TL;DR

- The advent of Uniswap v4 may lead to further fragmentation of Uniswap pools, a problem Uniswap X could ameliorate.
- Uninformed flow may bypass DEX and get executed through Direct Fill by Fillers, which could reduce LP profitability on DEX.
- The analysis reveals that around 90% of transactions utilizing Uniswap X do not involve DEXs.
- Despite Fillers' informational edge, however, the tiered structure of Ethereum blocks managed by Builders could affect Swappers' execution quality of Direct Fill through Uniswap X.

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Introduction

Earlier this year, Uniswap unveiled Uniswap v4 and Uniswap X, shaking up the DEX landscape. This article explores the impact these releases could have on the DEX space.

Initially, we will dive into how Uniswap v4 and X aim to solve a major issue that Uniswap has been facing - Liquidity Fragmentation. Then, we will examine the concern that Liquidity Providers (LPs) might be exposed to more toxic flows after the Uniswap X launch by using actual transaction data by Filler. Lastly, we will scrutinize whether the Request for Quote (RFQ) truly holds an advantage over DEXs by considering MEV, especially focusing on the flows of CEX-DEX arbitrage.

Liquidity fragmentation and Uniswap X as the solution

One of the notable issues faced by Uniswap is the liquidity fragmentation. Since the launch of Uniswap v3, three main fee tiers have been set, and multiple pools for the same trading pairs across different chains. Moreover, with Hooks in Uniswap v4, a substantial increase in the number of liquidity pools is anticipated. Consequently, it is expected that routing through pools will become more highly complex when users execute transactions.

Uniswap X emerges as a solution to this issue. Uniswap X, a type of intent-centric application, aims for best execution by having a third-party entity known as Filler handle the complexity of routing. Furthermore, Uniswap X facilitates interactions with multiple DEXs including Uniswap, Curve, and SushiSwap, while also offering Direct Fill for immediate, direct transactions with Fillers.

Uniswap X's Impact on DEX Liquidity and Order Flow

The primary concern with the advent of Uniswap X is that uninformed flow may bypass DEX and get executed through Direct Fill by Fillers.

In finance, there are two main types of user orders: uninformed orders

, based on personal reasons, and informed orders

, where traders exploit price differences between centralized and decentralized exchanges for arbitrage gains.

Let’s assume at t = 0, the price of ETH/USDC at Binance and Uniswap v3 is $1500, hence no arbitrage occurs. However, if at t = 1, the price at Binance changes to $1600, then all buy orders towards $1600 can be considered as informed flow, while sell orders towards $1400 are uninformed flow.

In DEXs like Uniswap, providing liquidity targets uninformed orders—those that don't move prices. Despite short-term effects on DEX prices, informed trades neutralize this impact, enabling liquidity providers to collect fees without price risk.

However, DEX LP may fail to capture the uninformed orders due to Direct Fill in Uniswap X. In Ethereum, the block time is fixed at about 12 seconds, during which the state of Ethereum remains unchanged. Even if significant news emerges 6 seconds post block building, DEXs like Uniswap or Curve cannot reflect the price information until another 6 seconds pass. DEXs are always trailing CEX prices due to this latency issue. On the other hand, Uniswap X, through off-chain Dutch Auction, allows Fillers to bid based on real-time information. This creates information asymmetry, and Fillers can be considered to have informational superiority over DEXs.

Consider the following scenario, at t = 0, the price at Binance and Uniswap is $1500. At t=1, the price at Binance changes to $1600. Ignoring various conditions, Fillers can bid prices between $1500 and $1600 against uninformed flow. This superiority risks a lot of uninformed flow being executed via Direct Fill by Fillers instead of going through DEXs. We will delve into this further in the following sections.

Analysis of Uniswap X Data

Method

This analysis utilizes all available data from July 27 to November 1, since Uniswap X became operational. Until the end of October, approximately 35,000 transactions have been conducted through Uniswap X, totaling $140 million by the end of September.

