SAFU - Risk Operator

POL Finance[1] and
Juan Samitier[2]

[1]dipa@pol.finance, agustin@pol.finance
[2]juan@safuprotocol.xyz

Disclaimer

The following disclaimer is intended to clarify the purpose and limitations of the report produced by POL Finance and the SAFU Core Team for the study of the SAFU Risk Operator Role. Please read this disclaimer carefully before reviewing the report.

No Financial Advice: The information provided in this report is for informational purposes only and should not be construed as financial advice, investment recommendations, or an invitation to engage in any buying, selling, or holding of any specific asset. POL Finance, SAFU protocol and the authors do not provide financial advice, and the content of this report should not be considered as a sole or definitive source for making decisions or relying upon.

Limitation of Liability: POL Finance, SAFU protocol and the authors assume no responsibility or liability for any financial losses, direct or indirect, incurred from using or interpreting the information provided in this report. Readers are responsible for their own investment decisions and should undertake their due diligence.

Information Obsolescence: It is crucial to acknowledge that the information provided in this report may become obsolete due to dynamic market conditions, regulatory shifts, technological advancements, or other factors. Readers should be aware that the report's content is subject to change, and it is advisable to conduct timely research and analysis before making any investment decisions.

Contents

Introduction

In both DeFi and traditional finance, access to reliable insurance or coverage for high-risk positions and assets remains limited and costly. Traditional insurance models often require large capital commitments upfront and charge expensive premiums, making coverage inaccessible or economically unviable for many users. Furthermore, existing solutions lack transparency and tend to impose rigid pricing structures, disconnecting coverage costs from actual market risk.

SAFU addresses this gap by providing decentralized, on-chain insurance that is both capital-efficient and fairly priced. Unlike conventional insurance models, SAFU enables participants to secure coverage without upfront capital requirements. Through a transparent, market-driven yield distribution framework, SAFU offers real-time risk assessment and fair pricing, allowing users to obtain reliable coverage in a way that is both efficient and aligned with actual market dynamics. This model not only democratizes access to insurance for high-risk DeFi and TradFi assets but also sets a new standard for transparency and efficiency in decentralized financial services.

Chapter 1

Risk Curator Role

The role of a Risk Curator in the SAFU protocol is pivotal in ensuring that insurance markets operate efficiently, maintaining adequate protection for users while optimizing the economic incentives of participants. This chapter outlines the responsibilities of a Risk Curator, highlighting their role in defining critical parameters like the Optimal Coverage Level (OCL) and calibrating the Yield Sacrificed (YS) to balance system security and economic efficiency.

1.1 Overview of the Role

Risk Curators are key participants in the SAFU ecosystem, responsible for ensuring the stability and effectiveness of the protocol's insurance framework. Their primary responsibilities include:

i. **Defining the Optimal Coverage Level (OCL):**
The Risk Curator determines the ideal Current Coverage Level ($C_{\text{restaked}}/C_{\text{insured}}$) for a specific insurance market. This ensures that the system remains adequately collateralized, balancing economic efficiency with security.

ii. **Formalizing Metrics for Policy Execution:**
The Risk Curator collaborates with policy writers to define the precise metrics under which an insurance policy is triggered. These metrics, rooted in quantitative risk assessment, ensure that policies activate only when predefined conditions are met, protecting both insured users and restakers.

iii. **Determining the Optimal Yield Sacrificed:**
The Risk Curator defines the optimal portion of yield to be sacrificed by insured users, ensuring sufficient incentives for restakers while maintaining cost efficiency for coverage buyers. This value is the yield sacrificed when the Current Coverage Level is equal to the optimal coverage level ($CCL = OCL$).

1.2 SAFU Insurance Markets

SAFU operates through a dual-pool structure, which the Risk Curator oversees to maintain balance and functionality:

- **Covered Capital Pool:**
Users deposit yield-bearing tokens (e.g., stETH, sDAI) to mint SAFU tokens. In

exchange, they forfeit a portion of their yield to gain coverage. The specifics of the coverage, including triggers and covered events, are unique to each market and transparently visible on-chain.

- **Restaked Capital Pool:**
  Insurers (restakers) deposit tokens into the restaking pool, underwriting risks for insured users. They earn the Yield Sacrificed by insured parties as compensation for assuming these risks.

The Risk Curator ensures that these pools remain balanced, adjusting parameters like the OCL and the optimal yield sacrificed to optimize economic incentives and mitigate risks.

