

# DeltaFi – Whitepaper

DeltaFi Labs

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# 1 Introduction

With the advent of cryptocurrency and blockchain-based platforms, the global financial landscape is experiencing change at an unprecedented rate, with daily breakthrough innovations. As a result, interest is shifting from traditional centralized financial products to ones that offer more control and flexibility without relying on intermediaries to dictate the rules imposed by such centralized exchanges.

DeltaFi is pushing this space forward with our novel design and technologies, ushering in a new era of decentralized exchanges. We are building the world's most efficient automated market maker (AMM) on Solana and innovating the space with intelligent AMM design.

## 1.1 Decentralized Exchanges

To build a well-designed AMM, we first explore the mainstream decentralized exchange designs and their shortcomings: AMM and Order Book.

Current AMMs are mainly forks of the Constant Product Curve pioneered by Uniswap V2 and stableswap by Curve Finance. The Constant Product Curve builds inefficient markets and suffers from divergent loss, price slippage, and capital efficiency issues. To mitigate these problems, stableswap supports swaps between stable coins but does not offer such functionalities between any tokens. Professional market makers cannot participate in either Uniswap V2 or stableswap.

Uniswap V3 offers a concentrated liquidity design in which professional market makers do not get the flexibility needed for efficient market making. In particular, market makers can only adjust the price ranges without differentiating order directions. Important trade information such as order imbalance signals is missing as well.

Order Book decentralized exchanges like Serum provide optimal user experience to traders and professional market makers. However, unlike AMMs, Order Book design does not offer liquidity provision functionality, a critical feature for yield farming.

## 1.2 Intelligent Market Making

Our vision is to provide the optimal user experience for traders, liquidity providers, and market makers. Four essential design and technology innovations make it possible:

- Intelligent market making
- Bounded liquidity risk
- Personalized pools
- Cross-chain functionality

## 1.3 Building on Solana

Solana is the ideal chain to build an intelligent AMM. In addition to Solana's lightning speed, their community is thriving, with new project developments occurring daily. Furthermore,

DeltaFi notably leverages innovations with institution-grade reliability such as real-time oracle prices and cross-chain bridges.

We build on Solana with the belief that DeltaFi will become the liquidity hub in the multi-chain world.

## 2 AMM Trilemma

As an innovative AMM, the Constant Product Bond Curve overhauled the space and achieved exponential growth. Regardless of trade size and direction, token prices are determined by the **Constant Product Formula**. Liquidity providers deposit tokens to the pools and facilitate the trades. Thus, resolving the liquidity issues puzzling existing decentralized exchanges like 0x. However, it is at the cost of a worse user experience for traders, liquidity providers, and market makers:

- **Price Slippage.** Traders suffer from price slippage, for large trade orders in particular due to the mechanical nature of the Constant Product Curve. To reduce price slippage, a considerable amount of token capital is required to be deposited into the pool, leading to low capital efficiency.
- **Divergent Loss.** Liquidity providers lose their deposited capital in the long run for the inefficient pricing. In a crypto market with volatile asset prices, the prices governed by the Constant Product Curve can be very different from the asset prices in centralized exchanges such as Coinbase. Arbitrage leads to liquidity loss.
- **Inefficient Market.** Professional market makers cannot leverage their in-house market-making solutions to promote an efficient market. Compared with professional market makers' solutions, the Constant Product Curve is a dummy solution that quantitative traders and hackers can easily exploit.

While other projects built on Solana like Orca and Raydium have successfully launched and gained traction, they are still merely a Uniswap V2-type solution falling short of solving the issues mentioned above.

DeltaFi's focus is not building a replica of existing solutions but sets forth a mission to redefine what is possible. On current iterations of the design and implementations, optimal user experiences are attained for traders, liquidity providers, and market makers. Multiple new technologies and innovations support such a breakthrough in user experience, indicating a new era of AMM-based decentralized exchange.

## 3 Intelligent AMM

To build an efficient AMM market, we've broken out the solution space into three segments:

- **External market:** It refers to the price and market situation in both centralized and decentralized exchanges.
- **Internal market:** It models trade information within the DeltaFi exchange.

- **AMM algorithm:** It is the mechanism governing the price with internal and external markets as inputs.

Let's go deeper.

Market prices on other crypto exchanges capture **external market** signals. Fortunately, Pyth Network builds real-time oracle prices on-chain with institution-grade market data. DeltaFi's intelligent AMM leverages such real-time oracle prices to close the price gap with other crypto exchanges. This can effectively minimize the divergent loss to liquidity providers. In addition, the time-weighted average price is implemented on-chain as a safeguard, especially when the real-time oracle fails with too big a price movement and data anomalies.

The **internal market** includes history token prices, order information, and trade directions. Our first implementation reflects such market information with momentum, pool position changes, and time-weighted average price signals. For example, if the pool position significantly deviates from the initial position, it reflects non-negligible divergent loss. In addition, order sizes and directions are critical signals to the AMM algorithm because they may reflect the trade direction imbalances for intelligent market making.

As a result, our proposed AMM algorithm is structured as:

$$p = o \cdot m$$

Where  $p$  is the token price determined by our intelligent AMM,  $o$  is the intelligent oracle, and  $m$  is the multiplier learned by our machine-learning-powered AMM algorithm.

The intelligent oracle is built on an internal time-weighted average price and Pyth Network price, while our intelligent AMM algorithm calculates the market multiplier. Thus, it is a combination of an internal oracle and an external oracle. The internal oracle, a time-weighted average price of history trade price data, is more stable and reliable than external oracle prices. On the other hand, the external oracle prices reflect external market situations, including data sources from multiple world-class institutions.

