the advantages of DeFi lending and borrowing, the hazards associated with doing so, and providing an outlook on the future path of DeFi research.

Keywords: Decentralized Finance (DeFi), lending protocol, compound

1. Introduction

With the development of decentralised finance (DeFi), decentralised lending agreement has gradually become one of the main models of DeFi, and its status and future development direction have attracted the attention of scholars. The total value locked in lending platforms has grown dramatically in recent years and is now the third largest sector of DeFi with a total TVL of \$42.96 billion (Figure 1). DeFi lending is more flexible, simpler, and quicker to use than centralized financial (CeFi) lending, and it facilitates the use of funds in the DeFi world. It is important to understand more about the DeFi lending model.

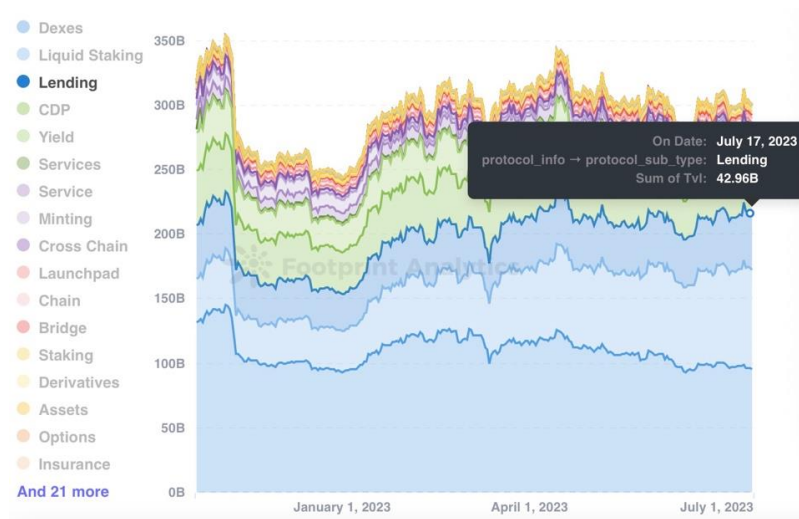


Figure 1: Total value locked in the decentralized financial.

By comparing the differences between CeFi and DeFi lending contracts, this paper focuses on the specific model of DeFi lending, its advantages and disadvantages, and its prospects. Blockchain allows all transactions made on a network to be recorded on a distributed ledger, ensuring that transactions cannot be altered or deleted. Users of the network can then connect to the system in real time and view the contents of each transaction. As a result, it has been argued that there is no longer a need to rely on [1]. We will compare the differences between Cefi and DeFi from four different perspectives. By comparing the subject of the legal relationship, the presentation of collateral, the borrowing rate, and the lending relationship, we can see that DeFi lending is mostly a form of "pooled" lending, where both borrowing and lending interact with a pool of funds. intermediaries such as banks or financial institutions. In DeFi lending, smart contracts are used to facilitate transactions between borrowers and lenders, eliminating the need for a centralized intermediary. All transactions on the DeFi lending platform are recorded on the blockchain, making them transparent and immutable. The DeFi lending platform offers a range of lending options, including variable and fixed rate, secured and unsecured loans.

The following structure of this paper will include a brief literature review of previous work. The paper will then compare the differences between the Cefi and DeFi lending protocols. Next, we will discuss the concepts and features of the composite lending model and its innovations in the DeFi lending protocol. Finally, the paper will summaries the benefits and existing risks DeFi lending and borrowing, and then provide a brief conclusion and outlook for the future.

