

Refract: A Universal Risk Tranching Protocol

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Abstract

Refract is a universal risk tranching protocol that transforms any yield-bearing asset into custom risk-reward profiles. By splitting assets into Senior and Junior Tranches, the protocol allows for liquid, composable, and programmable risk management within the DeFi ecosystem. Refract introduces an innovative yield splitting model that transparently prices risk, programmatically shifting yields to Senior or Junior tranches based on real-time demand.

1 Introduction

Refract is a universal risk tranching protocol that transforms any yield-bearing asset into custom risk-reward profiles.

Refract splits any yield-bearing asset, for example stablecoins, lending vaults, credit market funds, or other ERC-4626 vaults, into Senior and Junior Tranches. Depositors receive receipt tokens for both tranches, making them liquid and composable.

The protocol is built on two primary layers:

- **Junior Tranche:** Absorbs the first loss of the underlying asset (insurance layer). For the higher risk, Junior Tranche depositors are rewarded by receiving a higher share of the underlying asset's yield (risk premium) determined by market dynamics. Junior Tranches may come with lockups.
- **Senior Tranche:** Protected from losses up to the coverage provided by the Junior Tranche; it only takes a hit after 100% of the Junior Tranche is depleted. This provides depositors with risk-adjusted yield while being protected from losses up to the coverage provided by the Junior Tranche. Senior Tranches are instantly withdrawable.



Figure 1: Overview

2 Core Value Proposition

Refract differentiates itself through four key pillars:

1. Risk-optimized

“Tranche markets should be about tranching risk first, with yield used as the lever to achieve risk optimization. Not the other way around.”

Refract’s economic design optimizes for the coverage of the Senior Tranche, providing risk-averse investors with the required assurances. Upon creation of a tranche market, the curator sets a target coverage. The yield distribution curve dynamically adjusts to market situations, moving risk premiums for the junior tranche up or down, to bring the coverage to the target. This is similar to interest rate models of popular lending protocols, balancing liquidity with other goals, such as utilization, or in Refract’s case, coverage.

2. Automated

All of the economic design is encoded into an algorithmic framework that programmatically optimizes the system, removing the need for manual intervention.

3. Independent & Resilient

Refract’s system splits the underlying asset’s yield to optimize risk, providing free-floating APRs for both Junior and Senior Tranche based on market dynamics. No reliance on external benchmark rates or fixed yield based on vibes.

4. Customizable

Refract uses a curator model. Curators can launch tranche markets according to their risk assessment. Curators can parameterize how yield and losses are distributed. This allows for multiple tranche markets being launched for the same asset, letting users decide which market is the best.

2.1 Opportunity

What Refract unlocks:

- **Programmable Risk-Reward Profiles:** Instead of a “one-size-fits-all” profile for a yield strategy, the protocol allows for the creation of bespoke tranches. Curators can define exactly how yield and losses are distributed.
- **Risk and Reward Matching:** While institutional capital may seek safer, lower yield, crypto-native users may be more willing to go out the risk curve for higher returns. Through a dynamic tranching system, both can achieve their goals while the market transparently prices risk and returns.
- **Stability and Scale:** By separating “yield-hungry” capital from “protection-seeking” capital, DeFi can tap into a much deeper, more stable pool of liquidity than pro-rata models allow.

Refract enables the following use cases:

- **DeFi Curators:** Design “institutional-grade” vaults with differentiated tiers, focusing on low-risk tranches for risk-averse investors.

- **Retail "Savings" Products:** Fintech apps can offer "protected yield" products more suitable for retail users.
- **RWA Issuers:** Facilitate the tokenization of private credit and trade finance by managing maturity mismatches through structured pools with lockups.
- **Company Treasuries:** Teams can securely earn yield on reserves with a focus on capital preservation for operational expenses.

3 Protocol Mechanism

Refract uses a proprietary yield splitting model to distribute the base yield (yield of the underlying asset) across Senior and Junior Tranche.

Characteristics

- Each tranche market optimizes for a target coverage that protects the Senior Tranche. The coverage is provided by the Junior Tranche acting as a first-loss buffer. The target coverage is set at market creation.
- The protocol shifts yield between Senior and Junior Tranche dependent on the actual coverage and the gap to the target coverage. The market determines the risk premium (APY) required for Juniors to provide the target coverage.
 - Below-target coverage means higher Junior APY to incentivize deposits, increasing coverage. As the base yield that can be distributed stays constant, Senior APY automatically decreases (inverse correlation between Senior and Junior APY).
 - Above-target coverage has Junior APY decrease until it converges with the Senior APY. This reduces coverage as Juniors take on more risk for a smaller (or even no) risk premium compared to Seniors. The system is designed so that the Junior APY is equal to or smaller than the Senior APY.
- Refract lets yield for both Junior and Senior Tranches float freely based on real-time market dynamics (actual coverage vs target coverage). By moving away from fixed rates and external benchmarks, our system eliminates yield speculation. Both Senior and Junior tranches float freely, allowing the market to price risk with total clarity. This ensures the system self-optimizes for target coverage based on actual demand, rather than fluctuating interest rate spreads.

