Supervaults Explainer

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Objective

> 🎯 **Democratizing market making profits to beat the competition on pricing and attract liquidity at scale.**

Our goal(s) are :

1. To offer the tightest spreads (best prices) for on-chain spot markets in a sustainable way.

2. Maximize the supply capacity for non-USDC assets as collateral for lending/borrowing and perpetuals to unlock new trades.

The design of Supervaults allows us to efficiently crowdsource the capital to achieve each of these goals. As a result, they are are a powerful tool to bootstrap markets and rapidly win aggregation volume and increase capacity for lending/borrowing. This in turn should lead to organic fees which sustain the liquidity and enable us to scale the market further to improve depth and allow larger traders to rely on this liquidity.

What are Supervaults?

💡 Supervaults are CosmWasm contracts that leverage the price feeds from Neutron's enshrined oracle, Slinky, and native automation via the CRON module to provide liquidity with tight spreads on the Duality orderbook.

Key Terms

- **Duality**: Neutron's enshrined orderbook, featuring advanced order types designed to enable market makers (whether automated or not) to minimize risks and costs when providing on-chain liquidity. Many of these features are impossible to build outside of an app-specific chain.

- **Slinky**: Neutron's enshrined, high-performance oracle operated by our validator set as part of consensus, guaranteeing up-to-date prices at every block for any asset on CEXs.

- **Cron Module**: A Neutron module enabling guaranteed scheduled smart-contract execution at the start or end of each block.

- **Spread**: The price gap between the highest buy order and the lowest sell order on an orderbook.

  - Smaller spreads indicate better-prices for traders.

- Market makers profit by consistently buying slightly lower and selling slightly higher.

- Too wide a spread loses order flow; too tight risks **adverse selection** (providing liquidity for better informed *arbitrageurs*).

- **Gas Fees:** Cost to perform on-chain computation.

- **Inventory Costs**: The costs of holding volatile and/or low liquidity assets from their risks and opportunity cost.

- **Adverse Selection**: Losses incurred to liquidity providers from arbitragers due to outdated or inaccurate pricing that arbitrageurs take advantage of.

- **Market Makers ("MM"):** Actors that provide liquidity by constantly offering to buy or sell, ensuring traders always have counterparties. They aim to maximize profits and minimize cost. Minimizing these costs enables market makers to provide tighter spreads, attract more order flow, and sustain long-term profitability.

$$\text{costs of market making} = \text{gas fees} + \text{inventory costs} + \text{adverse selection}$$

$$\text{profit of market making} = \text{revenue} - \text{costs}$$

AMMs in Context

Traditional market-making is challenging on-chain due to latency, financial incentives for censoring orders/cancels, and high costs (inventory, gas, and opportunity costs). To address this, **automated market makers (AMMs)** use simple, static algorithms to provide liquidity, relying on arbitrage to align prices with external markets.

Traditional AMMs lack external price feeds (i.e., CEX prices), causing them to rely on off-chain arbitrageurs to inform them about the true price of an asset. As a result they leak immense value to arbitrageurs who make money by taking these price setting trades at the expense of the liquidity providers. Neutron, however, offers several advantages that can be used to mitigate the costs to liquidity providers and the accuracy of prices :

- **Cron Module**: Enables reliably automated strategies without expensive and unreliable keeper systems.

- **Customizable Fee Markets**: Enables certain strategies to be made increasingly cost-effective.

- **Slinky Module**: Provides high-frequency, censorship-resistant price feeds which enable AMM strategies to stay up-to-date with CEX prices without needing to leak value to arbitrageurs.

- **Customizable Transaction Ordering:** Begin and end block execution can enable high-value, order-sensitive transactions to avoid front and back-running.
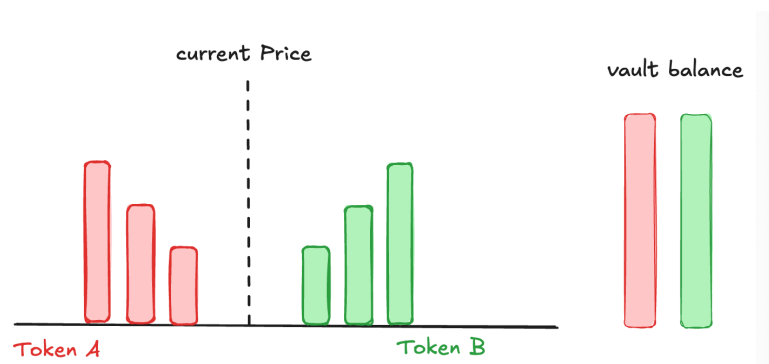
# System Design

Market Making

> 💡 We are simplifying here for the sake of clarity.