2. Literature Review

DeFi automates the provision of financial services by integrating a decentralized infrastructure based on blockchain technology. DeFi aims to ensure the functionality of the financial system in a digital and decentralised way [1]. While traditional financial activities usually require trusted intermediaries such as brokers or banks, DeFi aims to replace them with code embedded in blockchain and smart contract protocols. Since all parties may access information on whether a contract's conditions have been met, smart contracts guarantee high levels of accuracy, transparency, speed, and security. This is anticipated to encourage disintermediation and foster an atmosphere of distrust [2]. DeFi financial services are provided by users for users, deploying the software in a decentralised manner through peer-to-peer networks, but without counterparty risk [3]. Most 1DeFiapplications are developed in an Ethereum environment using open code, which allows developers to create new protocols on top of

existing ones and combine them with each other. The rapid development DeFi has already undergone in a short amount of time [4]. The top five tokens account for over half of the \$60–70 billion market valuation of Defi crypto tokens [5].

DeFi, an up-and-coming industry, offers conventional financial services and goods, like lending services, in the cryptocurrency environment [3]. Currently, DeFi lending and borrowing agreements occupy the third place on the DeFi platform in terms of volume. By using one's own digital assets as security for a loan or investment in credit resources according to the agreed agreement, anybody interested in DeFi lending has the chance to gain [6]. Credit transactions are also available in the DeFi ecosystem. Borrowers can raise money through transparent agreements, and smart contracts that control loan terms and collateral can secure interest and instalments. Crypto asset deposits can be pooled, and those who are interested can borrow some of them. Depositors typically get interest in addition to their original deposits, which may have a different nominal value [1]. Additionally, the lack of a requirement for credit checks for all lending speeds up the funding process [6].

However, there are still significant obstacles preventing DeFi from being widely used. Due to technology hazards, illicit operations, and regulatory ambiguity, there are still concerns about institutional embeddedness, scalability, and overall security [7]. The price of gathering, processing, and storing information considerably rises when distributed trust is used [8]. As a result, distributed trust is frequently somewhat expensive, which might restrict its use. Due to its highly unknown, quickly developing, unique technology components and as-yet-unknown socio-economic repercussions, DeFi has a degree of complexity that makes it challenging to understand despite its many advantages [9].

3. Comparison of CeFi Lending and DeFi Lending

3.1. Differences in the Presentation of Collateral

The borrower's collateral under a DeFi loan agreement is expressed in the form of collateralizable mainstream digital assets. Any customer, regardless of their geographical location, can access the decentralised exchange via their smartphone or computer to place an order for digital assets or 'tokens' [1]. These tokens ultimately represent ownership of any type of asset [1]. Traditional lending relationships can be used as collateral to obtain a loan, except for Article 37 of the Security Law, which states, for example, that "land ownership, arable land, homesteads, self-owned land and other physical assets cannot be mortgaged".

3.2. Differences in Lending Rates

In traditional finance, the borrower and lender agree on a borrowing rate, usually linked to the bank lending rate. This rate usually does not change during the term of the loan, and even if it does, both parties agree to it and sign a contract before the loan starts. In contrast, the DeFi borrowing rate is updated in real time. Deposits, withdrawals, borrowings, repayments, and liquidations all cause the interest rate to fluctuate. Unlike the stable rates of traditional lending, DeFi lending rates are variable, and smart contracts that control loan terms and collateral then act as a guarantee for interest and instalment payments [1]. Of course, there are also lending platforms that try to offer a "stable rate" for a certain period, based on past lending rates and the availability of funds in the pool.

3.3. Differences in the Lending Relationship

Traditional lending relationships are peer-to-peer, and usually require a loan agreement with the lender that specifies the length of the loan and the interest rate. We have to repay the loan on time

and pay interest, and if we fail to do so, we suffer a credit crisis. Such a lending relationship is not peer-to-peer. Unlike peer-to-peer lending, DeFi funds are pooled. Most projects take a "pooling" approach, where borrowers and lenders interact with a pool of funds. Demand for borrowing and lending is aggregated through smart contracts without the need for a contract. A lender can lend to multiple borrowers and vice versa. Lenders can put idle funds back into the pool at any time to earn interest on the loans and can also call the funds back at any time. Borrowers, who can borrow from the pool at any time, can repay and pay interest at any time. Deposit interest and borrowing rate is the lending platform will be based on the funds in the pool of funds, real-time dynamic adjustment. By replacing traditional financial intermediaries with a set of smart contracts, the Open Lending Protocol creates a marketplace of lendable cash [10].