Our intelligent AMM decides the market multiplier by leveraging historical data and becomes more and more complex with our machine-learning algorithms. Furthermore, our design implements an anomaly detection module to avoid control by external oracle prices, especially in cases of failures. Such a design leverages external oracles for external market modeling and keeps the AMM algorithm self-controlled and fully automated.

The pricing curve is bidirectional. That is, buy and sell orders have different prices. Here are several examples to illustrate its role in pricing:

**Example 1: Divergent Loss** – Divergent loss occurs when the executed token position and the initial token position in the liquidity pool deviates. DeltaFi's algorithm would rectify the impermanent loss with corresponding price adjustments.

**Example 2: Price Prediction** – Order information in the past several minutes is not imbalanced. Such signals, together with price trends, can serve as directional information for the price movements. The model is trained with large volume data from both CEX and DEX.

**Example 3: Frontrunning** – When exposing more design details, such protocol design information can be exploited by hackers and quantitative traders to affect the price substantially. Our AMM algorithm intelligently designs mechanisms to protect against such attacks.

## 4 Bounded Liquidity Risk

The crypto market is highly volatile, leading to massive capital risk to liquidity providers. With our intelligent AMM algorithm, we significantly mitigate such risks. In addition, liquidity providers can specify their risk tolerance levels when depositing using our bounded liquidity risk solution. This design further protects liquidity providers with a Volatility Index that uses internal market price to classify the market volatility into **low**, **medium**, and **high-risk** categories.

- **Low Risk:** Normal price fluctuations with low volatility
- **Medium Risk:** Price fluctuations and volatility higher than normal
- **High Risk:** Extreme situations such as a market flash crash

Liquidity providers with high-risk tolerances are rewarded with higher transaction fee rates when the market is volatile. There are two sources for the Volatility Index: a) Pyth Network will build volatility oracle data, and b) on-chain implementation based on DeltaFi's internal exchange prices. Example implementations include but are not limited to relative token price changes between the two tokens in the pool, implied volatility, and so on. We will publish a more detailed design on the Volatility Index in the future.

With such a design, the risk of liquidity provision is bounded automatically without the requirements of expert knowledge in trading and crypto.

## 5 Personalized Pools

The use of in-house algorithms of professional market makers is the key to building a more efficient market. Personalized pools are a product for such purposes.

Uniswap V3's concentrated liquidity design is not friendly to market makers due to the lack of flexibility because one can only control the price range of market-making. There is no option to set different prices for different directions, and the dynamic fees are rigid.

Order book like solutions (e.g., Serum) are friendly to market makers. However, liquidity providers cannot deposit tokens and earn yields without market-making expertise.

DeltaFi provides a malleable market-making API to professional market makers exposing the order information, allowing bidirectional trade pricing, customizable dynamic fees, and order

history data. In turn, liquidity providers leverage these market makers' algorithms to deposit and earn more than ever before.

Technical design recap on the flexibility provided to market makers:

- **Bidirectional pricing:** Market makers can specify different prices for buy and sell orders
- **Dynamic fees:** For different pools, market makers can customize the fee collected. This is especially useful for longtail asset pairs that can be difficult to profit from with standard fee rates.
- **Order information:** API is provided for market makers to log order information such as trade amount, price, and direction.

## 6 Cross-Chain

We believe that Solana will become the liquidity hub in a multi-chain world. Therefore, we are building a cross-chain exchange on Solana with the Wormhole. The assets are bridged between Solana and other mainstream chains like Ethereum, BSC, Terra, etc.

## 7 DAO Governance

Centralized entities behind the scene control current AMMs. We build a DAO contract for community members to vote for liquidity mining rates for different pools, trade farming rates, developer funds, and beyond.

Liquidity Mining DAO

- Liquidity reward allocation to pools

Trade Farming DAO

- Trading reward allocation to pools

Developer Fund DAO

- To this end, a developer fund is set up to incentivize the community to build DeFi products such as fixed income, yield optimizer, market-making libraries, binary options, and interest rate swaps.

## 8 The DeFi Innovation Infrastructure

As the DeFi innovation infrastructure on Solana, DeltaFi will build a thriving developer community to enable developers to freely and easily build on top of DeltaFi.

For illustration, fixed income products can be built on top of DeltaFi yield farming pools. Such products are very attractive to liquidity providers who are seeking fixed earning rates. In

addition, developers can also build advanced financial products such as interest rate swaps, binary options, and yield farming optimizers on top of DeltaFi.

## 9 Roadmap

Here is a peek at our roadmap:

Milestone	Deliverables	Estimated Timeline
<b>DeltaFi v1</b>	<ul style="list-style-type: none"><li>• Intelligent AMM</li><li>• Bounded Liquidity Risk</li><li>• Cross-Chain Functionality</li></ul>	Q4, 2021
<b>DeltaFi v2</b>	<ul style="list-style-type: none"><li>• Personalized Pools</li><li>• DAO Governance</li></ul>	Q1, 2022

## 10 Summary

With intelligent AMM, personalized pools, and cross-chain functionality, we build the optimal user experiences:

- **Traders:** DeltaFi offers low-price slippage to traders.
- **Liquidity Providers:** On-chain intelligent AMM and personalized pools enable long-term profitability of liquidity providers without token rewards.
- **Market Makers.** Flexible APIs are provided to professional market makers to build an efficient DeltaFi market.

DAO governs DeltaFi for liquidity mining, trade mining, developer fund, and beyond.