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Liquidity Provision Strategies on DEXs

Ocean Data Challenge

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Introduction

Decentralized exchanges (DEXs) have become increasingly popular in the cryptocurrency ecosystem due to their unique features such as trustlessness, transparency, and permissionless access. With the rapid growth of decentralized finance (DeFi) applications, the role of DEXs has become even more significant as they provide a crucial infrastructure for users to access and trade various cryptocurrencies without relying on centralized intermediaries. However, the performance of DEXs depends heavily on the liquidity provision strategies employed, which can affect the trading volume, price volatility, and liquidity depth of the market.

In this technical report, we will focus our analysis on automated market makers AMMs, specifically Uniswap with UniswapV2 and UniswapV3. We will analyze performance over time and investigate how AMM mechanisms have impacted metrics, such as trading volume, price volatility, and liquidity depth. In addition, an analysis of the impacts of the transition from Uniswap V2 to UniswapV3 will be carried out at the level of the metrics but also through the new liquidity provision technique used in UniswapV3.

For our analysis of Uniswap V2 and V3, we focused on two trading pairs - USD-C/WETH (a volatile pair) and USDC/USDT (a stable pair) - and for UniswapV3, we specifically selected the pool with 0.3% fees.

As a Data Scientist who is not in the field of Defi and is just starting out, some of the interpretations made with the extracted and worked data should be taken with caution.

Data Collection and Processing

Data source and API

To collect the necessary data for our analysis, various public blockchain explorers, APIs, and DeFi data aggregators were used. Specifically, I was able to obtain DEXs data using Spice.xyz, a high-performance web3 data provider and platform for applications, machine learning (ML), and data science. Spice made it easy to query blockchain data using SQL and obtain the results in JSON format for easy use with apps and libraries like NumPy and Pandas. In addition, Etherscan API to convert block numbers to block timestamps to facilitate our analysis has been used. This allowed to easily and accurately retrieve the relevant data for our analysis without having to build and operate archive a big data infrastructure.

Type of Data

In order to conduct our analysis on the performance of Uniswap V2 and V3, we collected data on various events such as mints, burns, swaps, and pool statistics. Mints and burns events correspond to the creation and destruction of liquidity pool shares, respectively, and provide insights into the overall liquidity provision on the platform. Swaps events represent the trades that occur between different cryptocurrencies on the platform and allow us to analyze the trading volume and price volatility of the market. Pool statistics, such as liquidity depth, reserve balances, and fees earned,

give us a deeper understanding of how the platform's liquidity provision mechanisms are affecting market dynamics. By analyzing these events and statistics, we can better understand how the different AMM mechanisms employed by Uniswap V2 and V3 have impacted the trading volume, price volatility, and liquidity depth of the market, and how the transition from V2 to V3 has affected these metrics.

Global Analysis

UniswapV2

In Uniswap, liquidity provision strategy is a critical aspect of the decentralized finance (DeFi) ecosystem. The liquidity of a Uniswap pool is determined by various pool statistics, including the reserve and total value locked (TVL).

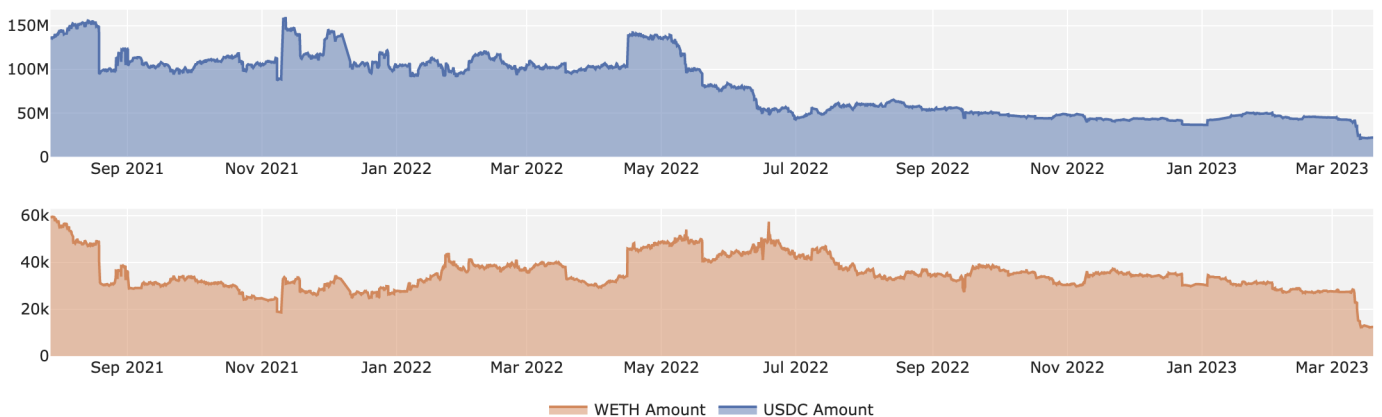
The reserve refers to the amount of tokens held in a Uniswap pool. This statistic can help determine the overall liquidity of the pool. A higher reserve generally means a more liquid pool, which can attract more trading volume and higher trading fees for liquidity providers. Total value locked (TVL) is the product of the reserve and the current price of each token in the pool, representing the total dollar value of tokens held in the pool. TVL is important because it can help assess the attractiveness of a pool to traders and liquidity providers.

Pool Statistics for USDC/WETH pool

Corellations:

- TVL & WETH/USDC Price: 0.85
- USDC Reserve & WETH/USDC Price: 0.85
- WETH Reserve & WETH/USDC Price: -0.24

Pool Tokens



When the TVL of a pool decreases (as we can see on the graph Pool TVL (\$)), it could indicate a drop in the value of the tokens in the pool or liquidity providers withdrawing their funds. This can result in wider bid-ask spreads and greater price

Pool TVL (\$)



volatility, making it more challenging for traders to execute trades at favorable prices. Additionally, if the TVL of a pool drops below a certain threshold, the pool may become less attractive to traders and liquidity providers, leading to a spiral of decreasing liquidity.

Trading Volume & Fees

The scatter plot shows dense clusters of transactions at approximately \$1200, \$1500, and \$3000. This suggests that traders are more active and willing to trade at these price points, perhaps due to favorable market conditions or liquidity levels. These clusters may also indicate support and resistance levels, where traders are more likely to buy or sell tokens in the USDC/WETH pool. Understanding these clusters can inform trading strategies, such as buying or selling at certain price points to take advantage of market trends.

