Hey all!

We just put out a new paper showing some interesting properties of Uniswap and its generalizations. The paper can be found on arXiv.

Essentially, we show a few things:

1. The instantaneous Uniswap arbitrage problem (along with the Balancer arbitrage problem) is convex, even when adding in most reasonable (read: convex, monotonic) models of the market. This implies that the arbitrage conditions are often easy to compute and are extremely likely to hold in practice.

2. There doesn't seem to be a way of depleting Uniswap markets of their reserves by only trading the pair of coins found in the market (i.e., the only possible way to truly deplete a market is by burning UNI coins).

3. As one might expect, the larger the fees, the larger the no-arbitrage bounds are, which means that the Uniswap price may stray further from the true market price.

4. The paper also gives an explicit formula for Uniswap returns in the no-fee case by constructing an equivalent portfolio.

We also leave some questions which may be of interest to the Eth research group:

1. What is the right view of convexity for AMMs? We mention that both Balancer and Uniswap are also log-log convex (as is any AMM which uses concave, nonincreasing functions for their bonding curves), but don't explore this topic further.

2. Under what conditions can we guarantee that liquidity providers have positive expected value relative to a portfolio with equivalent weights to the UNI coins minted?

3. Are there even more natural generalizations (or classes) of AMMs which have better properties than Uniswap/Balancer? Can we characterize what conditions are necessary/sufficient for a "good" AMM? What does this even mean in practice?

Anyways, please feel free to ask us any questions (or pose any problems that come to mind!) about/from this paper