



# GOVERNANCE TOKEN FLOWS

● FINAL PRESENTATION - GROUP 1

# TABLE OF CONTENT

---

**01** Research Questions

**02** Gathering Data

**03** Analysis

**04** Framework

**05** Conclusion



# RESEARCH QUESTIONS

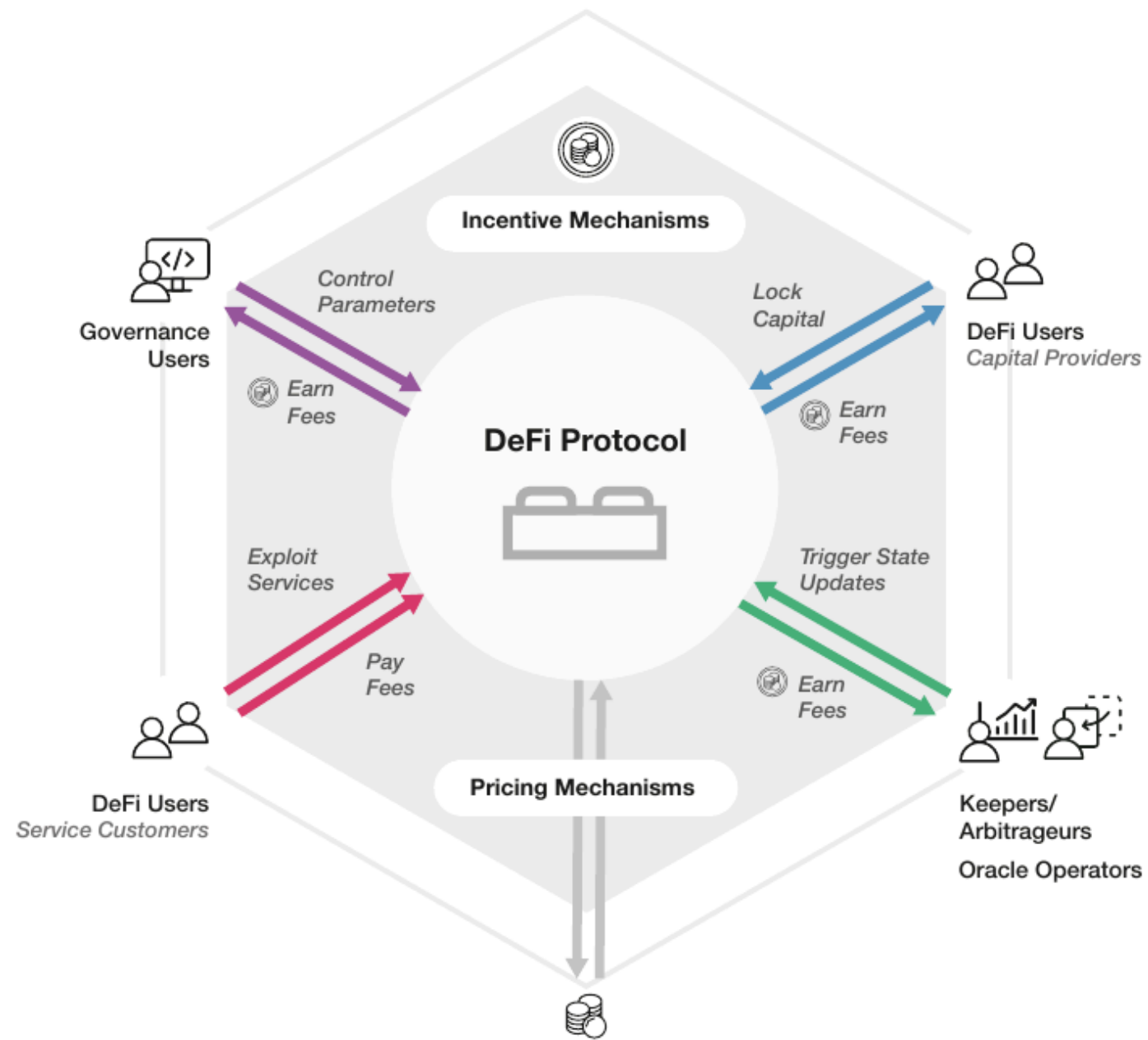


Image source: The Technology of Decentralized Finance (DeFi) ; by Raphael Auer, Bernhard Haslhofer, Stefan Kitzler, Pietro Saggese and Friedhelm Victor; BIS Working Papers No 1066; Figure 8

**01** How are governance tokens distributed?

**02** Who and how often trades them?

**03** What fraction is held by CEXs and by users?

# DEFI PROTOCOLS

## SELECTED TOKENS

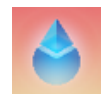
DeFi protocols often use governance token for voting rights and liquidity mining programs.



Dai: Maker MKR (MakerDao's native governance token)



Uniswap: UNI



Lido: LDO (Granting governance in Lido DAO)

# GATHERING DATA

## API CALLS

- ERC20 Token Transfer Event (0xddf252ad)
- Infura API

### Problem

- Request limit of 10,000 logs per requests
- Daily limit per account
- Response for API calls take too long for many requests

### Solution

- Call for small block ranges (e.g. 100 blocks)
- Multiple threads to speed up

```
w3.eth.get_logs({  
    'fromBlock': from_block,  
    'toBlock': to_block,  
    'address': address,  
    'topics': [topic]  
})
```

# GATHERING DATA

## WORKFLOW

Block ranges: End block #200000000 (Jun-01-2024)

- UNI: from #10861674 (Sep-14-2020)
- MKR: from #4620855 (Nov-25-2017)
- LDO: from #11473276 (Dec-17-2020)

### 1. Fetch all transfer logs

tx\_hash, block\_number, from, to, amount

### 2. Preprocess data: Create balances

address, amount\_in, transfer\_frequency\_in, amount\_out, transfer\_frequency\_out, balance, cex