3.4. Differences in the Subjects of Legal Relations

The parties to a DeFi loan agreement are much simpler: the parties to a DeFi loan agreement are generally just the creditor and the debtor. The debtor borrows a corresponding number of stablecoins from the agreement against their own digital assets. The creditor in a DeFi loan agreement may be a third party user in the event of liquidation. The proceeds from the liquidation of the debtor's collateral are automatically used as an incentive for the third party user to repay the debtor, and the debtor does not need to trust the third party. There is no role for the mortgagee in the DeFi loan agreement.

The various parties in a traditional lending relationship are the debtor, the creditor, and the mortgagor. The debtor and the mortgagor may or may not be the same. In a traditional lending relationship, the creditor borrows money from the debtor primarily based on trust in the debtor, and the creation of security for the lending relationship is merely an additional protection of that "trust".

4. Comparison of CeFi Lending and DeFi Lending

4.1. Lending and Borrowing Models

Lenders and borrowers deposit assets into the Compound smart contract money market. The assets deposited by lenders and borrowers are the underlying assets. The smart contract issues cToken, the Compound token corresponding to the underlying assets, to the user's account according to the exchange rate. Lenders deposit assets into Compound's money market to earn interest on loans, and Compound automatically matches the demand for loans. Borrowers can borrow from the money market after over-collateralizing their assets. Unlike P2P borrowing, the borrower does not need to negotiate with the lender, if the relevant money market has sufficient liquidity, the smart contract automatically matches, and the borrowing rate is determined in real time by Compound's smart contract based on market supply and demand for funds [11]. Lenders, who can put idle funds into the pool at any time to earn interest on loans, can retrieve the funds at any time. Borrowers, who can borrow funds from the pool at any time, make repayments and pay interest at any time. The lending platform dynamically adjusts the deposit rate and borrowing rate in real time according to the funds in the pool [10]. The borrowing rate is the same for all borrowers within the same block.

Compound operates close to a traditional banking model, aggregating funds deposited by depositors in a liquid pool and lending them to borrowers, algorithmically balancing supply and demand and setting interest rates [12]. The Compound platform is designed to be free of counterparty risk, with depositors contributing crypto assets to the pool and receiving interest, and borrowers lending tokens to the pool and paying interest. As a result, depositors do not have to wait for their counterparties to repay their loans. On the Compound platform, each token has its own funding pool. When a borrower pledges a token, the pool increases; when a borrower lends a token, the pool decreases. Compound's pools are designed to provide borrowers with a high level of liquidity. Depending on the supply and demand for an asset, Compound uses an algorithm to set the lending

rate for each asset [13]. When borrower demand for a crypto-asset is low, there is an excess of borrowable amount in the pool, liquidity is high, and the interest rate falls, encouraging more lending; when borrower demand for a crypto-asset is excessive, the borrowable amount falls, liquidity is low, and the interest rate rises, attracting supply from depositors [11]. The existence of a pool of funds eliminates the need for separate matching between the two parties to a transaction and the absence of counterparty risk, increasing the efficiency of the transaction [13]

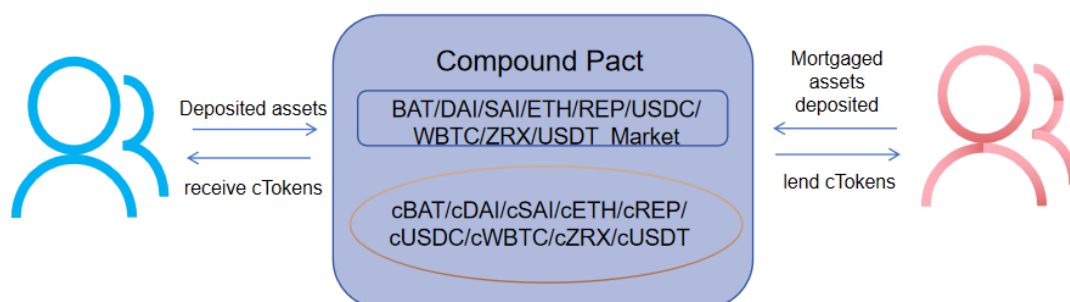


Figure 2: The lending process.

