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CENTRAL CLEARING OF CRYPTO-DERIVATIVES IN A DECENTRALIZED FINANCE (DeFi) FRAMEWORK: AN EXPLORATORY REVIEW

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Abstract

The embrace of cryptocurrencies by institutional investors is well underway. The futures market has already had a significant impact on this industry. Digital asset exposure may go up while the risk of loss is reduced by using derivatives. Decentralized finance and crypto-derivative trading are the focus of this article. We analyzed the function of a central clearing house (C.C.P.) and Exchange for Derivatives, especially Cryptocurrency derivatives. We mapped some critical attributes of DeFi (Decentralized Finance) to the concept of decentralized Exchange. In the light of this analysis, we reviewed an existing Cryptocurrency derivatives exchange that is trying to become a decentralized exchange. We studied dYdX, a major decentralized crypto-derivative exchange. We assessed its core purpose as a crypto-derivative exchange to investigate the positive aspects of the D.C.E. (Decentralized Crypto-derivative exchange). Decentralized crypto-derivative exchanges have considerable problems in terms of liquidity and market-making, and we determined that different incentive schemes by these exchanges have successfully overcome these issues. By linking additional trading nodes and boosting the trust of traders and investors, we believe these exchanges may be made more efficient.

Keywords: CeFi, DeFi, Crypto-Derivatives, Decentralized Crypto-Derivative Exchange, Blockchain, Smart Contract.

Introduction

We live in a technology-driven- driven world. Technology has advanced at a breakneck pace during the last few decades, affecting practically everyone. Digital payment is one area where technology has grown tremendously. Cash transactions, which were once the standard for every company, are quickly phased out in favor of digital payments. The total value of non-cash transactions has surpassed 700 billion (Capgemini, 2021).

Additionally, this analysis indicates that by 2025, quick payments and e-money transactions will account for more than 25% of all non-cash transactions globally, up from 14.5 percent in 2020. Each party participating in a typical digital payment must retain a payment record that must be confirmed through a clearing system (F.E.D., 2022). Multiple record-keeping and validations through a clearing mechanism add complexity and delay to the transaction. "Distributed Ledger Technology (D.L.T.)" is one technology that may help you solve this dilemma. It is a system for continuously recording and sharing data across several stores or ledgers across a network.

Additionally, D.L.T. secures the transaction by requiring that any modifications to the transaction be authorized across the network. This speeds up, simplifies, and ensures transactions via D.L.T. Any digital payment system must be quick, simple, and secure. Cryptocurrencies are electronic payment systems that use encryption techniques to regulate the formation of monetary units and validate transactions using D.L.T. technologies (B.N.Y. Mellon, 2021).

The financial world has discovered a new way of trading thanks to the growth of blockchain (Guo & Liang, 2016) and the advent of cryptocurrencies (Chang Jia & Han Feng, 2016)) in the sphere of technology. Although bitcoin was founded to decentralize (Chen and Bellavitis, 2020) the financial trading system, it was solely used for Cryptocurrency trading (Fang et al., 2022). The emergence of Bitcoin and Blockchain technology just a short time ago caused quite a revolution in the financial world. The original purpose of cryptocurrencies was to decentralize the financial trading system; however, they were only ever used for crypto trading until recently. The norm for trading cryptos was centralized finance. It dominates a substantial portion of the Cryptocurrency market. A central exchange (Fantazzani and Calabrese, 2021) processes all crypto trade orders in centralized finance (CeFi).

The central Exchange is administered by specific entities that manage the funds. It means you don't have accessibility to your crypto wallet (Yadav, Goar & Kuri, 2020) since you don't have a private key (Buchanan, 2019). Binance (Binance, 2021), Coinbase (S.E.C. Coinbase, 2021), and Libra (Amsden et al., 2020), to name a few, are well-known CeFi exchanges that have been providing crypto-financial services for a significant period. Users typically open an account with these firms and primarily utilize the platform to send and receive money. However, some exchanges provide additional services like lending, borrowing, and margin trading. As a consequence, the greater the numbers of services a CeFi exchange offers, the higher the number of users. Users must accept that other individuals handle the assets and assistance given by centralized finance if they are to benefit from them. It all comes down to putting your faith in the individuals or organization in charge of the platform. In addition, CeFi systems such as Hodlnaut are custodial, which means that we accept user deposits and oversee the accrual and payment of interest on such deposits.