# ANALYSIS

## OVERVIEW

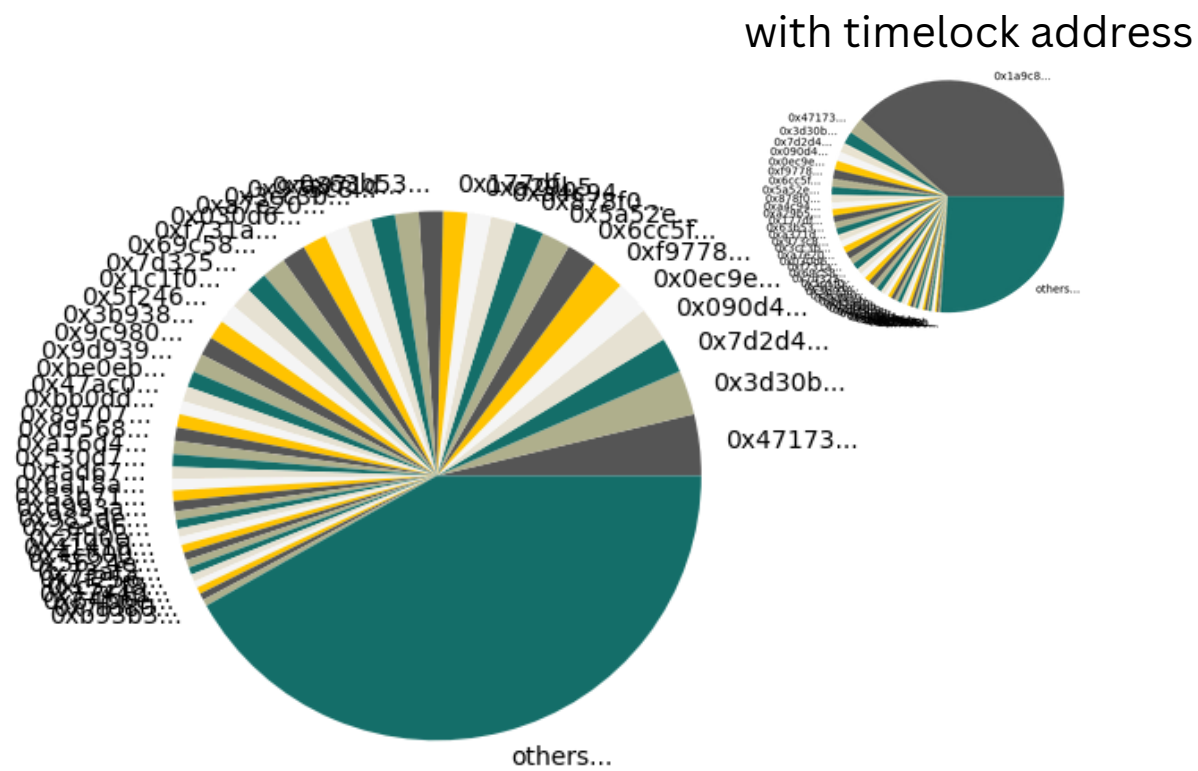


	UNI	MKR	LDO
Number of transfer log events	4.628.958	2.259.044	1.017.228
Number of addresses that hold tokens:	382.522	108.471	44.726
Transfer frequency	0.51	0.15	0.12



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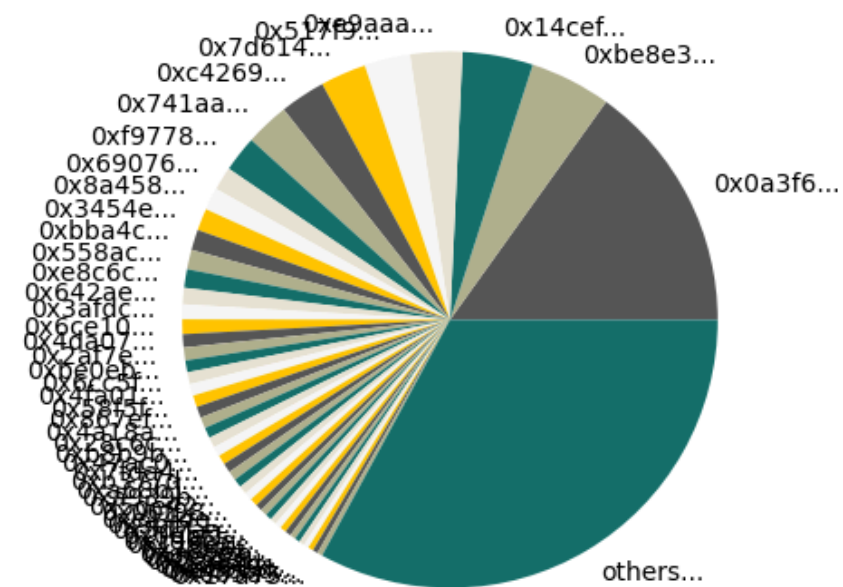