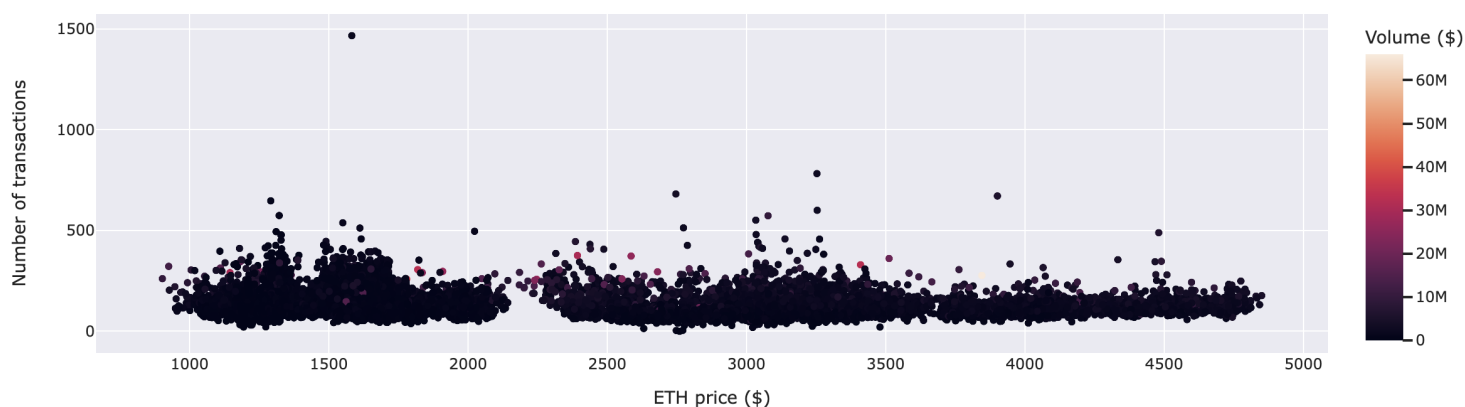
No Transactions around \$2100: The scatter plot also shows a complete absence of transactions at the \$2100 price point. This could indicate a lack of liquidity in the USDC/WETH pool at this price point, making it difficult or impossible for traders to execute trades at this price. Alternatively, it could suggest that traders are avoiding trading at this price due to market conditions or other factors. Understanding this absence of transactions can inform investment decisions, such as adjusting liquidity provision strategies or waiting for market conditions to change before executing trades.

USDC/USDT Pair:

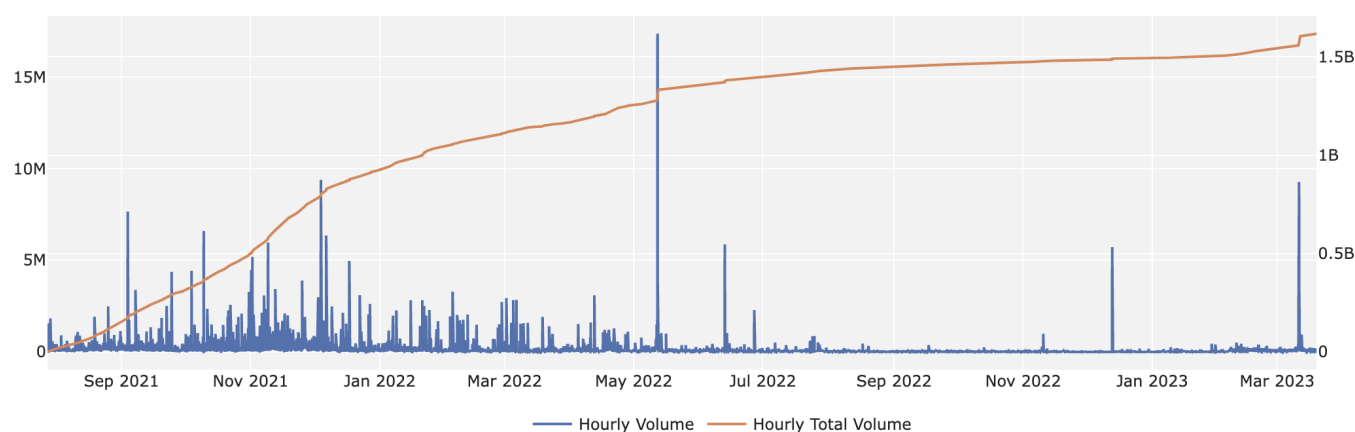
The plot shows a sharp drop in transaction volume for the USDC/USDT pair in UniswapV2 after the launch of UniswapV3. This drop indicates a migration of liquidity from UniswapV2 to UniswapV3 for this pair. The plot also shows a decline in cumulative volume and generated fees in dollars for the USDC/USDT pair since the launch of UniswapV3, suggesting a reduced liquidity and trading activity for this pair in UniswapV2.

Pool yield provides an indication of the profitability of providing liquidity to a particular pool. A higher pool yield means that LPs can earn more fees for providing liquidity to the pool, relative to the amount of value locked in the pool. On the other hand, a lower pool yield means that LPs can earn fewer fees for providing liquidity, relative to the amount of value locked in the pool.

Number of transactions according to the price of the USDC/WETH pair



Volume and Cumulative Volume of the USDC/USDT UniswapV2 pool (\$)

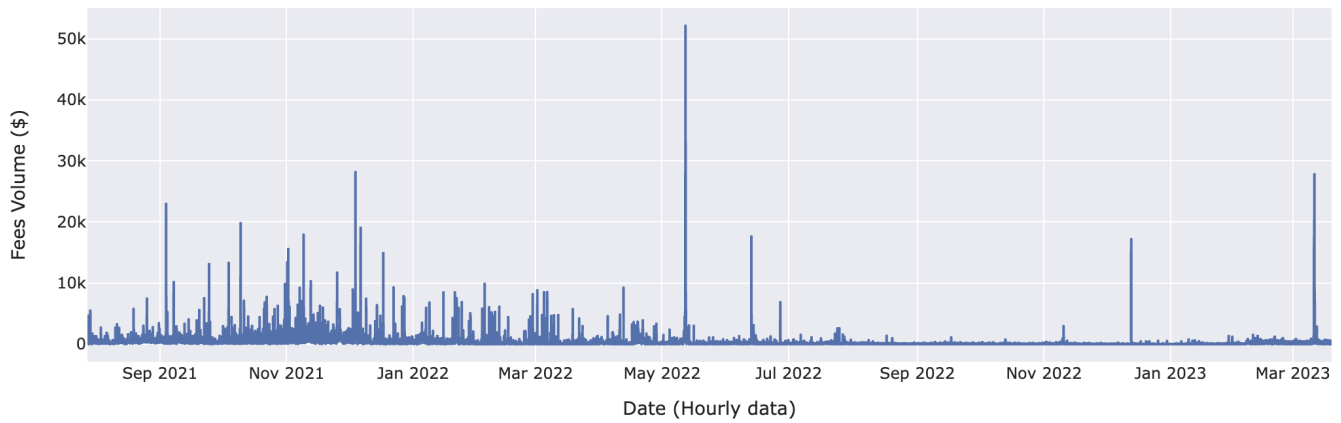


With the depeg of USDC a week ago, we can see that profitability has never been so high.

