Cross-Asset Yield Vaults

Decoupling Price Exposure from Yield Generation in DeFi

ABSTRACT

Cross-Asset Yield Vaults (CAYVs) are a novel DeFi financial instrument that decouple the price exposure of a token from its yield stream. This mechanism allows an investor holding one asset to earn yield generated by an entirely different asset, without abandoning their original price exposure. CAYVs operate through matched counterparty staking and unstaking combined with oracle-triggered price settlement to maintain accurate vault balances. This paper describes the motivation, architecture, and roadmap of the CAYV system.

1. PROBLEM

The current DeFi landscape presents a structural mismatch between who holds certain assets and who can productively put those assets to work. Yield-bearing opportunities are often tightly coupled to price exposure: to earn yield from a protocol, a user must first hold that protocol's native token and accept its price risk in full.

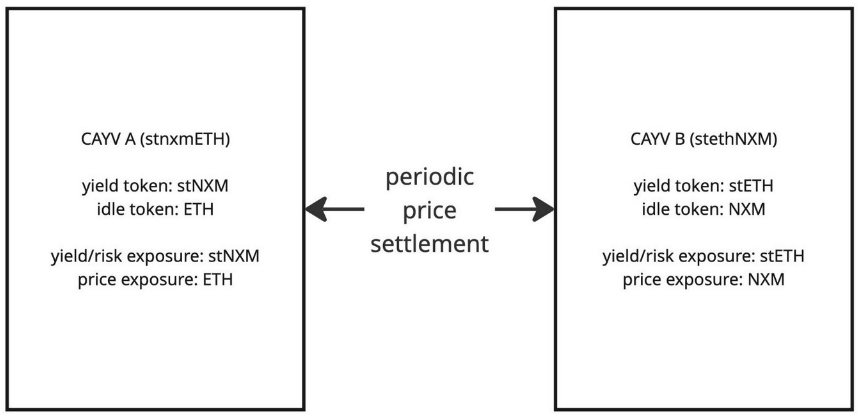
This coupling produces two underserved investor profiles that currently have no clean solution. The first is the conservative token holder who is bullish on a protocol's long-term price appreciation but does not want to expose their position to the volatility of that protocol's yield stream, such as variable underwriting returns that fluctuate with claims activity. The second is the yield seeker: an investor holding a stable or lower-risk asset who wants access to higher-risk, higher-reward yield streams that are ordinarily locked behind price exposure to a volatile token they have no interest in holding.

Protocols that sell future yield streams over a fixed period exist, but they are inherently time-bounded and focus on trading yield directly rather than generating yield using a token the investor wants to hold. There is currently no mechanism for an investor to permanently maintain price exposure to one token while permanently earning yield from an entirely different asset. CAYVs fill this gap.

2. SOLUTION

Cross-Asset Yield Vaults pair two vaults together so that each vault's depositors get price exposure to the other vault's token, while earning yield from their own yield-bearing position. The two vaults are each other's counterparty, with no external collateral, no borrowing, and no liquidations. Any two assets where yield is generated by holding a specific token can be paired this way.

Each vault has a yield token it holds to generate yield, and a price token whose value it tracks. The first part of the vault name is the yield source, the second is the price exposure. stnxmETH holds stNXM for yield and tracks ETH price; stethNXM holds wstETH for yield and tracks NXM price. The two vaults periodically settle with each other to keep price exposure accurate.



HOW IT WORKS

NXM holder depositing into stethNXM. You deposit NXM. The protocol matches it with ETH from the sister vault. The matched ETH is converted to wstETH via Lido and held in the stethNXM vault as the yield-bearing position. Your NXM is staked with Nexus Mutual to receive stNXM, which is sent to the stnxmETH vault. You receive stethNXM vault tokens. Your token value tracks the NXM price: NXM up 50%, your tokens up 50%. ETH price movements don't affect you. Your wstETH earns Lido's yield throughout, accruing directly into your token's value.

ETH holder depositing into stnxmETH. You deposit ETH. The protocol matches it with NXM from the sister vault. The matched NXM is staked with Nexus Mutual to receive stNXM, held in the stnxmETH vault as the yield-bearing position. Your ETH is converted to wstETH via Lido and sent to the stethNXM vault. You receive stnxmETH vault tokens. Your token value tracks the ETH price: ETH up 3x, your tokens up 3x. NXM price movements don't affect you. Your stNXM earns Nexus Mutual's yield throughout.