UNI

Top 10: 21.70%

Top 100: 73.94%

Top 1000: 95.61%

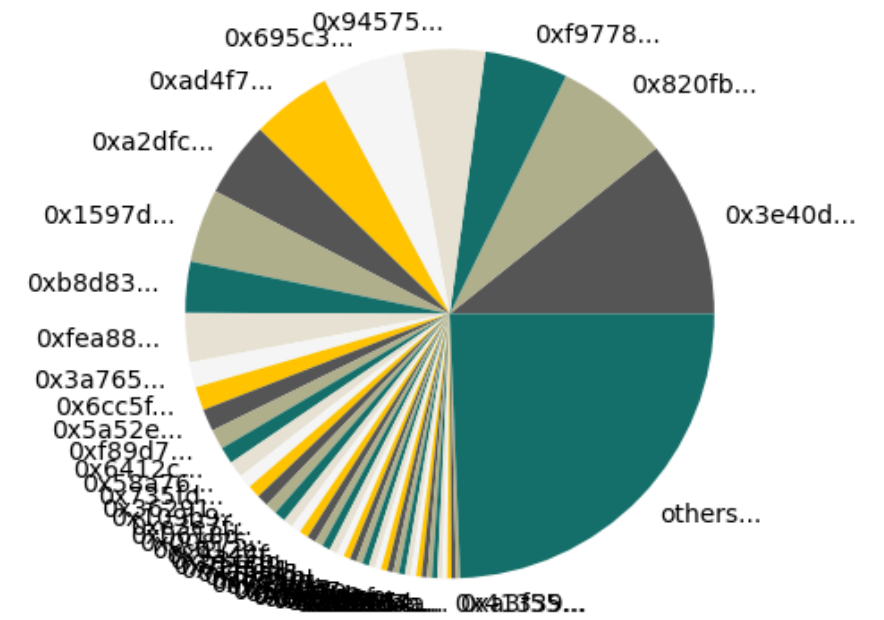


MKR

Top 10: 41.89%

Top 100: 77.95%

Top 1000: 96.53%



## LDO

Top 10: 52.94%

Top 100: 84.71%

Top 1000: 98.04%

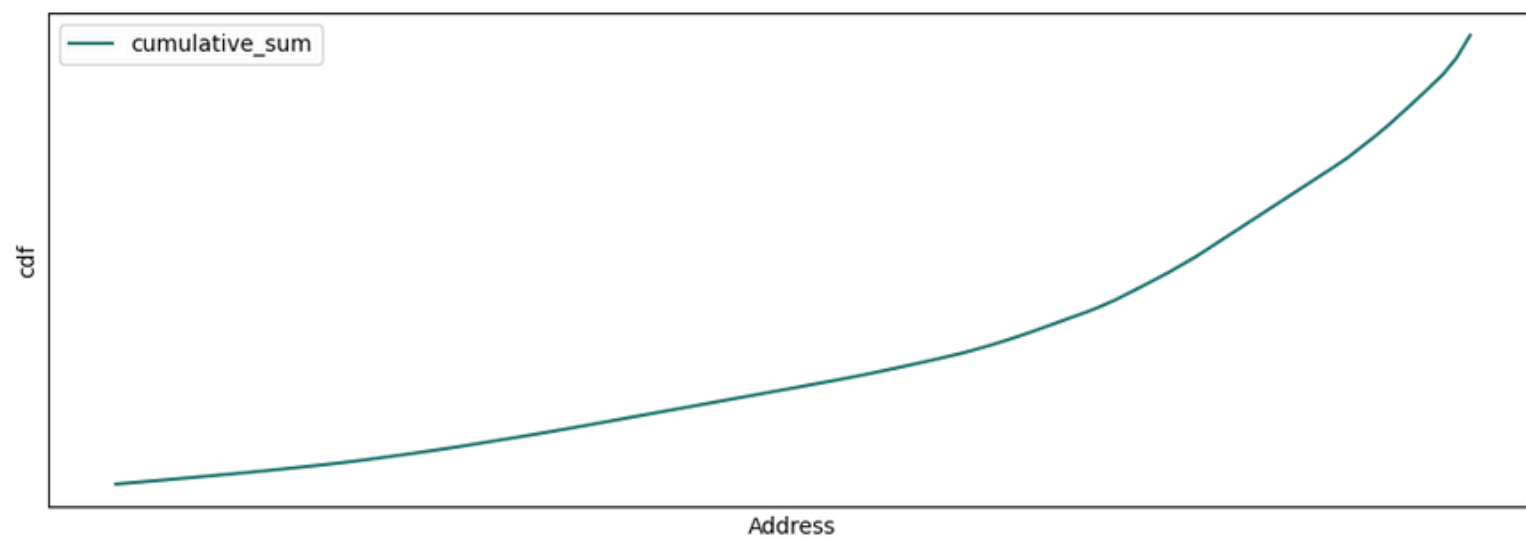


# RQ1 - UNI

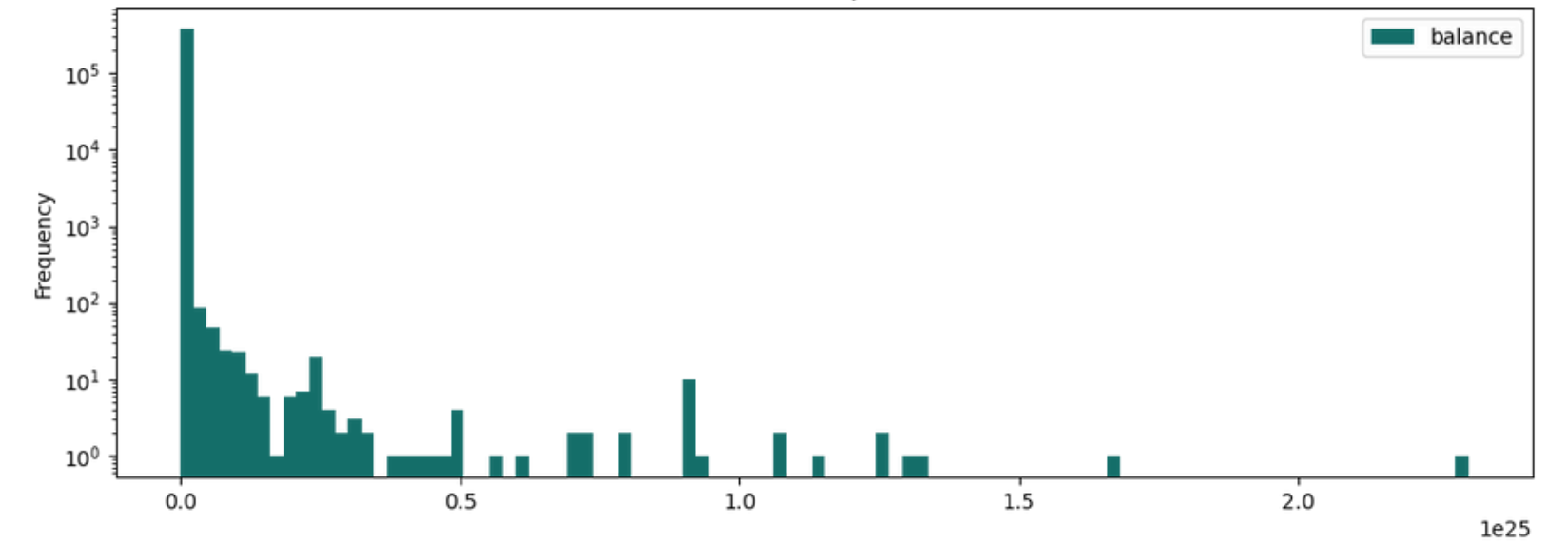
ALL



TOP 100



Distribution by balance



## Distribution & CDF

Gini Index:

- 0.995 (all)
- 0.841 (top 1,000)
- 0.424 (top 100)