4.2. Interest Rate Models

On the compound platform, the utilization rate = total borrowings / (total cash + total borrowings - total reserves). The utilization rate is used to measure the efficiency of the platform's use of funds, i.e., the percentage of borrowed amounts in the pool of funds corresponding to the money market. Borrowings represent the amount borrowed, cash represents the pool balance and reserves represent the reserves. The borrowing rate is determined by the utilization rate and the deposit rate by the borrowing rate. The utilization rate is essentially a quantitative indicator reflecting the supply and demand for loans, and a low utilization rate indicates that there are many deposits but too few loans, i.e., supply is greater than demand. Currently, it is necessary to encourage users to borrow more and deposit less, so the borrowing rate is low, and the deposit rate is also low. Conversely, when the utilization rate is high, the borrowing rate and the deposit rate are high, encouraging people to deposit more and borrow less. A high take-up rate means that there is less money left in the pool and there is a risk that the pool will be depleted. If the pool is depleted, deposit users will have no funds to withdraw and no funds to borrow, which could lead to systemic risk. For deposits, making a deposit on the Compound platform is very similar to making a bank deposit, in that the depositor invests their crypto assets in a smart contract and earns the resulting interest. In addition, depositors can withdraw their deposited capital and interest from Compound at any time.

In terms of borrowing, borrowing from Compound requires the borrower to over-collateralize the tokens backed by the platform to receive a loan amount and lend other tokens. Overcollateralization significantly reduces the borrower's risk of default [14]. The locked-in collateral assets are automatically recovered when the borrower pays back the borrowed money and interest. Due to the volatility of the price of the collateral asset, if the price falls below the loan level threshold, the borrower will be required to cover the position or the smart contract will be triggered to automatically liquidate, at which point the borrower will retain the loan but lose the collateral asset [15]. In other words, if the borrower's borrowing capacity is insufficient, its collateral will be sold at auction to pay off the debt.

4.3. Liquidate

Compound's liquidation model falls into the category of liquidation in lieu of repayment, where a third party liquidator assists the borrower to make a partial repayment and receives collateral assets equal to the value of the repayment assets plus a percentage of the liquidation incentive, which is also a collateral asset. Compound will automatically initiate liquidation for accounts with a health of less than 1 and a borrowing rate that exceeds the collateral rate. The percentage of repayment is defined by the Close Factor, if the Close Factor is 50%, it means that the liquidator can repay 50% of the money for the borrower. the Close Factor is a protection for the borrower, it protects the borrower's assets from a one-time total liquidation. The collateral assets that the liquidator can obtain by carrying out the liquidation are $\text{Seize Tokens} = \text{Actual Repayment Amount} * \text{Liquidation Incentive} * \text{Borrowed Price} / (\text{Collateral Price} * \text{Exchange Rate})$. Seize Tokens is the number of collateral assets that will be received in the end, which is the number of cTokens. Actual Repayment Amount is the actual repayment amount. Liquidation Incentive is the liquidation incentive, which is 1.08, i.e., the liquidator receives an additional 8% of the value of the borrowed funds. Price Borrowed is the current price of the borrowed assets. Collateral price is the price of the underlying asset of the collateral.

5. Conclusion

5.1. Advantages of DeFi Lending

In addition to having characteristics that beyond those of conventional banking and finance, DeFi also permits the unfettered creation of wholly new applications. To impose governance measures, centralized platform owners often regulate access and have the power to withdraw access [16]. DeFi financial services, on the other hand, shouldn't rely on centralized intermediaries like banks, brokers, stock exchanges, or insurance firms. Developers of decentralized platforms are allowed to create and test new applications without needing approval [17].

