Option Contracts in the DeFi Ecosystem: Motivation, Solutions, & Technical Challenges

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***Abstract*—This paper investigates the current state of option trading platforms for cryptocurrencies, encompassing both centralized and decentralized exchanges. Option contracts in cryptocurrency markets offer functionalities akin to traditional markets, providing investors with tools to mitigate risks, particularly those arising from price volatility. The paper discusses these applications of option contracts in the context of decentralized finance, emphasizing their utility in managing market uncertainties. Despite a recent surge in the trading volume of option contracts on cryptocurrencies, decentralized platforms account for less than 1% of this total volume. Hence, this paper takes a closer look by examining the design choices of these platforms to understand the challenges hindering their growth and adoption. It identifies technical, financial, and adoption-related challenges faced by decentralized exchanges. Subsequently, the paper provides commentary on existing platform responses.**

***Index Terms*—Options, Volatility, Decentralized Finance, DEX, CEX, Cryptocurrency, DeFi, Derivatives**

I. Introduction

Option contracts are financial derivatives that give its holder the right, but not the obligation, to buy or sell an underlying asset at a predetermined price (*strike price*) within a specified period of time (*expiration date*) [1]. These contracts provide investors with flexibility in their investment strategies by offering a wide range of uses, including hedging, income generation, and risk management. All these allow investors to tailor their investment approach to their specific objectives and market conditions, making option contracts a valuable tool in traditional finance. As per FIA, a leading global trade organization, 2023 saw a trading volume of 100 billion option contracts globally and a growth rate of 100% over its previous year[1]. In the remainder of this paper, we use the term "options" and option contracts interchangeably.

Like traditional assets, options are also traded for cryptocurrencies, particularly Bitcoin [2] and Ethereum [3]. Roughly speaking, the financial markets for cryptocurrencies can be classified into centralized- (CeFi) and decentralized-finance (DeFi). CeFi involves custodial applications and services that are managed by a registered corporation. On the other hand, DeFi consists of autonomous programs, known as smart contracts, running on blockchains that replace central intermediaries to provide financial services. Characterized by zero market downtime, application interoperability, and permissionless access, DeFi has seen rapid user adoption in recent years with over 50 million unique market participants [2]. With billions of dollars in total value locked (TVL), evidently, it has emerged as a successful alternative to "traditional" financial services, including spot exchanges (\$19.8 billion), futures exchanges (\$2.7 billion), decentralized lending services (\$32.9 billion), and risk-free yield services (\$55.2 billion) [4].

Apart from providing flexibility in investment strategies, the existence of options in a DeFi ecosystem have the potential to mitigate many existing risks, especially those stemming from heightened volatility. However, to the best of our knowledge, no substantial work discusses at length current solutions offering options in DeFi. Thus, it becomes important to examine the current landscape so to understand the associated challenges.

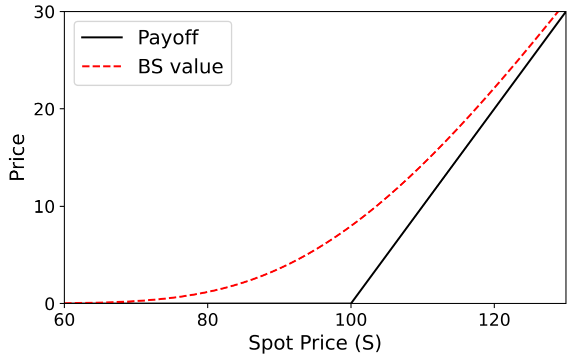
This paper delves into the realm of option exchanges for cryptocurrencies. After outlining the fundamentals of options, we underscore their significance in DeFi by exploring their potential to address numerous ongoing challenges stemming from the early stage of DeFi markets, particularly focusing on mitigating the effects of increased volatility. Thereafter, the paper studies existing option exchanges, both centralized (CEXes) and decentralized (DEXes), under three aspects: *(i)* how the platform(s) work, *(ii)* user benefits and shortcomings, and *(iii)* market adoption trends. Our findings demonstrate that despite harnessing the inherent advantages of blockchains, DEXes have historically captured a significantly lower market share (less than 1%) in options trading. Nevertheless, recent advancements in option DEX protocols and user interfaces are fostering a notable improvement in this trajectory. Consequently, the paper proceeds to elucidate the technical and financial challenges faced by the DEXes that hinder their mainstream adoption. It is important to note that while regulatory hurdles behind options is an open issue[3], our paper focuses on addressing only technical challenges.