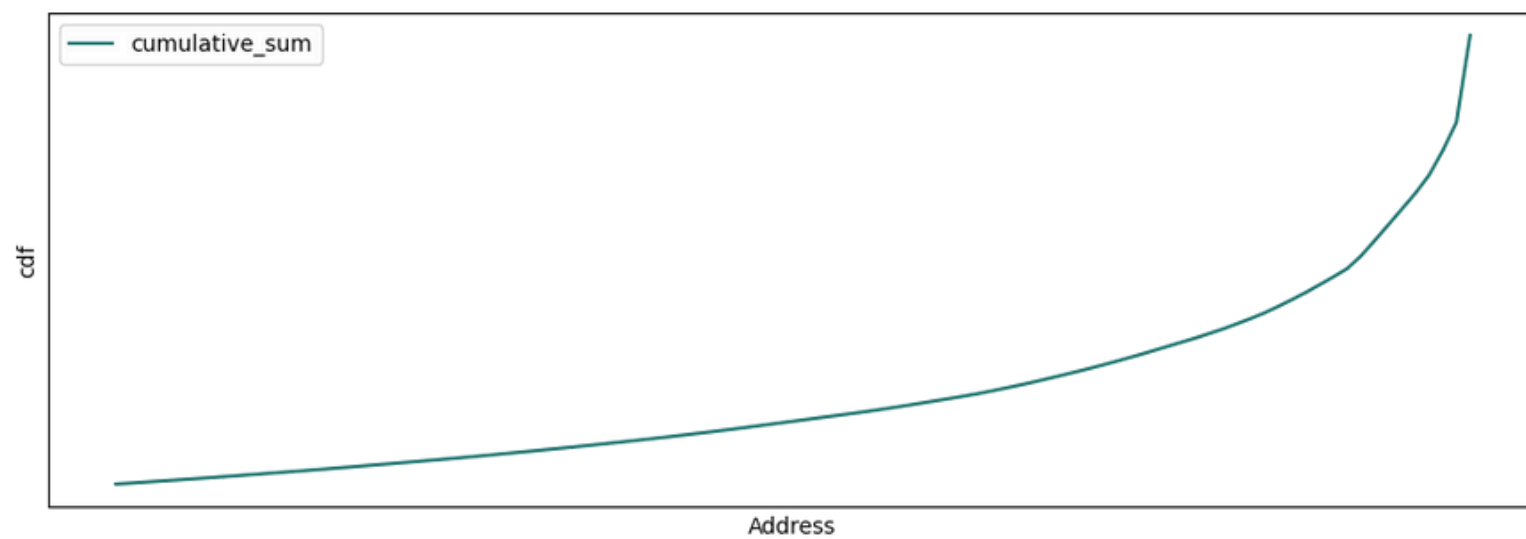
HHI: 0.0097

# RQ1 - MKR

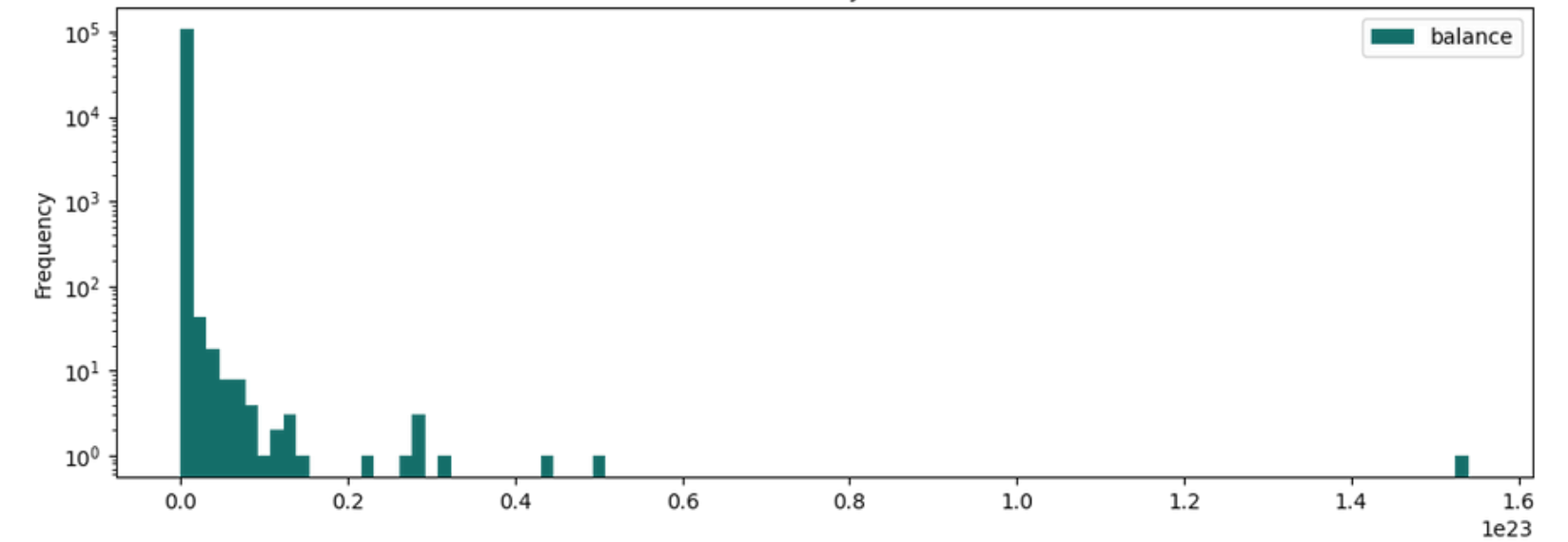
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TOP 100



Distribution by balance



## Distribution & CDF

Gini Index:

- 0.996 (all)
- 0.861 (top 1,000)
- 0.604 (top 100)

