Meta Defender

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The security industry is enormous and plays an important role in the traditional financial market. However, the traditional insurance model does not work in the Web3 world because the claiming procedures are time-consuming and opaque. Furthermore, one cannot enter the insurance industry efficiently because capital for underwriting is only available to the "Big Money". MetaDefender serves as a pioneer in creating a permissionless platform for risk/insurance trading on-chain, allowing both underwriters and policy buyers to benefit from the blockchain's instant, convenient, and transparent service.

1 Background

Since DeFi's inception in 2020, more than 5.7 billion dollars[1] have been lost due to hacking attacks or contract faults. Furthermore, the depreciation of LUNA and the collapse of FTX harm the crypto world. The crypto realm is unmanageable and fascinating, like a wild horse. The threats we face must not be underestimated.

We are now in the Web3 Age of Discovery, fearless of hardships, fearless of ships that are not strong enough, not technologically advanced enough, but we will always take risks, break away from the stale comfort zone, return to the great seafaring era, write amazing music in the deathly unknown, and establish our own order.

[1] https://rekt.news/leaderboard/

2 Introduction

In this paper, we present Meta Dedender, a novel automated protocol for trading insurance deployed in blockchains. Prior to the protocols before, we present several advantages:

- *Dynamic Pricing Model* : We modified the option pricing model to make it acceptable for buying and selling policies. The pricing model will automatically compute the price of each insurance based on the policy's period and coverage.
- *EpochManagement in Trading* : The epoch is included to prevent lengthy loops in computation. We divided the timeline into discrete epochs so that others might deposit and withdraw independently. We can simply compute how much one's asset is locked and how much one receives in incentives using the epoch.
- *Rug Pull Token Collection* : Unlike other risk-coverage protocols. MetaDefender assesses policyholder claims and collects rug pull tokens from these policyholders to rescue the rug pull community. With all of these rug pull tokens locked, we will play a significant part in securing the project and helping to rebuild the community.

3 Solution Overview

The workflow of the underwriting, buying, and settlement process, as well as the claim procedure, is depicted in the two charts below. Here are the main parts of the system.

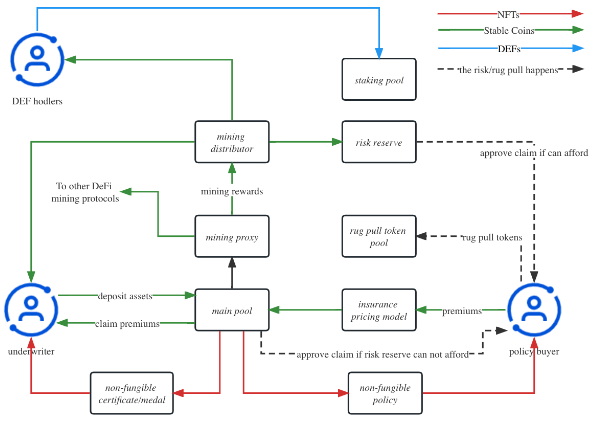

Figure 1: *MetaDefender Workflow*

- main pool: The key component of the system. The (total value locked)TVL in the pool is made up of three components: the underwriters' assets given, the premium paid by policyholders, and the unfrozen assets temporarily held for some underwriters' early departures.
- insurance pricing model: The premium computation portion. It employs the American binary option formula to estimate the insurance premium using the policy duration and policy coverage as input parameters.
- non-fungible certificate/policy: The NFT is responsible for the liquidity certificate and policy. The NFT is coined and transmitted to the user when the user underwrites/purchases insurance. The NFT adheres to the ERC721 standard, and users can sell their liquidity at any moment.
- risk reserve: Because preserving underwriters' capital SAFU is vital, a portion of the mining rewards will be transferred to the risk reserve pool. If the risk situation occurs and policyholders apply for claims, the protocol will initially use the funds in the risk reserve pool rather than the main pool. If the funds are inadequate to cover all claims, the main pool will step in to pay the rest of money, putting the underwriters' capital at risk.
- DAO: The DAO is made up of numerous stakeholder groups, including the MetaDefender team, insurance specialists, the EVM safety team, and DEF hodlers. They vote in the DAO voting system to determine if we will approve the claim after a thorough investigation of the issue.

