

Analysis of Maximal Extractable Value on the Algorand Blockchain

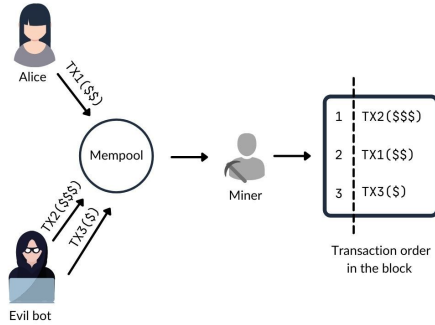
Jonas Gebele, April 24, 2023, Final Presentation - Guided Research

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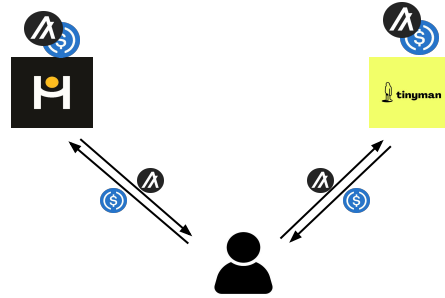
1. Motivation and Background Information
2. Problem Statement
3. Research Objectives & Results
 - 3.1. Analyze Theoretical Arbitrage-Related MEV on the Algorand Blockchain
 - 3.2. Identify Potential Opportunities for Profitable cross-DEX Arbitrage Transactions
 - 3.3. Analyze Behavior of Market Participants in the Algorand Ecosystem
4. Conclusion

Motivation and Background Information

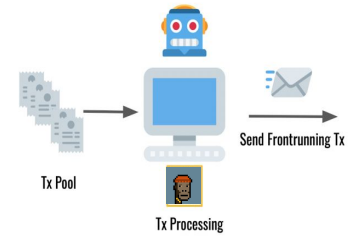
Types of MEV Strategies



Sandwich Attack



DEX Arbitrage



Front-Running
Back-Running
Liquidations

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Problem Statement

MEV Dynamics on Fixed Fee Blockchains



Dynamic Fee Blockchains



Fixed Fee Blockchains

Algorand

No Transaction Prioritization by Fee

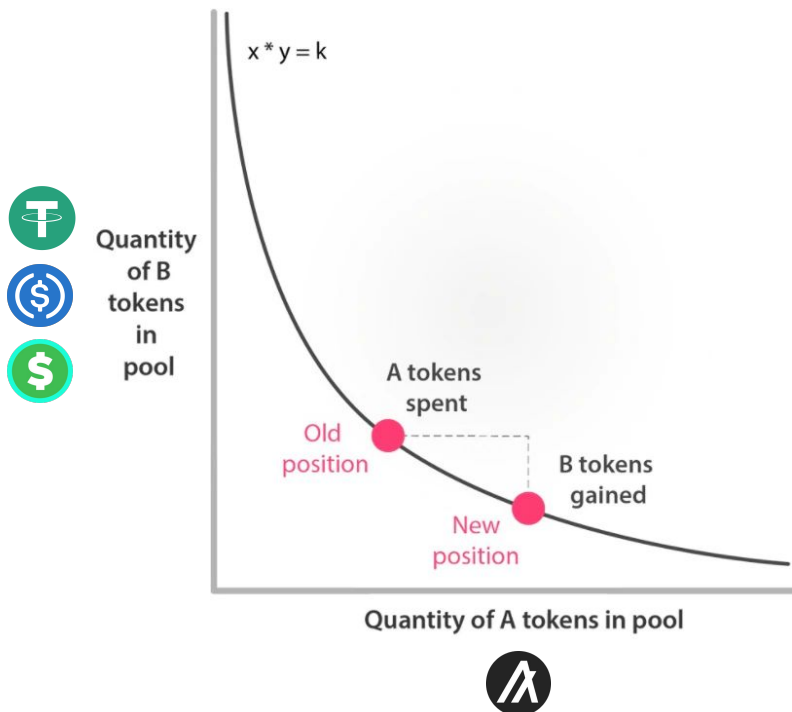
Transaction Fees go to Algorand Foundation

Certain MEV only exploitable by block-producers
(network-level MEV)

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Research Objectives & Results

Analyze Theoretical Arbitrage-Related MEV on the Algorand Blockchain



AMMs (Constant-Product Market Maker)

The screenshot shows an "Order Book" interface with a dropdown menu set to "0.5". The table displays the following data:

