Discussion of “Battle of the Bots: Flash Loans, Miner Extractable Value and Efficient Settlement” by Alfred Lehar and Christine A. Parlour

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The paper in a nutshell

- Theoretical study on DeFi arbitrageurs' incentives to find and exploit profitable arbitrage opportunities

- How these incentives change with changes in clearing and settlement (public/private settlements)

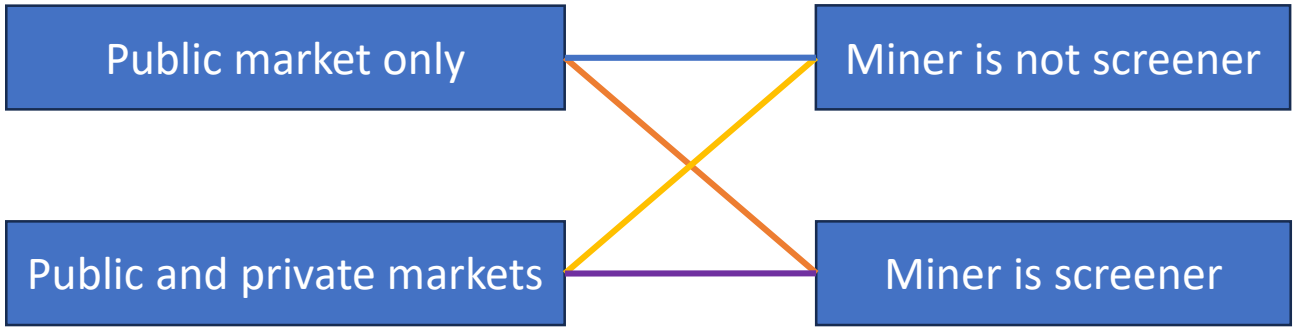
- Empirical data indicating the arbitrage activity and private settlements

Agents

- **Miner** – charge a fee f for processing transactions
- **Private value trader** – valuation per transaction $v \sim U[0, \bar{v}]$
- **Strategic agents** – with probability λ
  - **Arbitrageur** – generate a common value trade of size $R > 0$ with probability e_a at the cost of $c_a(e) = \frac{ae_a^2}{2}$
  - **Screener** – identify then expropriate the common value trade with probability e_s at the cost of $c_s(e) = \frac{se_s^2}{2}$

Model

- Markets (two transactions at a time)
  - Public market (P2P mempool) – transaction fee f
  - Private market (flashbots) – take-it-or-leave-it offer $x > f$



- Optimal effort level of arbitrageur/screener e_a/e_s
- Optimal transaction fee f

Findings (public market only)

