Antimatter perpetual option model V2

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1 What is an option

An option is a financial derivative that grants the buyer the rights to buy and sell the underlying assets at a specific price within a period of time. A call option gives the buyer right to buy, while a put option allows the buyer to sell.

2 Antimatter token as a perpetual option

2.1 Main Goal

We aim to decide whether a particular cryptocurrency is bullish or bearish by using a financial derivative: perpetual options. We achieve this by tokenize perpetual options, so that investor can generate, redeem, and trade these tokens. One can judge based on two facts: the market price of the asset and the cost of generating tokens.

2.2 Perpetual Option

A perpetual option is a non-standard option that can be exercised any time without expiration.

2.3 Generation and Redemption

Antimatter token is a perpetual option. There are two token types: call token and put token, which correspond to call and put perpetual options. To understand how they work, we have a price interval that contains the current price of a specific cryptocurrency and in this model we anticipate that the price of the cryptocurrency will change within this interval. If we work with ETH and USDT and in case that the price varies within the interval, one can generate antimatter token(call and(or) put) by providing two types of underlying assets, such as ETH and USDT. Typically, one needs to provide more ETH to generate a call token and more USDT to generate a put token.

The redemption of tokens is simply exercising corresponding options.

2.4 Pricing of tokens

Given a price range $[F, C]$ within which the price of the specific cryptocurrency varies, where F is the strike price for call and C is the strike price for put. Let $c \in [F, C]$ be the market price of the cryptocurrency on the platform. Thus $c - F$ is the intrinsic value of a call token, while $C - c$ is the intrinsic value of a put token. Let x, y be the amount of call and put token respectively, and z be the total reserved value. The total reserved value is all the premium collected that are used to generate Antimatter tokens. If call and put tokens increase at the same ratio, the price should not change. We aim to build a model that z is a function of x and y, $z = f(x, y)$, such that

$$kf(x, y) = f(kx, ky)$$

With this equation, we are able to define the price of each token:

$$\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}$$

When the volumes of both tokens are equal, it is expected that the prices of both tokens are equal. When the volume of call tokens far exceeds the volume of put tokens, it is expected that the price of put token approaches 0. When the volume of put tokens far exceeds the volume of call tokens, it is expected that the price of put token approaches $C - F$. The behavior of call token is wilder but in the same way. One note is that the price of both tokens depends on the ratio of volume of both tokens, rather than the difference between them.

For example, we work with ETH and USDT. The price of ETH in terms of USDT varies within the interval $[1000, 4000]$. Here \$1000 is the strike price of call, and \$4000 is the strike price of put. If the ratio between call token and put token generated is $6 : 4$, it is expected that the market price is \$3500 In this case, the cost to generate a call token is about \$6000 and the cost to generate a put token is about \$240. When there is a difference between the market price and market price of ETH, one can buy and sell call or put token in two market to make profit.

2.5 Mathematical modelling

The actual model goes as follows. Let

$$z = \frac{(C - F)y^2}{\sqrt{x^2 + y^2}} + e \cdot \frac{C - F}{C} \frac{x^2}{\sqrt{x^2 + y^2}}$$

where e is the price of ETH. This expression ensures that $\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y} > 0$. This model works well with prices of tokens. Because the lowest possible price of ETH is 0 and the highest price of ETH is infinity, the price of call token will be appreciated to a greater extend, if the price moves in the right direction. The

prices of both tokens remain in the interval $[0, C-F]$ for current version. Starting from homogeneity condition, we find the general solution:

$$z = e \cdot \sum_{i=1}^{\infty} e_i \frac{x^2}{\sqrt{x^2+y^2}} + \sum_{i=1}^{\infty} u_i \frac{y^2}{\sqrt{x^2+y^2}}$$

The only possible solution that agrees with our model is when $k = 1$ in the infinite sum. By some numerical analysis, we finally arrived at the expression above.