At the beginning of each block the vaults create a single transaction that does the following:

1. The vault notes its internal token balances. Here it has equal amount of token A and token B.

2. It then gets the current token prices using Slinky.

3. The vault provides part of its liquidity at a tight spread around the current Slinky price.
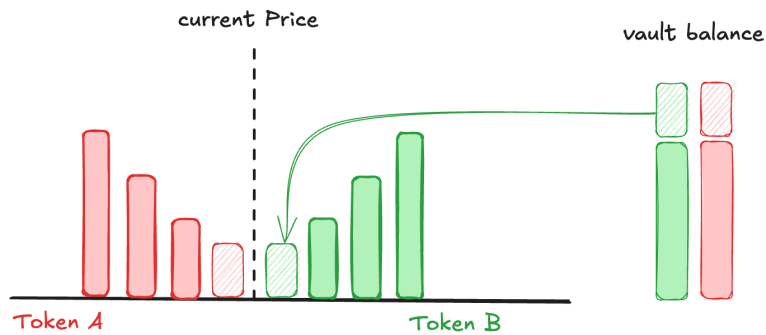
4. The vault provides the remainder of its liquidity (e.g. the Reserve Liquidity) at a larger spread around the slinky price.
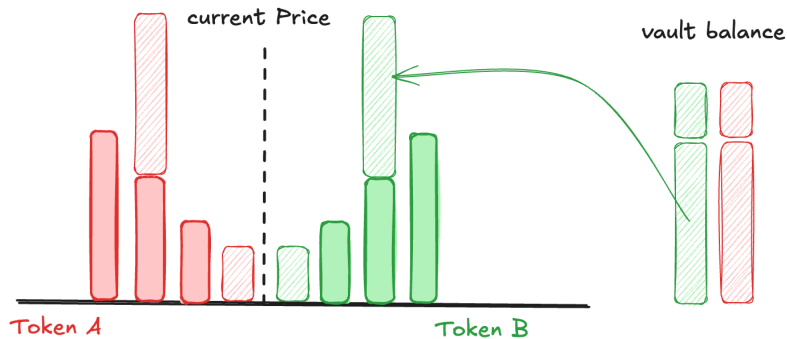
Reserve Liquidity

In traditional market making strategies, the Reserve Liquidity would just remain untradable at any given block, but Supervaults instead provide it at a significantly larger spread (~ +-5% depth) in order to bootstrap **supply capacity** on lending/borrowing protocols.

Mars' risk methodology for setting the amount of a non-USDC asset that can be used as collateral is to look at how much of that asset can be atomically (in a single, synchronous transaction) traded into USDC. Since the Mars liquidation

bounty is 5% on top of the debt's value, they specifically look at the -5% depth from the spot price of the asset.

By providing the reserve liquidity just above -5% depth, Mars is able to offer 20x higher caps for the same amount of capital compared to XYK pools. There are also significant (although smaller) gains compared to concentrated liquidity and other types of market making.

This also enhances liquidity providers profitability as in the event of a large liquidation, they are buying the asset at a ~5% discount (netting them 5% APY in a single trade in expectation).

At the end of each block, the vaults will withdraw all their provided liquidity and re-provide it at the new slinky price, slightly modifying the spread each time.