In this study, we employ a systematic methodology, concentrating on the four largest CEXes and the seven largest DEXes by trading volume on Ethereum. We select Ethereum because it is the largest DeFi ecosystem with over \$55.9 billions in TVL [4]. To our knowledge, this paper represents the first deep-dive investigation into the options landscape within the context of DeFi.

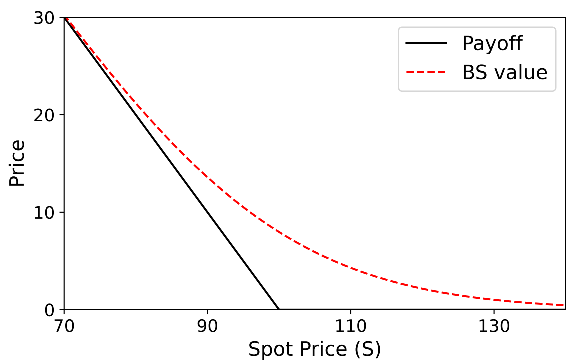
[1] https://www.fia.org/fia/etd-tracker

[2] https://dune.com/rchen8/defi-users-over-time

[3] https://www.forbes.com/sites/digital-assets/2023/07/09/sec-regulation-of-defi-could-box-out-diverse-entrepreneurs-and-impact-projects/



(a) Call Option Valuation



(b) Put Option Valuation

Fig. 1: Value of options calculated using the B-S model

The paper is organized as follows: Section II gives preliminaries on options, Section III discusses applications of options in DeFi, Section IV gives an overview of option exchanges, Section V examines various design aspects of DEXes, Section VI presents the implementation challenges faced by an exchange, and finally, the paper is concluded in Section VII.

II. Background

This section presents the basic characteristics of options, including estimation models for determining their price. Then, we present everlasting options that will be useful for the rest of the paper.

A. Option Fundamentals

An option is called a *call* or a *put* if it gives its holder the rights to buy or sell, respectively, an underlying asset at a strike price of K. Let $\mathcal{S}$ denote the spot price of the underlying asset. Then, the *payoff* of an option is defined as the value obtained by its holder if they exercise their rights and is determined using $\mathcal{S}$ and K. For a call option, the payoff is positive if the spot price is above the strike price when exercised, while the opposite holds for a put option:

$$\text{Payoff} = \begin{cases} \max(\mathcal{S} - K, 0), & \text{for call options} \\ \max(K - \mathcal{S}, 0), & \text{for put options} \end{cases} \tag{1}$$

Similarly, the *notional value* of an option is defined as the value of its underlying asset. For instance, if a call option for 1 ETH is created, and the price of ETH is

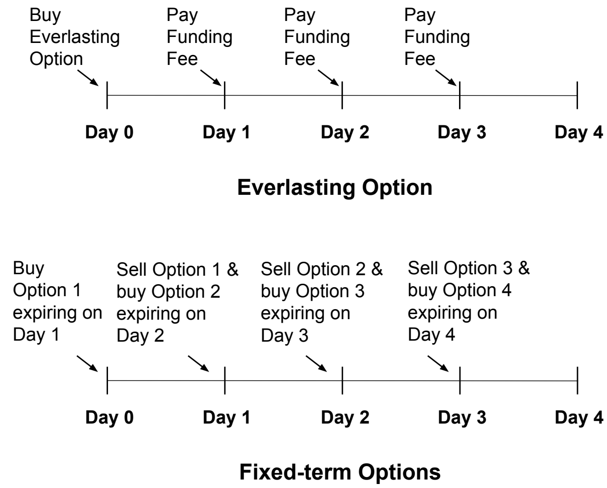


Fig. 2: Comparison between everlasting options and rolling daily options.

\$1000, then the notional value of this option is \$1000. Notional values serve to quantify option trading volume, commonly referred to as notional volume. Apart from payoff and notional value, options have a theoretical valuation that is harder to calculate than the previous two. The first method in calculating it has been the Black-Scholes (B-S) model [5]. It assumes the asset's price follows a Geometric Brownian Motion [6], and its input parameters include the asset's spot price, the risk-free interest rate, the option's strike price, market volatility, and time to expiration. Figures 1a, 1b illustrate the value of a European call and put option, respectively, calculated using numerical methods for Black-Scholes pricing [7]. Here, we assume a strike price of 100, volatility of 20% per year, a term of 1 year, and a zero interest rate.