Users trust these platforms when revealing private and confidential information about themselves since these are established companies and they have been operating for a considerable time. However, since these platforms are centralized, there is always the risk of data security breaches and thefts, as these platforms are vulnerable to cyber assaults and data leaks. Some of the CeFi exchanges are tabulated in table 1.

Table 1: Example of CeFi based marketplace and related entities.

CeFi Entity	Description
Coinbase	A Cryptocurrency exchange enables trading, borrowing, margin trading, and payment processing, among other functions.
Fairlay	It is a Cryptocurrency prediction market and Exchange built on the CeFi paradigm.
BlockFi	A platform for borrowing and lending cryptocurrencies and fiat.
Celsius	A Cryptocurrency borrowing and lending program
Ledn	An insured Bitcoin borrowing and lending platform.
Libra	A foundation of financial infrastructure and cryptocurrencies on a global scale.

Some of the drawbacks of Centralized finance (CeFi) are as follows.

Centralized Control: Many individuals believe that a tiny group of people has undue power over the economy, with money playing a pivotal role. According to a detailed investigation (Vitali et al., 2011), 147 multinational enterprises at the core of the network control 40% of the economic value of transnational firms. Note: The survey used 43060 companies as a point of reference. Findings show that 75% of the 147 international businesses were in the financial services sector. The banking business has high entry barriers (Cetorelli & Strahan, 2004), making it difficult for new companies to join and suffocating innovative ideas. Additionally, it enables a small group of powerful actors to establish their norms and adhere to them without interference. Until the 2008 financial crisis (Acharya, 2013), banks took advantage of the regulatory latitude they were afforded to create an expanding variety of risky financial products, promote them, and provide mortgages to people who would never be able to repay them.

High transaction fees and sluggish transactions: Transaction costs in centralized finance in very high (Qin et al., 2021). Bank fees received by big banks like Wells Fargo, JPMorgan Chase, and Bank of America are huge and make a significant portion of their non-interest income (Deposit Accounts, 2018). Banks are businesses that exist only to make money, and a customer will be charged wherever possible. Speed to the transaction is also usually slow as it requires a central netting of the transactions.

Lack of transparency: Centralized financial institutions' activities are not suitable for clarity. A study (Transparency Institute, 2012) has been established. Anti-corruption moves, organizational transparency, and country-by-country reporting were employed to measure transparency. It's no surprise that banks have consistently outperformed the industry average. They were not candid regarding their anti-corruption initiatives and their subsidiaries' organizational transparency and reporting or other holdings.

Lack of Trust: Trust is our belief that another person (or organization) will behave in a way that is advantageous to us, regardless of our ability to monitor those activities (Ermisch & Gambetta, 2010). It is hard to trust financial service providers when there isn't enough information about the prices of financial products, confusing products, unwanted sales, problems with solving problems, and a lack of response from financial institutions to customers (Edelman, 2018).

Decentralized Finance (Defi) exchanges, on the other hand, went a step further and enabled not just the trading element of cryptocurrencies but also many use cases like providing crypto credit, trading crypto derivatives like Bitcoin Futures, tokenizing digital assets, etc. Some of the popular Defi are shown in Table 2.

Table 2: DeFi based Marketplace and related entities.

DeFi Entity	Description
Totle	A decentralized liquidity aggregator with automated price optimization.
Augur	A decentralized Prediction Market
Nexus Mutual	A decentralized Insurance tool
Kyber	A Cryptocurrency borrowing and lending program
MakerDAO	A decentralized stable coin (a bitcoin pegged to USD) lending tool.
bZx	A decentralized margin trading tool.

