COTI's Treasury Whitepaper

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September 20th, 2021

Abstract

COTI Treasury is a unique liquidity providing service that allows COTI holders to obtain maximum exposure within the COTI ecosystem (against their collateral) without paying any interest. After locking up COTI as collateral in the treasury and creating an individual position called a "Trove", the user can get instant exposure by minting $tCOTI (treasury share tokens). Each Trove is required to be collateralized at a minimum of 110%. Any owner of $tCOTI can redeem their treasury tokens for the underlying collateral at any time. A liquidation mechanism based on incentivized stability deposits and a redistribution cycle from riskier to safer Troves provides stability at a much lower collateral ratio. Stability is maintained through economically-driven user interactions, rather than by active monetary interventions.

What is COTI Treasury?

COTI Treasury is COTI's first product for a risk adjusted liquidity product which benefits from the full COTI ecosystem. COTI's treasury is a pool of $COTI where users can deposit $COTI and are rewarded for their participation. The pool grows over time as the entire ecosystem pays fees, directly or indirectly, to the treasury, which acts like a pool of $COTI. So, if a user has deposited enough $COTI to represent 1% of the pool, and a month later the pool is bigger, his 1% now worth more $COTI.

The treasury is completely flexible and users are free to decide on how they want to participate and be rewarded. Using the treasury, users will be able to decide exactly how much they want to stake, for how long and even adjust their leverage and risk level - all of which will determine the user's specific reward and APY.

COTI Treasury Ecosystem

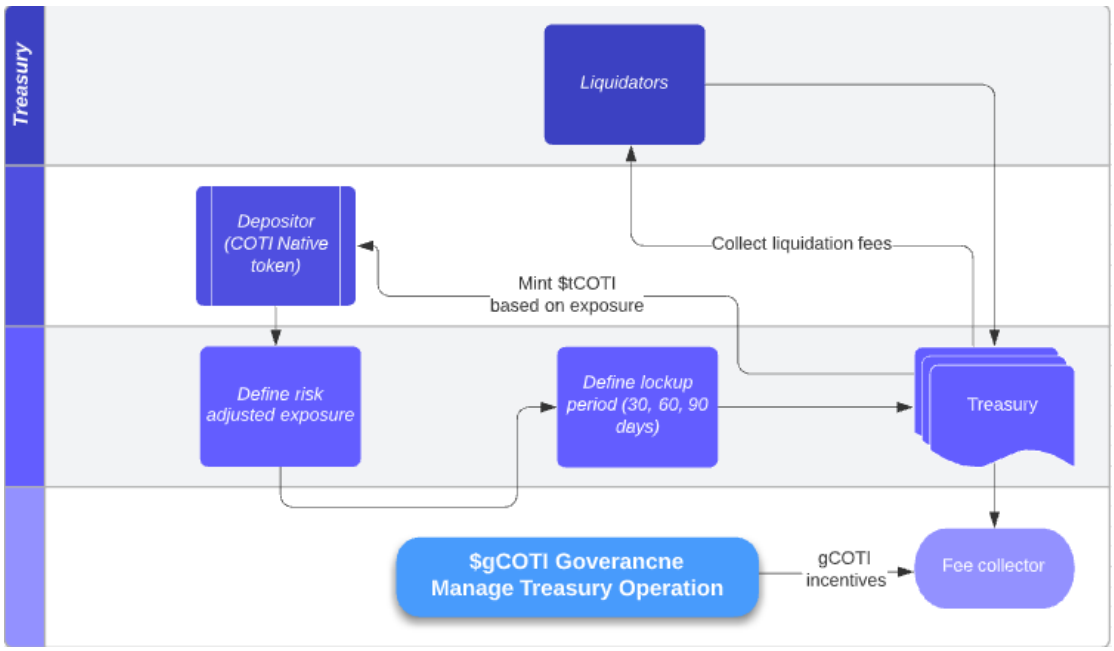
COTI treasury consists of several components which serve and control the treasury mechanism and ecosystem.