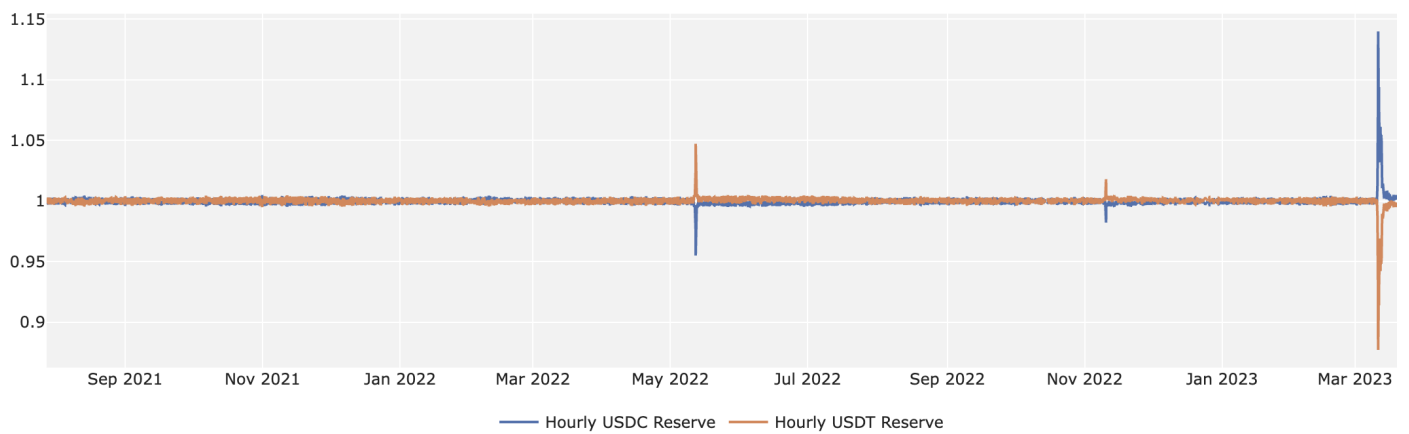
USDC/WETH Pair:

In contrast to the USDC/USDT pair, the plot shows a relatively stable transaction volume for the USDC/WETH pair in UniswapV2 since the launch of UniswapV3. The plot indicates that the launch of UniswapV3 has not had a significant impact on the liquidity and trading activity of this pair in UniswapV2. The plot also shows a steady increase in cumulative volume and generated fees in dollars for the USDC/WETH pair in UniswapV2 over time, suggesting continued demand and liquidity for this pair in UniswapV2.

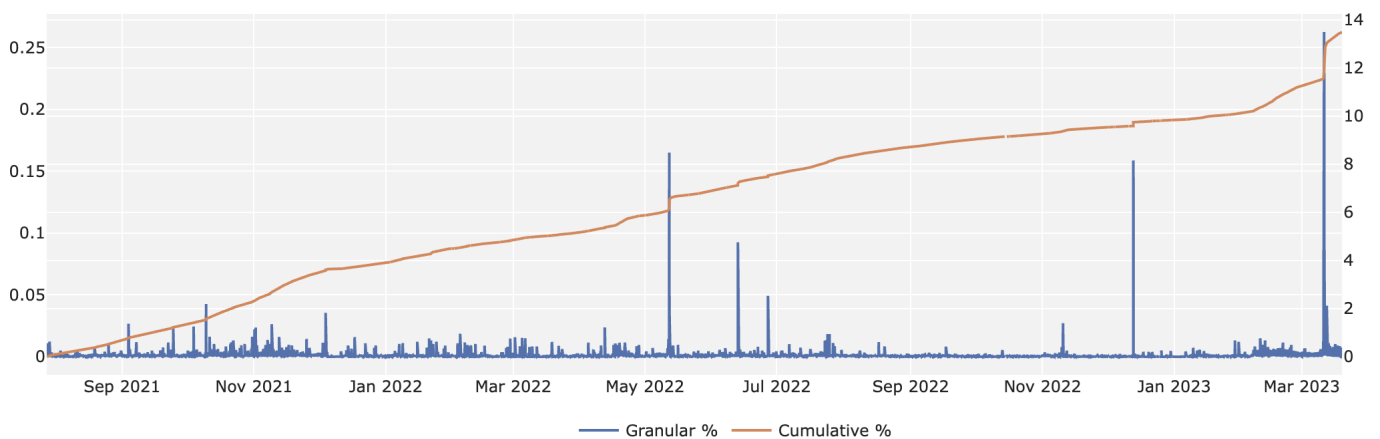
Generated Fees (\$) of the USDC/USDT pair (UniswapV2 - Fee fixed 0.03%)