The B-S model is useful since it can help estimate future values for *volatility*, which represents the uncertainty in the asset's price. Mathematically, it is defined as the standard deviation of an asset's daily returns over a time window, usually a year. Specifically, given that options are freely traded on exchanges, one can use their market prices as inputs to the B-S equation. Then, the volatility value that satisfies the equation serves as an estimate, commonly known as *implied volatility*.

Finally, options can be either fixed-term or perpetual. Fixed-term options expire on a particular day, while perpetual options have no expiration. Options can further be classified based on their exercise methods. *European* options can only be exercised at the time of expiration. Therefore, these options are always fixed-term. On the other hand, *American* options can be exercised at any time until expiration. Therefore, such options can have both fixed-term and perpetual terms.

B. Everlasting Options

Everlasting options, as introduced in [8], represent perpetual options wherein the contract holder is obligated to pay a daily *funding fee* to maintain the option's validity. These options are particularly significant to holders who desire flexibility in the holding period. They serve as an alternative to continually *rolling over* multiple fixed-term options with incrementally increasing expirations. In the rollover strategy, as the option nears expiration, the holder executes a rollover by selling the existing option and purchasing a new one with a more distant expiration date. A comparison of both of these options is presented in Figure 2.

Contrary to everlasting options, the latter alternative is anticipated to incur higher costs. This is due to the transactional fees associated with buying or selling an option, known as the *spread*, which are paid to market makers—agents who provide liquidity in the market. Consequently, each time the holder executes a rollover, they must bear additional fees. Furthermore, the fixed-term alternative necessitates the existence of multiple markets, each corresponding to a different expiration date. This results in greater liquidity fragmentation compared to everlasting options that rely on a single market.

The funding fee for an everlasting option is calculated once per day. It is represented as (mark – payoff), indicating the difference between the option's trading price on the exchange and its payoff, which is determined at the end of the day. An everlasting option on Day 0 is demonstrated in [8] to be equivalent to a portfolio comprising $\frac{1}{2}$ of an option expiring on Day 1, $\frac{1}{4}$ of an option expiring on Day 2, $\frac{1}{8}$ of an option expiring on Day 3, and so forth. This equivalence provides a means to price everlasting options by decomposing them into multiple fixed-term options and leveraging the accurately defined valuation provided by the B-S model.

III. Study Motivation

Options have the potential to mature DeFi markets by bringing novel services to users to offset the risks of extreme price movements, among other. Some of these key applications are discussed below.

A. Portfolio optimization

Options are particularly useful in creating *hedging* strategies against price *volatility*. The key idea is to utilize the relationship between the option's price and the underlying asset's spot price. As illustrated by the red dashed curves in Figure 1, the price of an option, both call and put, changes non-linearly with the asset's price. This relationship provides a range of values for the δ of the option, which represents the slope of the option's value $\mathcal{V}$ with respect to the spot price, *i.e.* $\delta = \frac{d\mathcal{V}}{d\mathcal{S}}$. For call options, δ varies between 0 and 1, while for put options, it ranges from -1 to 0. One can use this property to construct novel portfolios consisting of assets, options, and other derivatives whose net δ is zero. Such portfolios are interesting because their net value stays the same regardless of price movements in the market and are referred to as *δ-neutral portfolios*. A simple example of such a portfolio consists of 1 ETH ($\delta = 1$), and 2 put options each with $\delta = -0.5$. The weighted δ of this portfolio turns out to be zero: $1 - 2 \cdot 0.5 = 0$.

A δ-neutral portfolio can also ensure its investors a steady income stream with minimal risk from market price fluctuations. In the context of current DeFi platforms, Rysk Finance [9] uses this strategy to offer a risk-minimized yield to its liquidity providers.

B. Liquidation-free leverage

Leveraged returns, often provided by exchanges, occur when the investment's payoff exceeds the returns achievable solely through deposited assets or margin. Thus, a trader with a margin of 1 ETH and leverage of $2\times$ gets a return of $2x\%$ on margin when the price of ETH changes by $x\%$. However, when the price of ETH reduces by 50%, their leveraged return becomes -100%, reducing the position size to 0 ETH. To mitigate the risk of negative returns where the trader owes the exchange, the exchange may liquidate the trader's position when the margin approaches zero.