Treasury Liquidity providers can get high trading fees APY from taking on risk adjusted liquidity providing positions ("Troves"). By allowing users to set their personalized preferred risk profile, COTI treasury would allocate a higher exposure share within the treasury pool to the depositor. The risk adjusted profile and exposure to the treasury can also be defined by locking up the deposits for longer periods of time (e.g. 30, 60, 90 days).

Treasury Liquidators can earn 5% bounty by liquidating positions that are at a 100% debt ratio.

Treasury Lenders depositors to the treasury can choose to lend $COTI to other users and earn lending interest rates. The lending interest rate comes from risk adjusted yield farmers/liquidity providers borrowing these assets to yield farm/provide liquidity to and from the treasury. In later phases the lending platform will support external collaterals of other tokens (stablecoins).

Treasury Governance is responsible for defining, managing and setting the ground rules for the treasury and its ecosystem. In later stages the treasury governance will also be responsible for exposure confirmation and for the risk adjusted profile of users (as described below).



Treasury Components and where APY comes from

For all deposits in the treasury (regardless to the risk adjusted exposure), the APY comes from:

- Yield farming APY on leverage share within the treasury
- Treasury Deposits/Withdrawal fees
- Liquidation of high risk positions
- Fees collected from the COTI ecosystem
- COTI staking rewards
- Governance token $gCOTI which is distributed to treasury liquidity providers as described in the following section

COTI Treasury Troves and Positions

A depositor first locks up $COTI in the treasury and creates an individual liquidity position called a “trove”. Each trove is required to have a minimum collateralization ratio of only 110%. The depositor can then mint $tCOTI tokens, which are calculated as a debt against collateral. For $COTI that is worth $100, the depositor can obtain up to 90 $tCOTI. When the depositors are ready to retrieve their collateral, they simply return the $tCOTI to the treasury to repay their loan and free up their collateral (returned $tCOTI are then burned).

Depositor collateral requirements contribute to better capital efficiency. For example, if the liquidation ratio was set to 150%, risk-averse depositors might want to keep their trove’s collateral ratio above 300% at all times so that the position would survive a sudden collateral price drop by up to 50%. If liquidations only occur below a ratio of 110%, the depositor could have the same comfort level by maintaining a collateral ratio of only 220%. Better capital efficiency,higher exposure to the treasury and the fees collected contribute to a more liquid COTI market and facilitate integration through higher ROI. High-collateral (higher exposure) depositors provide stability to the treasury system. They are rewarded for their roles by receiving collateral surplus gains from troves that are liquidated. In addition, the depositors will receive $gCOTI (governance treasury token) as a kickback from the treasury.

Risk adjusted profile of depositors

The depositor risk adjusted profile and exposure is defined by several aspects:

1. Amount of COTI deposited
2. Lockup period of his tokens - 30, 60, 90, 120 days
3. Requested exposure - up to 9x of his deposited collateral

Factoring the above metrics is applied by:

$$E_t^c = E_{t-1}^c(1 + stake_p/100)(exposure_t^c)(lending_p^c)$$

$$exposure_t^c \in [0, 4]$$
$$lending_p^c \in [0, 0.1]$$

Highly capital-efficient through instant liquidation

A liquidation mechanism allows COTI treasury to be more capital-efficient while remaining robust against price shocks. Liquidation is needed to ensure that the protocol can cover outstanding debt before a trove's collateral ratio falls below 100%. The liquidation pool is COTI Treasury's primary mechanism to instantly absorb troves with insufficient collateral. When a trove falls below the minimum collateral ratio of 110%, the system liquidates its debt.

All the collateral of each liquidated trove is sent to the Treasury and distributed proportionally among all depositors. This mechanism is expected to yield a net gain to the depositors. This holds because the liquidation is triggered below a collateral ratio of 110%, but with a very high probability above 100%. For example, if a trove with exposure of $109 worth of COTI and 100 $tCOTI of debt is liquidated, 100 $tCOTI are burned and the depositors receive $109 worth of COTI. This means the "liquidation penalty" under normal system operation is no more than 10%.

By redistributing the riskiest positions to the safest and adjusting the incentive structure in times of low collateralization, the treasury quickly stabilizes itself via direct feedback loops.