Note:

Although Uniswap X launched on July 5, for analytical convenience, we start aggregating data from July 27.

Among these, we have quantified the amount of Direct Fills, which are transactions that do not involve DEXs including Uniswap. Specifically, we first fetch Fill events from transactions utilizing Uniswap X. Then, from the transaction hash, we obtain Transaction Receipt Event Logs. Finally, if a transaction passes through a DEX, we should always be able to fetch a Swap function or a similar event log, deeming it a DEX-routed transaction. In contrast, transactions primarily involving Transfer functions are labeled as Direct Fill. We recognize six DEXs: Uniswap, Sushiswap, Curve Finance, Balancer, Maverick Protocol, and Pancake Swap. (Although transactions via other DEXs are noted as Direct Fill, considering various metrics, we don't expect this to cause significant inaccuracies.)

Direct Fill vs DEX liquidity

The analysis reveals that around 90% of transactions utilizing Uniswap X do not involve DEXs.

Moreover, the trend of Direct Fill transactions has been increasing over time, where in July, about 60% were Direct Fills, which surged to 90% in September and October.

Note:

- Even with the use of the Swap function, not all transactions necessarily go through a DEX and are filled. For instance, 0x6aF49606D941cdA32de1Ee94397dc821ceB09DAc conducted arbitrage through Uniswap X and Uniswap V3's Pool.*

Fillers Profiles

We also explored the profiles of entities currently acting as Fillers. (While Uniswap X's Fillers are anticipated to be permission-less in the future, Fillers are currently limited.)

The table aggregates the 30 addresses that have executed trades as Fillers. A noticeable point, even at this nascent stage of Uniswap X, is the emergence of Filler centralization. A few top addresses occupy a large portion of all executed Fill transactions.

Let's delve further into the attributes of the addresses acting as Fillers. According to Flashbots' Dune, it can be speculated that FIllers are mainly market makers and MEV searchers as follows:

- The top address, 0x2008b6c3D07B061A84F790C035c2f6dC11A0be70, executing around 8,000 transactions, is speculated to be the trading firm Altonomy by [Flashbots' Dune](), possibly engaging in market-making.
- For the second position, 0xaAFb85ad4a412dd8adC49611496a7695A22f4aeb, it can be surmised to be an MEV searcher. By reviewing Etherscan's Transactions, it's clear that besides Uniswap X-related transactions, major block builders like rsync-builder, beaverbuild, and Titan Builder are involved.
- Most transactions of the third address are related to Uniswap X, and from the transactions sent to Block Builders, it can also be inferred to be a close actor to an MEV searcher.
- Other trading firms like Amber and Flow Traders are also participating as Fillers.

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From these results, it can be speculated that mainly market makers and MEV searchers will enter as Fillers.

Next, we'll delve deeper into the tendencies of these over 20 addresses regarding fill transaction executions. The graph shows whether these addresses prefer Direct Fill or DEX routing. Addresses at higher ranks predominantly execute transactions through Direct Fill, while some addresses focus on DEX-routed transactions.

Moreover, we explored which addresses are actively executing orders as Fillers. The result indicates that addresses like 0x2008b6c3D07B061A84F790C035c2f6dC11A0be70 and 0xaAFb85ad4a412dd8adC49611496a7695A22f4aeb, which ranked higher in the previous analysis, have been increasing their orders as Fillers over time. Furthermore, addresses like 0x32801aB1957Aaad1c65289B51603373802B4e8BB and 0x3B9260A928D30F2A069572805FbB6880FC719A19 have executed over 4,000 Fills since October.

The profitability of Fillers

Having analyzed the addresses acting as Fillers, a commonly pondered question is whether Fillers are indeed profitable and to what extent. Here, we estimated the profits of Fillers by comparing the execution price on Uniswap X, excluding fees, against the price on Binance at the same timestamp, specifically for the ETH / USDC token pair as an example. The detailed formula is as follows, and for simplicity, we used the results from the most straightforward Direct Fill transactions in our analysis.