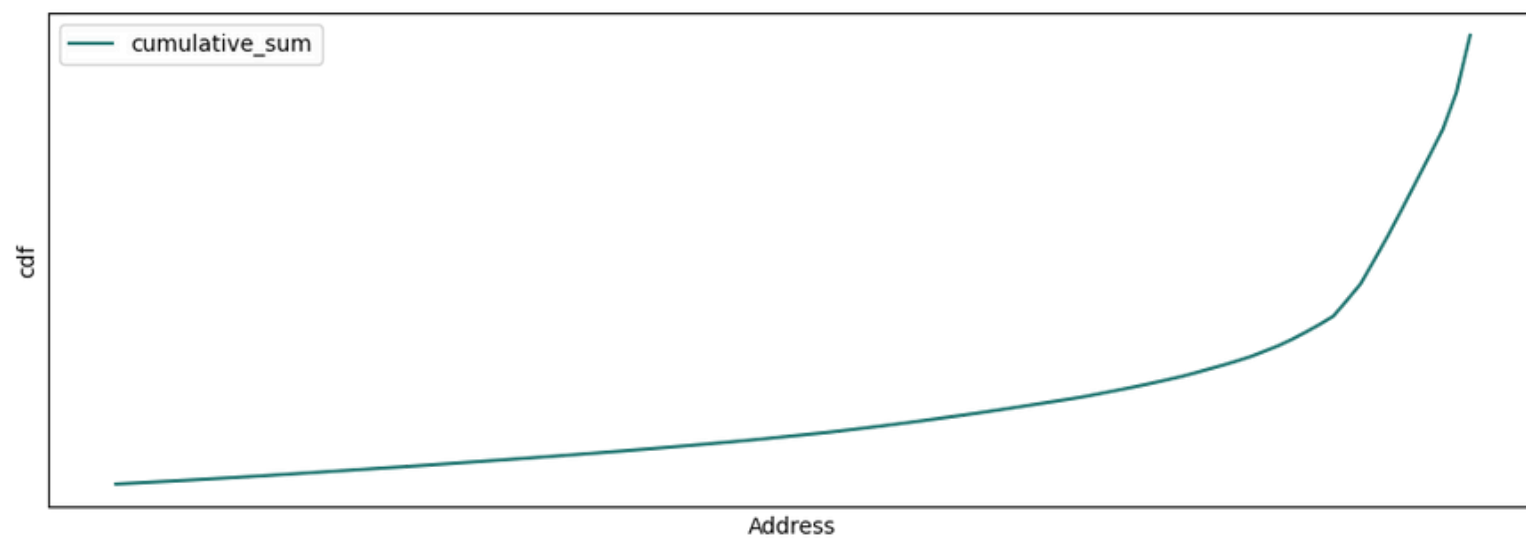
HHI: 0.034

# RQ1 - LDO

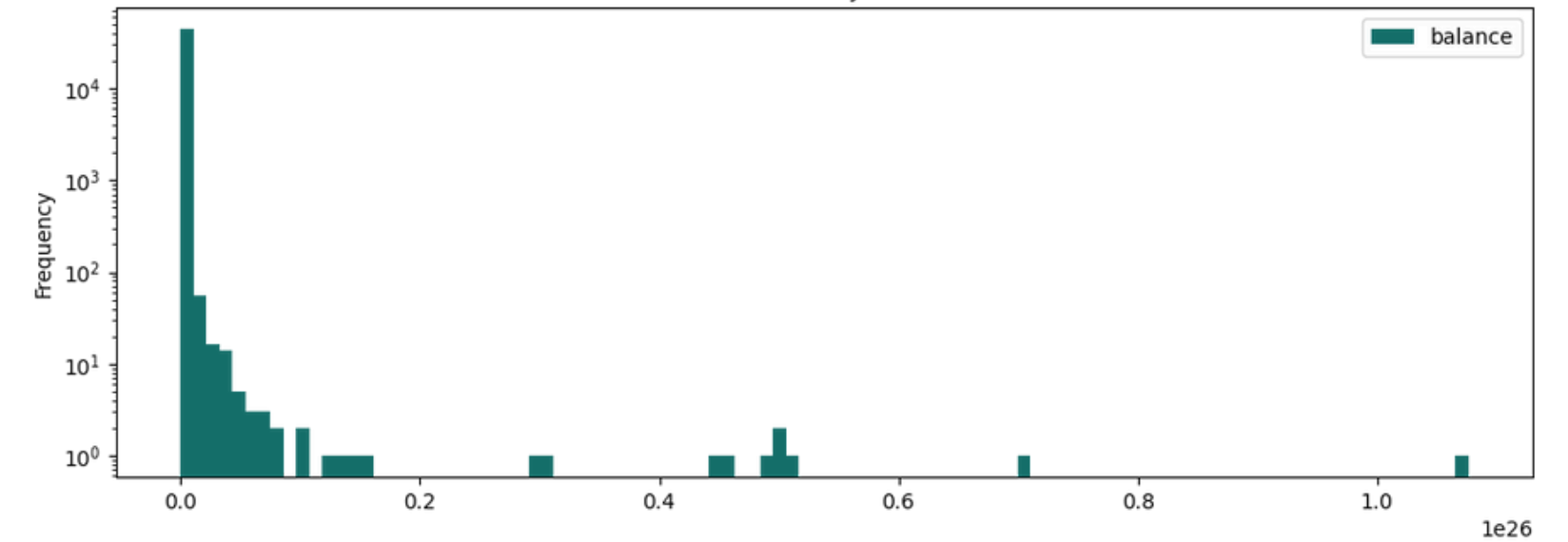
ALL



TOP 100



Distribution by balance



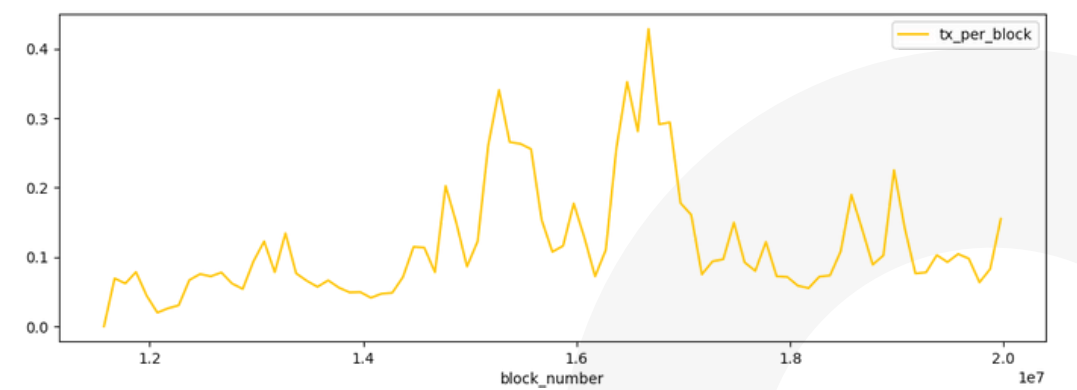
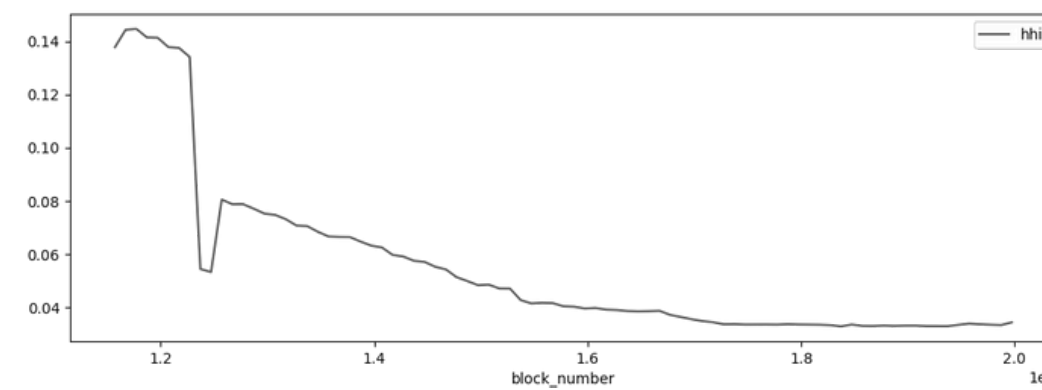
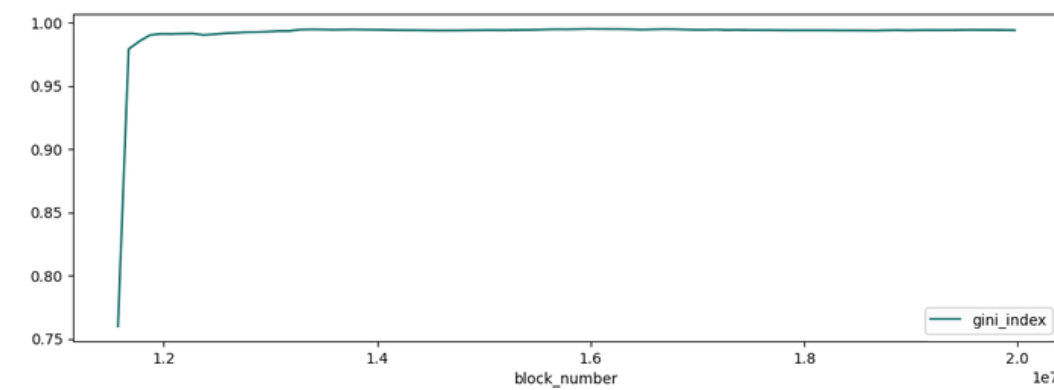
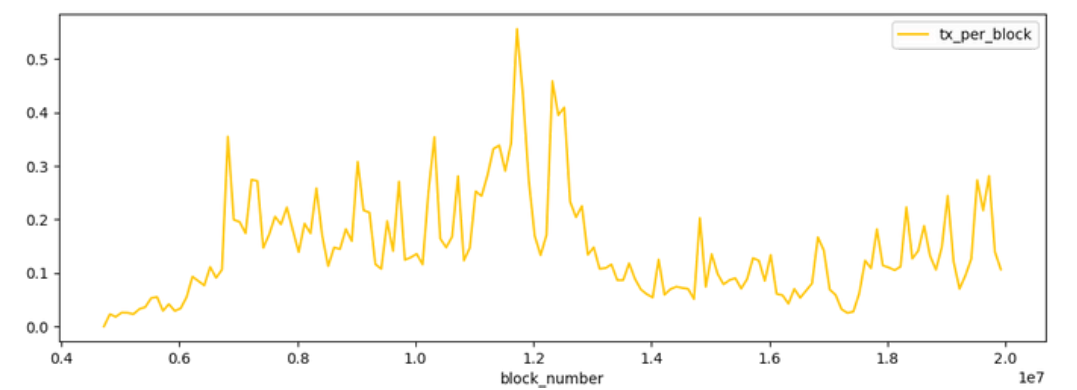
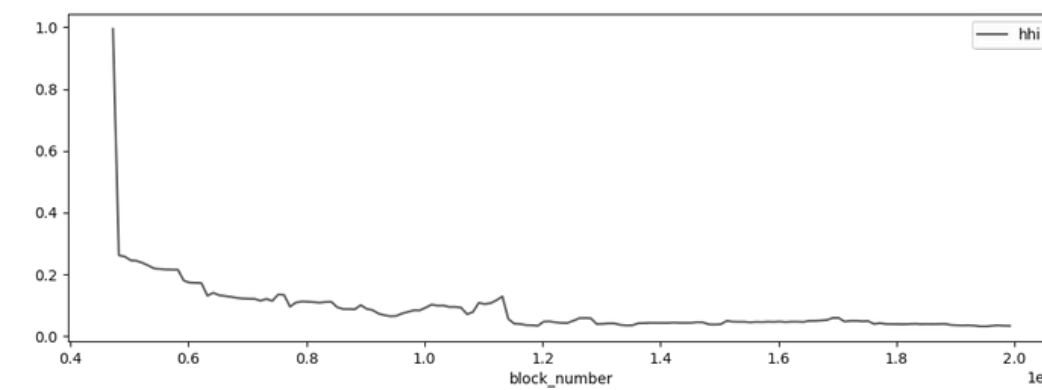
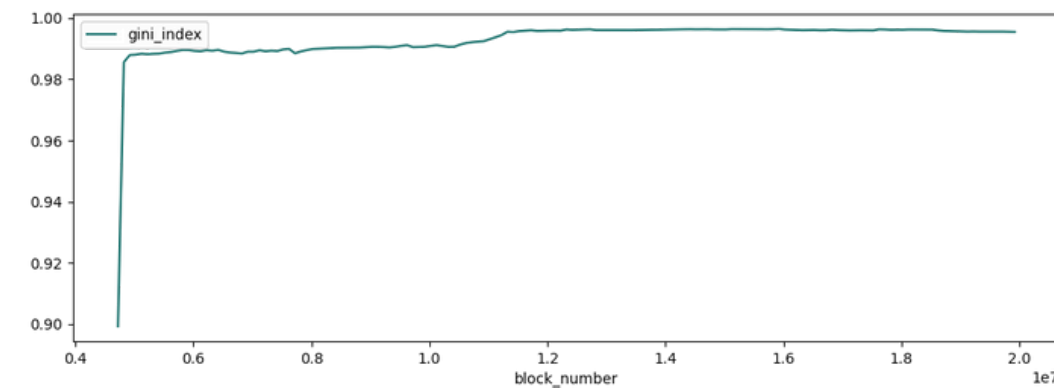
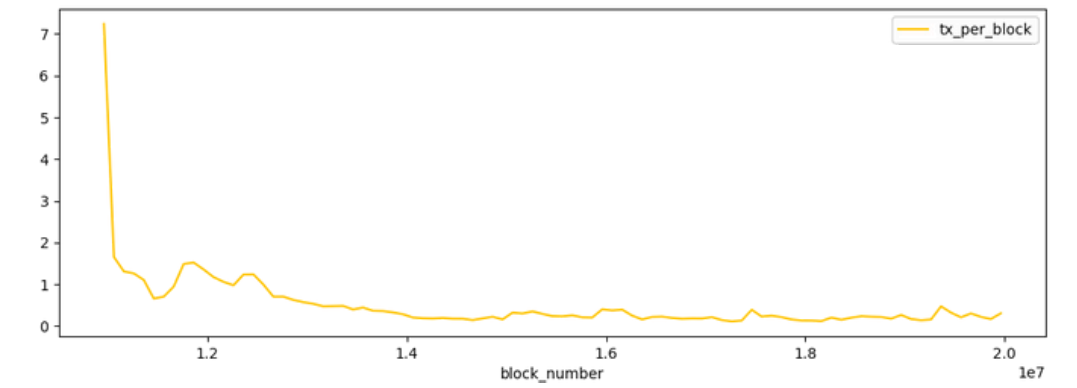
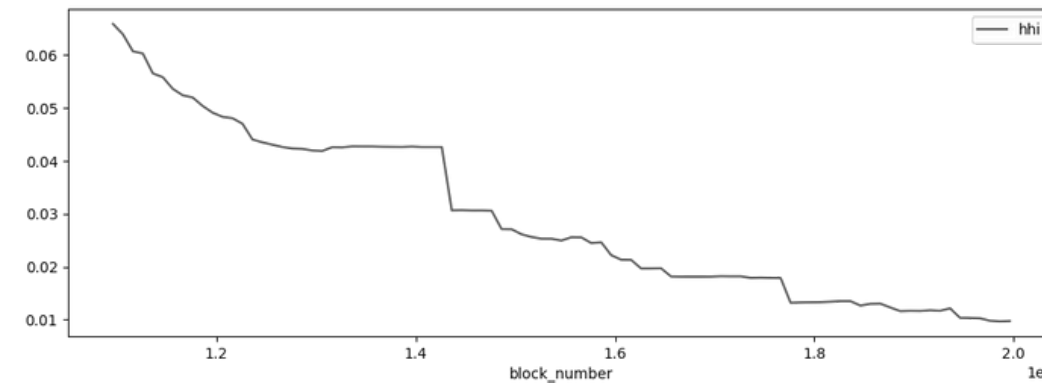
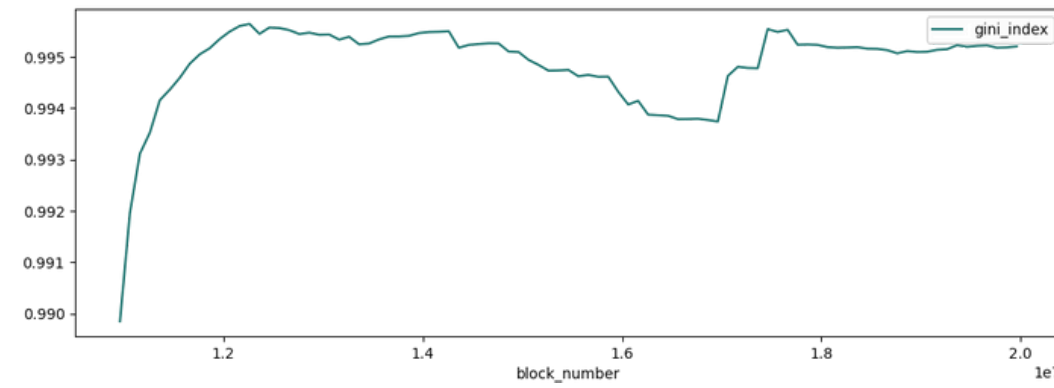
## Distribution & CDF