1.3 The Importance of Yield Sacrificed

A well-calibrated YS is critical for maintaining system balance. Its importance lies in:

- **Economic Efficiency:**
  Balances the cost for insured users with returns for restakers, ensuring sustainable participation in the ecosystem.
- **Market Adaptability:**
  Dynamically adjusts to changing risk profiles and market conditions, keeping the protocol competitive and robust.
- **Adequate Risk Coverage:**
  Ensures that sufficient collateral exists to cover potential losses from adverse events such as slashing or depeg. While adequate risk coverage is directly tied to the coverage level (CCL), it also benefits indirectly from improvements in market adaptability and economic efficiency, as these factors enhance the perception of risk and promote proper allocation of resources in the system.

The dynamic adjustment of YS follows a similar approach to interest rate models used in money markets. When the Current Coverage Level (CCL), defined as $CCL = C_{\text{restaked}}/C_{\text{insured}}$, deviates from the Optimal Coverage Level (OCL), the YS adjusts non-linearly to realign the system. This mechanism ensures that under-coverage incentivizes restakers through higher yields, while over-coverage minimizes unnecessary costs for insured users.

Chapter 2

Yield Sacrificed (YS)

The *Yield Sacrificed (YS)* is a foundational metric in SAFU protocol's risk management framework. It determines the portion of yield foregone by insured parties to maintain an adequate insurance fund, ensuring the system remains solvent while balancing the economic incentives for all participants. This chapter explores the importance of defining the YS, its formal definition, the variables involved, and the methodology used to dynamically adjust it.

2.1 Importance of the Yield Sacrificed

Defining an appropriate Yield Sacrificed (YS) is essential for several reasons:

- **Risk Coverage Adequacy:** The YS aims to maximize incentives to help the insurance fund accumulate sufficient capital to cover potential losses from events such as slashing, depegging, or protocol exploits.

- **Economic Balance:** A well-calibrated YS minimizes costs for insured depositors while providing fair and attractive returns for restakers underwriting risks, promoting sustainable participation in the ecosystem.

- **Market Responsiveness:** By dynamically adjusting to changes in risk profiles, the YS ensures the insurance framework remains competitive and robust against evolving market conditions.

An appropriately defined YS aligns the interests of both insured parties and restakers, ensuring the system operates efficiently while promoting long-term sustainability.

2.2 Dynamic Adjustment of Yield Sacrificed (YS)

The dynamic adjustment of the Yield Sacrificed (YS) follows a model inspired by interest rate mechanisms in money markets such as Aave or Morpho. In this framework, the YS is a function of the *Current Coverage Level (CCL)*:

$$CCL = \frac{C_{\text{restaked}}}{C_{\text{insured}}},$$

where C_{restaked} represents the total restaked capital provided by restakers, and C_{insured} is the total insured capital.

2.2.1 Framework for Adjusting YS Based on CCL

The YS is adjusted dynamically to maintain an optimal Current Coverage Level (CCL), denoted as the *Optimal Coverage Level (OCL)*. For the SAFU protocol, the OCL is initially set at 90%.

The dynamic adjustment follows these principles:

- **Under-coverage** ($CCL < OCL$): When the system is under-collateralized, the YS increases to incentivize restakers to contribute more capital, raising the CCL.
- **Optimal or Over-coverage** ($CCL \geq OCL$): When the system is adequately or over-collateralized, the YS stabilizes at a minimum level to prevent over-incentivization.

Inspired by interest rate models used in money markets (e.g., Aave), the $YS(CCL)$ is defined as:

$$YS(CCL) = \begin{cases} YS_{\text{max}} - \frac{CCL}{OCL} \cdot R_{\text{slope1}}, & \text{if } CCL \leq OCL, \\ YS_{\text{max}} - R_{\text{slope1}} - \frac{CCL - OCL}{1 - OCL} \cdot R_{\text{slope2}}, & \text{if } CCL > OCL, \end{cases}$$

where:

- $R_{\text{slope1}} = YS_{\text{max}} - OYS$: The reduction rate for $CCL \leq OCL$.
- $R_{\text{slope2}} = OYS - YS_{\text{min}}$: The reduction rate for $CCL > OCL$.
- YS_{max}: Maximum Yield Sacrificed, set to 90%.
- OYS: Optimal Yield Sacrificed at $CCL = OCL$, set to 30%.
- YS_{min}: Minimum Yield Sacrificed, set to 10% at $CCL = 1$.
- OCL: Optimal Coverage Level, set to 90%.

2.3 Behavior of the Formula

The behavior of $YS(CCL)$ ensures:

- **Under-coverage:**
  For $CCL < OCL$, the YS decreases linearly with a slope R_{slope1}. This gradual reduction incentivizes restakers to increase their capital contributions, ensuring sufficient coverage to reach OCL.
- **Optimal or Over-coverage:**
  For $CCL \geq OCL$, the YS decreases more steeply with a slope R_{slope2}. This discourages excessive over-collateralization while ensuring that YS never drops below YS_{min}. The rationale behind $YS_{\text{min}} = 10\%$ is to guarantee that restakers always earn a baseline yield for providing coverage, maintaining their incentives to participate.