When a price change occurs, one side grows larger in USD value than the other. When NXM rises, the wstETH staked in stethNXM is now worth less relative to the stNXM staked in stnxmETH. The protocol settles: it sells enough stNXM from stnxmETH and sends the proceeds as NXM into stethNXM's idle buffer. That NXM, now worth more because NXM rose, is what gives stethNXM token holders their NXM price exposure. When ETH rises, the process works in the other direction: stethNXM sells wstETH and sends the proceeds as ETH into stnxmETH's idle buffer, preserving ETH price exposure for stnxmETH holders. After these price adjustments are made, the vaults rebalance back to equal USD value staked so they are correctly positioned to respond to the next price move.

Key properties

Vault token NAV accurately tracks the target price through consistent oracle updates, with less than 0.1% error across all tested scenarios. If a price rises and then falls back to where it started, the vault token value returns to where it started as well, plus any yield earned. Unlike an AMM LP position, there is no impermanent loss from oscillating prices. The rebalancing step is also unconditionally solvent. It can mathematically never require selling more than is available, regardless of the size or speed of a price move.

Each vault earns only its own yield-bearing asset's yield. Yield growth is stripped out before any rebalancing comparison, so rising yields never trigger spurious price settlement. Redemptions are always possible: the equal-staked invariant guarantees that any withdrawal can be sourced symmetrically from both vaults.

Slippage and tracking deviations

The vault's accounting is based on oracle prices, but actual token conversions happen on DEXes at market prices. This creates small potential deviations from theoretical NAV that users should be aware of.

On deposit, your token is deposited to the yield-bearing form (NXM into stNXM, or ETH into wstETH). This itself will never lead to any slippage because it's deposited directly into the protocol.

On redemption, however, the yield-bearing token is swapped back to the underlying (wstETH to ETH, or stNXM to NXM) on a DEX. Slippage on this swap falls entirely on the redeeming depositor. If wstETH or stNXM is trading at a discount to its peg at the time of redemption, you will receive less than the oracle-based NAV implies. The vault does not insure against depeg risk.

During price settlement, cross-vault sells also execute on DEXes. If liquidity in the relevant pools is thin, price settlement trades may execute at a worse rate than the oracle price, causing a small NAV tracking error that resolves on the next oracle update. Deeper liquidity reduces this effect.

3. ARCHITECTURE

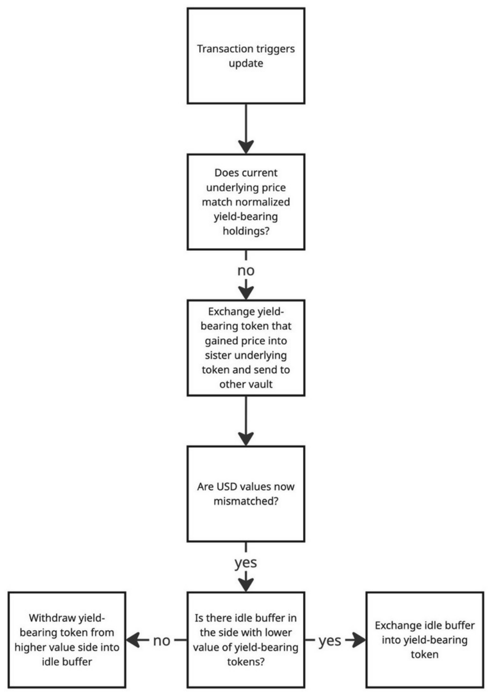
Each vault holds two categories of assets: a staked position that earns yield and backs the cross-vault price exposure, and an idle buffer that holds unmatched deposits awaiting a counterparty. The staked position is the yield-generating, price-tracking core of the vault. The idle buffer is idle capital waiting to be put to work.

The equal-staked invariant

The single rule that governs the system: the USD value staked in stethNXM must equal the USD value staked in stnxmETH. This is the resting state the vaults return to after every rebalancing. When a price change occurs, one side grows larger in USD than the other, and the protocol sells from the larger side to the smaller to correctly transfer the price gain or loss to the right vault. After those adjustments are made, a rebalancing step brings both staked positions back to equal USD, ready for the next price move. This equality is maintained through an atomic four-step routine that runs on every oracle update.