Low collateral ratio (110%)

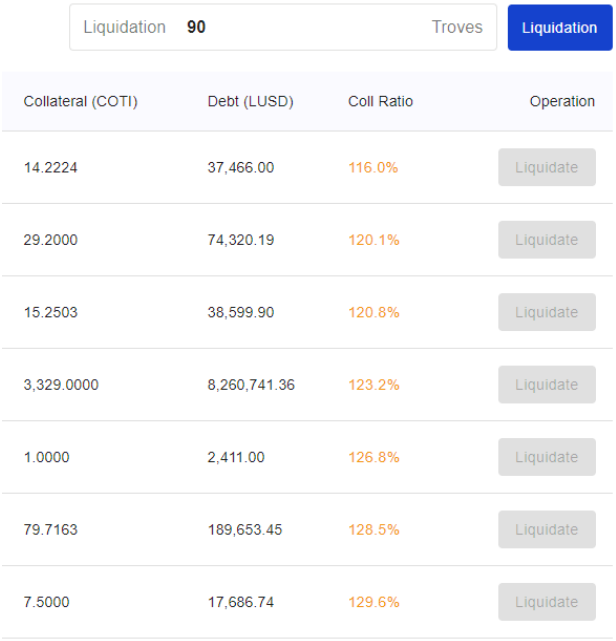
When an individual position's collateral ratio falls below a certain threshold, a treasury system must take special action to ensure the treasury supply remains fully backed. In existing systems, this is done by liquidating the position in an interactive process. Selling the collateral from undercollateralized positions at a fixed price is inefficient by design as it requires a significant discount to the current collateral price to ensure that it can be sold quickly in difficult situations. Collateral auctions replace discounts by an economically fair, but potentially lengthy and error-prone bidding mechanism. The longer it takes to sell the collateral, the higher the risk that its value might drop further. Auction-based systems thus have to set their liquidation ratio high enough to provide an extra margin for subsequent price drops during liquidation.

COTI Treasury applies a two-step liquidation mechanism aimed at instantly liquidating undercollateralized positions. Since the acquirers are known in advance, there is no need to find a buyer for a collateral buyout on the spot when a position becomes undercollateralized. This advantage allows for a considerable reduction in the collateral ratio, while keeping stability high. The system also relies on sufficient collateralization of all positions in aggregate, rather than on the collateral of individual positions.

Out-of-order and batch liquidations

As part of the treasury operation we want to enforce a strict order on liquidations: a Trove should only be liquidated if there are no liquidatable Troves with a lower collateralization ratio. This is intended to be an elegant way of providing fairness to the depositors.

Given that our system heavily relies on quick and efficient liquidation of debt, we need to offer an easy way to specifically liquidate large Troves, making sure that a substantial portion of the debt can be cleared quickly. To that end, we will allow liquidations of arbitrary batches of Troves. The system can tolerate smaller Troves remaining unliquidated for a longer time, as it is not the number, but the total pending debt that matters in the end.



Growth and early adopter incentives

Users that drive growth and robustness by contributing to the treasury at early stages get rewarded with treasury governance token $gCOTI, the system's secondary token. These tokens can be staked back to the treasury in order to earn a proportion of the protocol revenue stemming from COTI ecosystem and treasury issuance and redemption fees. The protocol continuously issues $gCOTI to users who have deposited $COTI to the treasury. $gCOTI is issued according to a release schedule that halves the number of tokens distributed each year, favoring early adopters.

System functionality

Deposit (Risk adjustment position) operations

Anyone may obtain liquidity anytime in an entirely permissionless manner after depositing $COTI into a Treasury Trove .The deposited $COTI collateral gets locked up in the Treasury Trove and allows its owner to adjust is exposure to the treasury with up to 90% of its current dollar value in the form of $COTI. In other words, the Treasury Trove must always maintain a Minimum Collateral Ratio (MCR) of 110%, defined as the ratio of the current dollar value of the collateral to the withdrawn liquidity. Depositors can repay or extend their exposure within the limits of the MCR whenever they wish. Within the same limit, they can retrieve their collateral. Moreover, a Treasury Trove can be topped up with more collateral as needed.

