The Value of Uninformed Orderflow on the Uniswap Protocol

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Abstract

In this paper, we analyze how *uninformed orderflow* – orders that are not predictive of future price movements – affect the revenue earned by liquidity providers on the Uniswap Protocol. We also present an opinionated framework for how much the protocol should value liquidity. Finally, we conclude by providing a recommended upper bound on how much the protocol should pay for uninformed orderflow.

1 Introduction

The Uniswap Protocol.

Orderflow information. We can formally define uninformed flow using price expectations. Let t_0 be the current time, $t > t_0$ be any fixed time in the future, let P_t be the true price [1] of token0 relative to token1 at time t; let O be a random variable representing the next order in the pool, and let $x(O)$ be the number of token0 purchased in order O (X_O is negative if token0 is sold). We say that an order o is *informed* if P_t's expected value changes in the same direction as the order o when it is known that $O = o$:

$$\begin{aligned} \mathbb{E}[P_t \mid O = o] > E[P_t] \text{ if } x(o) > 0, \\ \mathbb{E}[P_t \mid O = o] < E[P_t] \text{ if } x(o) < 0. \end{aligned} \quad (1)$$

In contrast, we say that an order is *uninformed* if P_t's expected value does not change in the same direction as the order o when it is known that $O = o$:

$$\begin{aligned} \mathbb{E}[P_t \mid O = o] \leq E[P_t] \text{ if } x(o) > 0, \\ \mathbb{E}[P_t \mid O = o] \geq E[P_t] \text{ if } x(o) < 0. \end{aligned} \quad (2)$$

Informed trades are directionally predictive of the future relative price of the two assets in the Uniswap pool. In the case where we the expected future price is equal to the current Uniswap price , $\hat{P}_{t_0}$, then we have that an informed trade satisfies

$$\begin{aligned} \mathbb{E}[P_t \mid O = o] > \hat{P}_{t_0} \text{ if } x(o) > 0, \text{ and} \\ \mathbb{E}[P_t \mid O = o] < \hat{P}_{t_0} \text{ if } x(o) < 0. \end{aligned}$$

In this scenario, the expected future price gets pushed in the direction of the informed order, and this means that by virtue of its existence as an informed order, the order was in the *correct* direction. Since the Uniswap LPs took the other side of the informed order, they traded in the *wrong* direction, insofar as they transacted at an unfavorable price relative to the future true price.

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[1]We do not have a formal definition of what makes a "true" price, and perhaps it is flawed to suppose that such a single number even exists. For instance, there may at any given time exist a minimum offer and a maximum bid, but the existence of a "true" price is not guaranteed. Nevertheless, in practice we would measure this as some weighted average of midpoint prices among multiple trading venues for the assets in question.

Related work.

The profitability of Uniswap LPs is not a new topic of research. Angeris et al. provided analytic formulas for the profitability of Uniswap LPs between discrete points in time [Ang+19]. White demonstrated that Uniswap LPs with nearly-zero fees outperform those with higher fees under specific volatility and drift conditions. A number of reports have shed light on the historical profitability of Uniswap V3.

2 Value of Uninformed Orderflow for LPs

3 Value of LPs for the Protocol

4 Discussion

5 Conclusion

References

[Ang+19]   Guillermo Angeris et al. "An analysis of Uniswap markets". In: *arXiv preprint arXiv:1911.03380* (2019).