2.6 Ratio of underlying assets

As usual, we have a difference between the price floor(F) and price celling(C), x, y be the call and put token generated respectively. We divide the premium into two parts: stable coin U and any cryptocurrency Ee, where E is the quantity and e is the price. Since stable coin preserves value, we may always assume that its price is 1. Then, we define the following:

$$U = \frac{(C-F)y^2}{\sqrt{x^2+y^2}}, E = \frac{C-F}{C}\frac{x^2}{\sqrt{x^2+y^2}}$$

Using a calculator, we find that $\frac{\partial U}{\partial x} < 0, \frac{\partial U}{\partial y} > 0, \frac{\partial E}{\partial x} > 0, \frac{\partial E}{\partial y} < 0$. This feature agrees with our expectation in that generating more call tokens requires more cryptocurrency and less stable coin, while generating put tokens requires more stable coins and less cryptocurrency. it is required because the platform must be prepared for any possible token redemption at any time.

3 Arbitraging examples

For the examples given below, which involves interaction between the value of underlying assets and current price, we work with ETH and USDT and we restrict that the price of ETH varies between \$1000 and \$5000. The examples only include call tokens. Here generating a token essentially the same as buying a token.

3.1 Case 1

Supposing that the price of ETH is \$3000 and the value of underlying asset is \$3500, one has incentive sell(redeem) a token to make profit. This is due to the market price is less than the underlying value, then selling a call token will give the profit equalling to the difference between two prices.

3.2 Case 2

The investor has finite arbitraging opportunities, making the the whole system stabilized as arbitraging takes place. Arbitraging strategies are exactly the opposite for put tokens.

3.3 What if market is volatile

In a volatile market, the market price of ETH moves ahead of the value of underlying asset. This creates opportunity to arbitrage. In general, price of call tokens should be positively related to price of ETH and price of put token should be negatively related to price of ETH. As the our platform stabilizes itself, the lag in time creates opportunity to arbitrage.

4 More risky version

The current version(R3) is defined under the condition that $C \leq 2F$, resulting in that the leverage is moderate and the price of both tokens will remain in the the interval $[0, C - F]$. The rate of change of token prices will be medium as price of ETH changes. Future versions will include $4F \geq C \geq 2F$(R4) and $C \geq 4F$(R5). In these cases, the price of call token will exceed $C - F$, meaning that when price spikes, one can make more money if he holds a call token. If the price of ETH dips, the call token price will drop in the same fashion. In the extreme case, there might be negative prices, which can be seen either as an anomaly or a perfect change to generate a token.

5 How Antimatter works without oracle

Oracles play an important role in defi applications and are sources of many forms of attacks. Antimatter designs an innovative way to abandon the use of oracles to secure the system and maintain systematic independence. In Antimatter, arbitrage activities will act as "oracles" to make sure price of call and put tokens follow the trend of market price movement of target assets.

Flash loan allows investors to borrow and return significant amount of money without interest rate within one transaction block. Flash loan attack can have devastating effect to the exchange(platform). Here is an example: one can first borrow a large amount of asset A from the protocol. He swaps asset A to asset B, so that the price of asset A will decrease. He then use the swapped asset B as collateral and borrow more asset A. This could be achieved because the price of asset A has decreased. After he returned asset A, the difference in the amount is his profit. It seems profitable but it will ultimately drain the pool since the above process can happen every block. Asset A and B can be contracts too. Contract trading always includes inherent leverage, so the effect can be magnified, which is detrimental to the platform. Certainly with flash loan, one can arbitrage and wash trade, but stabilizing the platform is of more importance.

A large number of protocols uses oracle. Oracle is used to receive Defi-related data from other platforms. The use of oracle can sometimes cause trouble to the protocol. Suppose that it takes 1 second to display the price of a certain cryptocurrreny. Within 1 second, the price changes and one smart trader realizes this change. He then can open position and take advantage of the pricing lag. The drawback of the delay can cause trouble in extreme volatile market. If one pumps and dumps a certain asset, the execution price will be unfavorable to other traders because of this lag. Since the decentralized exchange generally exhibits prices slower than the centralized exchange, a delay in the price display is unfavorable to contract trader. A simple example is that the trader's position may have been liquidated before he realizes the price change. Antimatter platform, however, does not rely on oracle. The pricing mechanism can stabilize itself.