COTI Treasury imposes a minimum exposure of 100 COTI. Thus, Treasury Troves can only be opened with an initial debt of at least 100 COTI and may never go below a debt of 100 COTI, unless when fully repaid and closed.

Liquidation Reserve

When a depositor opens a new Treasury Trove, an amount of 200 $COTI (TBD) is reserved and held back by the treasury as a compensation in case the Treasury Trove needs to be liquidated at some point. The 200 $COTI are added to the Treasury Trove's debt, impacting its collateral ratio. When a borrower closes his Treasury Trove, the Liquidation Reserve is refunded, i.e. the corresponding 200 debt on the Trove is cancelled. The depositor thus needs to pay back 200 $COTI less than the amount of the debt to fully pay it off.

Deposit Fee

COTI Treasury charges a one-time Depositing Fee. The fee is added to the Treasury Trove's debt and is given by a base rate + 0.5% multiplied by the amount of exposure drawn by the depositor. The minimum Depositing Fee is 0.5%, and the maximum is 5%.

Example: The base rate stands at 0.5%. The depositor opens a new Treasury Trove by depositing 8,000 $COTI and increasing his exposure by another 4,000 $COTI. Being subject to a Liquidation Reserve of 200 $COTI and charged a 1% fee on the 4,000 $COTI, the depositor will obtain 4,000 $tCOTI, while incurring a debt of 4,240 $COTI (4,000 + 200 + 40). To close the Treasury Trove and fully retrieve his $COTI, the depositor will need to repay 4,040 COTI as the Liquidation Reserve gets refunded.

Trove liquidation mechanism

To ensure that the entire supply remains fully backed by collateral, Treasury Troves that fall under the Minimum Collateral Ratio of 110% (referred to as "undercollateralized") are subject to liquidation. Liquidation can be triggered by anybody and allows liquidating multiple Troves in one batch, either by specifying a set of Treasury Troves or in ascending order starting from the Trove with the lowest collateral ratio. While the former approach allows to quickly liquidate large Treasury Troves, the latter is more resilient against the race conditions that may occur in case of multiple simultaneous liquidations. In most cases, Treasury Providers and/or high-collateral Treasury Troves will have a financial incentive to trigger liquidations as fast as possible. To compensate for a liquidation, COTI Treasury pays the reserved 200 $COTI plus 0.5% of the Treasury Trove's collateral to the liquidator.

Liquidation mechanism

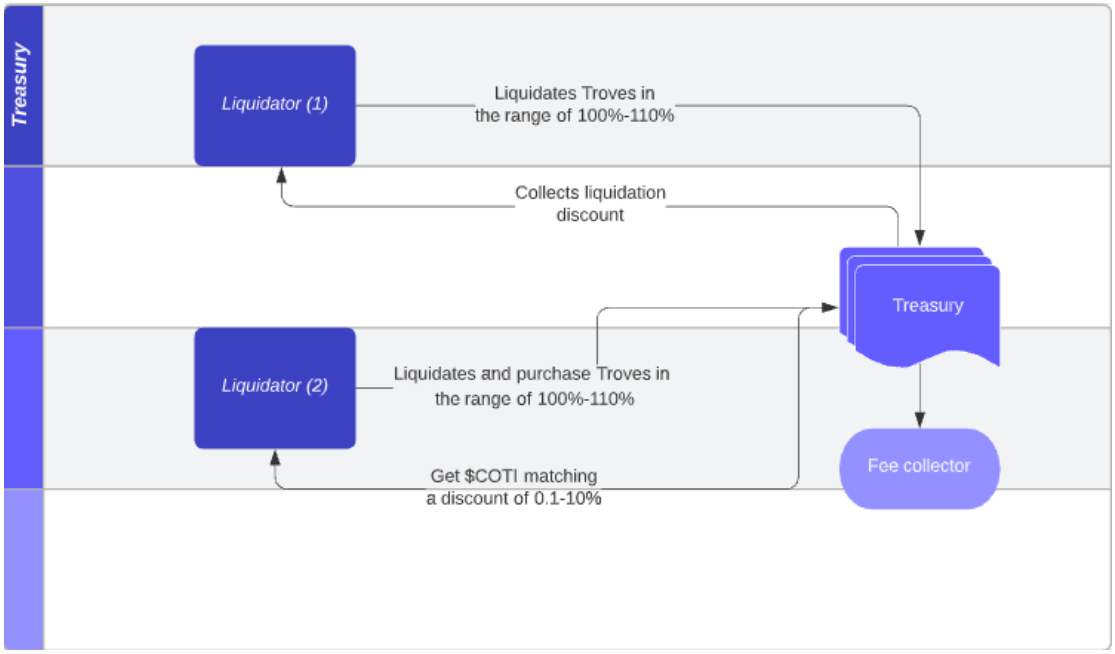
Trove's Collateral Ratio	Liquidation Procedure
$< 100\%$	The Trove is liquidated by directly redistributing its entire debt and collateral to other Troves, with no prior Stability Pool offset.
between 100% and 110%	As under normal operation, the Trove is liquidated by first offsetting its debt and collateral against the Stability Pool and redistributing any remainders to other Troves.
between 110% and TCR	The Trove is liquidated by offsetting its debt against the Stability Pool, provided that the entire debt can be liquidated. The liquidated collateral is capped at 110% of the debt, and the remainder above 110% is reclaimable by the borrower.
$>$ TCR	No liquidation possible.

