Tokenized SPV for Prediction Market Underwriting

DeFi Structured Finance Project

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Abstract

This project presents a decentralized Special Purpose Vehicle (SPV) designed to underwrite risk in prediction markets. By using a tiered "tranching" structure, the SPV allows investors to participate in risk-bearing activities with different priority levels (Senior, Mezzanine, and Equity), effectively redistributing the premiums collected from market participants based on mathematical waterfall logic.

1 Introduction

In traditional finance, an SPV is a legal entity created for a specific, narrow objective. In this DeFi implementation, the SPV acts as the liquidity provider (the "house") for a prediction market. It collects premiums from users betting on an outcome and distributes the final pool of capital to its investors according to a hierarchical "Waterfall" payment system.

2 System Architecture

2.1 Risk Tranches

The capital is divided into three tokens representing different risk-return profiles:

- **Senior Tranche (TKN_{SR}):** Low risk, fixed 5% return. First to be paid.

- **Mezzanine Tranche (TKN_{MZ}):** Medium risk, fixed 12% return. Paid after Senior.

- **Equity Tranche (TKN_{EQ}):** High risk, variable return. Absorbs all initial losses but captures all residual "upside" profit.

2.2 Cash Flow Logic (The Waterfall)

Once the market event is resolved, the total capital V_f is calculated. The distribution follows this strict order:

1. **Senior Payment:** $D_{sr} = \min(V_f, Principal_{sr} \times 1.05)$

2. **Mezzanine Payment:** $D_{mz} = \min(\max(0, V_f - D_{sr}), Principal_{mz} \times 1.12)$

3. **Equity Payment:** $D_{eq} = \max(0, V_f - D_{sr} - D_{mz})$

3 Mathematical Modeling

The health of the SPV is determined by the relationship between the invested principal, the premiums collected (P), and the eventual liability (L) if the SPV loses the bet.

$$V_f = \max(0, (Principal_{sr} + Principal_{mz} + Principal_{eq}) + P - L) \qquad (1)$$

If $V_f < (Principal_{sr} + Principal_{mz})$, the Equity tranche ROI becomes -100%, acting as a "first-loss" cushion to protect the Senior investors.

4 Simulation Results

Using our Python simulation tool, we modeled a scenario with a significant collateral loss:

Tranche	Principal	Final Payout	ROI
Senior	700.00	735.00	+5.00%
Mezzanine	200.00	15.00	-92.50%
Equity	100.00	0.00	-100.00%
Total	**1000.00**	**750.00**	**-25.00%**

Table 1: Waterfall distribution under a 400 unit loss scenario with 150 units in premiums.

5 Visual Representation of the Model

5.1 Tranching and Risk Hierarchy

Figure 1 illustrates the structural hierarchy of the SPV. The Equity tranche acts as a buffer, absorbing the first losses to provide capital preservation for the Senior investors.
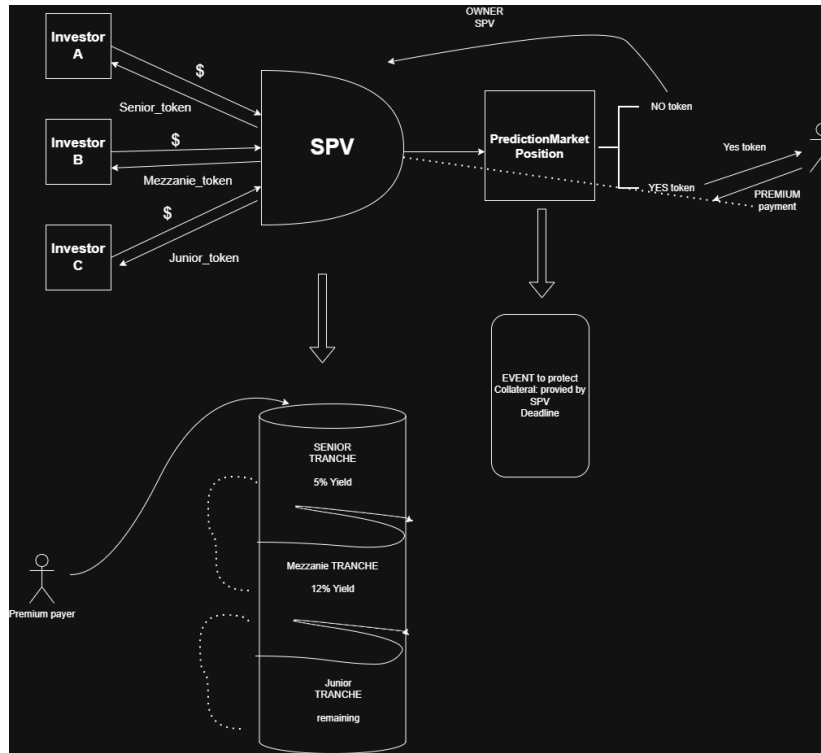

Figure 1: Capital structure and risk/return profile of the SPV.