New imputed currencies have emerged due to blockchains' decentralized, permissionless nature. One of the important features of the blockchain is moving and trading financial assets without the need for trusted intermediaries. An additional blockchain sector focuses on developing financial systems and services based upon ledgers and uses smart contracts. This is known as "decentralized finance." DeFi eliminates the need for intermediaries by employing cryptocurrencies and smart contracts to power its service delivery. At this time, the financial world's financial institutions function as transaction guarantors. As a result of your money passing through these institutions, they exert great power. Smart contracts are used in DeFi instead of traditional financial institutions in transactions. DeFi works with most of CeFi's businesses, including asset exchanges, loans, leveraged trading, decentralized governance voting, and stable coins. The number of available commodities, on the other hand, continues to rise, and some of the most complex goods, such as options and derivatives, are exploding in popularity.

Transparency, control, and accessibility are three distinctive qualities of DeFi. A user can see the detailed rules governing the functioning of financial assets and items in DeFi. For example, DeFi works to remove secret agreements, back-dealing, and centralization, which are significant impediments to CeFi openness. Ownership of assets means that no one should be allowed to move or destroy them without the user's permission. DeFi gives its customers the ability to do anything they want. All you need to start producing and implementing DeFi solutions is a good computer, an internet connection, and technical know-how. The DeFi program, on the other hand, is operated by the blockchain and its distributed miners.

What are Derivatives Contracts?

Derivatives are financial contracts that draw their values from the movement of another underlying asset. Trading financial risk in financial markets using financial derivatives connected to a specific financial instrument, indicator, or commodity (I.M.F., 1998). A derivative security is a financial contract that derives its value from the price of an underlying asset, such as a equity or commodity, or from a financial index, such as the interest rate. Based on the type of underlying, derivatives can be Equity Derivatives (Linetsky, 2006), Interest Rate Derivatives (Kuprianov, 1998), Credit Derivatives (Kiff & Morrow, 2000), F.X. Derivatives (Giles Jewitt, 2015), Commodity Derivatives (HKEX, 2020), and also Crypto derivatives (GBCC, 2021).

Based on the structure of the pay-off profile, there can be various types of derivative contracts. Some of the commonly traded derivative contracts are Forward contracts (Islam and Chakraborti, 2015), Futures (Gay, Hunter, and Kolb, 1998)), Options (JC Hull, 2018), Swap (Tsouknidis, Boukrami, 2015), and Exotic Derivatives (Rutter, 2016).

Crypto-Derivatives

Crypto-Derivatives are derivative contracts where the underlying asset is a crypto asset. The underlying asset in crypto derivatives trading may be any Cryptocurrency token. They guess how much worth the coin will have when it's sold in the future. The first stage in the contract is for the parties to agree on a price for selling or purchasing the Cryptocurrency on a particular day, regardless of market pricing. An investor might profit from price changes by buying and selling the underlying item at a discount. As in the regular derivative structure, crypto derivatives can also be of various types, for example, Forward Contracts, Futures, Options, and Perpetual Swaps (CoinDesk, 2019). Among all the derivatives, perpetual contracts are the most common ones.

Standard Crypto-Derivative Product: Perpetual Contract

One of the most common Crypto-Derivative contracts is "Crypto-Perpetual Contract." Crypto perpetual contracts are derivative contracts comparable to BTC futures contracts (Corbet et al., 2018). Bitcoin futures contracts are simple: a buyer and a seller agree to exchange BTC at a specified price on a specific date. When that day comes, if BTC is more than the negotiated price, the buyer wins, and the seller loses. A perpetual crypto contract is similar, except the Exchange does not have a set expiry. In other words, a perpetual contract may be held perpetually. The key benefit of trading perpetual versus futures is that if the deal goes against you, you won't be trapped with a loss. Instead, you may finance the position and keep riding it, allowing for a possible turn of events later.

Margin Trading with Cryptocurrency

Margin trading with cryptocurrencies is when you borrow Cryptocurrency to increase your trade size. You may take one of two positions in margin trading: long or short. You are long if you believe the asset's price will rise; you are short if you believe the asset's price will fall. So, when you trade on margin, you use your cash as collateral to borrow additional money, enabling you to trade with a more significant portfolio of assets. You can borrow more money if you put down more collateral. Margin trading in Cryptocurrency implies utilizing various leverage ratios (Chen and Zhao, 2006), such as 5x, 10x, 25x, etc. Higher leverage allows you to capture more substantial rewards, but it also means you're taking on more risk since you're also taking on more risk.