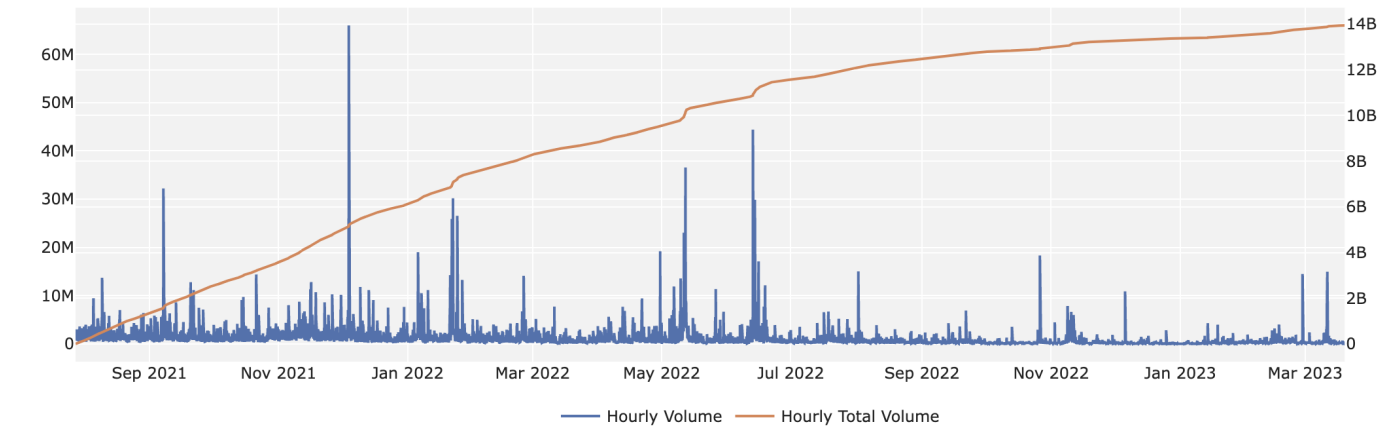
USDC/USDT Price UniswapV2 pool



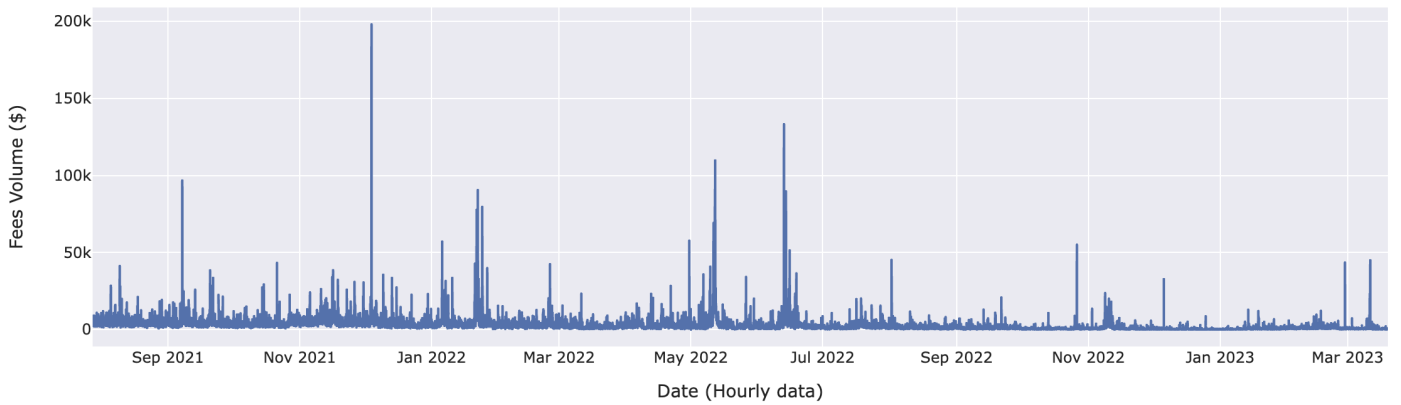
Pool Yield of the USDC/USDT UniswapV2 pool (%) - Fees/TVL



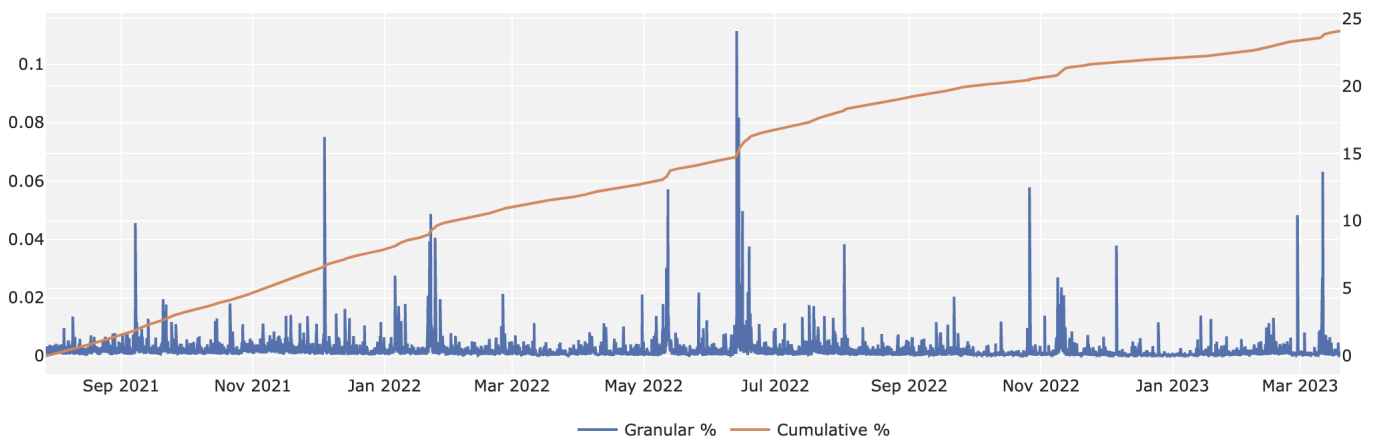
Volume and Cumulative Volume of the USDC/WETH UniswapV2 pool (\$)



Generated Fees (\$) of the USDC/WETH pair (UniswapV2 - Fee fixed 0.03%)



Pool Yield of the USDC/WETH UniswapV2 pool (%) - Fees/TVL



Mints & Burns

Mints and burns are important metrics for analyzing liquidity provision strategy on decentralized exchanges (DEXs) such as UniswapV2. Mints refer to the creation of new liquidity provider (LP) tokens when users deposit tokens into a liquidity pool, while burns refer to the destruction of LP tokens when users withdraw tokens from the pool.

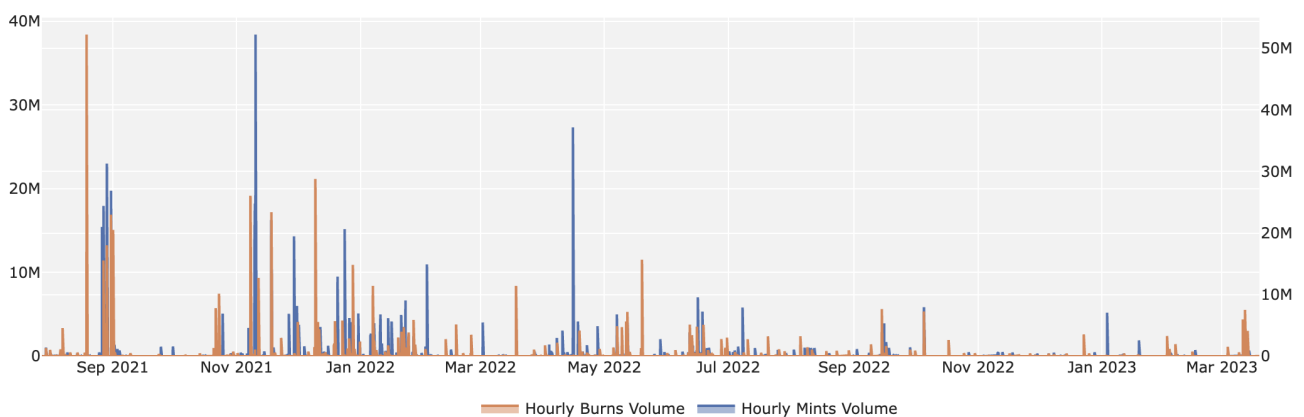
These metrics provide insights into the supply and demand of liquidity in a pool, as well as the profitability of providing liquidity. A high rate of mints indicates that there is strong demand for the pool, as users are depositing more tokens to trade. On the other hand, a high rate of burns may suggest that LPs are withdrawing their funds from the pool, potentially due to lower profitability or changes in market conditions.

By monitoring mints and burns, liquidity providers can adjust their strategy to optimize their returns. For example, if mints are high but burns are low, it may be advantageous to increase their investment in the pool to take advantage of the high demand. Conversely, if burns are high and mints are low, LPs may want to consider withdrawing their funds or reallocating them to a more profitable pool.

