Objective and Description of Project

In this project, we aim to contribute to the decentralized finance (DeFi) ecosystem by minting a new ERC20 token and deploying a stable swap Automated Market Maker (AMM). Our objective is to create a robust and efficient mechanism that facilitates stablecoin liquidity while minimizing volatility risks and enabling frictionless token exchange.

The importance of AMMs in DeFi cannot be overstated. As a foundational element of decentralized exchanges (DEXs), AMMs replace traditional order books with algorithmic pricing models, allowing for continuous liquidity provision without centralized intermediaries. AMMs democratize access to trading and liquidity, facilitating decentralized, permissionless transactions and helping to establish trustless environments where users retain control of their assets.

We chose to implement a stable swap AMM because it better addresses the needs of stablecoin liquidity providers. Unlike CFMMs, stable swap AMMs are structured to reduce slippage and improve capital efficiency by narrowing the trading range around a target value. Traditional CFMMs, while effective in general-purpose scenarios, introduce substantial impermanent loss and slippage for assets expected to maintain a stable price ratio, as seen with many stablecoins. According to the paper "*StableSwap – Efficient Mechanism for Stablecoin Liquidity*" (Angeris et al., 2020), stable swap AMMs enable tighter pricing and reduced capital requirements, as the bonding curves used are optimized for low-volatility asset pairs.

Evaluation Criteria for AMMs

A primary consideration in AMM evaluation is capital efficiency, as capital usage impacts both liquidity provider returns and user experience in terms of slippage and price stability. For stable swap AMMs, the bonding curve design must ensure low slippage, especially during large trades, to maintain user trust in consistent pricing. Another criterion is impermanent loss, a potential risk for liquidity providers when the market value of assets in the pool diverges. In a stable swap AMM, the risk of impermanent loss is mitigated due to the low volatility of stablecoin pairs.

Arbitrage plays a vital role in aligning the AMM's internal pricing with the broader market. However, an ideal AMM should minimize the arbitrage space — the pricing gap that incentivizes arbitrageurs to trade. A well-optimized stable swap AMM should naturally attract liquidity and trading activity while limiting excessive arbitrage opportunities. A minimized arbitrage space can enhance the AMM's efficiency by maintaining tighter price alignment with external markets, ultimately benefiting liquidity providers and users.

Expectations and Project Impact

Through this project, we aim to demonstrate a deeper understanding of AMM mechanics and improve upon existing designs for stablecoin liquidity. We expect the stable swap AMM implementation to illustrate superior capital efficiency and reduced slippage compared to conventional AMMs. Additionally, we anticipate this project to showcase effective strategies for achieving a balanced and functional ecosystem within DeFi.

Stable Swap AMM

The Stable Swap AMM uses a custom invariant equation:

$$An^n \sum x_i + D = ADn^n + \frac{D^{n+1}}{n^n \prod x_i}.$$

Here:

A is the amplification parameter, which controls the curvature of the invariant and directly impacts slippage.The amplification factor allows liquidity to concentrate around the equilibrium price, enabling larger trades without exhausting liquidity. This concentration provides higher effective liquidity for smaller price ranges, ideal for stable pairs.

A larger *A* value causes the AMM's curve to become flatter around the target exchange rate (1:1 for stable assets like stablecoins). This results in lower slippage and a smaller price impact for trades near the target price, making it ideal for assets expected to maintain a stable or pegged ratio, as it mimics a constant-sum curve near the equilibrium. However, a very high *A* value can reduce the AMM's ability to handle larger price deviations, potentially resulting in less flexibility if the peg is broken.

In summary, a larger *A* value is better for stable assets where minimal price impact and low slippage are desired, while a smaller *A* value suits more volatile assets by offering flexibility at the expense of higher slippage near the equilibrium. In stable swap AMMs, a higher *A* is typically preferred.

n represents the number of assets in the pool (e.g., BTC and ETH).

$\sum xi$ is the sum of the values of each asset in the pool, while $\prod xi$ represents their product.

This invariant is crafted to minimize slippage for stable asset pairs, allowing the pool to stay closer to a 1:1 ratio. By applying amplification, the AMM can handle larger trades without significant price deviations. This design is particularly useful for assets with similar values, like stablecoins or tokenized assets with close prices (e.g., BTC/USDT, ETH/USDC).

Benefits of Choosing ERC20 for Our Project

ERC20 tokens offer significant advantages for our stable swap AMM project due to their fungibility, broad DeFi integration, and compatibility with liquidity pools. Being fungible, each ERC20 token unit is identical, allowing for seamless, interchangeable trading, which is essential for an AMM where assets need to be easily swapped. Additionally, the ERC20 standard's wide acceptance across DeFi protocols, wallets, and tools maximizes interoperability, enabling smooth integration with other DeFi platforms and enhancing our token's utility. This compatibility extends to liquidity pools, where the uniformity of ERC20 tokens facilitates efficient liquidity provision and enables fractional contributions, enhancing pool stability and reducing slippage. These characteristics make ERC20 tokens an ideal choice for achieving our project's goals of liquidity, ease of use, and scalability.

References

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