Decentralized finance has no physical borders and is not restricted using fiat money. It is independent of any specific country or central bank [18]. Any customer can use decentralized trading to do transactions using their smartphone or computer, regardless of where they are physically located [1]. Without the involvement of middlemen, DeFi users can engage in financial transactions such as lending, asset speculation, diversification, earning returns, and insurance [19]. In comparison to centralized finance, these methods have also become straightforward.

5.2. Disadvantages of DeFi Lending

Decentralised finance has yet to reach its full potential due to the challenges of fraud, instability, availability and regulatory uncertainty. At present, DeFi still faces the following risks. First, transparency is the foundation of decentralised networks and distributed trust, but too much of it can compromise privacy. To support distributed trust, transaction logs are often maintained and made accessible on public blockchains, but this can be abused to compromise user privacy [20]. Numerous public blockchains protect user privacy by encrypting usernames and transaction data while maintaining a public record of all transactions [21]. The high computational requirements of this approach increase the cost of information processing, while limiting transparency. The second is smart contract platform risk. Because stable coins use algorithmic execution, errors in their specification or implementation can have serious consequences in the absence of specific institutional oversight. The anonymous and permissionless nature of the system means that no counterparty can be held accountable, which can exacerbate these problems [22]. Security audit reports are the first gateway to avoiding smart contract risks and are currently the only measure that can front-load the avoidance of smart contract risks. However, the process by which smart contract vulnerabilities and

authoring errors emerge is time-resistant, and it is possible that a smart contract that is not vulnerable at the start of a project audit may be exposed when other smart contracts are combined or deployed.

5.3. Future Prospects of DeFi

As the number of blockchain platforms supporting DeFi grows, cross-chain interoperability will become increasingly important. Many projects are working towards seamless communication and asset transfer between different blockchains, which can improve the overall efficiency of the DeFi ecosystem. A decentralised system can help bring more trust and transparency to the DeFi platform, while maintaining user privacy. Such systems can allow users to prove their identity or creditworthiness without revealing personal information. How to promote a more secure and compliant service is also something that DeFi needs to consider. As DeFi matures, more institutional investors and traditional financial institutions are likely to enter the space, seeking the opportunities and revenues offered by DeFi applications. This may lead to the development of new products, services and infrastructure to meet the needs of institutional users. Regulatory scrutiny is a pressing issue for DeFi at this time, and DeFi projects will need to navigate the changing regulatory environment and develop strategies to ensure compliance with applicable laws and regulations. Security will become increasingly important as more value is locked into the DeFi platform. Projects are likely to focus on enhanced security measures, including thorough audits, vulnerability bounties and improved smart contract design. In addition, the market for decentralised insurance products is likely to grow to protect against smart contract failure, hacking and other risks. As DeFi grows strongly, it is likely to increase collaboration and integration with traditional finance. We are working with banks, which are traditional financial institutions, to explore how DeFi can be used to accelerate innovation and improve existing products and services.