Senior and Junior Tranche receive yield based on Base APY, coverage, and target coverage. As they share the underlying Base APR, the yield Seniors and Juniors receive is inversely correlated.

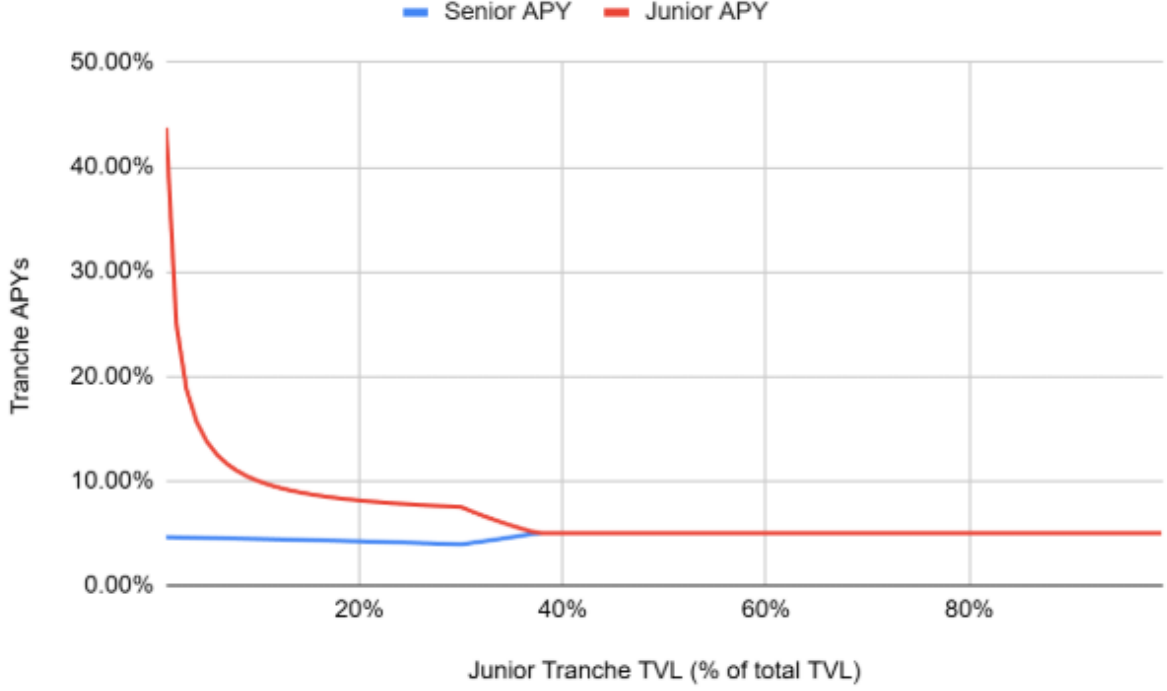


Figure 2: Exemplary APYs for Junior and Senior Tranche for different coverage levels (percentage of total TVL in Junior Tranche) with a Base APY of 5.00 percent

3.1 Target Coverage and Yield Splitting

Refract uses a proprietary yield splitting model that dynamically distributes underlying yield to Senior and Junior Tranche based on the coverage (% of total TVL in the junior tranche).

The Junior Tranche receives at minimum the same yield as the senior tranche and more yield the further coverage is from the target coverage.

3.1.1 Parameters

At market creation, curators can set the following parameters.

Target Coverage ($tgtTVLratio_{jr}$)

The targeted TVL of the junior tranche, as a percentage of the total TVL in the Senior and Junior Tranche

$$Coverage = \frac{TVL_{jr}}{TVL_{jr} + TVL_{sr}} \quad (1)$$

Target Boost ($tgtBoost_{jr}$)

The percentage APY boost the Junior Tranche receives on the Base APY at $tgtTVLratio_{jr}$

Boost Curve Slopes ($s1, s2$)

The steepness of the Junior APY Boost curve below ($s1$) and above ($s2$) the target coverage $tgtTVLratio_{jr}$

From these parameters, the initial Junior APY Boost Curve is generated. The target coverage and target boost provide the anchor point for the curve. The slope $s1$ defines the steepness of the curve below target coverage; $s2$ determines the steepness above target coverage and influences how quickly the Junior APY converges with the Senior APY.