Central Clearing of Derivative

Central clearance modifies the allocation of market risk in derivatives contracts. The original counterparties remain exposed to each other's inability to fulfill their commitments throughout a standard O.T.C. transaction.

In contrast to these bilateral transactions, when trades are cleared, the contracts between the original counterparties are replaced by a pair of contracts with a central counterparty (C.C.P.). The C.C.P. takes on the role of both buyer and seller of the first seller. If either the buyer or seller fails, the C.C.P. is legally obligated to pay the non-defaulting party any money owed. The C.C.P. relies on a range of financial resources to satisfy its duties, including collateral placed by people clearing through it and financial commitments made by its members and owners. To reduce and reallocate the losses associated with derivatives counterparty's failure, C.C.P.s use a variety of tactics. Netting offsetting exposures decrease the dollar amounts at risk in the event of a contract failure.

In contrast, netting exposures across many contracts cleared at a single C.C.P. lessens the risk of contract default. In derivatives contracts, collateral reduces the implicit credit risk. Default losses are transferred to the C.C.P.'s equity holders and members who share in the risk of default via equalization and mutualization.

To summarize, the facility of central clearing of Derivative provides the following functions:

- (i) An efficient execution facility
- (ii) Risk Management
- (iii) Efficient Settlement Process.

(i) An efficient execution facility: A central clearing facility of Exchange provides its user a transparent quoting mechanism for the traded security. It provides an unbiased source of market data to price the security, runs the daily M.T.M. (Mark-to-Market) for the held positions, and facilitates an adequate reporting infrastructure for interested parties like Traders, Portfolio Managers, Custodians, Regulators, Agents, Brokers, and others.

(ii) Risk Management: Another important function of the C.C.P. (Central Counterparty) & Exchange is to provide a good risk management process and minimize default and settlement risk as much as possible. Some of the risk management objectives are achieved by:

- *Netting of Bilateral Position*: When O.T.C. derivatives contracts include positive exposure values, that is, the value of payment received by the non-defaulting party if the agreement were terminated today, counterparties are exposed to the risk of other counterparties defaulting. In the absence of close-out netting, counterparty's maximum loss to a defaulting counterparty is equal to the total of the positive replacement values (i.e., "derivative receivables"). On the other hand, most O.T.C. derivatives transactions are handled via bilateral master agreements that pool all exposures between two counterparties. When one of the counterparties defaults, these bilateral master agreements permit or close-out netting, which allows the use of "derivative payables" (the sum of the replacement values of the contracts with negative values owed to the defaulting party by the non-defaulting Counterparty) to offset the derivative receivables.

- *Collateralization of Residual Exposure*: Parties might further mitigate their risk to one another by requiring collateral (usually cash and highly rated liquid assets) in Exchange for significant exposures. Contracts often incorporate an "independent amount" to cover future exposure and residual risks. Customers often provide stores with their data. A hedge fund or a broker-dealer are examples of end-users.

- *Multilateral Compression and Tear-Ups*: Compression and tear-up activities on a multilateral scale decrease duplicate contracts and counterparty risk while also shortening and simplifying systemic linkages. Multiple bilateral transactions result in duplicate contacts. For instance, if party A owes party B a quantity of money, say \$10, and party B owes party C the same sum of money, say \$10, then party B may be deleted, leaving party A owing party C the \$10.

(iii) Efficient Settlement Process: A CCP (Central Counterparty) also ensures that all the post-trade settlement occurs as smoothly as possible using the standard rules and conventions. Each trade position is based on the settlement convention and settled without any issues.

So, in any decentralized Cryptocurrency derivatives exchange, these functions above need to be fulfilled.

Conceptualization of Decentralized Crypto derivatives exchange

The backbone of "Decentralized Crypto derivatives exchange - DCDX" is the DeFi. Decentralized finance (DeFi) is a blockchain-based financial platform that has lately become popular. This refers to a protocol stack built on public intelligent contract platforms, such as the Ethereum blockchain (Buterin, 2013). This new model has upgraded traditional financial services to be more open and transparent. It is a decentralized system that does not depend on intermediaries or central entities. Instead, open protocols and decentralized apps are used (DApps).