4 Dynamic Pricing Model

Marcus et al.; **1984** examined the value of FDIC deposit insurance as an option and utilized the option pricing model to calculate the cost of insurance. Following that, **RONN et al.**; **1986**, **Laeven et al.**; **2002**, and **Falkenheim et al.**; **2003** conducted more study on insurance and option comparisons.

The DeFi insurance market, like the traditional insurance market, will pay either a defined amount of money known as policy coverage or nothing at all. If the risk/rug pull occurred during the time designated by the policy buyer, the policy buyer will get the claim if the application is granted by the DAO; otherwise, the underwriters will claim the premium and the policy buyer will receive nothing. This scenario is quite similar to the American binary option. If the underlying price reaches the strike price before the expiration period, the option can be exercised at any moment before the expiry time.

4.1 Initialization

Before a certain DeFi project is placed on the MetaDefender, Our team will thoroughly evaluate the project's safety, such as contract audit. We'll start by estimating the likelihood of the hack/dePeg/rug pull. Then we'll create an American binary option model with the same likelihood of hitting the strike price and add it to the smart contract. These parameters will be inaccurate when initiated, however they will be changed by insurance buyers and underwriters in the market.

4.2 Standard Coverage

The insurance price impact is strongly related to the coverage. It is simple to calculate that purchasing coverage for 10,000 USDT would result in a bigger price effect than purchasing coverage for 100 USDT.

The insurance coverage is calculated by the number of SCs, which is a predefined constant in the smart contract.

$$N = \frac{C}{SC} \tag{1}$$

Where N is the amount of SCs, C is the coverage, and SC represents the preset standard coverage.

For example, if Alice purchases 10000USDT coverage and Bob purchases 2000USDT coverage, and the SC is set at 1000USDT, we may say Alice purchases 10SCs and Bob purchases 2SCs.

SC indicates the sensitivity of a particular insurance market. If the SC is set very low, even a tiny amount of money could have a significant influence on the insurance premium, and vice versa. If the DeFi protocol has a low TVL, or if it is readily hacked, the SC will be set lower to make the insurance price more market sensitive.

4.3 Risk Impact

The risk rises by one base point for each SC purchased from the pool. The risk falls by one base point for each SC resolved without any risk occurring. For every SC claimed as a result of hack/dePeg/rug pull incident, the risk stays unchanged.

$$Risk_{new} = \begin{cases} Risk_{old} + N * 1\%, sold\, N\, SCs \\ Risk_{old} - N * 1\%, N\, SCs\, settled \\ Risk_{old}, N\, SCs\, claimed \end{cases} \quad (2)$$

In this method, the smart contract modifies the risk based on the number of SCs purchased and settled. As a result, the contract can eventually calculate the insurance price with the risk, which is the IV in the American binary option equation.

4.4 Insurance Price

The American binary option formula is as follows:

$$P_{insurance} = \frac{1}{2} e^{a(\xi - b)} \{1 + sgn(a) erf\left(\frac{bT - a}{\sqrt{2T}}\right) + e^{2ab}[1 - sgn(a) erf(\frac{bT + a}{\sqrt{2T}})]\} \quad (3)$$

where:

$$a = \ln(\frac{K}{S}), \xi = \frac{r - q}{\sigma}, b = \sqrt{\xi^2 + 2r} \quad (4)$$

We use this American binary option formula to calculate the insurance price.

Unlike other protocols in which the insurance premium is fixed or linear to the coverage, MetaDefender is inspired by the option market, and the insurance price is a dynamic surface as the coverage and period change.