Gini Index:

- 0.994 (all)
- 0.899 (top 1,000)
- 0.665 (top 100)

HHI: 0.034

# TIMELINE



GINI

HHI

Transfers/Block

# RQ2

## WHO AND HOW OFTEN TRADES THEM?

UNI

### Top senders:

	address	amount_out	balance	cex
340204	0x41653c7d61609d856f29355e404f310ec4142cfb	100000001000000000000000000000	2758162612694493	NaN
1	NaN	640546332991585989963242362	36697432554638172652161204	binance
153078	0x1d42064fc4beb5f8aaf85f4617ae8b3b5b8bd801	510292271219545437350139811	2389244318714231259971746	NaN
1095711	0xd3d2e2692501a5c9ca623199d38826e513033a17	483216915993710051574549398	296150534151073172965800	NaN
745201	0x8fdb3816fe10e16aaa9b12b3c4688c873efe2eca	3999999999999997760000000000	2240000000000	NaN
447613	0x56178a0d5f301baf6cf3e1cd53d9863437345bf9	375499200011535391854412326	2287	NaN
6	NaN	197204257345611112358315921	165471168316191250849500	coinbasepro
279335	0x35a18000230da775cac24873d00ff85bccded550	178292089903904833367364378	1710109454349553903820275	NaN
48214	0x090d4613473dee047c3f2706764f49e0821d256e	1369655806886740000000000000	13037019770979843000000000	NaN
948567	0xb739d0895772dbb71a89a3754a160269068f0d45	116394118341249950082884173	3908801744899348008	NaN

### Top receivers:

	address	amount_in	balance	cex
340204	0x41653c7d61609d856f29355e404f310ec4142cfb	1000000010002758162612694493	2758162612694493	NaN
1	NaN	677243765546224162615403566	36697432554638172652161204	binance
153078	0x1d42064fc4beb5f8aaf85f4617ae8b3b5b8bd801	512681515538259668610111557	2389244318714231259971746	NaN
1095711	0xd3d2e2692501a5c9ca623199d38826e513033a17	483513066527861124747515198	296150534151073172965800	NaN
745201	0x8fdb3816fe10e16aaa9b12b3c4688c873efe2eca	4000000000000000000000000000	2240000000000	NaN
447613	0x56178a0d5f301baf6cf3e1cd53d9863437345bf9	375499200011535391854414613	2287	NaN
6	NaN	197369728513927303609165421	165471168316191250849500	coinbasepro
279335	0x35a18000230da775cac24873d00ff85bccded550	180002199358254387271184653	1710109454349553903820275	NaN
48214	0x090d4613473dee047c3f2706764f49e0821d256e	1500026004596538430000000000	13037019770979843000000000	NaN
948567	0xb739d0895772dbb71a89a3754a160269068f0d45	116394122250051694982232181	3908801744899348008	NaN



# RQ2

## WHO AND HOW OFTEN TRADES THEM?

UNI - Contd.