The **Junior APY Boost** is built as follows:

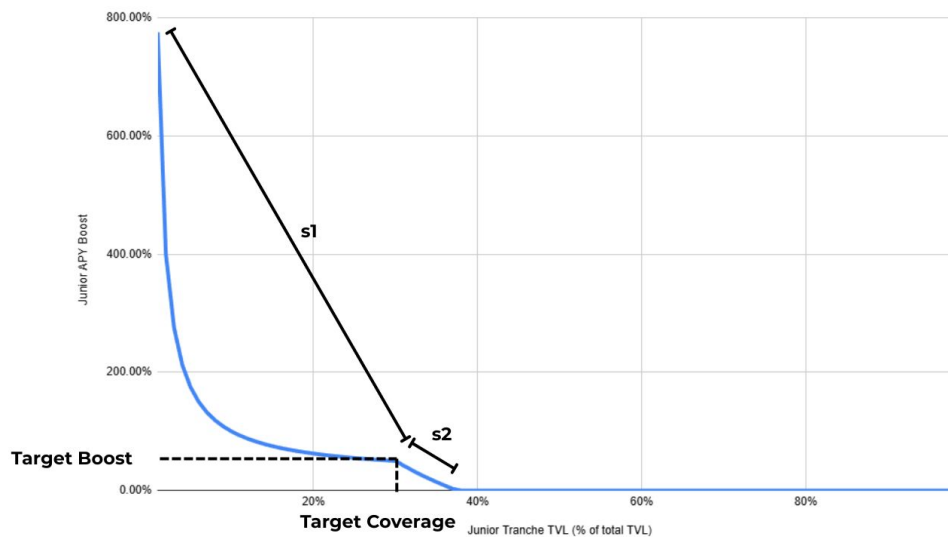


Figure 3: Exemplary Junior APY Boost Curve

From the APY Boost Curve and the Base APY, we can generate the **Junior APY Curve**. The realized Junior APY is determined along the curve based on the actual coverage.

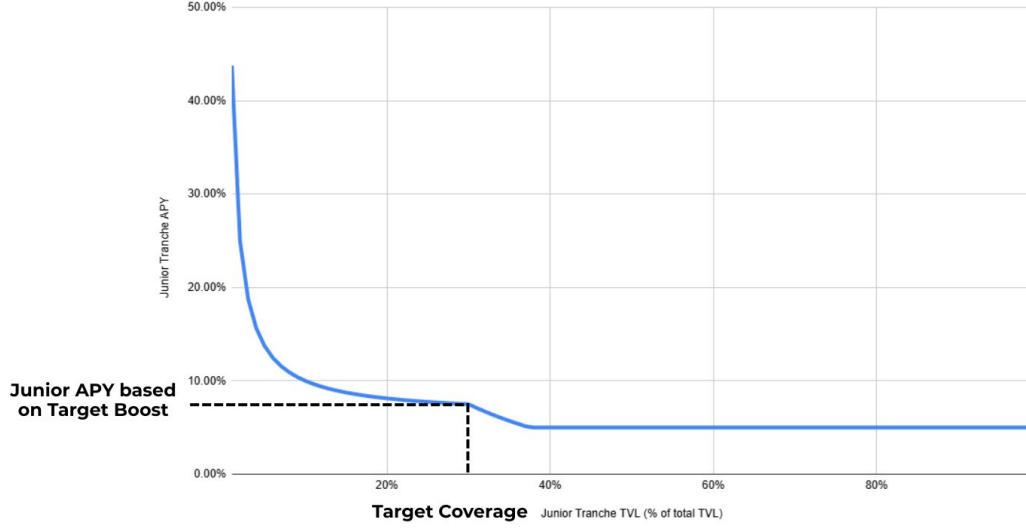


Figure 4: Exemplary Junior APY Curve

3.1.2 APR Calculation

Junior APR

First, the APY Boost for the Junior Tranche is calculated based on the boost curve parameters and the actual coverage (% of total TVL in the Junior Tranche). The APY boost is applied to the Base APY.

The further the coverage is below target, the higher the Junior APY Boost as determined by s_1 . Above target coverage, the APY Boost decreases to zero as defined by s_2 . When the boost is 0, the Junior APY is equal to the Senior APY.

$$\text{Boost}_{jr} = \min \left(\frac{\text{TVLratio}_{sr}}{\text{TVLratio}_{jr}}, \begin{cases} \text{tgtBoost}_{jr} \times \left(1 + s_1 \times \left(\frac{\text{tgtTVLratio}_{jr}}{\text{TVLratio}_{jr}} - 1 \right) \right) & \text{if } \text{TVLratio}_{jr} < \text{tgtTVLratio}_{jr} \\ \max \left(0, \text{tgtBoost}_{jr} \times \left(1 + s_2 \times \left(\frac{\text{tgtTVLratio}_{jr}}{\text{TVLratio}_{jr}} - 1 \right) \right) \right) & \text{if } \text{TVLratio}_{jr} \geq \text{tgtTVLratio}_{jr} \end{cases} \right) \quad (2)$$