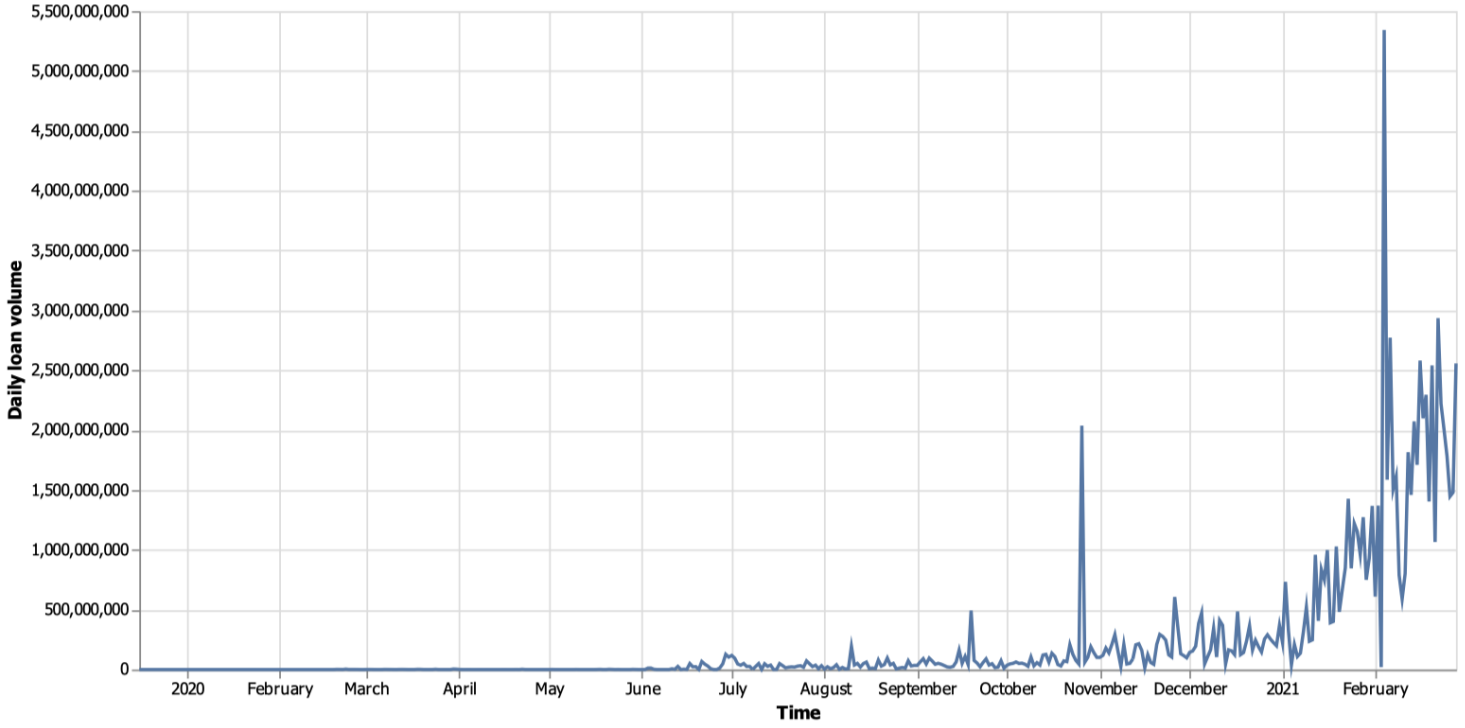
- Miner is not a screener
  - Both the arbitrageur and screener efforts depend on the equilibrium fees, which are chosen by the miner.
- Miner is also a screener
  - The optimal fee charged by the miner is lower.
  - The expected welfare of the private value traders is higher.
  - Arbitrage activity is lower.

Findings (public and private markets)

- Miner is not a screener
  - All arbitrage trades go through the private market and only liquidity trades are observed in the public market.
  - In equilibrium there is no screening and the private fee is equal to the fee in the public market $x = f$.
- Miner is also a screener
  - Leads to lower fees and higher volume of liquidity trade in the public market.
  - Leads to higher welfare for liquidity traders
  - Leads to less congestion the public blockchain.