Most active senders:

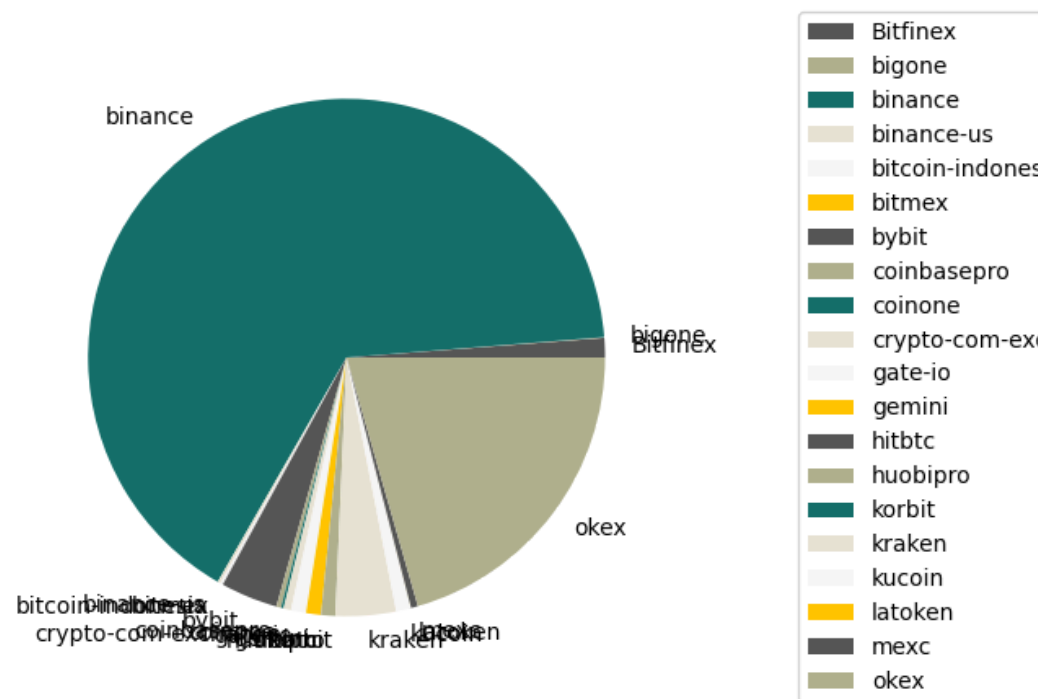
	address	transfer_frequency_out	balance	cex
1095711	0xd3d2e2692501a5c9ca623199d38826e513033a17	0.033204	296150534151073172965800	NaN
48214	0x090d4613473dee047c3f2706764f49e0821d256e	0.024291	13037019770979843000000000	NaN
1	NaN	0.014018	36697432554638172652161204	binance
153078	0x1d42064fc4beb5f8aaf85f4617ae8b3b5b8bd801	0.012833	2389244318714231259971746	NaN
948567	0xb739d0895772dbb71a89a3754a160269068f0d45	0.010984	3908801744899348008	NaN
606035	0x74de5d4fcfb63e00296fd95d33236b9794016631	0.009736	5646	NaN
447613	0x56178a0d5f301baf6cf3e1cd53d9863437345bf9	0.009273	2287	NaN
1132850	0xdafd66636e2561b0284edde37e42d192f2844d40	0.004821	19867948362411031121355	NaN
6	NaN	0.004787	165471168316191250849500	coinbasepro
397331	0x4c6007e38ce164ed80ff8ff94192225fcdac68cd	0.004051	3029432537672326914704064	NaN

Most active receivers:

	address	transfer_frequency_in	balance	cex
1095711	0xd3d2e2692501a5c9ca623199d38826e513033a17	0.050709	296150534151073172965800	NaN
153078	0x1d42064fc4beb5f8aaf85f4617ae8b3b5b8bd801	0.012762	2389244318714231259971746	NaN
447613	0x56178a0d5f301baf6cf3e1cd53d9863437345bf9	0.010035	2287	NaN
606035	0x74de5d4fcfb63e00296fd95d33236b9794016631	0.007449	5646	NaN
1	NaN	0.007272	36697432554638172652161204	binance
1132850	0xdafd66636e2561b0284edde37e42d192f2844d40	0.004951	19867948362411031121355	NaN
948567	0xb739d0895772dbb71a89a3754a160269068f0d45	0.004918	3908801744899348008	NaN
18	NaN	0.003405	11521347873058447678147604	okex
413120	0x4f6742badb049791cd9a37ea913f2bac38d01279	0.003286	1082	NaN
1080940	0xd0fc8ba7e267f2bc56044a7715a489d851dc6d78	0.002711	46927549980290611277729	NaN

# CEX - RQ3

## CENTRAL EXCHANGES AS BALANCE HOLDERS



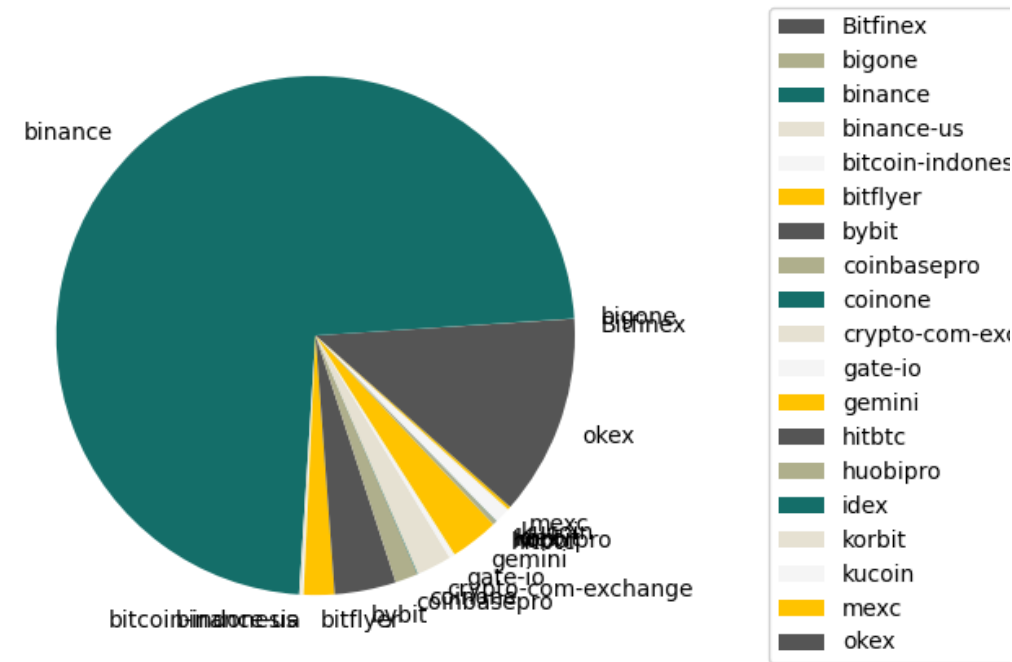
### UNI

# cex addresses: 43

All cex hold 9 % of tokens.