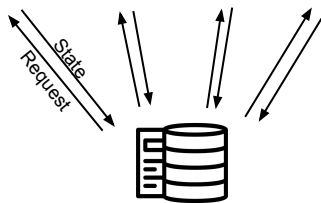
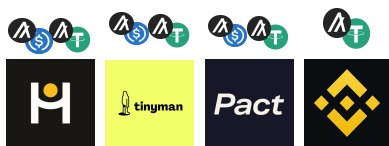
Price	Size(Cont)	Total(Cont)
19281.0	102	8.70M
19280.5	10.00K	8.70M
19280.0	200	8.69M
19279.5	10.00K	8.69M
19278.5	12.00K	8.68M
19277.5	2.64M	8.67M
19277.0	2.33M	6.02M
19276.5	1.55M	3.69M
19276.0	1.71M	2.13M
19275.0	178.04K	417.89K
19274.5	233.35K	239.84K
19274.0	6.49K	6.49K

Below the table, a price of 19273.5 is shown with an upward arrow, and a price of 19285.1 is shown with a downward arrow. The bottom part of the screenshot shows a list of orders with their respective prices, sizes, and totals.

Continuous-Limit Order-Books

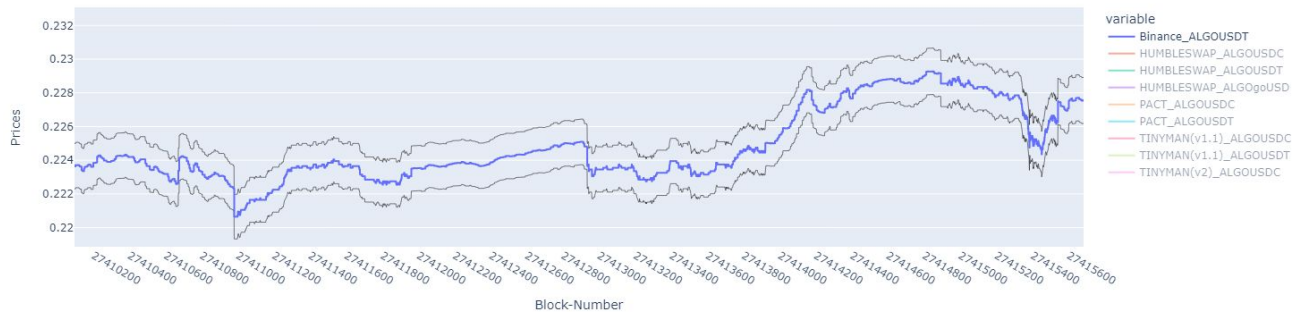
Research Objectives & Results