Rebalancing

Under certain market conditions or if demand for one asset exceeds the other, the vault can become unbalanced, where there is much more of one token compared to the other.
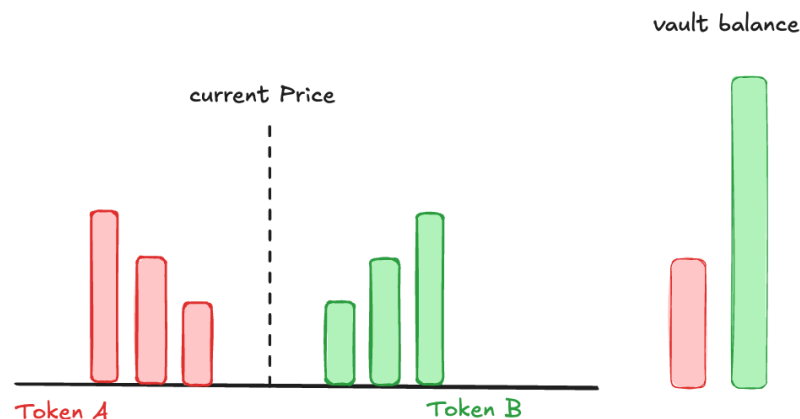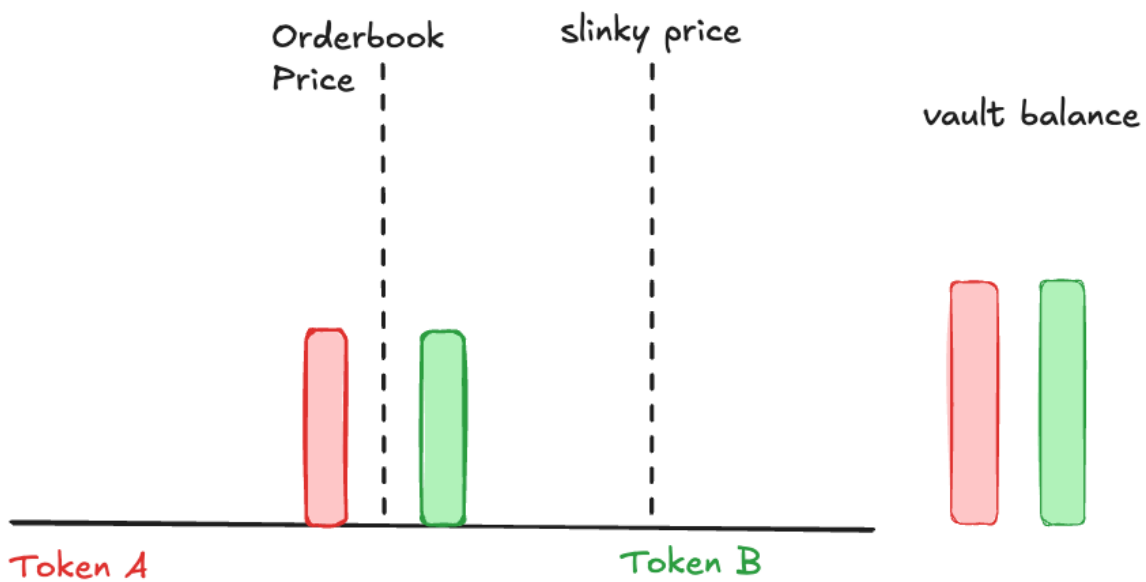

in order to rebalance, we offer more of the oversupplied token at the tightest spread.
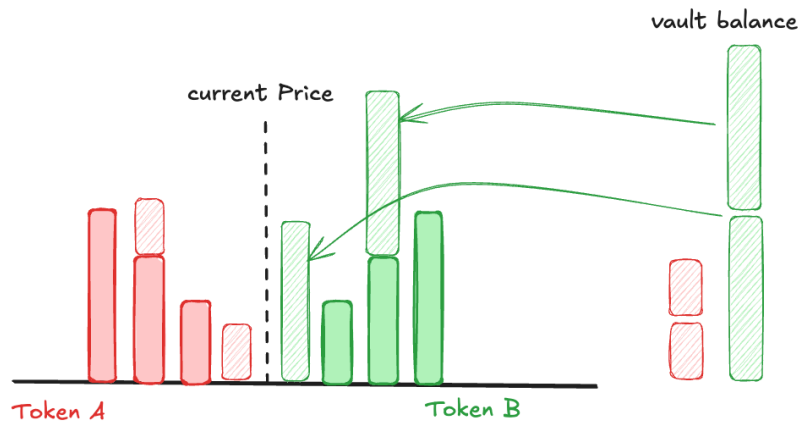
This increases the supply of the oversupplied asset and over time brings the vault back to parity.