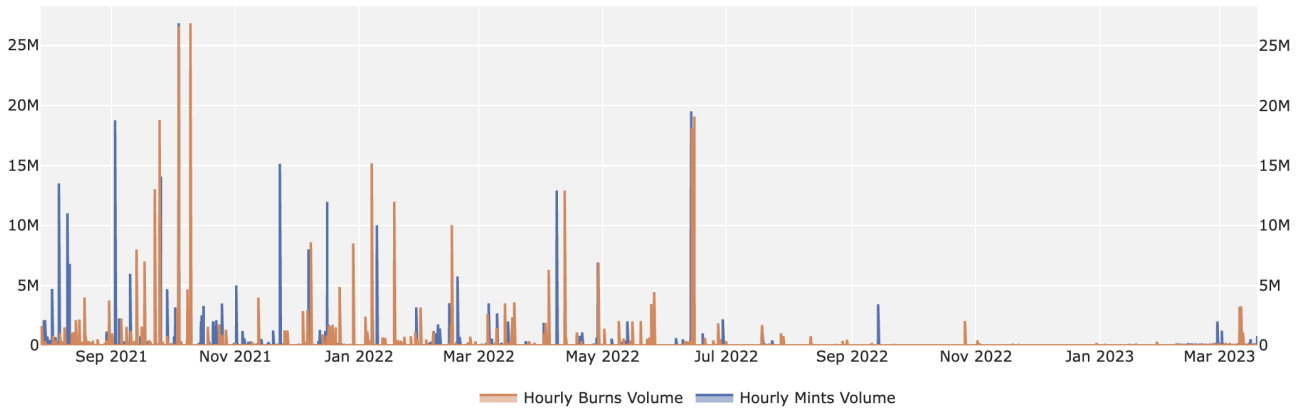
On these different plots, one could analyse that large volumes of Mints or Burns involved a large movement on the price of WETH/USDC. However, the correlations are still quite low:

- Mints & WETH/USDC Price: 0.21
- Burns & WETH/USDC Price: 0.15

Burns and Mints of the USDC/WETH UniswapV2 pool (\$)



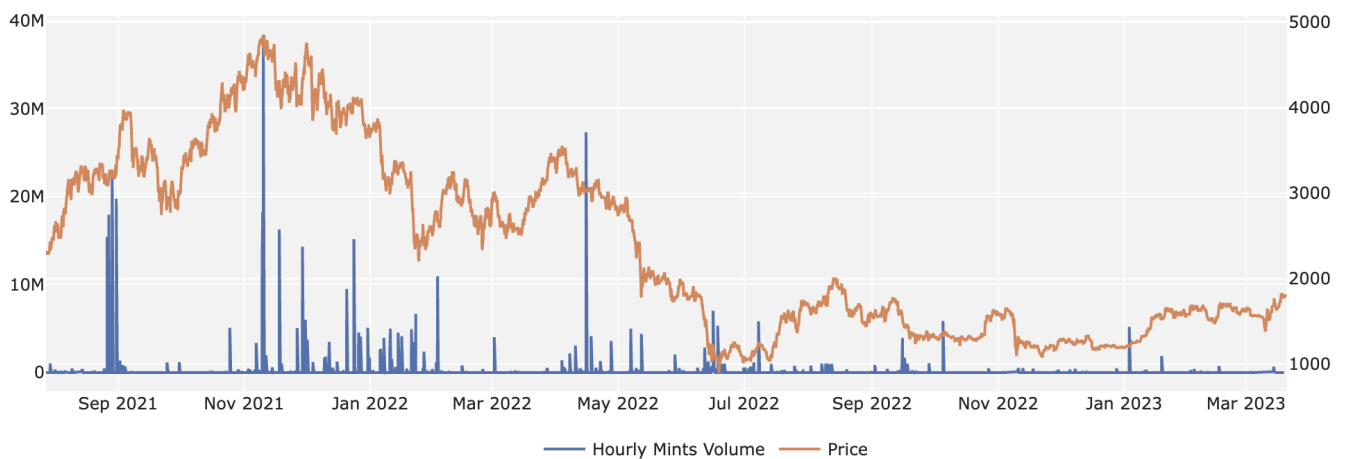
Burns and Mints of the USDC/USDT UniswapV2 pool (\$)



Relation Price and Burns of the USDC/WETH UniswapV2 pool (\$)



Relation Price and Mints of the USDC/WETH UniswapV2 pool (\$)



UniswapV2 to UniswapV3 (transition)

Uniswap V2 and V3 are both decentralized exchanges that operate on the Ethereum blockchain, but they have some differences in their liquidity provision strategies.

One of the main differences between Uniswap V2 and V3 is how liquidity providers (LPs) provide liquidity. In Uniswap V2, LPs provide liquidity in equal amounts of two tokens, whereas in Uniswap V3, LPs can specify a price range in which their liquidity will be utilized, resulting in more efficient use of their capital. This means that LPs on Uniswap V3 can provide liquidity with higher capital efficiency, resulting in lower impermanent loss compared to Uniswap V2.

Another difference is that Uniswap V3 introduces concentrated liquidity, which allows LPs to concentrate their liquidity around a specific price range, resulting in higher trading efficiency and better capital utilization. This is particularly beneficial for stablecoin pairs, such as USDC/USDT, which have a narrow price range and are less volatile than other pairs. As a result, LPs can provide liquidity with minimal exposure to price fluctuations, leading to lower impermanent loss and more stable returns.

In addition, Uniswap V3 allows LPs to earn trading fees at multiple price ranges simultaneously, which was not possible in Uniswap V2. This is particularly advantageous for USDC/WETH pairs, which have a wider price range and can benefit from LPs providing liquidity across multiple price ranges. As a result, LPs can earn more fees and increase their capital efficiency.

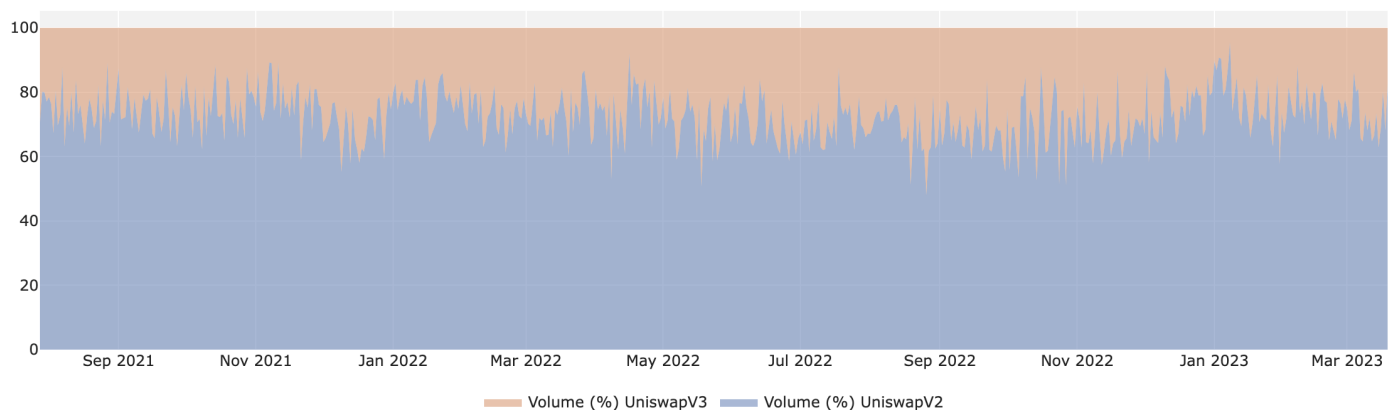
Based on my analysis of Liquidity Provision strategy on DEXs, specifically UniswapV2 and UniswapV3, I have made some observations using stack normalize plots. When examining the USDC/WETH pair on the UniswapV2 pool, it appears that there are still more trades occurring compared to the UniswapV3 pool with a 0.3% fee. However, it's important to note that there are multiple USDC/WETH pools on UniswapV3 with varying fees (0.01%, 0.05%), which makes not really accurate if a movement to UniswapV3) happen. The trade quantity appears to be relatively consistent between the two pools.