Note:

"The most straightforward Direct Fill transactions" refers to transactions with four event logs. The Swapper transfers token A to the Filler, and the Filler transfers the token B back to the Swapper. In the case of pairs like WETH/USDC, a fee is incurred, so the transactions in focus are those with a Fee Transfer and Fill event.

From July 27 to November 1, using the 2,115 Direct Fill transactions in the USDC / WETH pair on Uniswap X, we derived the profits for Fillers. While the total trading volume during this period was about $20 million, the profit for Fillers amounted to $44,630.

The graph illustrates the cumulative profits and the profitability rate of each Filler. In the USDC / WETH pair, 0x32801aB1957Aaad1c65289B51603373802B4e8BB made the most profit, followed by 0x2008b6c3D07B061A84F790C035c2f6dC11A0be70. The above addresses, having a certain trade volume as Fillers, also possess relatively high profitability rates.

On the contrary, 0xaAFb85ad4a412dd8adC49611496a7695A22f4aeb, though being second in total trade volume, exhibits extremely low profitability. The same applies to 0x752e87b5f1397e171D5383cec3D4C51A8D3C114B. In future research, we intend to delve into factors affecting profitability and the cause of differing profitability rates among Fillers.

trading volume and execution price

Lastly, we analyzed the relationship between trading volume and Uniswap X's execution price.

The graph plots price spread between UniswapX and Binance on the x-axis against user trading volume on the y-axis. It suggests that smaller orders tend to experience larger price spread, implying a risk of being executed at prices deviated from the true market price by Fillers.

When comparing orders of more than 1 ETH with orders of less than 1 ETH, the Price Spread tends to be more than 5 times larger. The average Price Spread for orders over 1 ETH is about 0.2%, while for orders under 1 ETH, there is a tendency for a Price Spread of 1.3% to occur. This is partly due to Fillers paying for Gas in Uniswap X. Smaller orders are expected to yield smaller profits for Fillers, hence they might increase slippage to earn profits. This suggests that smaller orders might still achieve better execution by routing through DEXs. It's important to note that a third party fulfills your order to make a profit, applicable across all intent-centric applications.

Assessing the Impact of RFQ on Execution Quality for Swappers

So far, we have analyzed Uniswap X by utilizing real data. Now let's delve into whether the RFQ mechanism, exemplified by Uniswap X, truly ameliorates the execution quality for users. While such Intent-based applications simplify user execution, they don't necessarily improve it. The previously described scenario presented an ideal condition for Fillers; however, a closer examination of Ethereum's order flow could reveal a more nuanced reality.

Let's revisit the earlier example. At t = 0, the price at Binance is $1500, the same as the Uniswap pool. At t = 1, the price changes at CEX $1600. In this scenario, all buy orders on DEX are considered informed flow, while sell orders are uninformed flow. Fillers could bid between $1500 and $1600 for uninformed orders, as previously assumed, but this flow might not materialize in reality.

Let's consider the flow from a user using Uniswap X to having their transaction included in a block and confirmed on Ethereum. Digging deeper into the example, Fillers have an information advantage over DEX as they can reference CEX prices, not just at t = 0, but even at t = 0.1 or 0.2. However, is DEX really informationally disadvantaged to the Fill transaction?

The price change on DEX is triggered by arbitrageurs. They also have an informational advantage over DEX, leading to an issue known as LVR(Loss versus Rebalancing), caused by CEX-DEX arbitrage, which is more deeply rooted in Ethereum rather than Uniswap. To understand this better, we delve into Ethereum’s Block building. Currently, Ethereum is advancing with a PBS (Proposer-Builder-Separation) initiative, with around 90% of validators adopting Flashbots’ MEV-Boost.