Smart contracts are the underlying technology for all DeFi protocols and apps. In general, smart contracts relate to tiny apps that are recorded on a blockchain and run concurrently by a large number of validators. With public blockchains, the network is constructed in such a way that any member may participate in and verify the accurate execution of each action. Therefore, in the classic sense, smart contracts are inefficient compared to centralized computing. Their benefit, however, is their high degree of security: smart contracts are always performed as described and enable anybody to check the subsequent state changes independently. When appropriately implemented, smart contracts provide an unprecedented level of transparency and reduce the possibility of manipulation and arbitrary interference.

Some of the key features which make a DeFi an eligible candidate for Decentralized Crypto derivative exchange are:

1. The contract code is stored on the underlying blockchain and can be publicly scrutinized. Applying this concept, everyone can see the bid side and ask for side quotes available by how many market makers. It also gives a quote depth (Number of quotes available by the number of counterparties).
2. The contract's behavior is deterministic, and thousands of network members process function calls (in the form of transactions) in parallel, assuring the execution's legality. This also makes the trading and trade execution more transparent and trustworthy. Competitive bid/ask makes the bid/ask spread tighter, thus pushing for more liquidity.
3. The blockchain network's consensus rules apply when the execution changes state changes, such as account balance changes. The changes are recorded in and protected by the Blockchain's state tree. This will result in an efficient and smooth settlement of the trade. Post-trade activity is one of the most operationally intensive activities. Using the DeFi, this process will be more straightforward and more transparent.

4. DeFi allows the storage and safekeeping of Cryptocurrency assets and acts as a custodian, with entirely adjustable criteria for how, when, and to whom these assets may be delivered. This is also one of the critical functions of a Derivative Exchange.
5. A decentralized Database ensures the sharing of the Counterparty's credit quality and the activities that provide faith and trust in the market. Default management processes, including stress test (Ref), Scenario Analysis (Ref), and any other risk management process, become scrutinized and reviewed by others on the mode, allowing more trust and investor's confidence in the clearing and exchange system.

So, to summarize, we can tabulate the DeFi advantage of decentralized derivatives clearing as follows.

Table 3: DeFi Attributes helpful to conceptualize a decentralized exchange.

DeFi Attributes	Application in Decentralized Crypto-derivative Exchange
Contract code is stored on the underlying blockchain.	Transparent quote mechanism for the trade derivative security.
Parallel processing of function calls	Competitive Bid/Ask with tighter bid/ask spread pushing better liquidity.
Blockchain network's consensus rules application and consensus mechanism.	Better execution of the trade, matching orders with the smooth order management process.
DeFi allows the storage and safekeeping keep cryptocurrency assets with transaction control	They are allowing the post-trade settlement process much more manageable, which would have otherwise been operationally intensive.
Decentralized Database	Transparent Risk Management activities include Default management, Stress tests, Scenario analysis, etc.

How does Decentralized Crypto Derivative Exchange Works—An anecdotal case study of DYDX exchange?

Crypto derivatives exchanges have traditionally relied on the concept of centralized Finance -CeFi to organize loans and borrowing for trading on margin and everlasting contracts. Smart contracts have been utilized by Uniswap (Angeris et al., 2019), Compound Chain (Fabian Schar, 2021), and Sushi (Binance Academy, 2021), for example, to enable decentralized liquidity pools, collateralization, and lending. Our introduction section has discussed the benefits of Decentralized Finance -DeFi. A Crypto-Derivative trader would also look for the decentralized "Derivative Exchange" to reap those benefits. "Decentralized Derivative exchange is conceptually possible (Eskandari, 2017).

dYdX is a decentralized Cryptocurrency margin trading platform for assets like Bitcoin, Ethereum, S.O.L., and D.O.T. The preponderance of dYdX's crypto margin trading solutions is Ethereum-based. Antonio Juliano, a former Coinbase engineer, founded dYdX in 2017, and the company quickly attracted investors, garnering \$87 million in funding. Thanks to this long-term financing, the project's developers built the trading platform to demanding standards. Early versions of the dYdX exchange platform provided rudimentary margin trading features for traders with small capital.