Leverage is popular in DeFi and is implemented using overcollateralized lending and perpetual futures platforms [10]–[13]. However, liquidations caused by extreme and momentary price fluctuations, which are typical in today's cryptocurrency environment [14], can be seen as unfair to traders and they remain a big issue [15]. This risk can be mitigated in some part by using options whose payoff exceeds zero. For call options, this means that the spot price is greater than the strike price and vice-versa for put options. To understand this, consider the example of the call option plotted in Figure 1a. Here, the strike price is \$100, and the spot price is \$120. The option's B-S value, as shown in the figure, is approximately $\$120 - 100 = 20$. For higher values of spot price, the option's value changes almost linearly with a slope of 1. This means that a $x\%$ increase in the spot price increases the option's value by $120 \cdot \frac{x}{100}$ which is $\frac{120}{20} \cdot x\%$ of the option's original value. Thus, the return on the option gets levered by $6\times$. On the other hand, if the spot price reduces by 50%, or any larger value, the position does not get liquidated. If in the future the spot price returns to its original value, the user's position returns to their initial state without incurring any loss (neglecting any time-value decay).

C. Liquidation-free loans

Over-collateralized lending protocols such as Aave [16], Compound [17], and Morpho [18] have become an established financial instrument in modern DeFi. Such protocols enable borrowing of an asset, such as ETH, by depositing a different collateral, *e.g.* USDC, of much larger value. At all times during the loan duration, the collateral must hold a larger value than the loan. Any violation of this condition, even momentarily due to a spike to the price of the underlying asset, can lead to a liquidation of the loan.

As before, such liquidations resulting from sudden price fluctuations are detrimental not only to the borrowers but also to the DeFi ecosystem as a whole due to associated systemic risks [19]. Zero liquidation loans [20] and reversible call options [21] are two solutions to this problem that use options. At a high level, the first solution requires a user borrowing 1 ETH by depositing 1000 USDC to purchase a call option with a strike price of 1000 from the lender to prevent liquidation. The second solution, on the other hand, introduces agents known as supporters who re-collaterize a loan if it gets undercollaterized and prevent liquidation. In return, supporters receive a reversible call option implicitly written by the borrower.

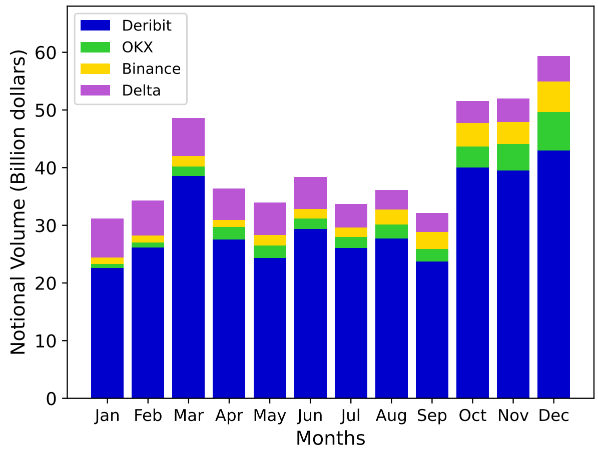


Fig. 3: Monthly notional volume of BTC and ETH options in 2023.

IV. Overview of Existing Option Platforms

We discuss options within the two classes of exchange platforms *viz.* centralized and decentralized. The latter can be further categorized between *composable-* and *custom rollup*-based designs. Subsequent to this classification, we present an analysis of option design choices within decentralized systems.

A. Centralized Exchanges

CEXes function as custodial platforms where users' digital assets are held by the exchange. Typically, these exchanges operate using traditional limit orderbook designs, wherein buyers and sellers submit their price quotes, and a matching engine facilitates trades by pairing compatible orders. Currently, CEXes dominate the options trading market, with the leading players being Deribit [22], Delta Exchange [23], Binance [24], and OKX [25]. In terms of market share for notional volume, Binance and OKX each capture 6%, Delta Exchange holds 12%, while Deribit commands the largest share at 76% [26].