Liquidators

Liquidators are highly trusted COTI users (TBD) which can benefit from an arbitrage and incentive given from liquidating Trove positions. There are two ways for liquidators to liquidate funds:

1. They are the first to liquidate funds in the range of 100%-110% - once liquidation is processed they pay the liquidation fee and retrieve the delta between the liquidation price and the current price (e.g. 0.1-10%) from the liquidated funds. The remaining collateral funds are returned to the treasury reserve and distributed between treasury holders.

2. Another option is to allow liquidators to buy the collateral at a discount (via other means, such as: USDC) and the delta between the liquidation price and the current price is the discount they will get for the collateral funds. The payments for the $COTI purchased from the treasury are returned to the treasury reserve and distributed between treasury holders.



Treasury Model Specifics

COTI price (exogenous)

COTI is the collateral for tCOTI. The COTI price P_t^e follows

$$P_t^e = P_{t-1}^e(1+\zeta_t^e)(1+\sigma_t^e),$$

where $\zeta_t^e \sim N(0, \text{sd\_ether})$ represents COTI price shock and σ_t^e the drift of COTI price. At the end of the year, the expected COTI price is:

$$E(P_{8760}^e) = P_0^e \cdot (1+\text{ drift\_ether})^{8760}$$

COTI Endogenous Price

The deposited COTI treasury earning consists of the issuance fee revenue and redemption fee revenue

$$R_t^q = R_t^i + R_t^r.$$

From period 721 onwards, using the data in the last 720 periods (i.e. the last 30 days), we can calculate the annualized earning

$$E_t = \frac{365}{30} \sum_{\tau=t-720}^{t-1} R_\tau^q.$$

For example, in period 721 (the first hour of the second month), we can calculate the annualized earning

$$E_{721} = \frac{365}{30} \sum_{\tau=1}^{720} R_\tau^q.$$

In period 722 (the second hour of the second month), we can calculate the annualized earning

$$E_{722} = \frac{365}{30} \sum_{\tau=2}^{721} R_\tau^q.$$

The annualized earning E_t takes into account the last 720 periods' earning only and then annualize it to represent the whole year's revenue. Only the latest 720 periods matter! The earlier ones become irrelevant over time.

The P/E ratio is defined as follows

$$r_t = \frac{COTIMarketCap}{AnnualizedEarning} = \frac{MC_t}{E_t}$$

$MC_t = P_t^q \cdot$ COTI_total_supply

Therefore, the COTI price dynamics is determined

$$P_t^q = discount \cdot \frac{r^{PE}}{COTI\_total\_supply} E_t$$

Interpretation: The denominator implies that with more COTI tokens distributed, COTI price decreases. However, the depreciation effect can be counteracted by the growth of the earning.