Many cryptocurrencies have been added to the dYdX platform, including margin and perpetuals. It has also included lending and borrowing capabilities to decentralize the trading process further. dYdX uses decentralized financial technology to build the world's first crowd sourcing-based crypto derivatives exchange. When you deposit collateral to open a leveraged trading position, you borrow from a decentralized liquidity pool that other traders entirely back. dYdX is an incentive-based model, so the more you trade and use it, the more you will gain. Decentralized liquidity is the fundamental component of any decentralized crypto exchange to be successful. The Exchange can't satisfy demand and compete with centralized derivatives exchanges without money deposited by liquidity sources. So, to motivate Liquidity providers, dYdX compensates everybody who puts USDC in the pool with DYDX tokens. As part of the initiative, 25 million dYdX tickets are up for grabs, accounting for 2.5 percent of the entire token supply. dYdX comes in two flavors. It offers two alternatives to traders: Layer 1 dYdX and Layer 2 dYdX (on Ethereum) (on StarkWare).

dYdX's Layer 1 version is a highly liquid decentralized exchange for margin and spot trading in cryptocurrencies. Leverage up to 5x on assets like BTC and ETH when combined with stable -coins is available here (Ref). Borrowing to finance your positions is a simple process that involves cash being put straight into your wallet, as long as you properly collateralize. The collateralization requirement is 125 percent, which means

you must deposit much more than the amount you wish to borrow. Over-collateralization protects lenders in the case of your bankruptcy.

Layer 2 dYdX facilitates the trade of perpetual crypto contracts for a diverse range of digital assets. The USD-pegged cryptocurrencies accessible for business are BTC, ETH, S.O.L., D.O.T., AAVE, LINK, U.N.I., SUSHI, MATIC, and L.T.C. You may apply up to 25x leverage, a significant increase over Layer 1 dYdX.

Conclusion

Institutional investors' acceptance of cryptocurrencies is well underway. Already, the futures market has had a considerable influence in this sector. Through derivatives, investors may increase their exposure to digital assets while lowering their risk of loss. Therefore, in some circumstances, investors may be able to sidestep the complications associated with dealing with digital tokens by using platforms with a broader reach. When E.T.P.s (Exchange-traded Products) and ETFs (Exchange Traded Funds) were implemented in the United States, Europe, and Asia in 2021, this asset class will be accessible. In the present paper, we attempt to identify the motivation to go for decentralized finance and further exploit the benefit of decentralized crypto- derivative Exchange. We further analyzed the market acceptability of decentralized crypto-derivative exchanges (D.C.E.). To explore the positive side of the D.C.E. (Decentralized Crypto-derivative exchange), we studied a leading decentralized crypto-derivative exchange, dYdX, and analyzed its primary function as Crypto-derivative exchange. We found that liquidity and market-making are significant challenges for the decentralized crypto-derivative Exchange. We also concluded that various incentive programs by these exchanges have been working well to overcome the liquidity and market-making challenges in a decentralized -DeFi setup. We recommend a further study on making these exchanges more efficient by connecting more trading nodes and increasing traders'/investors' confidence.

References

Amsden et al. (2020), The Libra Blockchain

<https://files.static-nzz.ch/2019/6/18/9b721442-c11d-4b56-89b9-dd03f3a7c8e1.pdf>

Angeris et al. (2019), An analysis of Uniswap Markets

https://web.stanford.edu/~quillean/papers/uniswap_analysis.pdf

Anatoli Kuprianov (1998), Over the counter Interest Rate Derivatives

https://www.richmondfed.org/-/media/RichmondFedOrg/publications/research/special_reports/instruments_of_the_money_market/pdf/chapter_16.pdf

Binance (2021), 2021 Global Crypto User Index

https://research.binance.com/static/pdf/Global_Crypto_Index_2021.pdf

Binance Academy (2021), What is Sushi Swap and How does it work

<https://academy.binance.com/en/articles/your-guide-to-sushiswap>

B.N.Y. Mellon (2021), Digital Assets: From Fringe to Future

<https://www.bnymellon.com/content/dam/bnymellon/documents/pdf/insights/digital-assets-from-fringe-to-future.pdf>