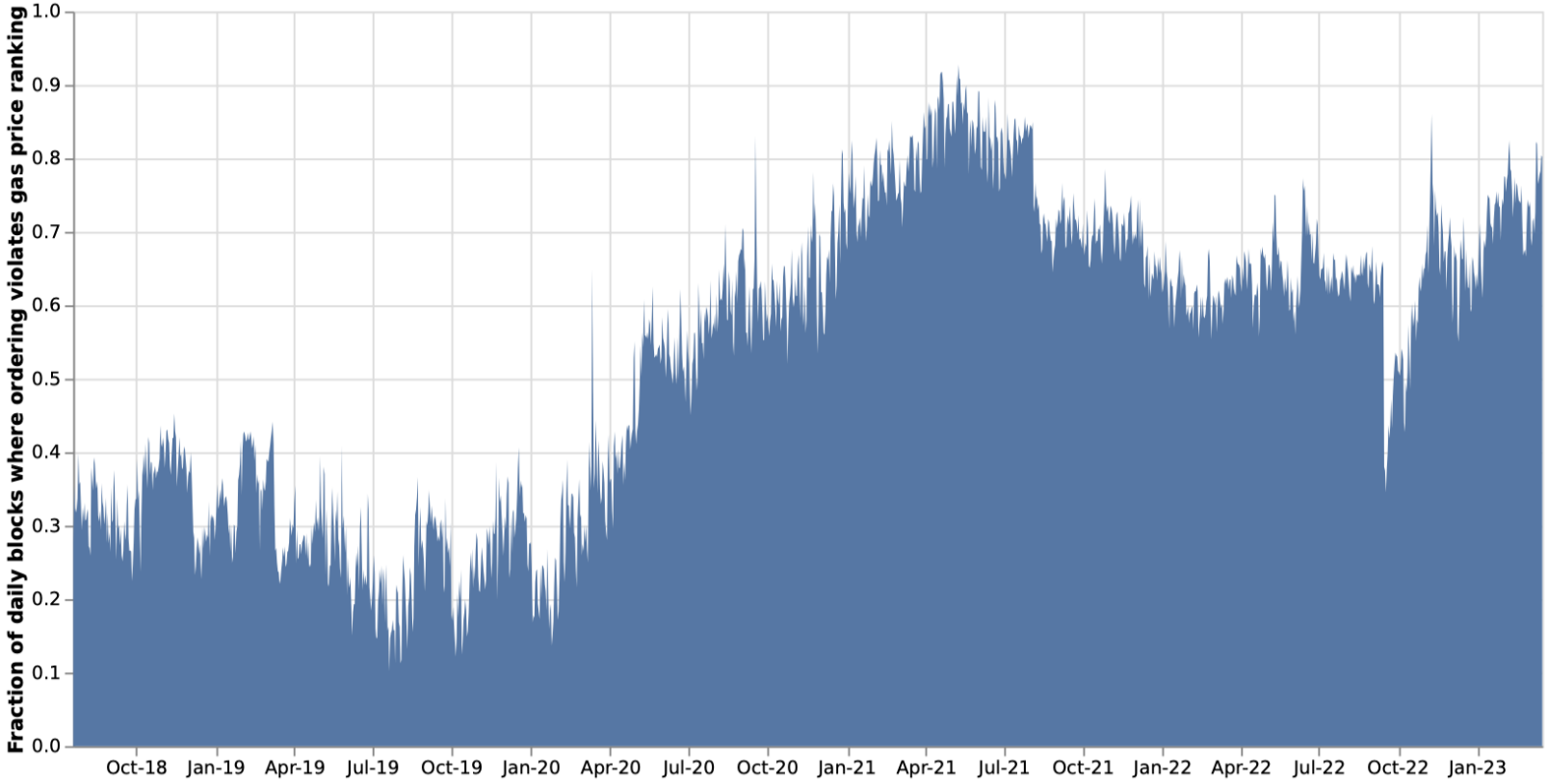
Empirical Study

Use flash loans as a measure of arbitrage activity (dYdX, Aave and Uniswap)



Empirical Study

Fraction of blocks with unconventional ordering



Comment 1: Strengths

- Timely and important topic
- Valuable theoretical framework
- Illuminating insights