References

- [1] Schueffel, P. (2021) 'Defi: Decentralized finance - an introduction and overview', *Journal of Innovation Management*, 9(3). doi:10.24840/2183-0606_009.003_0001.
- [2] Buterin, V. (2016). *Ethereum: Platform review: Opportunities and challenges for private and consortium blockchains*. Available at: <http://www.smallake.kr/wp-content/uploads/2016/06/314477721-Ethereum-Platform-Review-Opportunities-and-Challenges-for-Private-and-Consortium-Blockchains.pdf>
- [3] Schär, F. (2021) 'Decentralized finance: On blockchain- and Smart Contract-based Financial Markets', *Review*, 103(2). doi:10.20955/r.103.153-74.
- [4] Katona, T. (1970) *Decentralized finance - the possibilities of a Blockchain & Q*, *Financial and Economic Review*. Available at: <https://ideas.repec.org/a/mnb/finrev/v20y2021i1p74-102.html> (Accessed: 25 July 2023).
- [5] *DeFi Market Cap*. (2021) *Top 100 Defi tokens by market capitalization*. Available at: <https://defimarketcap.io/> (Accessed: 25 July 2023).
- [6] Stepanova, V. and Eriņš, I. (2021) 'Review of decentralized finance applications and their total value locked', *TEM Journal*, pp. 327–333. doi:10.18421/tem101-41.
- [7] Chen, Y. (2019) 'Decentralized finance: Blockchain technology and the Quest for an open financial system', *SSRN Electronic Journal* [Preprint]. doi:10.2139/ssrn.3418557.
- [8] Kumar, M., Nikhil, N. and Singh, R. (2020) 'Decentralising finance using decentralised blockchain oracles', *2020 International Conference for Emerging Technology (INCET)* [Preprint]. doi:10.1109/incet49848.2020.9154123.
- [9] Meyer, E.A., Welpel, I.M. and Sandner, P. (2022) *Decentralized finance – A systematic literature review and Research Directions*, *AIS Electronic Library (AISeL)*. Available at: https://aisel.aisnet.org/ecis2022_rp/25/ (Accessed: 25 July 2023).
- [10] Gudgeon, L. et al. (2020 b) 'DEFI protocols for loanable funds', *Proceedings of the 2nd ACM Conference on Advances in Financial Technologies* [Preprint]. doi:10.1145/3419614.3423254.
- [11] Gudgeon, L., Perez, D., et al. (2020 a) 'The decentralized financial crisis', *2020 Crypto Valley Conference on Blockchain Technology (CVCBT)* [Preprint]. doi:10.1109/cvcbt50464.2020.00005.
- [12] Bartoletti, M., Chiang, J.H. and Lluch-Lafuente, A. (2021) 'A theory of Automated Market Makers in defi', *Lecture Notes in Computer Science*, pp. 168–187. doi:10.1007/978-3-030-78142-2_11.

- [13] Xu, J. et al. (2023) 'Sok: Decentralized exchanges (DEX) with Automated Market Maker (AMM) protocols', *ACM Computing Surveys*, 55(11), pp. 1–50. doi:10.1145/3570639.
- [14] Meegan, X., & Koens, T. (2021). *Lessons learned from decentralised finance (DeFi)*. ING.URL:https://new.ingwb.com/binaries/content/assets/insights/themes/distributed-ledger-technology/defi_white_paper_v2.0.pdf.
- [15] Gramlich, V. et al. (2023) 'A multivocal literature review of Decentralized Finance: Current knowledge and future research avenues', *Electronic Markets*, 33(1). doi:10.1007/s12525-023-00637-4.
- [16] Rietveld, J., Schilling, M.A. and Bellavitis, C. (2019) 'Platform strategy: Managing ecosystem value through selective promotion of complements', *Organization Science*, 30(6), pp. 1232–1251. doi:10.1287/orsc.2019.1290.
- [17] Chesbrough, H. and Van Alstyne, M. (2015) 'Permissionless Innovation', *Communications of the ACM*, 58(8), pp. 24–26. doi:10.1145/2790832.
- [18] . Ammous, S. (2018) *The bitcoin standard: The decentralized alternative to Central Banking*. Hoboken: John Wiley & Sons.
- [19] Chohan, U.W. (2021) 'Decentralized finance (DEFI): An emergent alternative financial architecture', *SSRN Electronic Journal [Preprint]*. doi:10.2139/ssrn.3791921.
- [20] . Feng, Q. et al. (2019) 'A survey on privacy protection in Blockchain System', *Journal of Network and Computer Applications*, 126, pp. 45–58. doi:10.1016/j.jnca.2018.10.020.
- [21] Chen, Y. and Bellavitis, C. (2020) 'Blockchain disruption and decentralized finance: The rise of decentralized business models', *Journal of Business Venturing Insights*, 13. doi:10.1016/j.jbvi.2019.e00151.
- [22] Zetzsche, D.A., Arner, D.W. and Buckley, R.P. (2020) 'Decentralized finance', *Journal of Financial Regulation*, 6(2), pp. 172–203. doi:10.1093/jfr/fjaa010.