Analyze Theoretical Arbitrage-Related MEV on the Algorand Blockchain



0.18465, 0.185404, 0.194214, 0.184586, 0.182313, 0.184843, 0.187997

Price Data



Price Data

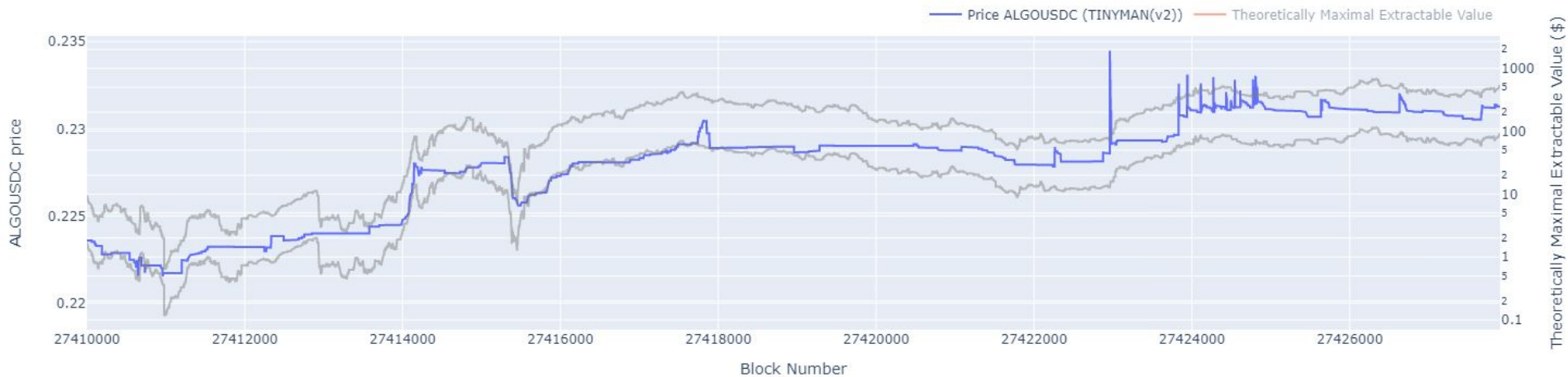


Research Objectives & Results

Analyze Theoretical Arbitrage-Related MEV on the Algorand Blockchain



ALGOUSDC price-chart on TINYMAN(v2) with theoretically Maximal Extractable Value

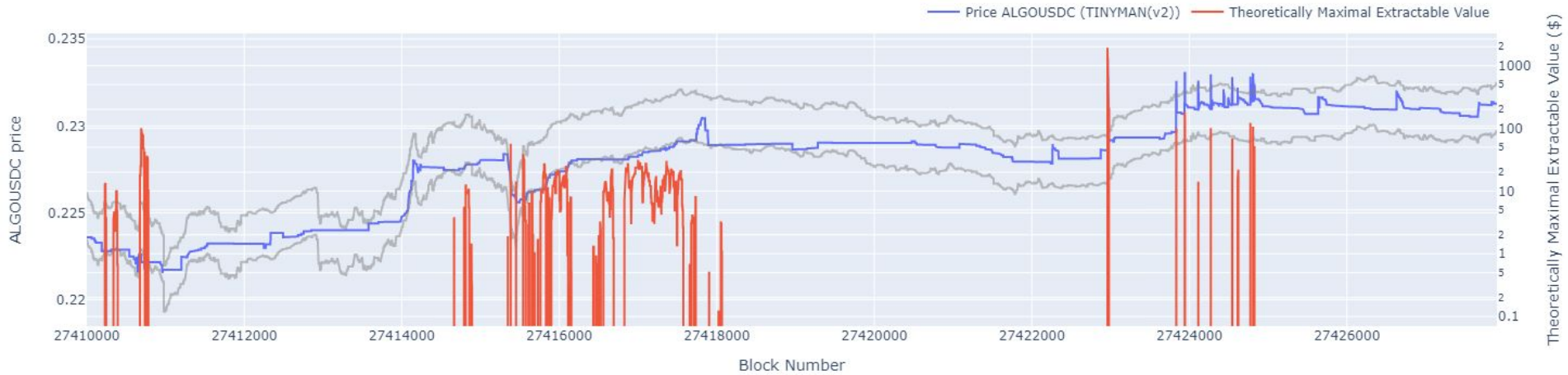


Research Objectives & Results

Analyze Theoretical Arbitrage-Related MEV on the Algorand Blockchain



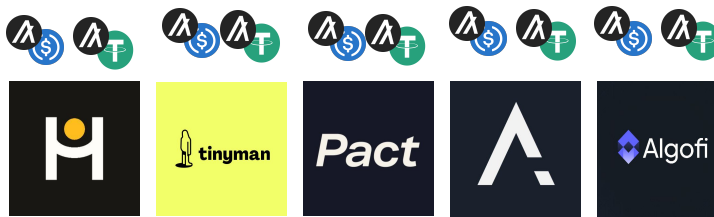
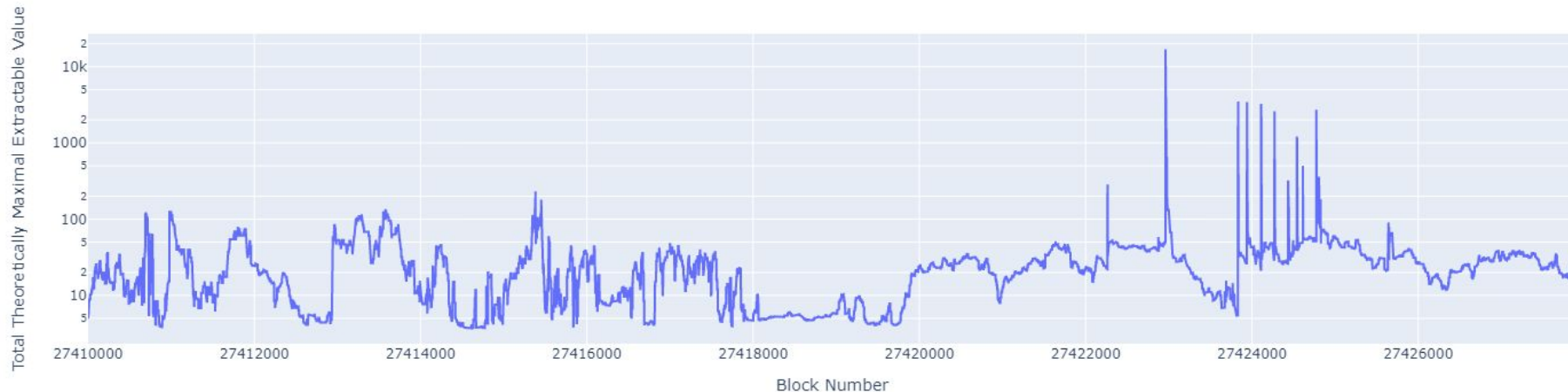
ALGOUSDC price-chart on TINYMAN(v2) with theoretically Maximal Extractable Value