Buchanan, William. (2019). Guessable Private Keys: How To Make A Million in Cryptocurrency. 10.13140/RG.2.2.19142.93764/1

Chang Jia, Han Feng (2016) Blockchain: From Digital Currencies to Credit Society [M]. CITIC Publishing Group

Capgemini (2021), World Payment Reports 2021

<https://worldpaymentsreport.com/resources/world-payments-report-2021/>

Cetorelli, Nicola and Strahan, Philip E., Finance as a Barrier to Entry: Bank Competition and Industry Structure in Local U.S. Markets (January 2004).

Available at SSRN:

<https://ssrn.com/abstract=506002> or <http://dx.doi.org/10.2139/ssrn.506002>

CoinDesk (2019), Crypto Derivatives, What to expect in a fast-changing market,

https://downloads.coindesk.com/crypto-investing/crypto_derivatives.pdf

Corbet et al. (2018), Bitcoin Futures- What use are they? Economic Letters, Volume 172, pp. 23-27

<https://www.sciencedirect.com/science/article/abs/pii/S016517651830291X>

DepositAccount (2018), Banks make how much income from Fees, Banks Make How Much Income from Fees?! (depositaccounts.com)

Edelman (2018). 2018 Edelman Trust Barometer Methodology

[https://www.edelman.com/sites/g/files/aatuss191/files/2018-10/2018 Edelman Trust Barometer Global Report FEB.pdf](https://www.edelman.com/sites/g/files/aatuss191/files/2018-10/2018_Edelman_Trust_Barometer_Global_Report_FEB.pdf)

Eskandari, Shayan & Clark, Jeremy & Sundaresan, Vignesh & Adham, Moe. (2017). On the Feasibility of Decentralized Derivatives Markets. 553-567. 10.1007/978-3-319-70278-0_35.

Fabian Schar (2021), Decentralized Finance: On Blockchain- and Smart Contract- based Financial Market

<https://files.stlouisfed.org/files/htdocs/publications/review/2021/04/15/decentralized-finance-on-blockchain-and-smart-contract-based-financial-markets.pdf>

Fang, F., Ventre, C., Basios, M. et al. Cryptocurrency trading: a comprehensive survey. Financ Innov 8, 13 (2022).

<https://doi.org/10.1186/s40854-021-00321-6>

Fantazzini, Dean, and Raffaella Calabrese. 2021. Crypto Exchanges and Credit Risk: Modeling and Forecasting the Probability of Closure. Journal of Risk and Financial Management 14: 516.

<https://doi.org/10.3390/jrfm14110516>

F.E.D. (2022), Money and Payments: The U.S. Dollar in the age of Digital Transformation

<https://www.federalreserve.gov/publications/files/money-and-payments-20220120.pdf>

Galen Moore (2019), Crypto Derivatives, what to expect in a fast-changing market, Coin Desk

https://downloads.coindesk.com/crypto-investing/crypto_derivatives.pdf

Gerald D. Gay, W.C Hunter and R. W Kolb (1998), A comparative analysis of Futures Contract Margins, The Journal of Futures Market, Vol. 6, Issue 2

GBCC (2021), Introduction to Crypto derivatives, Global Standards Mapping Initiatives

<https://gbbcouncil.org/wp-content/uploads/2021/11/GSMI-2.0-Introduction-to-Crypto-Derivatives.pdf>

Giles Jewitt (2015), F.X. Derivatives Trader School, ISBN: 978-1-118-96745-4, Wiley

<https://www.wiley.com/en-us/FX+Derivatives+Trader+School-p-9781118967454>

Guo, Y., Liang, C. Blockchain application and outlook in the banking industry. *Financ Innov* 2, 24 (2016)

<https://doi.org/10.1186/s40854-016-0034-9>

HKEX (2020), An Overview of the Global Commodity Derivatives Market, Research Report

https://www.hkex.com.hk/-/media/HKEX-Market/News/Research-Reports/HKEx-Research-Papers/2020/CCEO_CommDeriv_e_202005.pdf?la=e

I.M.F. (1998), Eleventh Meeting of the I.M.F. Committee on Balance of Payments Statistics, BOPCOM98/1/20

Islam, Misbahul & Chakraborti, Jayanta. (2015). Futures and forward contracts as a route of hedging the risk. *Risk Governance and Control: Financial Markets & Institutions*. 5. 68-79. 10.22495/rgcv5i4art6.

