Charity-Escrow Tokens

Stake2Care*

December 18, 2024

I. Motivation

MSF Stake2Care[1] is an innovative liquid staking donation initiative which allows "ETH owners to participate in liquid staking via the Lido protocol and [to] effortlessly commit their rewards to Doctors Without Borders (MSF)[2] via a dedicated Impact staking pool".[3]

In a nutshell, the system works by allowing Lido stETH holders to exchange their stETH against msfETH on a 1-to-1 basis. The yield generated by the underlying stETH is accrued to MSF, hereby allowing msfETH holders to donate to MSF without consuming capital.

Donation income stability through time is paramount to the efficiency and sustainability of the impacted charity projects. This is why Stake2Care offers donors the option - but not the obligation - to commit to donating their staking rewards for a chosen time-length. This is technically achieved by an ancillary time-lock smart contract into which donors can lock their holding for a period of their choice.

As an incentive, donors choosing to lock their tokens will accrue an influx of "MSF-points", a utility token, which can be used within the Stake2Care ecosystem. This short note aims at explaining the rationale behind the computation mechanism of MSF-points.

II. Set-up, Donor Time-Preference, Value accrued to MSF

Let us define:

- K, the locked ETH amount
- T, the lock horizon
- c, the underlying stETH yield (assumed constant)
- U_T the donor time-preference function.

We further suppose that there exists $\gamma \in \mathbb{R}^+$, a time-preference parameter, so that:

$$U_T = \frac{1}{1+\gamma T} \tag{1}$$

In other words, an ETH locked for a duration of T is worth $\frac{1}{1+\gamma T}$ current ETH for the investor.[4]

The Staked Ethereum do not compound as their interest is continually used by MSF. So that the value accrued to MSF writes:

$$C_T^K = KcT \tag{2}$$

We can sensibly suppose that MSF has actualisation factor of 0 for ETH, given their time-insensitive institutional nature and that ETH has a nil risk-free rate.[5] (2) can consequently be seen as the utility accrued to MSF by the staking of K tokens for a time period of T.

*nassib.boueri@cadmos.finance, rbraud@arabbank.ch

[1] https://stake2care.msf.ch/

[2] https://www.msf.org/

[3] https://docs.google.com/presentation/d/1wxAxK_eVWEqdMZATQWudrFVwY6QUn-YBh89YE2gB_0g/edit?usp=sharing

[4] This model called *hyperbolic temporal discounting* is currently dominant in behavioural sciences.

[5] At the time of writing this note, Ether has had an effective nil inflation rate since the merge, furthermore ETH staking returns are not "risk-free".

III. MSF Points

MSF-points attribution aim to achieve the following objectives:

1. Compensate the *expected utility loss* of donors choosing to lock their msfETH instead of remaining fully liquid.

2. Be proportional to the utility accrued to MSF by the staking of the donor's tokens for a length of time.

As such, we define M_T^K the MSF points accrued by the donor locking K ETH for a period of T as equal to the value accrued to MSF(2) divided by the investor's time-preference function at horizon T(1). In other words:

$$M_T^K := KcT(1 + \gamma T) \tag{3}$$

this can be interpreted as the donator using the yield generated by the staked ETH in order to "buy" MSF-points at a discount depending on his chosen time-lock period.

MSF-point accrual is composed of a linear "base-accrual" (KcT) reward and of a quadratic "time-lock" reward as illustrated below in *Figure 1*, where we take as an example $c = month^{-1}$ and $\gamma = year^{-1}$ so that the donor effectively enjoys a $\times 2$ multiplication factor when locking-up his ETH for one year. Note that to prevent exploitation, the lock-up periods must be bounded and we take here a maximum of 3 years, in line with Curve's *vote-escrow* system, which heavily inspired the present note.[6]

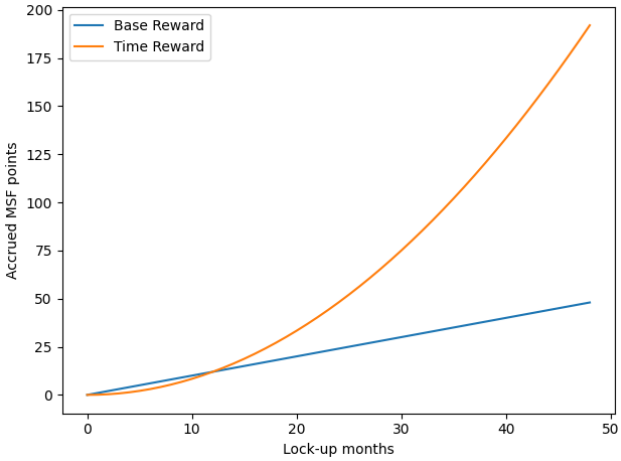

Figure 1: Accrued MSF Points for 1 ETH locked for various time periods.

IV. Unlocking Tokens and other Implementation Considerations

The smart contracts implementing the MSF-point system are derived from Curve's *ve-token* system, with the following differences:

1. In the context of a DAO voting system, Curve's contract have a linear base reward when staking tokens. We are here adding a quadratic "time-factor" to further encourage sustainable charity commitments.

2. Contrary to the ve-system, MSF points are fungible and fully transferable. Under the hood, MSF points are represented by a separate ERC-20 token which is minted when a donor locks his msfETH and can be burned to unlock utility within the Stake2Care ecosystem.

3. Building on the last point, we also give staked donors the option to unlock their tokens by burning MSF-points. In order to prevent arbitrage, the MSF-point amount to be burnt must be greater than the remaining base reward plus the total time reward received by the investor when locking his tokens. For instance, if the donator wishes to unlock his tokens at time $t < T$, we could ask him to burn $B = K\left(c(T-t) + c\gamma T^2\right) \times P$, where P is a penalty factor, for instance 1.10 to account for a 10% 'early-unlock' penalty.

4. Consequently, MSF-points will also be available for sale from MSF directly at a price no lower than c^{-1}ETH so as to encourage staking and the locking of msfETH.

[6] See https://curve.readthedocs.io/dao-vecrv.html.