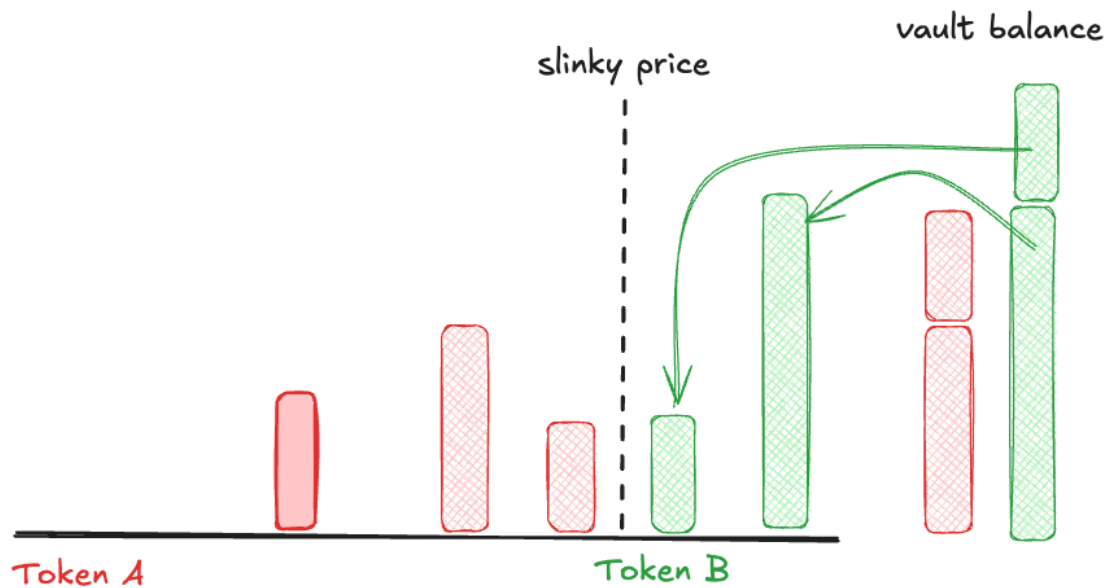## Capturing Arbitrage

When the spot price of the orderbook diverges from the slinky price, there is an arbitrage opportunity to be captured:

In this case, the vault can buy token B at a price lower that it's belief price. So before providing liquidity, it will purchase this misplaced liquidity using it's token A reserve.
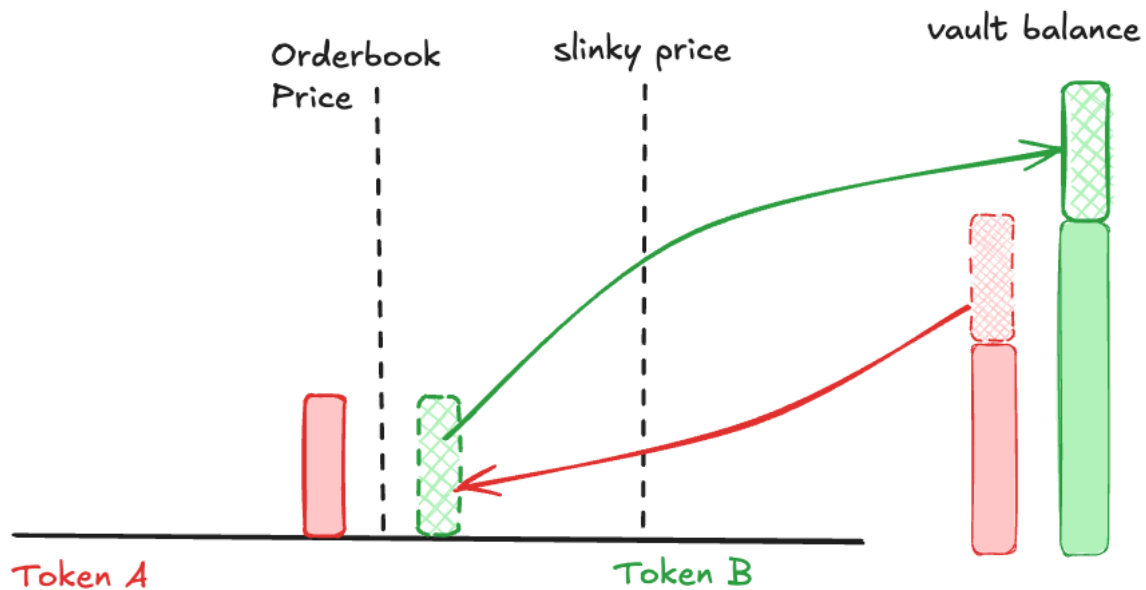
After the mispriced liquidity is cleared, the deposit sequence continues.