Among all cryptocurrencies, options for BTC and ETH are the most heavily traded. Figure 3 illustrates the monthly notional volume for BTC and ETH options traded on the aforementioned CEXes. In the previous year (2023), the cumulative volume of BTC options reached an impressive \$325 billion, while ETH options stood at \$162 billion, nearly half of BTC's volume. These figures underscore the significant demand for options within the market. It's noteworthy that the current options market is primarily focused on BTC and ETH, indicating a substantial opportunity for the expansion of option derivatives to encompass a broader range of assets.

B. Decentralized Exchanges

Composable Designs: Composability in DeFi refers to the interaction between multiple applications, each benefiting from the other's permissionless and public infrastructure [27], [28]. Traditional finance has limitations on practical composability due to its permissioned nature and high barrier to entry. On the other hand, composable smart contracts serve as fundamental building blocks within the DeFi ecosystem, or money LEGOs, allowing other financial applications to be built on top of them. In the context of composable option DEXes, we consider only those design paradigms that facilitate end-to-end order execution through smart contracts on a public and permissionless blockchain (Layer-1 or -2). This entails quoting and settling of buy and sell orders entirely on the blockchain.

Despite leveraging on the advantages of composability, this category of exchanges has struggled to gain user adoption compared to centralized exchanges. In 2023, they accounted for a cumulative volume of \$1.7 billion [29], representing only 0.35% of the trading volume observed on the centralized counterparts. One of the major reasons is the difficulty posed by application development on smart contracts due to the constraints imposed by the underlying blockchain infrastructure, such as high gas cost, adherence to specific virtual machines and contract languages. These limitations can restrict flexibility in design choices, often forcing developers to adopt innovative workarounds as discussed in Section V. To address this, some designs opt for custom rollups, as discussed next, although this may come at the expense of composability.

Custom Rollup-based Designs: Layer-2 solutions are designed to enhance the scalability of blockchain networks without altering the underlying trust assumptions. These protocols operate atop Layer-1 blockchains and offer various scaling mechanisms. Among these, roll-ups are the predominant scaling solutions for DeFi protocols deployed on Ethereum [30]. Their primary objective is to alleviate the burden on the main chain by batching transaction executions off-chain and consolidating them for on-chain verification. This yields significantly reduced, between $10 - 20\times$, transaction costs [31].

In the realm of decentralized finance, Layer-2 solutions tailored specifically for DeFi projects are termed *appchains* [32]. Among option appchains, AEVO (formerly known as Ribbon Finance) [33] is the most successful on Ethereum in terms of trading volume [4]. AEVO adopts an orderbook mechanism for BTC and ETH options, similar to CEXes, where buyers and sellers post their orders off-chain. Once an order is matched, settlement occurs on the AEVO rollup. Unlike CEXes, users retain custody of their assets on appchains. However, users may typically experience a waiting period of as much as 2 hours for order confirmation and/or asset withdrawal.

Unlike composable designs, which benefit from network effects within the ecosystem, appchains are prone to isolation. Neglecting this aspect can significantly hinder the success of the protocol. One effective approach to addressing this issue is introducing multiple DeFi products on the appchain that add value to each other. This is observed in AEVO, which also operates as a perpetual futures exchange. Parameters such as *funding rates* from the futures exchange are then used to price options on altcoins in the options exchange.

Although user adoption trends on appchains were similar to composable designs with a notional volume of \$928 million in 2023, this category has seen a recent surge with \$14.9 billion in the first two months of 2024 [29]. The former volume comprises 0.2% while the latter comprises 16.9% of the volume on centralized exchanges. These figures underscore a significant uptick in user interest in decentralized options trading.

V. Decentralized Option Design Considerations

A key consideration required while designing a decentralized application is execution efficiency, owing to the *cost of gas* associated with each execution step. Traditional orderbook-based designs necessitate submitting multiple quotes over time, leading to increased gas costs. In an effort to provide an efficient alternative, several smart contract-based designs have been proposed and implemented, each differing in terms of option duration, oracle requirements, and price discovery mechanisms. We discuss these aspects for the protocols AEVO [33], Lyra [34], Deri [35], Rysk Finance [9], Dopex [36], Hegic [37], and Premia [38] in the subsequent text. Notably, except for AEVO, the rest of the protocols belong to the composable category.