Research Objectives & Results

Analyze Theoretical Arbitrage-Related MEV on the Algorand Blockchain

Total Theoretically Maximal Extractable Value across all analyzed pairs and DEX's



Research Objectives & Results

Identify Potential Opportunities for Profitable cross-DEX Arbitrage Transactions

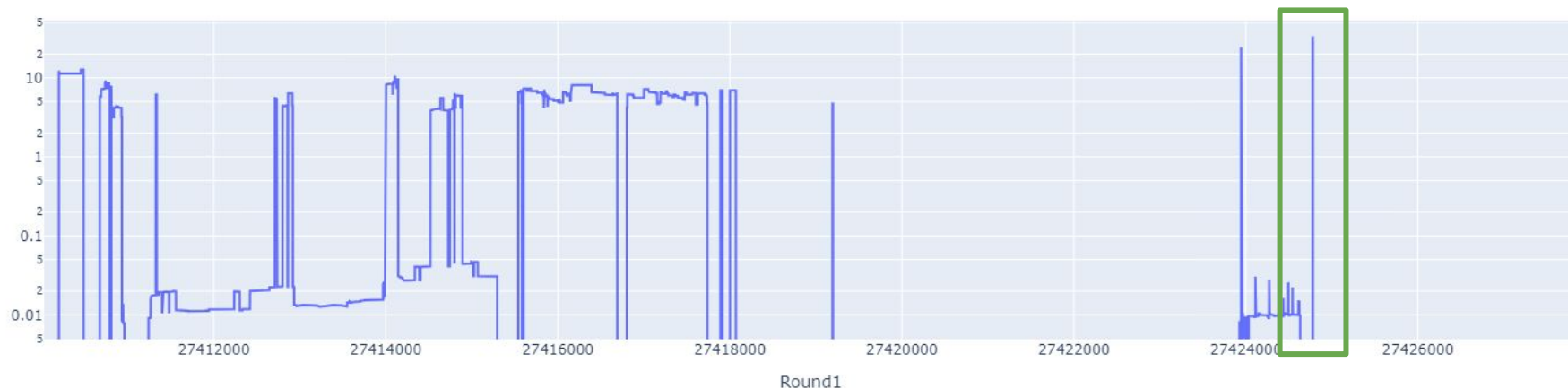


Algorithm for Lower-Bound cross-DEX Arbitrage Estimate

1. Search for DEX's with theoretical MEV with prices being below deviation boundary
2. Search for DEX's with theoretical MEV with prices being above deviation boundary
3. For each set of DEX's of 1. and 2. select the maxima
4. Perform transactions on both markets using the input of the smaller MEV



Total extractable value across all DEX'es on ALGO/USD



Research Objectives & Results

Identify Potential Opportunities for Profitable cross-DEX Arbitrage Transactions

Example in Block **27424778**



ALGO/goUSD

0.2282\$



ALGO/USDC

0.2341\$



1. Buy ALGO with goUSD on HumbleSwap using **2,472.06** goUSD for 10,746.32 ALGO
2. Sell 10,746.32 ALGO on HumbleSwap using for **2,505.61** USDC.

Profit of **33.55 USD** (assuming constant stablecoin-prices)

Research Objectives & Results

Analyze Behavior of Market Participants in the Algorand Ecosystem

Dominated by 3 market participant (*doing >95% of all DEX interactions*)

- EVESCVBC6VDIJAZM3HMUGYVQLKWHH4YJBMDV5EF65RMS67TFS5URZQ5YNY
- AACCDJTFPQR5UQJZ337NFR56CC44T776EWBGVJG5NY2QFTQWBWTALTEN4A
- J4BJWP67LHXT7LQTWZYWJGNSB25VZMO6SFZPKBSY7HJUCXJIFVE2PEOTVA

Activity in times of high volatility on CEX's



High likelihood market-making operations or CEX to DEX arbitrage

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Summary

First insights into MEV dynamics on the Algorand blockchain with fixed gas-price dynamics
High number of theoretical arbitrage opportunities across various DEX's
No evidence for systematic cross-DEX related MEV extraction

Limitations

Limited time frame
Limited number of tokens and markets
Relatively simple algorithm for finding profitable cross-DEX arbitrage transactions

Future Work (Application Project)

Extend time periods to generalize
Improve lower-bound estimate of cross-DEX related MEV



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INFORMATIK INFORMATIK