Boost : A Multi-Asset Collateral Protocol

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1 Introduction

We present boost: a multi-asset collateral protocol that extends Hyperliquid's USDC-denominated perpetual futures infrastructure to accept diverse spot assets as collateral. The core innovation lies in bootstrapping a shared stablecoin pool that serves as an intermediary liquidity layer between users' heterogeneous collateral deposits and Hyperliquid's native perpetual markets.

Users deposit spot assets (BTC, ETH, SOL, etc.) to borrow against this pool, enabling them to open leveraged perpetual positions without converting holdings to USDC. The protocol implements continuous health monitoring of user positions, dynamically assessing both collateral value fluctuations and perpetual P&L to maintain system solvency.

Risk management is achieved through asset-specific collateral factors, real-time oracle-based valuations, and a graduated liquidation framework that protects both users and the protocol from cascading failures. This architecture unlocks capital efficiency by allowing traders to maintain spot exposure while accessing leverage, reduces operational friction, and broadens Hyperliquid's addressable market to users holding diverse crypto assets. The pool design ensures protocol resilience while maintaining compatibility with Hyperliquid Core's existing market structure.

2 Mathematical Framework

2.1 Protocol wide variables

$$\mathrm{LTV}_{\max} = \text{Maximum Loan-to-Value ratio} \in (0,1] \tag{1}$$

$$R_{\text{ratio}} = \text{Minimum reserve ratio in the USDC pool} \in (0,1] \tag{2}$$

$$\mathrm{USDC}_{\text{total}} = \text{Total USDC in the protocol pool} \tag{3}$$

$$\mathrm{USDC}_{\text{available}} = \text{Available USDC for borrowing} \tag{4}$$

2.2 Loan Collateral Variables

$$\boldsymbol{Sz}^c \in \mathbb{R}^{1\times M} = \text{Units of loan collateral posted by user} \tag{5}$$

$$\boldsymbol{Px}_0^c \in \mathbb{R}^{1\times M} = \text{Mark price of loan collateral at borrowing time} \tag{6}$$

$$\boldsymbol{Px}_t^c \in \mathbb{R}^{1\times M} = \text{Current mark price of loan collateral at time } t \tag{7}$$

$$C = \text{Current value of the loan collateral (in USDC)} \tag{8}$$

$$L = \text{Notional loan borrowed against the USDC pool} \tag{9}$$

The current loan collateral value C is calculated as:

$$\boxed{C = \boldsymbol{Sz}^c \cdot (\boldsymbol{Px}_t^c)^T = \sum_{i=1}^{M} Sz_i^c \cdot Px_{t,i}^c} \tag{10}$$

Expanded form: If a user has multiple loan collateral assets (e.g., 2 BTC, 10 ETH, 100 SOL), the total loan collateral value is:

$$\begin{aligned} C &= Sz^c_{\text{BTC}} \cdot Px^c_{t,\text{BTC}} + Sz^c_{\text{ETH}} \cdot Px^c_{t,\text{ETH}} + Sz^c_{\text{SOL}} \cdot Px^c_{t,\text{SOL}} + \dots \\ &= (2 \times \text{BTC price}) + (10 \times \text{ETH price}) + (100 \times \text{SOL price}) + \dots \end{aligned}$$

2.3 Loan Constraints

The loan amount L must satisfy multiple constraints:

$$\boxed{L \le \min\{C \times \text{LTV}_{\text{max}},\ \text{USDC}_{\text{available}}\}} \tag{11}$$

where:

$$\text{USDC}_{\text{available}} = \text{USDC}_{\text{total}} \times (1 - R_{\text{ratio}}) - \sum_k L_k \tag{12}$$

and $\sum_k L_k$ represents the total loans already issued to all users.
This ensures that:

- The loan does not exceed the collateralized value: $L \le C \times \text{LTV}_{\text{max}}$
- The protocol maintains minimum reserve liquidity: $L \le \text{USDC}_{\text{available}}$

2.4 Position Variables

$$\boldsymbol{Sz} \in \mathbb{R}^{1\times N} = \text{Vector of the signed contract sizes} \tag{13}$$
$$\boldsymbol{l}_{\max} \in \mathbb{R}^{1\times N} = \text{Max leverage vector for each market} \tag{14}$$
$$\boldsymbol{Px}_0 \in \mathbb{R}^{1\times N} = \text{Entry price vector for positions} \tag{15}$$
$$\boldsymbol{Px}_t \in \mathbb{R}^{1\times N} = \text{Mark price vector at time } t \tag{16}$$
$$\boldsymbol{Px}_t^{\text{liq}} \in \mathbb{R}^{1\times N} = \text{Liquidation price vector} \tag{17}$$
$$\mathbf{L}_{sl} = \text{The liquidation slack} \tag{18}$$
$$\text{TWM} = \text{Trading Wallet Margin (USDC in the trading wallet)} \tag{19}$$
$$\text{MMR} = \text{Maintenance Margin Requirement} \tag{20}$$

2.5 Account Equity

The Boost Account Equity (BAE) represents the net value considering both loan collateral and leveraged Hyperliquid positions:

$$\boxed{\text{BAE} = C \times \text{LTV}_{\max} + \text{TWE} - L} \tag{21}$$

where the Trading Wallet Equity (TWE) is:

$$\boxed{\text{TWE} = \boldsymbol{Sz} \cdot ((\boldsymbol{Px}_t - \boldsymbol{Px}_0))^T + \text{TWM}} \tag{22}$$

and the Maintenance Margin Requirement is:

$$\boxed{\text{MMR} = \boldsymbol{Px}_t \cdot \left(\boldsymbol{Sz} \odot (2\boldsymbol{l}_{\max})^{-1}\right)^T + \mathbf{L}_{sl} L} \tag{23}$$

Expanded form: If a user has multiple perpetual positions, the TWE is calculated as:

$$\begin{aligned}
\text{TWE} &= \sum_{j=1}^{N} Sz_j \times (Px_{t,j} - Px_{0,j}) + \text{TWM} \\
&= Sz_{\text{BTC}} \times (\text{BTC}_{\text{current}} - \text{BTC}_{\text{entry}}) \\
&\quad + Sz_{\text{ETH}} \times (\text{ETH}_{\text{current}} - \text{ETH}_{\text{entry}}) \\
&\quad + \ldots + \text{TWM}
\end{aligned}$$

Example: For a long position, if the current price > entry price, the position is profitable. For a short position, if the current price ¡ entry price, the position is profitable.

2.6 Health Monitoring Conditions

At all times, the following conditions must hold:

2.6.1 Maintenance Margin Condition and solvency

$$\boxed{\mathrm{BAE} > \mathrm{MMR}} \tag{24}$$

2.7 Liquidation Framework

2.7.1 Partial Liquidation

The Hyperliquid positions are partially reduced when condition (25) is not met but condition below is still satisfied:

$$\mathrm{BAE} \leq \mathrm{MMR} \quad \text{and} \quad C \times \mathrm{LTV}_{\max} + \mathrm{TWE} > L(1 + \mathbf{L}_{sl}) \tag{25}$$

2.7.2 Full Liquidation

The portfolio is fully liquidated when the following condition is reached:

$$\boxed{C \times \mathrm{LTV}_{\max} + \mathrm{TWE} \leq L(1 + \mathbf{L}_{sl})} \tag{26}$$

This ensures the protocol remains solvent by liquidating positions before the loan exceeds the total value of loan collateral plus trading wallet equity.