Post-Merge block building, from my Devcon presentation

Hence, validators relay blocks composed by Builders, instead of constructing blocks themselves. The inclusion of transactions in block space is finally decided by these Builders. Within this block space, there's a “tier” concept, implying transactions at the beginning of a block have different tendencies compared to those in the middle. Research by Special Mechanism Group reveals that CEX-DEX arbitrage transactions are mostly included at the top of the block, while the block body contains transactions arising from frontrunning and sandwich attacks.

The top of the block" tends to be occupied by CEX-DEX arbitrage transactions.

Taking this into account, let’s reorganize the situation. In Uniswap X, during the off-chain Dutch Auction, Quoters bid on the price at which they'll execute the transaction. The winning Quoter executes the Fill as a Filler; however, this execution happens on-chain. So, even if the auction is based on information at t = 0.1, the Fill occurs at t = 1. In this case, it's not the Filler who has the upper hand in information. Rather, it is the Builder or the Proposer, the ones constructing the block themselves, who have the most up-to-date access to price information. This is because by the time the Builder includes the

Fill transaction in the block, the execution price by the Filler is already determined. Hence, we can conclude that the informational advantage flows from DEX < Filler < Builder.

Yet, it is important to recognize—as noted earlier—that CEX-DEX arbitrage transactions take place at the very start of a block. Consequently, general swappers executing transactions via a DEX are in effect trading in the most updated pool, which mirrors the latest information the blockchain has to offer. This reality suggests that a Direct Fill in Uniswap X might, in fact, hinder optimal execution outcomes for Swappers

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Certainly, in the case of Fills via DEX, MEV such as Sandwich attacks can occur, hence Direct Fill might be effective in certain situations. However, does MEV risk not exist in Direct Fill itself? I consider that there is a risk of censorship in Fill transactions. I will explain again using the previous example. Suppose the price of WETH/USDC on CEX is $1600 and the Quoter acquired the right to Fill at $1550. Thus, the profit for the Filler can be considered as $50. However, as mentioned several times before, transactions are not confirmed by the Filler on Ethereum. Builders include the transaction in a block, and the Proposer proposes the block to Ethereum. Therefore, there is an incentive for the Builder, in particular, to censor the Fill transaction. That is to say, since the Filler can earn $50 from this transaction, conversely, the Filler is prepared to pay an incentive of up to $50-ε to the Builder to include it in a block. There is a high possibility that such risks will arise for large orders when the price moves significantly. Moreover, from the concerns mentioned above, a very troubling scenario is anticipated in cases where major Builders take on the role of the Filler.

Conclusion

In this article, we pondered on the ramifications of Uniswap X's emergence in the DEX space. The advent of Uniswap v4 may lead to further fragmentation of Uniswap pools, a problem Uniswap X could ameliorate. On the other hand, Uniswap X, through its RFQ system, allows Fillers access to various liquidity sources. This enables Fillers to execute Direct Fills, essentially making peer-to-peer transactions using their own EOA (Externally Owned Account), without going through a DEX. Especially for what's known as Uninformed flow orders, this gives Fillers an advantage over DEX, leaving DEX LPs to trade against Arbitrageurs' informed or toxic flow, which could reduce LP profitability and potentially decrease liquidity provision.

However, extending our scope to Ethereum's order execution unveils another aspect. Since Block Builders include CEX-DEX arb transactions at the beginning of a block, many Swappers trading via DEX actually execute trades on the most updated pool reflecting the most recent information available to the blockchain. In this scenario, Direct Fill on UniswapX might actually be impeded. Bearing all this in mind, at Orange Finance, we aim to address both spheres by continuing with Orange for the DEX domain, and deploying Lime for the RFQ domain, ensuring versatility in addressing the evolving landscapes.

- Alphaist

Reference

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About Orange Finance

Orange Finance offers advanced liquidity management on Arbitrum, specifically designed for concentrated liquidity DEXes. Through statistical modeling and delta hedging, we enhance v3 AMM capital efficiency against asset price fluctuations.