On each oracle update, the oracle strips yield growth out of the comparison so that only genuine price changes trigger selling. Next it settles from whichever side became larger due to price change, sending proceeds to the other vault's idle buffer rather than its staked position. It then rebalances the two staked positions using each vault's own idle buffer, with the larger side unstaking any remainder into its own idle buffer if the smaller side's idle funds are insufficient. Finally it records the current yield factors so the next normalisation starts from the right baseline.

All four steps execute in a single transaction. The vault is never left in a partially-updated state. If price change has passed the threshold to rebalance (likely around 1%), any deposit or redemption will trigger this routine before processing the user's request, ensuring the vault state is always current at the moment funds enter or leave.



WHY PRICE SETTLEMENT PROCEEDS GO TO THE IDLE BUFFER

When stnxmETH settles stNXM during a price change, those proceeds go into stethNXM's idle buffer as NXM, not into stethNXM's staked position. This is intentional and important. If they went into the staked position, the staked amount would grow with NXM price rises, not just with yield. The idle buffer correctly captures the price exposure without inflating the staked position artificially. On a price reversal, stethNXM sells wstETH back to stnxmETH, and that free NXM buffer is what funds the symmetric sell.

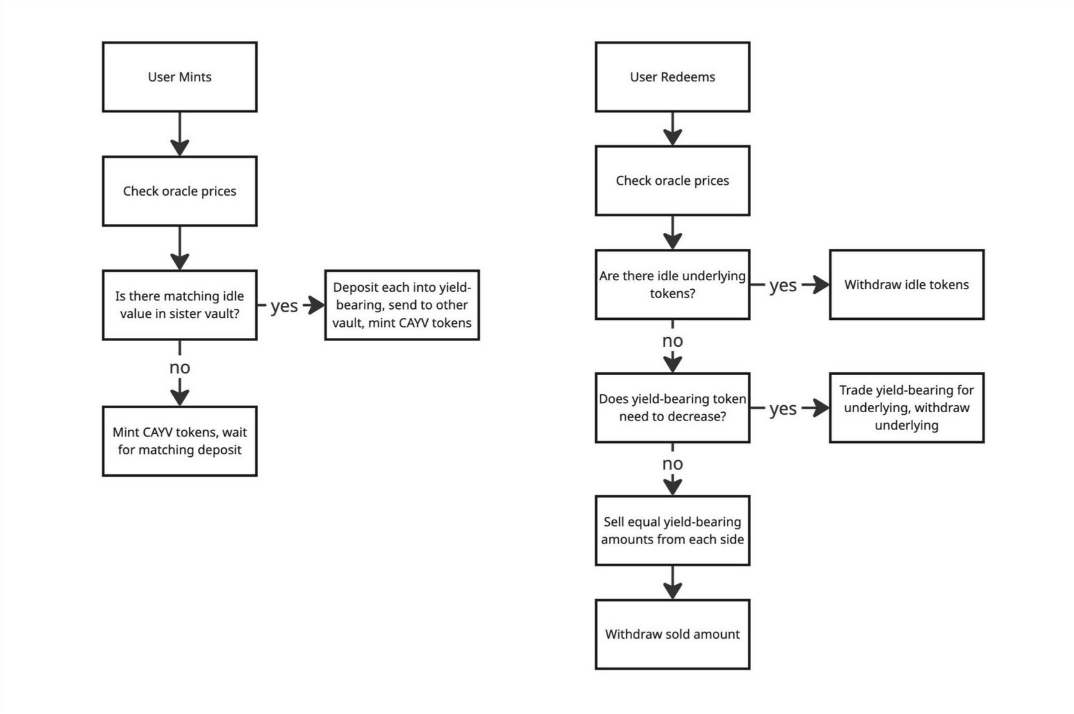
SOLVENCY

Price settlement only ever needs to sell the difference between the two staked positions, but it always has the larger position available to sell from. Since the difference is always smaller than the total, the required sell is always less than what is available, unconditionally, for any price move. The equal-staked invariant is both the mechanism that enables price tracking and the proof of solvency.