Liquidity Pool

The demand of tokens from liquidity pool is defined by

$$D_t^l = D_{t-1}^l (1+\zeta_t^l)(1+\sigma_t^l)(\frac{P_t^l}{P_{t-1}^l})^\delta,$$
$$D_0^l = liquidity\_initial$$

where $\zeta_t^l \sim N(0, sd\_liquidity)$ is the shock in the liquidity pool, $1+\sigma_t^l = drift\_liquidity$ and $\delta \leq -1$.

Treasury Pool

The demand of tokens from treasury pool is defined by

$$D_t^s = D_{t-1}^s (1+\zeta_t^s)(1+R_{t-1}^s - R_t^n)^\theta,$$
$$D_0^s = treasury\_initial$$

where $\zeta_t^s \sim N(0, sd\_stability)$ is the shock in the liquidity supplied.

During the first month the formula above is also multiplied by a drift factor, $drift\_stability$.

R_{t-1}^s is the return in the treasury pool, which consists of liquidation gain, fees collected and airdrop governance token gain (TBD).

The natural rate of the treasury pool follows

$$R_t^n = R_{t-1}^n (1+\zeta_t^n) \geq 0,$$

where $\zeta_t^n \sim N(0, sd\_return)$ is the natural rate shock and $R_0^n = natural\_rate\_initial$.

The natural rate compensates the opportunity cost and risk undertaken by the treasury pool providers. It resembles the risk-free government bond return in the macroeconomics model. Treasury pool depositors compare the return of the treasury pool with the outside investment opportunities. A positive shock ζ_t^n implies investment on other platforms, e.g. Compound, Uniswap, Aave, yield higher returns, thus making the treasury pool less appealing.

Treasury Trove Definition

Each treasury trove is defined by five numbers

> (collateral in ether, debt in tCOTI, collateral ratio target, rational inattention, collateral ratio)

which can be denoted by

> $(Q_t^e(i), Q_t^d(i), CR^*(i), \tau(i), CR_t(i))$.

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*Open Troves (deposits) *

The amount of new troves (treasury positions) opened in period t is denoted by N_t^o, which follows

$$N_t^o = \begin{cases} initial\_open & \text{if } t = 0 \\ max(0, n\_steady \cdot (1 + \zeta_t^o)) & \text{if } P_{t-1}^l \leq 1 + f_t^i \\ max(0, n\_steady \cdot (1 + \zeta_t^o)) + \alpha(P_{t-1}^l - (1 + f_t^i))N_t & \text{otherwise} \end{cases}$$

where the shock $\zeta_t^o \sim N(0, sd\_opentroves)$.

R_t^o represents the break-even natural rate of opening troves and f_t^i represents the issuance fee.

P_t^l is the price of tCOTI.

N_t^o is rounded to an integer.

The amount of tCOTI tokens generated by a new trove is

$$Q_t^d(i) = \frac{P_t^e Q_t^e(i)}{CR^*(i)}.$$

The distribution of COTI $Q_t^e(i)$ follows

> $Q_t^e(i) \sim \Gamma(k, \theta)$

So that $E(Q_t^e) = collateral\_gamma\_k \cdot collateral\_gamma\_theta$ and
$Var(Q_t^e) = \sqrt{collateral\_gamma\_k} \cdot collateral\_gamma\_theta$

$CR^*(i)$ follows a chi-squared distribution with $df = target\_cr\_chi\_square\_df$, i.e. $CR^*(i) \sim \chi^2_{df}$, so that $CR^*(i) \geq target\_cr\_a$:

> $CR^*(i) = target\_cr\_a + target\_cr\_b \cdot \chi^2_{df}$.

Then:
$E(CR^*(i)) = target\_cr\_a + target\_cr\_a * target\_cr\_chi\_square\_df$,
$SD(CR^*(i)) = target\_cr\_b * \sqrt{2 * target\_cr\_chi\_square\_df}$

Each trove is associated with a rational inattention parameter $\tau(i)$.