Option Duration: As described in Section II-A, options can be categorized as either fixed-term or perpetual. Market participants, including option writers and traders, have long favored fixed-term options due to their established track record and familiarity. Consequently, an extensive body of literature exists on financial strategies utilizing fixed-term options [1]. Despite their popularity, fixed-term on-chain options present numerous implementation challenges, including constant market renewals after each expiration, which results in higher gas costs that can be particularly problematic for short-term options. Additionally, liquidity fragmentation among different expiration terms contributes to an overall low liquidity for each duration. Nevertheless, six of seven on-chain protocols——namely AEVO, Lyra, Rysk Finance, Dopex, Hegic, and Premia——offer fixed-term options, underscoring the industry's emphasis on standardization.

On the other hand, Deri is one of the few exchange designs to offer perpetual options. It implements everlasting options as the underlying financial instrument. While everlasting options have gained popularity among the perpetual category, alternative designs such as Panoptic [39] and Everlasting Asian Options [40] have also been proposed for decentralized perpetual options. However, these designs are relatively new and thus present a lack of research on strategies for various participants, particularly option writers, who may be hesitant to participate significantly due to under-confidence in assessing their risks and incentives.

Oracle Choices: Since blockchains operate as isolated systems, they lack direct access to real-world (off-chain) data. However, decentralized derivatives applications often require continuous monitoring of the underlying asset, such as its spot price. In these scenarios, oracles, which are third-party data providers, play a crucial role as data sources that bridge smart contracts with the outside world [41]. They are widely utilized in DeFi protocols to fetch various types of data, including spot price, trading volume, and price volatility.

Despite their utility, oracles introduce several challenges to DeFi projects. Both centralized and decentralized oracle designs are susceptible to malfunctions and manipulations, as witnessed in past exploits [42]. Such incidents can have a significant impact on DeFi applications unless preemptive mitigation strategies are adopted [43], [44].

Decentralized option exchanges typically rely on oracle sources for fetching either price feeds, volatility feeds, or both. Some applications, including Rysk Finance, AEVO, and Lyra, also fetch parameters such as risk-free interest rate, forward rate, etc. These parameters are often used for option pricing, as discussed in the subsequent text, or monitor collateral requirements for option writers. Figure 4 presents the oracle feeds used by major on-chain option protocols. Notably, decentralized oracle services such as Chainlink [45], Pyth [46], Oraclum [47], and DIA [48] are mostly utilized for spot price feeds except AEVO which uses weighted prices from 10 exchanges. This choice is more robust than the former, but incurs higher operation and management costs. On the other hand, API feeds from centralized exchanges such as Deribit or services like Block Scholes [49] are used for implied volatility data. Additionally, designs like Premia allow for permissionless integration of third-party oracles for spot price feeds. This approach is noteworthy as each oracle has its own benefits and limitations, and having a permissionless design allows protocols to leverage the strengths of multiple oracles.

Price discovery mechanism: This aspect examines how different protocols quote options prices to buyers and sellers. Price discovery mechanisms can be classified into three categories: *(a) market-based* where the price is determined by the demand and supply of the option, *(b) model-based*, where option prices are calculated by the protocol using established financial models, and *(c) hybrid* where a combination of both is used. In the following, we provide a brief description of each.

1) Market-based: This category of price discovery uses mechanisms such as orderbook-based markets, automated market makers (AMM), or on-chain auctions. Of the seven protocols, AEVO and Lyra use orderbooks for price discovery, with the former using this only for BTC and ETH options. On the other hand, Premia employs an AMM-based scheme where they create a concentrated AMM pool for each strike price of an option. This allows the protocol to discover the price for each strike independently.

2) Model-based: This pricing category is the most prevalent among existing on-chain option designs. Vanilla pricing models such as standard Black-Scholes, as used by Dopex and Hegic, require input values for spot price, implied volatility, and interest rates. On the other hand, advanced models like SABR [50], as used by AEVO over-the-counter (OTC) [51] and Rysk Finance, require additional parameters such as the forward price. While spot price oracles are readily available, sources for other parameters such as implied volatility are scarce. This scarcity is attributed to the immaturity and illiquidity of the options market, especially for altcoins. To confront this challenge, designs like AEVO and Rysk Finance use implied

Option Protocol	Price Feed Oracle	Volatility Feed Oracle
AEVO	Weighted price from CEXes	Pyth, Deribit
Dopex	Chainlink, DIA	Deribit (Offchain)
Deri	Oraclum, Pyth	Oraclum, Pyth
Hegic	Chainlink	Chainlink
Lyra	Block Scholes	Block Scholes
Premia	Permissionless	Amberdata/Deribit
Rysk	Chainlink	Deribit (Offchain)

Fig. 4: List of oracle feeds used by onchain exchanges.

volatility and funding fees from off-chain exchanges for BTC and ETH which are then used to derive any additional parameters. Moreover, AEVO calibrates these input parameters to determine volatility for other altcoins. Others like DOPEX and HEGIC use historical volatility feeds and neglect other parameters like interest rates, resulting in approximated outputs.