On the other hand, when analyzing the USDC/USDT pool, there is a significant difference between UniswapV2 and V3 in terms of trade quantity and volume in dollars. This is primarily due to the fact that liquidity has migrated towards UniswapV3, where the gains in terms of fees are more enticing. Specifically, users are drawn to the benefits of concentrated liquidity pools and the ability to earn higher returns through the use of dynamic fee tiers. Therefore, it appears that for the USDC/USDT pair, UniswapV3 is the preferred choice for liquidity provision strategy.

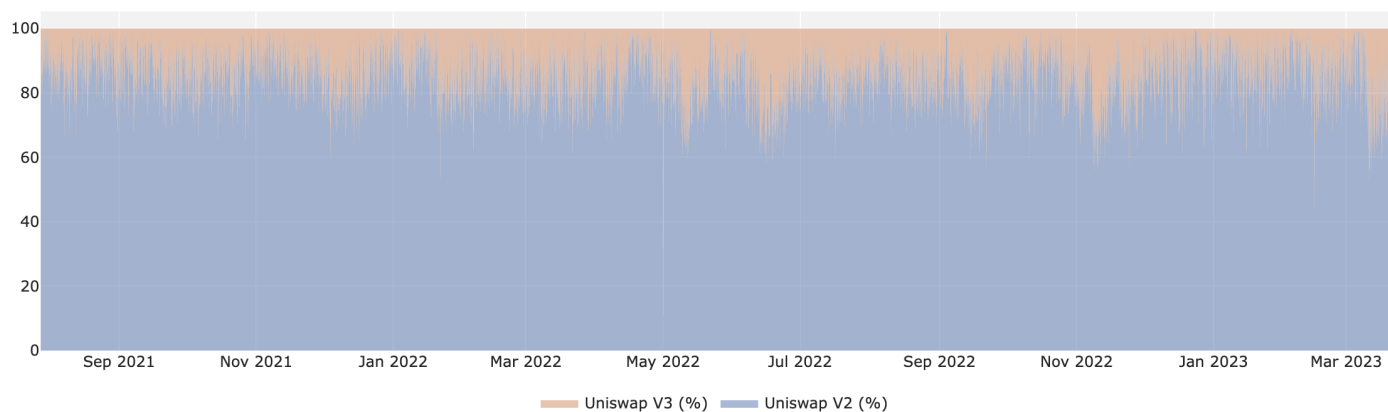
Users on UniswapV2 and UniswapV3

This analysis made above is also found when analysing the number of users on UniswapV2 as well as on UniswapV3. And we can clearly see this with the trading volumes on the USDC/USDT pool with almost 100% of the liquidity on UniswapV3. Furthermore the increase of users on the UniswapV3 USDC/USDC pool is exponential as the unique users graph shows.

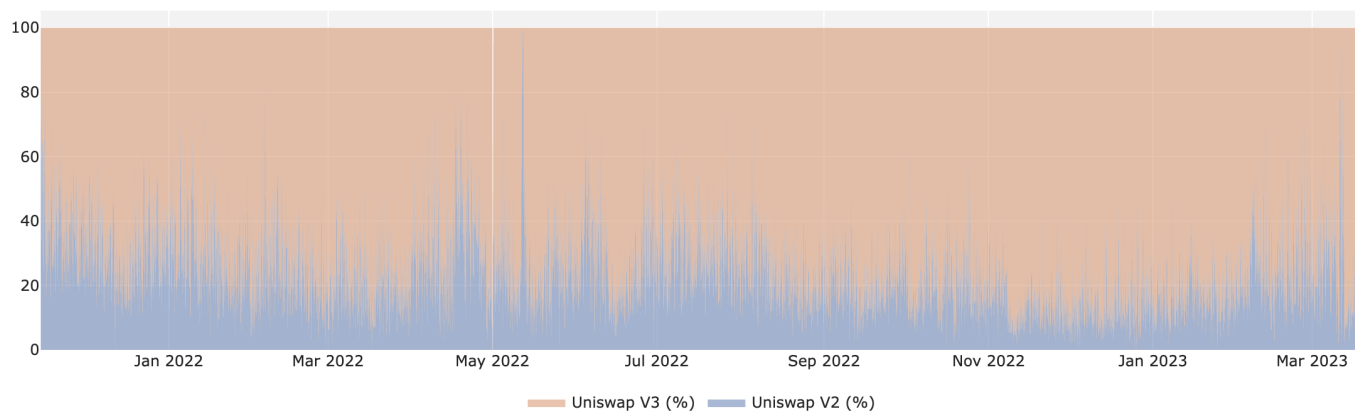
Transactions volume (Daily) of the USDC/WETH pair between UniswapV2 (0.3% fees pool) and UniswapV3 (0.3% fees pool)



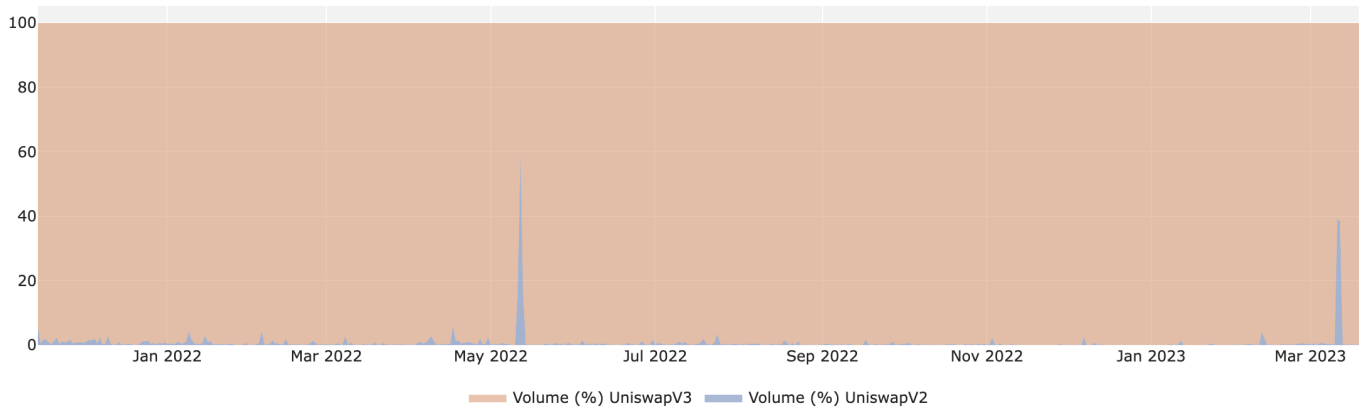
Transactions number of the USDC/WETH pair between UniswapV2 (0.3% fees pool) and UniswapV3 (0.3% fees pool)