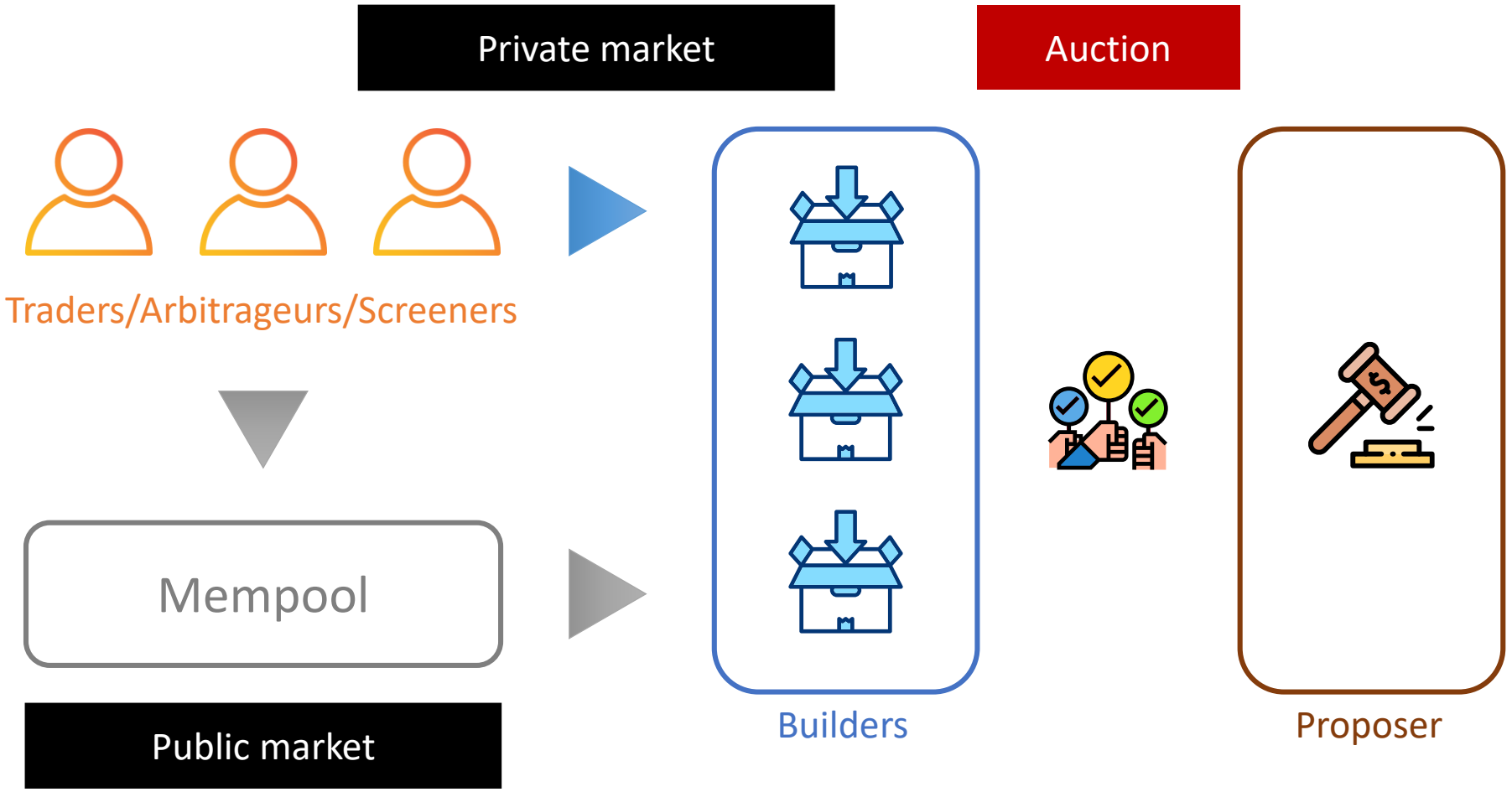
Highly recommend to read!

Comment 2: Reconciling Model Assumptions

- **Assumption:** the transaction fee f is chosen by the miner
- **Reality:** auction-based structure

- **Assumption:** the arbitrageur chooses between public and private markets
- **Reality:** both can be used simultaneously

Proposer-Builder Separation



Comment 3: Refining Empirical Methods

- The accuracy of estimating arbitrage activity with flash loans is not discussed.
  - Missing flash loan protocols
  - Advanced arbitrageurs might not use flash loans
- The computer science literature has provided probably more accurate ways to estimate arbitrage activity.

Qin, K., Zhou, L. and Gervais, A., 2022, May. Quantifying blockchain extractable value: How dark is the forest?. In *2022 IEEE Symposium on Security and Privacy (SP)* (pp. 198-214). IEEE.

Conclusion

- Valuable theoretical framework
- Noticeable divergence from reality
- Empirical methods can be improved

Thank you