3) Hybrid: This pricing category is used by DERI for determining the mark price of its everlasting options. DERI uses a mechanism called proactive market-making (PMM) that uses a liquidity pool but functions as an orderbook against which the users' market orders are filled. That is why it is also referred to as a *virtual orderbook*. To achieve this, PMM uses two parameters: the initial mid-price of the orderbook and the shape of the orderbook. To calculate the first parameter, *i.e.,* the option's theoretical value, the spot price, and volatility are fetched from the oracle feed, and the final value is calculated using the pricing formula for everlasting options derived in [35]. The protocol manager controls the second parameter, shaping the orderbook accordingly.

VI. CHALLENGES

The substantial notional volume of options traded on CEXes highlights their strong demand and importance within the cryptocurrency markets. Yet, despite this, DEXes collectively own only a small share of the options market. Thus, it is important to understand the challenges that need to be addressed for option DEXes to gain traction.

- *Liquidity Fragmentation:* Options with fixed-term expiration require separate markets, one for each strike price and expiry date. This makes aggregating sufficient liquidity per market challenging. One solution is the use of perpetual options since they use a single market for multiple time periods, however, they come with their own set of issues as discussed next.
- *Research Gap for Non-Vanilla Options:* These options include new designs, such as everlasting options, which aim to address technical challenges arising from vanilla fixed-term options. However, such designs may reveal a gap in the literature concerning strategies, risks, and incentives for various market participants, namely buyers, sellers, and liquidity providers.
- *Difficulty of Price Discovery:* Both market-based and model-based price discovery present challenges. For the first, time value decay is problematic since the continuously varying option value requires constantly updating price quotes (in orderbooks) or reserve states (in AMM), costing significant gas. For the other, complex (non-linear) pricing models create difficulties as it is challenging to accurately and cheaply calculate the price of an option on-chain. Thus, there is a need for innovative solutions for option price discovery that address these challenges.
- *Oracle Vulnerabilities:* Almost all decentralized designs depend on oracle feeds for price and volatility, which raises several operational and efficiency challenges. Operational challenges include the inability to list arbitrary assets caused by the lack of volatility feeds for these assets. On the other hand, efficiency challenges are inherent to oracle design and manifest as oracle malfunction and manipulation. By addressing these concerns or completely removing oracle dependency with "oracle-less" designs such as Panoptic [39], DeFi options can reach their next phase of adoption.
- *Illiquid Altcoin Markets:* The options market for altcoins is still in its early stages and lacks liquidity across all exchanges. This absence of liquidity results in a scarcity of volatility feeds, which in turn discourages other platforms from entering this sector. Although solutions like AEVO aim to address these challenges by calibrating such markets to BTC and ETH using correlated models, they come with their own limitations. These include invalidity of the model for longer-term options and inaccuracies in correlation assumptions [51].
- *Unresolved Regulatory Issues:* Although the observations of this paper are only technical, the DeFi sector is characterized by uncertainties surrounding regulatory issues around many of its activities. Consequently, developers are compelled to adhere to subjective "best practices", resulting in a deterrent effect on participation [52], which is also a pillar behind the technical observations of this work.

VII. CONCLUSION AND FUTURE WORK

This paper highlights the emerging status of options trading in cryptocurrency markets, despite its established status in traditional finance. After discussing the urgent need for a thriving options market, the paper examines current solutions for options trading in both centralized and decentralized platforms. While high volume in CEXes indicates strong demand for this instrument, decentralized platforms face challenges stemming from technical, adoption, and research issues. This study focuses on platforms with considerable volume, omitting research ideas and proposals that lack market validation. Future research endeavors will explore these unvalidated proposals, aiming to broaden our understanding of options trading in cryptocurrency markets and address the challenges faced by decentralized platforms.

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