The dynamic adjustment aligns system incentives, ensuring robust insurance coverage and efficient capital utilization.

To illustrate this framework, consider Ethena's insured stablecoin safuSUSDe (or sSUSDe) using SAFU protocol. In this example:

- The insured capital (C_{insured}) represents the value of safuSUSDe stablecoins issued.
- The staked capital (C_{restaked}) consists of restaked collateral backing the insurance.
- For $OCL = 90\%$ and $OYS = 30\%$, the YS dynamically adjusts to ensure optimal insurance coverage, incentivizing restakers and maintaining stability for USDe holders.

This case exemplifies the practical application of YS dynamics, ensuring a robust and sustainable insurance mechanism.

To better understand the relationship between the Current Coverage Level (CCL) and the Yield Sacrificed (YS), we plot the function $YS(CCL)$ as described in the case of Ethena's USDe. The plot below illustrates how YS adjusts dynamically depending on whether the system is under-covered ($CCL < OCL$) or over-covered ($CCL \geq OCL$).

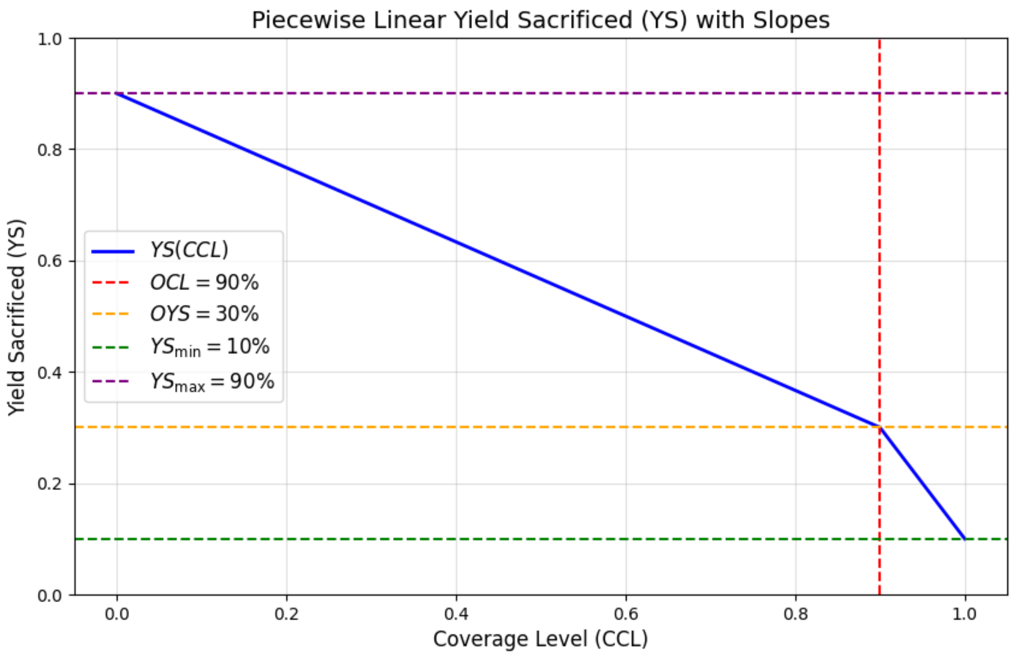

Figure 2.1: Yield Sacrificed (YS) as a Function of Current Coverage Level (CCL).

Figure 2.1 shows the following key elements:

- **Optimal Coverage Level (OCL):** Represented by the red dashed vertical line at $OCL = 0.9$. This is the threshold where the system reaches optimal collateralization, minimizing the cost of insurance for both insured parties and restakers.
- **Yield Sacrificed (YS):** The blue curve shows how the yield sacrificed evolves dynamically:
  - **Sub-coverage Region ($CCL < OCL$):**
    In this region, YS decreases linearly as CCL increases, reflecting a gradual reduction in yield sacrificed by insured users. This behavior is governed by R_{slope1}, which defines the rate of reduction. The slope $R_{\text{slope1}} = YS_{\text{max}} - OYS$ ensures a smooth transition from the maximum yield sacrificed ($YS_{\text{max}} = 90\%$) when $CCL = 0$ to the optimal yield sacrificed ($OYS = 30\%$) at $CCL = OCL$.

  - **Over-coverage Region** ($CCL \geq OCL$):
    In this region, YS decreases more sharply as CCL increases further beyond OCL, disincentivizing excessive over-collateralization. This sharper reduction is controlled by $R_{\text{slope2}} = OYS - YS_{\text{min}}$, where $YS_{\text{min}} = 10\%$ is the minimum yield sacrificed. The function ensures YS reaches this floor value at $CCL = 1$, maintaining a baseline incentive for restakers to participate in the system.