The collateral ratio of the existing troves vary with the ether price P_t^e

$$CR_t(i) = \frac{P_t^e Q_t^e(i)}{Q_t^d(i)}.$$

If the collateral ratio falls in the range

> $CR_t(i) \in [CR^*(i) - \tau(i), CR^*(i) + 2\tau(i)]$,

no action taken. Otherwise, the trove owner readjusts the collateral ratio so that

> $CR_t(i) = CR^*(i)$.

The distribution of $\tau(i)$ follows gamma distribution $\Gamma(k, \theta)$ with mean of $k\theta$ and standard error of $\sqrt{k\theta^2}$.

*Close Troves (Withdrawl position) *

The amount of troves closed in period t is denoted as N_t^c, which follows

$$N_t^c = \begin{cases} U(0, 1) & \text{if } t \in [0, 240] \\ max(0, n\_steady \cdot (1 + \zeta_t^c)) & \text{if } P_{t-1}^l \geq 1 \\ max(0, n\_steady \cdot (1 + \zeta_t^c)) + \beta(1 - P_{t-1}^l)N_t & \text{otherwise} \end{cases}$$

where the shock $\zeta_t^c \sim N(0, sd\_closetroves)$. N_t^c is rounded to an integer.

Trove Liquidation

At the beginning of each period, right after the feed of COTI price, the system checks the collateral ratio of the exisitng troves in the trove pool.

If the collateral ratio falls below 110%, i.e.

$$CR_t(i) = \frac{P_t^e Q_t^e(i)}{Q_t^d(i)} < 110\%,$$

this trove is liquidated. Namely, it is eliminated from the trove pool (And redistributed back to the liquidator and treasury pool).

Denote the amount of liquidated troves by N_t^l. The sum of the debt amounts to

$$Q_t^d = \sum_i^{N_t^l} Q_t^d(i)$$

The amount of ether is

$$Q_t^e = \sum_i^{N_t^l} Q_t^e(i)$$

The debt Q_t^d is paid by the liquidators in exchange for the collateral Q_t^e + 5% reward. Therefore, the return of the previous period's treasury pool is

$$R_{t-1}^s = \frac{R_t^l + R_t^a}{P_{t-1}^l D_{t-1}^s}$$

where:

- $R_t^l = P_t^e Q_t^e - P_{t-1}^l Q_t^d$ is the liquidation gain
- $R_t^a = P_t^q \hat{Q}_t^q$ is the airdrop gain, $\hat{Q}_t^q = 1000$ denotes the amount of tCOTI token airdropped to the treasury pool providers
- D_t^s is the total amount of COTI deposited in the treasury Pool

$tCOTI - Treasury position token

$tCOTI is the treasury position token issued by the treasury. It represents depositors risk adjusted exposure to the treasury and will be used to capture the fee revenue that is generated by the treasury system.

$gCOTI - Treasury governance token

$gCOTI is the secondary token issued by the treasury. It is used as the treasury governance token and incentivizes early adopters and trove holders.

$gCOTI is an ERC-20 asset that empowers community governance of the COTI treasury protocol; $gCOTI token-holders and their delegates debate, propose, and vote on all changes to the protocol.

By placing $gCOTI directly into the hands of users and applications, an increasingly large ecosystem will be able to upgrade the protocol, and will be incentivized to collectively steward the protocol into the future with good governance.

$gCOTI rewards will only accrue to Treasury liquidity providers — i.e. users who deposit COTI to the treasury.

Distribution Schedule

$gCOTI's issuance follows a yearly halving schedule, described by the following function: 32,000,000 * (1–0.5^year). The purpose of this issuance curve is to favorably incentivize early adopters while also maintaining incentives for the long term.

Summary

In summary, COTI Treasury offers a novel value proposition for $COTI holders by socializing COTI tail risk to treasury providers. The protocol's long term sustainability will rely on the treasury providers that act like insurance underwriters and accept the risk profile that is inherent to the protocol's long-term liquidation proceeds and binding their holdings with the success of the COTI ecosystem.