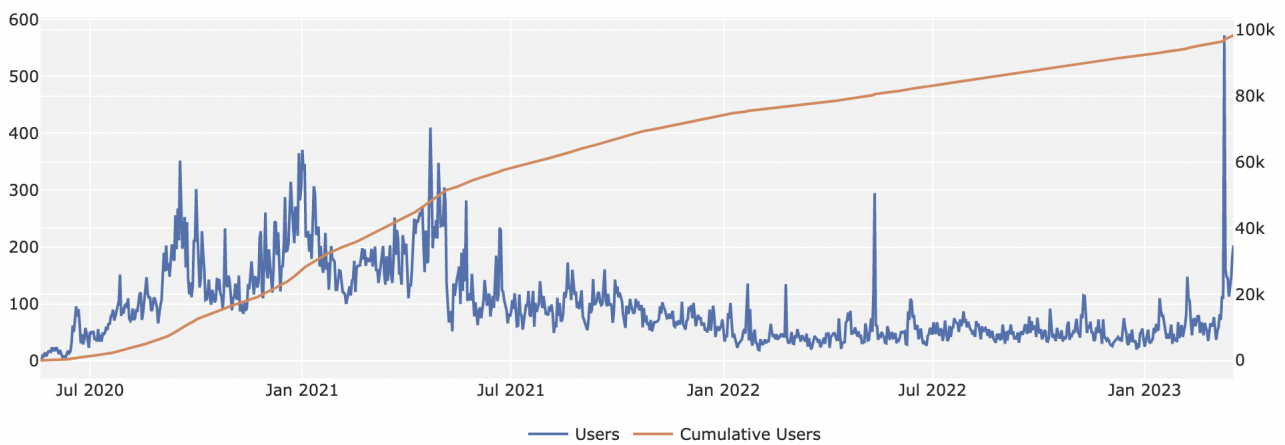
Transactions number of the USDC/USDT pair between UniswapV2 (0.3% fees pool) and UniswapV3 (0.01% fees pool)



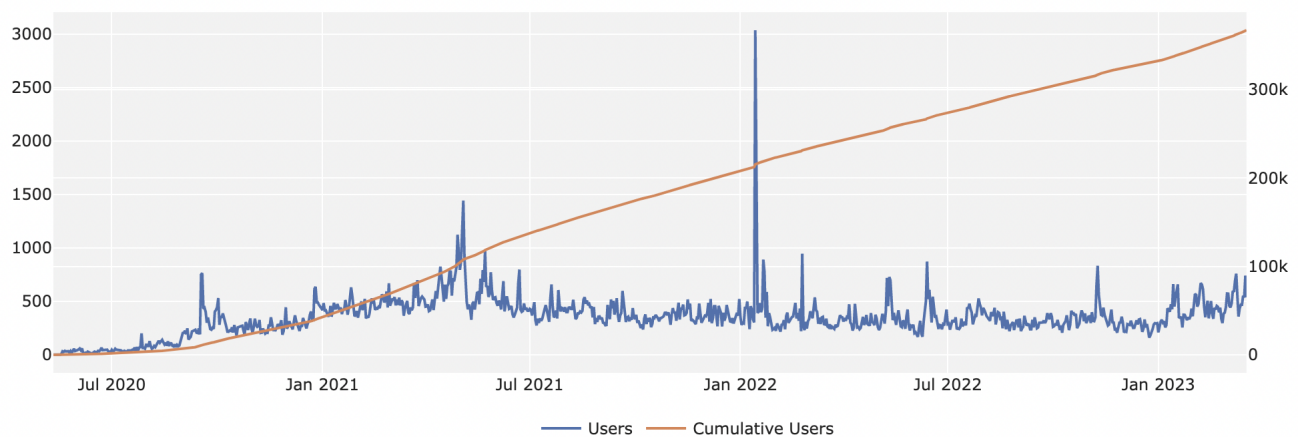
Transactions volume (Daily) of the USDC/USDT pair between UniswapV2 (0.3% fees pool) and UniswapV3 (0.01% fees pool)