  The selection of R_{slope1} and R_{slope2} reflects different priorities in each region:

  - R_{slope1} is designed to gradually reduce YS, ensuring a fair cost for insured users while incentivizing restakers to cover the insurance pool as CCL approaches OCL.
  - R_{slope2} provides a sharper decline in YS beyond OCL, reducing premiums for insured users and avoiding excessive costs in over-collateralized scenarios.

- **Dynamic Adjustment of YS:** The function ensures that YS responds adaptively to market conditions, incentivizing restakers to deposit more capital when under-covered while reducing costs for insured parties when over-covered.

2.4 Expanded Example: Ethena's safuSUSDe with Different Collateralization Levels

To provide a more concrete understanding of the $YS(CCL)$ behavior, we extend the example of Ethena's insured stablecoin, safuSUSDe (or sSUSDe). In this example, we assume a total of 1 million sSUSDe deposited in the insurance pool. We analyze three scenarios based on the staked collateral (C_{restaked}) and its effect Yield Sacrificed:

- **Case 1: Sub-collateralized** ($CCL = 50\%$)
  With 1 million sSUSDe deposited, only 500,000 units are staked as collateral. This results in a $CCL = 500,000/1,000,000 = 50\%$. The system is undercollateralized, leading to a higher YS to attract additional restakers.

- **Case 2: Near Equilibrium** ($CCL = 90\%$)
  In this scenario, 900,000 units of collateral are staked for the 1 million sSUSDe insured, resulting in $CCL = 900,000/1,000,000 = 90\%$, which matches the Optimal Coverage Level (OCL). The YS stabilizes at $OYS = 30\%$, balancing costs for insured users and incentives for restakers.

- **Case 3: Slightly Over-collateralized** ($CCL = 95\%$)
  Here, 950,000 units are staked against the 1 million sSUSDe insured, giving $CCL = 950,000/1,000,000 = 95\%$. The system is slightly over-collateralized, resulting in a YS that decreases below OYS, moving closer to $YS_{\text{min}} = 10\%$ while avoiding excessive over-incentivization.

Figure 2.2 illustrates the behavior of $YS(CCL)$ for these three cases, showing how the yield sacrificed adapts to varying levels of collateralization in real-world scenarios.

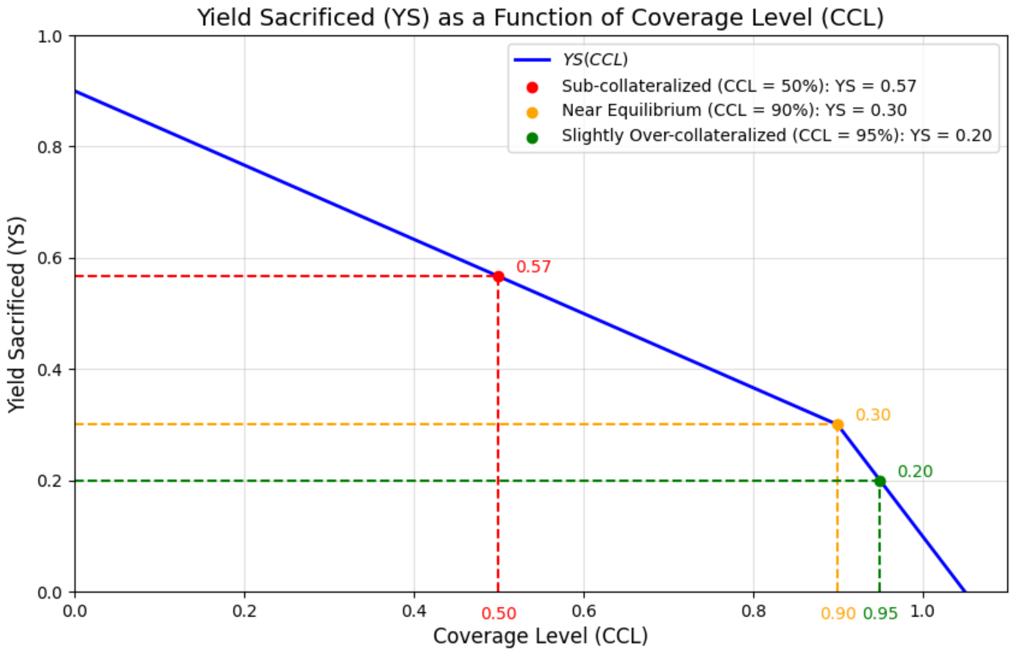

Figure 2.2: Yield Sacrificed (YS) as a Function of Coverage Level (CCL) for Ethena's safuSUSDe under different collateralization scenarios.