John Ermisch, Diego Gambetta. Do Strong Family Ties Inhibit Trust?. *Journal of Economic Behavior and Organization*, Elsevier, 2010, 75 (3), pp.365. ff10.1016/j.jebo.2010.05.007ff. final-00849413f

I.M.F (1998), Financial Derivatives, Eleventh Meeting of the I.M.F. Committee on Balance of Payment Statistics

<https://www.imf.org/external/bopage/pdf/98-1-20.pdf>

John C Hull (2018), Option Future and Other Derivatives, 10th Edition, Persons

<https://www.pearson.com/us/higher-education/program/Hull-Options-Futures-and-Other-Derivatives-10th-Edition/PGM333301.html>

John Kiff and Ron Morrow (2000), Credit Derivatives

<https://www.bankofcanada.ca/wp-content/uploads/2010/06/r005-ea.pdf>

Long Chen and Xinlei Zhou (2006), On the relation between the market-to-book ratio, growth opportunity, and leverage ratio. Finance Research Letters, Vol. 3, Issue 4, pp. 253-266.

Rutter Associates (2016), Demystifying Exotic Derivatives: what you need to know

<https://www.rutterassociates.com/wp-content/uploads/2016/06/Demystifying-Exotic-Derivatives-What-You-Need-to-Know.pdf>

Qin et al. (2021), CeFi vs. DeFi- Comparing Centralized to Decentralized Finance

<https://arxiv.org/pdf/2106.08157.pdf>

SEC Coinbase (2021), Coinbase global Inc.

<https://d18rn0p25nwr6d.cloudfront.net/CIK-0001679788/699359de-d974-4ad9-b7f6-5031f2f432d3.pdf>

Shayan Eskandari (2017), On the Feasibility of Decentralized Derivatives Markets, International Conference on Financial Cryptography and Data Security.

Transparency Institute (2012), The Best Practice of Anti-Corruption Commissions

https://www.transparency.org/files/content/corruptionqas/Best_practices_for_anti-corruption_commissions_2.pdf

Vadim Linetsky (2006), Pricing Equity Derivatives subject to Bankruptcy, Mathematical Finance

<https://doi.org/10.1111/j.1467-9965.2006.00271.x>

Vatik, Buterin (2013), A Next-generation Smart Contract and Decentralized Application Platform, Ethereum White Paper

https://blockchainlab.com/pdf/Ethereum_white_paper-a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf

Viral V Acharya (2013), Understanding Financial Crisis: Theory and Evidence from 2007-08, N.Y.U. Stern School of Business, CEPR and NBER

http://pages.stern.nyu.edu/~sternfin/vacharya/public_html/pdfs/NBER%20Reporter%20-%20Summary%20of%20Crisis%20Research%20-%20V%20V%20Acharya%20-%203%20Mar%202013.pdf

Vitali, Stefania & Glattfelder, James & Battiston, Stefano. (2011). The Network of Global Corporate Control. PloS one. 6. e25995. 10.1371/journal.pone.0025995.

Tsouknidis, Dimitris & Boukrami, Elias. (2015). Swaps. 10.1093/acprof:oso/9780199331963.003.0026

Yadav, Nagendra Singh & Goar, Vishal & Kuri, Manoj. (2020). Crypto Wallet: A Perfect Combination with Blockchain and Security Solution for Banking. International Journal of Psychosocial Rehabilitation. 24. 6056-6066. 10.37200/IJPR/V24I2/PR2021078.

Yen Chen, Chirstino Bellavitis (2020), Blockchain Disruption and decentralized finance: The rise of decentralized business Models, Journal of Business Venturing Insights, Vol. 13, June 2020.