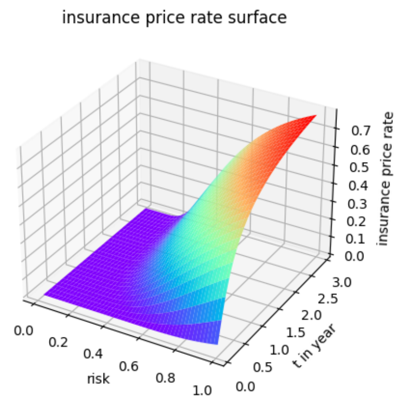

Figure 2: *Price Changes with the Risk and Expiry Time*

On the surface, the insurance price remains relatively low when the risk is less than 0.4, but it rapidly increases when the risk exceeds 0.4 and the expiry time reaches one year. When the risk is close to 1.0, it signifies that people have lost faith in this DeFi protocol, and if you buy 100USDT coverage for three years, you will pay more than 70USDT.

5 Epoch Management

The introduction of an epoch breaks up the continuous timeline so that the impact of every deposit, withdrawal, and policy purchase is recorded in the specific epoch. We can easily calculate how much is locked and how much can be withdrawn by epoch calculation.

5.1 Locked Asset Per Share

The coverage of each policy locked the assets given by all underwriters by their proportion. When a new policy is sold with the coverage of C, the locked asset per share is calculated as follows:

$$\Delta L = \frac{C}{total\, liquidity} \quad (5)$$

5.2 Epoch

An epoch is a period of time during which the net ΔL is calculated and the net ΔL is the sum of the ΔL **before** this epoch minus the ΔL that has already been settled among them.

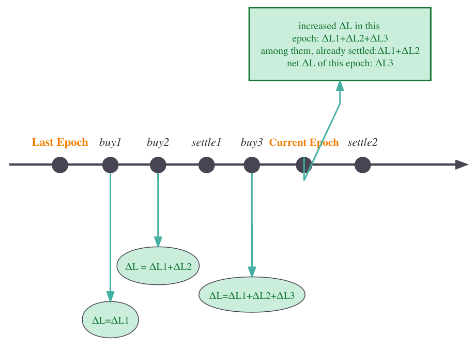

Figure 3: *Epoch and Net ΔL calculation*

The most important parameter in the epoch is the net ΔL. The epoch will also include some other parameters, such as an index and a start time.

The ΔL of a certain epoch simply indicates how much asset per share has been locked since the first epoch. If the underwriter provide the liquidity(l) at the epoch i and exit at the epoch j, the locked asset(L) can be calculated as follows:

$$L = l(net\Delta L_j - net\Delta L_i) \tag{6}$$

A certain underwriter's withdrawal asset(W) will be computed as follows:

$$W = l - L = l(1 - net\Delta L_j + net\Delta L_i)) \tag{7}$$

With the equation of [6] and [7], we can easily calculate the locked asset and the withdrawal asset of each underwriter. In this case, the underwriter can withdraw the asset at any time without a lock-up period.

6 Risk Reserve

DeFi insurance methods must provide the underwriters with a rate of return equivalent to market alternatives. Payouts are infrequent with insurance capital, whether underwritten or not, and the capital sits dormant for the most of the time. To maximize underwriter returns, we will invest a portion of the latent insurance funds in low-risk DeFi portfolios while keeping a payout reserve. The majority of the earnings on these investments will go to the underwriters, with the rest of them going to the risk reserve.

Risk reserve acts as a buffer in the protocol by collecting some of the mining rewards. When the risk reserve is sufficient to cover the claim amount, it will pay the policyholder directly rather than using capital from the main pool.

7 DAO

Meta Defender has assembled a team of experienced insurance specialists, including actuaries and financial analysts, to provide fair, open, objective, and transparent opinions and claims evaluations. When a policyholder files a claim, the protocol will thoroughly analyze the opinions of both expert evaluators and community members before deciding whether and how to pay the claim. Similarly, when the protocol needs a vote on whether to introduce a new insurance program, it will consider both parties' perspectives. In the future, Meta Defender token hodlers will find more diverse applications in more DeFi scenarios.

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