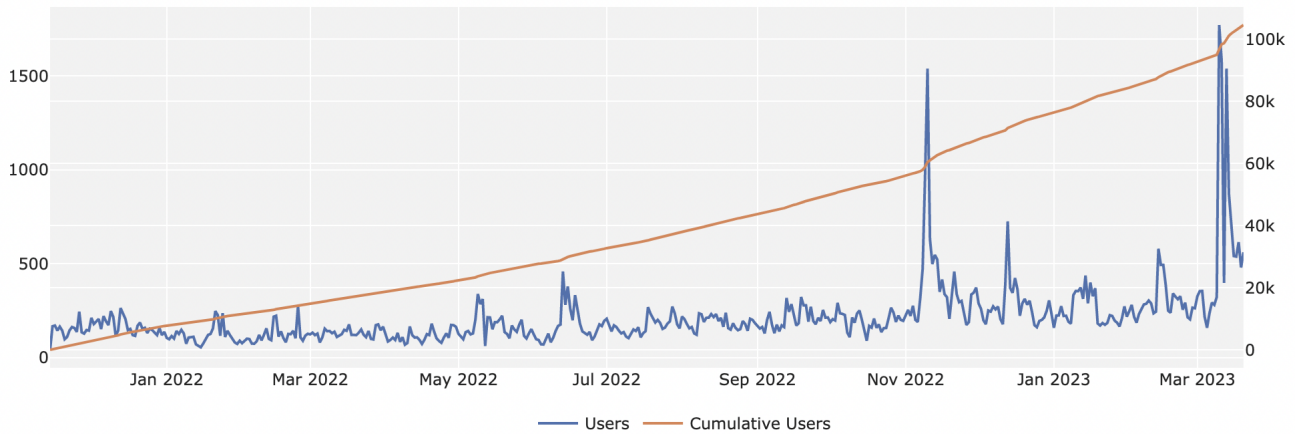
Unique users USDC/USDT UniswapV2 pool



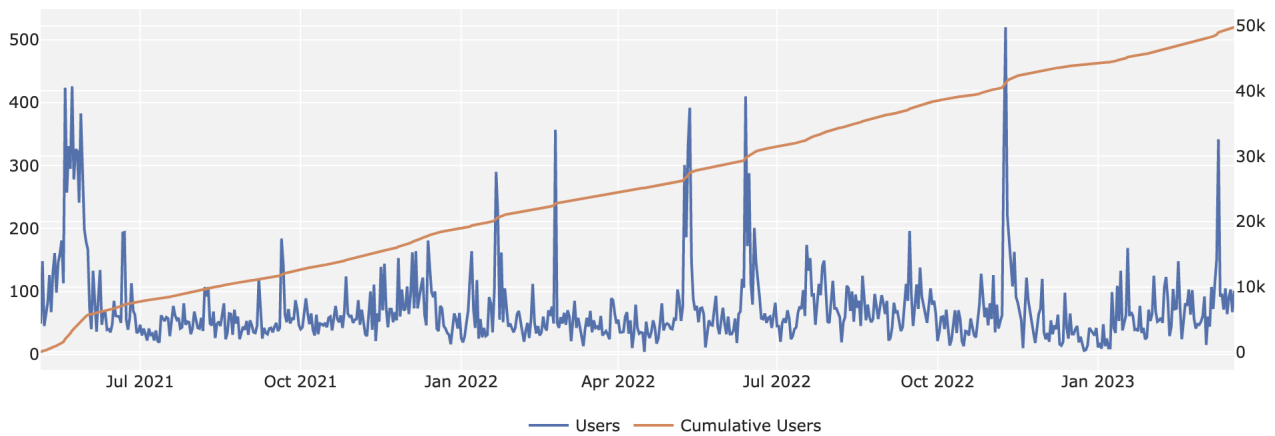
Unique users USDC/WETH UniswapV2 pool



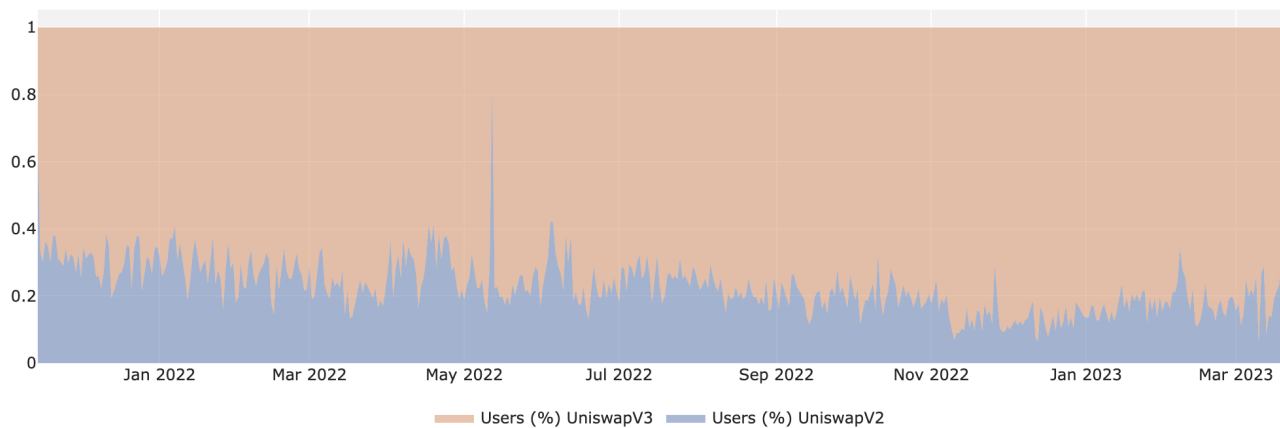
Unique users USDC/USDT UniswapV3 pool



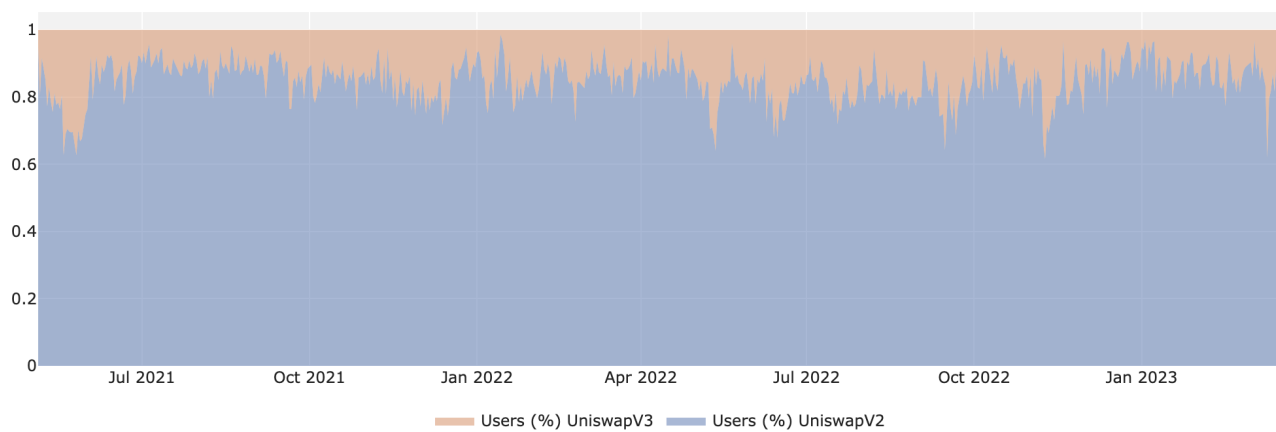
Unique users USDC/WETH UniswapV3 pool



Users (Daily) of the USDC/USDT pair between UniswapV2 (0.3% fees pool) and UniswapV3 (0.01% fees pool)



Users (Daily) of the USDC/WETH pair between UniswapV2 (0.3% fees pool) and UniswapV3 (0.3% fees pool)



Future work

Add analyses on UniswapV3 USDC/WETH pools (0.05%, 0.01%)

Create an algorithm would adjust the liquidity range based on the state of the market and other relevant factors such as burns and mints.

The algorithm could be designed to monitor the price of USDC/WETH pair and adjust the liquidity range accordingly. For example, if the market is volatile and the price of USDC/WETH is fluctuating rapidly, the algorithm could narrow the liquidity range to minimize impermanent loss. Conversely, if the market is stable, the algorithm could widen the liquidity range to capture more trading volume.

In addition, the algorithm could also take into account external events such as burns and mints, which could affect the price of USDC/WETH. For example, if there is a large burn of USDC, the algorithm could adjust the liquidity range to account for the potential decrease in the supply of USDC, which could result in a price increase. Similarly, if there is a large mint of WETH, the algorithm could adjust the liquidity range to account for the potential increase in the supply of WETH, which could result in a price decrease.

To maximize trading fees, the algorithm could also be designed to adjust the liquidity range based on the current state of the market. For example, if the market is bullish and there is a high demand for USDC/WETH, the algorithm could narrow the liquidity range to capture more trading volume and earn higher fees. Conversely, if the market is bearish and there is a low demand for USDC/WETH, the algorithm could widen the liquidity range to attract more trading volume and maintain a stable return.

Overall, this algorithmic liquidity provision strategy for Uniswap V3 could efficiently provide liquidity for the USDC/WETH pair while also maximizing trading fees by adjusting the liquidity range based on the state of the market and other relevant factors. This strategy could be implemented using programming languages such as Python, and would require access to real-time market data and relevant events.

Conclusion

In conclusion, the technical report analyzed the performance of Uniswap V2 and V3 in the context of automated market makers (AMMs). By analyzing events such as mints, burns, swaps, and pool statistics, the report provided insights into how the AMM mechanisms employed by Uniswap V2 and V3 have impacted the trading volume, price volatility, and liquidity depth of the market, and how the transition from V2 to V3 has affected these metrics. Liquidity provision strategy is a critical aspect of the decentralized finance (DeFi) ecosystem, and the liquidity of a Uniswap pool is determined by various pool statistics, including the reserve and total value locked (TVL). The report highlighted the importance of TVL and how a decrease in TVL can indicate a drop in the value of the tokens in the pool or liquidity providers withdrawing their funds, leading to wider bid-ask spreads and greater price volatility.

The report also highlighted the significance of dense clusters of transactions and the absence of transactions at certain price points in informing trading strategies and investment decisions. The report's use of Spice.xyz and Etherscan API to collect data made it possible to conduct a comprehensive analysis without the need for building and operating big data infrastructure.