Given this all occurs at the beginning of the block, the vaults will have **priority** in capturing this arbitrage.

Advantages over alternatives

Compared to AMMs

These vaults have a number of advantages over traditional AMMs:

1. They leverages 100% of the liquidity all the time, contrary to most AMMs where a large portion of the liquidity is too far from the mid price to be useful.

2. They do not require depositors to actively manage positions / ranges since the vault itself updates the liquidity's distribution at every block based on the freshest prices from the oracle.

3. Because the vault always market makes at the latest CEX prices, it does not offer stale prices nor rely on arbitragers to bring the price back to parity. As a result, the vault does not leak value to arbitragers and impermanent loss is thoroughly minimized for LPs.

4. Because the vault is trading on the same orderbook as other AMMs and limit orders, it captures arbitrage profits on behalf of it's liquidity providers (~"vault-owned-MEV").

5. They're tailor built to maximize lending/borrowing and perpetual supply capacity on Neutron with the -5% depth reserve deposits.

Compared to traditional Market Makers

These vaults also have several meaningful advantages over traditional market makers:

1. No gas cost to run since CRON Module computation is exempt from gas

2. Minimal adverse selection as liquidity is updated immediately every block at the most recent CEX price, effectively shrinking adverse selection risk.

3. Open vaults do not rely entirely on B2B deals to source capital. Anybody can deposit and get access to these highly performant market making strategies,

which is reinforced if incentives are distributed to the vaults via Liquidity Mining or Restaking.

Risks & Mitigations

Category	Description	Mitigations
Smart-contracts	Faulty code may result in: - UX degradation - Stuck funds - Loss of funds (exploit/hack)	- Best development practices - Audits - Bridge rate limits - Governance/Social consensus enforced contract migration to a patched version
Oracle	Failure to update prices, or erroneous data may result in: - Performance degradation - APR degradation	- Prices are sourced and aggregated across numerous CEXes/Providers - Prices are aggregated across all validators
Platform	Liveness failure may result in: - UX degradation - Performance degradation	- Best development practices - Audits - Social coordination for restart / upgrade

Supervaults in Strategic Context

Duality combines liquidity from Supervaults, AMMs & MMs.

Supervaults provide liquidity to Duality, Neutron's enshrined orderbook, which is open for anyone on the network to participate in (regardless of whether they are a traditional market maker, AMM or individual trader).

This means that Supervault liquidity is being compiled onto the same orderbook as Astroport's PCL liquidity and other MM strategies to enable the orderbook to offer both tighter spreads, higher depth and to internalize the profits from arbitrage.

Supervaults internalize Profits from Arbitrage

Because both Supervaults and other integrated AMMs (Astroport PCL, Margined Vaults, professional MMs, and possibly Astrovault, etc) market make on the same orderbook, Supervaults are actually arbitraging other sources of liquidity when they offer worst prices than the latest CEX prices. To illustrate:

Without Duality and Supervaults

AMM Pools from Astroport and Astrovault are fragmented, and they rely on sophisticated third-parties to update their prices through CEX/DEX arbitrage and need to pay costs for various integrations that drive volume (e.g., bootstrapping aggregator availability, arbitrageur activity, liquidation routing, front-end integrations and more). As a result, they leak value to these third-parties continuously, either in the form of integration costs or losing trades, and that value exits the ecosystem.

With Duality and Supervaults

All AMM Pools on the network, including Supervaults, Astroport and other AMMs, are compiled onto the same orderbook. This allows every market making strategy to benefit from volume that comes from various integrations without individually paying the costs for them.

And because Supervaults market make at CEX prices at every block, the vaults trade against the other pools' mispriced liquidity, therefore conducting CEX/DEX arbitrage automatically and internalizing the profits.

As a result, all AMMs benefit from increased volume and fees

- **Traditional AMM pools from Astroport and other AMMs no longer rely on 3rd party arbitragers to provide fresh prices.**

- **All AMMs benefit from increased volume, which generates fees for all LPs.**

- **Supervaults capture arbitrage profits, which are compounded back onto the orderbook instead of leaving the ecosystem.**

- **Less value is leaked from integration costs.**