The APY Boost is then used to calculate the Junior APY based on the underlying Base APY.

$$\text{APY}_{jr} = \frac{\frac{\text{TVL}_{jr}}{\text{TVL}_{total}} \times (1 + \text{Boost}_{jr}) \times \text{TVL}_{total} \times \text{APY}_{underlying}}{\text{TVL}_{jr}} = \text{APY}_{underlying} \times (1 + \text{Boost}_{jr}) \quad (3)$$

Senior APR

The yield the Senior Tranche receives is inversely correlated to the yield of the Junior Tranche. The higher the APY Boost for Juniors, the more of the underlying yield is allocated to them, leaving a smaller remaining yield for Seniors.

$$APY_{sr} = APY_{underlying} \times \left(1 - Boost_{jr} \times \frac{TVLratio_{jr}}{TVLratio_{sr}} \right) \quad (4)$$

3.1.3 Adaptive APY Boost Curve

The curve of the Junior APY Boost is dynamic. It moves up/down to autonomously find the market-clearing risk premium at target coverage (Target Boost) that brings the coverage to target. This adaptive APY Boost is how Refract uses economic levers to optimize yield distribution with the goal of reaching the selected target coverage in a tranche market.

The adaptive mechanic moves the Target Boost (anchor point of the curve) up/down when the coverage is below/above target. The “speed” (size) of the move is dependent upon A) size of the gap to target coverage B) duration the gap has persisted for.

As the Target Boost moves while keeping the slopes of the boost curve ($s1$, $s2$) and target coverage constant, the whole APY Boost Curve moves up or down with it. This impacts how yield is distributed across Seniors and Juniors. If the Target Boost moves up, Juniors receive more of the yield at the same coverage, and vice versa.

1. Calculate the error (gap to target rate, normalized)
2. Calculate the speed factor (how much the boost curve moves up/down)
3. Update the new target boost $tgtBoost_{jr}$

$$tgtBoost_{jr}(t) = MAX(0, tgtBoost_{jr}(t_{last}) \times speed(t)) \quad (5)$$

3.2 Risks & Mitigations

Asset Risk

The tranches are subject to the risks of the underlying asset, with the Junior Tranche taking first loss, therefore having more exposure.

Risks may include:

- Bad debt (for lending strategies)
- Liquidation risk (for strategies involving borrow or perp positions)
- Slashing risk (for strategies involving staking or restaking) Price risk: Potential loss of value due to adverse movements in the market price of one or more assets held, supplied, or paired within a strategy (e.g. Liquidity Provision)

- Smart contract risk and admin risk of underlying protocols (e.g. stablecoin allocating reserves to Aave is subject to Aave’s and its own Smart contract and admin risk)
- Custodial Risk
- Negative APR (e.g. leveraged borrowing or other strategies that try to capture a spread between rates)

Liquidity Risk

Tranches may experience limited phases of illiquidity. Junior Tranches may be subject to withdrawal delays if coverage is low. Additionally, markets may set lockup periods for the Junior Tranche which always apply. Senior tranches can always withdraw but may not be able to deposit if the coverage is low.

Smart Contract Risk

Deposits are subject to exploits of Refract’s smart contracts and all protocols used by the underlying assets. All Refract smart contracts have been audited by leading auditors to ensure the highest security standards.

Admin Risk

Critical protocol functions, such as including emergency actions, rely on privileged roles. If these roles are compromised, the protocol is at risk.

Mitigations

- Timelock & Multisig: Admin rights are managed by a 3/4 multisig behind a 48-hour timelock.
- Hardware Security: Proposers and signers exclusively use cold storage.
- Guardian: While the protocol can be paused instantly, all other changes can be vetoed by a Guardian before the 48-hour window expires.

4 Fee Structure

Fees can be granularly designed across tranches and user actions.

Protocol Fees

Refract takes the following fees on every tranche market.

Table 1: Protocol Fees

Fee Type	Parameter	Current Fee
Management Fee (Jr/Sr)	% of AUM per year	0.00%
Performance Fee (Jr/Sr)	% of Yield	5.00%
Withdrawal Fee (Jr/Sr)	% of withdrawn amount	0.05%

Curator Fees

Curators of tranche markets can set optional fees. Fees incentivize curators to actively monitor risks of the underlying asset and adjust market parameters to effectively manage risk.

Table 2: Curator Fees

Fee Type	Parameter
Management Fee Junior Tranche	% of Junior AUM per year
Management Fee Senior Tranche	% of Senior AUM per year
Performance Fee Junior Tranche	% of Junior Yield
Performance Fee Senior Tranche	% of Senior Yield