Deposits and redemptions

Deposits mint vault tokens at the current NAV after the oracle update routine runs. If the sister vault has idle counterparty funds, both sides are matched and staked immediately. If not, the deposit sits in the idle buffer earning no yield until a counterparty arrives.

Redemptions are sourced in priority order: idle buffer first, then unstaking. When unstaking is required, equal USD amounts are unstaked from both vaults simultaneously to preserve the invariant. The sister vault's unstaked proceeds go to its own idle buffer, and its token holders are unaffected in value.



Risks

Deposits and redemptions involve DEX swaps when converting between underlying and yield-bearing tokens. Slippage on these swaps falls on the individual depositor or redeemer and does not affect other participants. If wstETH or stNXM is trading at a discount to its peg at the time of redemption, proceeds will be below the oracle-based NAV. The vault does not insure against depeg risk.

If one vault has significantly more deposits than the other has counterparties, a large fraction of funds sits idle and earns no yield. Effective yield is proportional to the matched fraction.

4. ROADMAP

The protocol launches focused on a single, well-understood pair: wstETH and stNXM. This lets us validate the core mechanism with real capital before expanding.

Version 1: Nexus Mutual Staking Expansion

Our immediate priority is deepening the utility of NXM staking within Nexus Mutual. The current staking model constrains how NXM can be deployed for yield. We are working directly on expanding the staking capacity and flexibility available to NXM holders, making the stnxmETH vault more attractive and the yield rates more competitive. This is the foundation everything else is built on: without deep, reliable stNXM yield, the cross-asset vault pair has less to offer.

V1 also includes the full stethNXM/stnxmETH vault pair described in this paper, along with the oracle infrastructure, DEX integrations, and frontend for depositing and redeeming.

Version 1 Expansion: Additional Vault Pairs

Once the core mechanism is proven with the wstETH/stNXM pair, we will add additional cross-asset pairs. Any two assets where yield is generated by holding a specific token, and where reliable oracles and sufficient DEX liquidity exist, can be paired. This includes more NXM pairs but also other pairs that may work well together like tokens paired with Staked AAVE or GMX LPs. Each new pair gives users new combinations of yield source and price exposure to choose from.

Version 2: Permissionless Vault Creation

The second major version of the protocol aims to make vault creation permissionless. Rather than the core team deciding which asset pairs to support, anyone will be able to deploy a new vault pair by specifying two yield-bearing assets, an oracle source for each, and the relevant DEX routes (or, more likely, an auction mechanism). This is modelled on how Morpho allows permissionless market creation: the protocol provides the infrastructure and invariant guarantees, and the market decides which pairs are worth creating.

Permissionless vault creation dramatically expands the protocol's scope. Any asset can be paired with any other such asset without requiring governance approval. Not only are yield-bearing assets such as liquid staking tokens, real world assets, and protocol revenue tokens able to be used in this way, but also non-yield-bearing assets. This permissionless version can include the ability to pair a token with a yield source with a token with no possible yield sources and allow them to share yield.

This opens up capital that's currently completely unproductive to be used as collateral within many DeFi protocols that currently may be seen as too risky compared to other options the underlying token has for staking. For example, a large memecoin could be paired with a GMX ETH LP and holders split the yield 50/50. The scenario is then that ETH holders get a near risk-free ~9% yield, and the memecoin holders get ~9% yield on funds that were otherwise sitting around doing nothing.

5. CONCLUSION

Cross-Asset Yield Vaults introduce a new DeFi financial instrument: the ability to earn yield from one asset while holding price exposure to another, without leverage, without borrowing, and without impermanent loss.

The mechanism is simple at its core. Two vaults pair together, each holding their depositors' funds in a yield-bearing asset while their token tracks the other vault's price. A single invariant governs all price adjustments. That invariant is provably solvent across all price scenarios, ensures accurate price tracking, and guarantees that redemptions are always possible.

The first deployment pairs wstETH and stNXM, giving NXM holders NXM price exposure with Lido yield, and ETH holders ETH price exposure with Nexus Mutual's yield. From there, the protocol expands to additional pairs and ultimately to permissionless vault creation, making cross-asset yield exposure available for any two assets.