Top senders and receivers:

- Binance (#2)
- Coinbasepro (#7)
- Okex (#8)



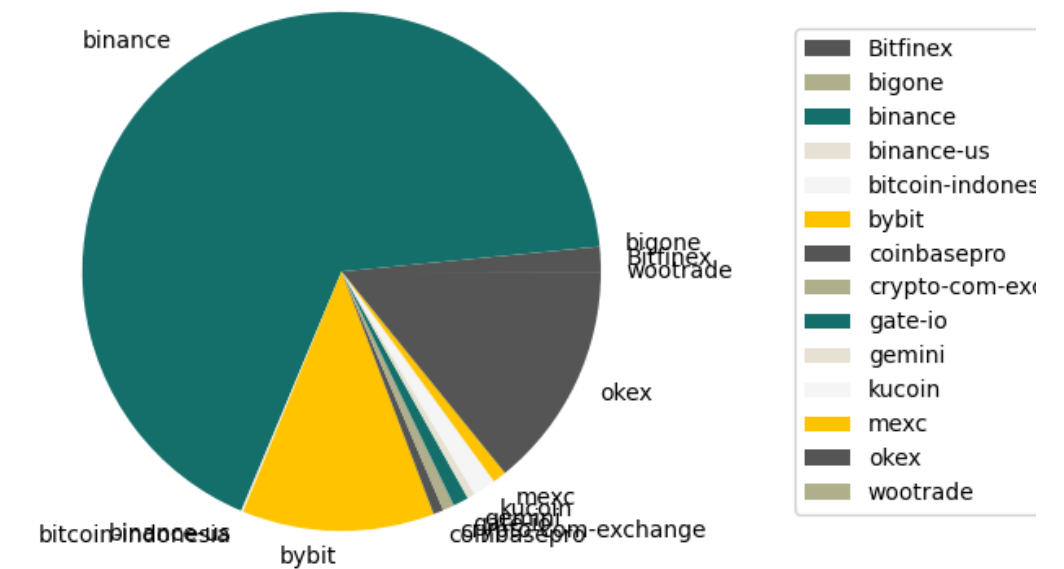
### MKR

# cex addresses: 43

All cex hold 6.12 % of tokens.

Top senders and receivers:

- Binance (#1)
- Coinbasepro (#5)



### LDO

# cex addresses: 23

All cex hold 9.99 % of tokens.

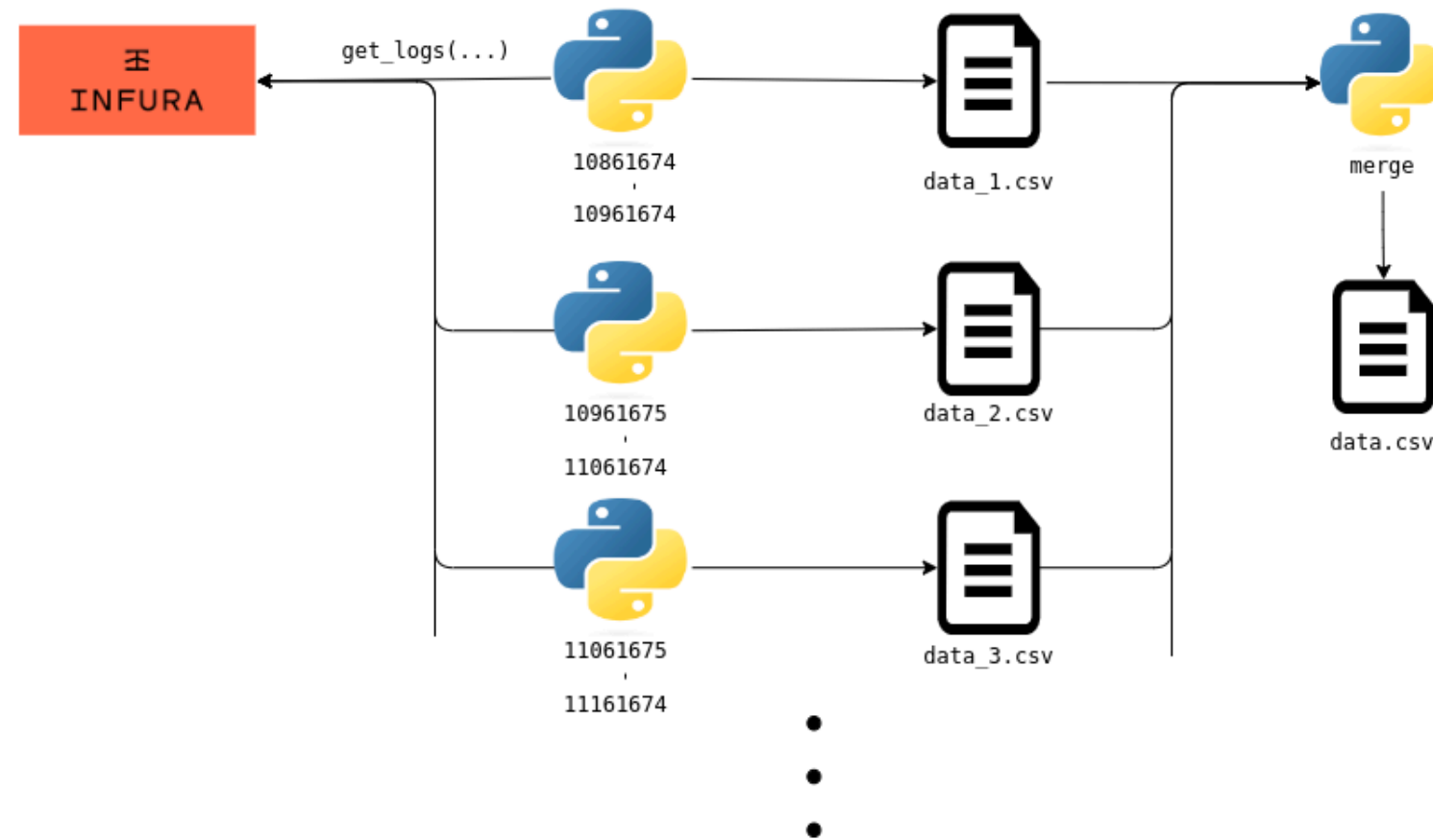
Top senders and receivers:

- Binance (#1)
- Coinbasepro (#3)

# FRAMEWORK

## ANALYSING TOKEN FLOWS

```
read_data.py -a 0x1f9840a8... -t 0xddf252ad -o data.csv --start-block 10861674 --end-block 20000000
```



One Framework to catch 'em all!

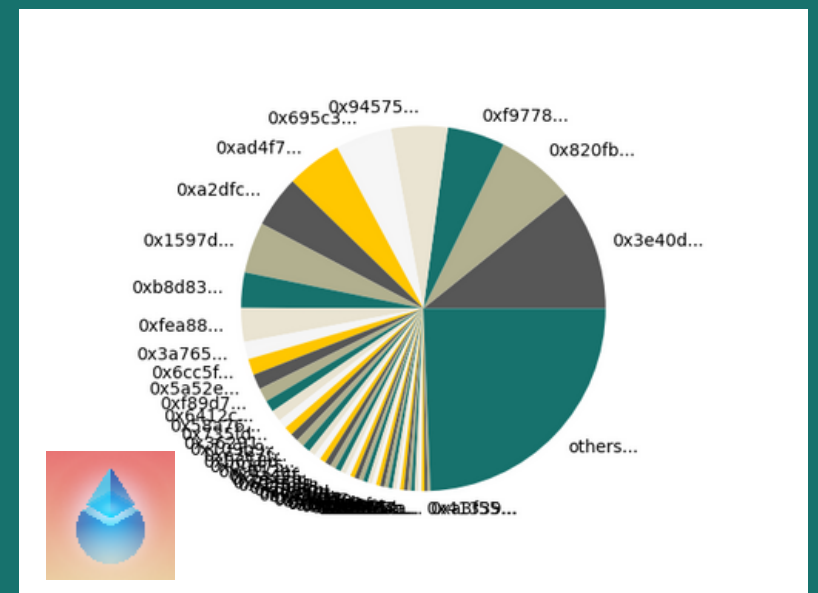
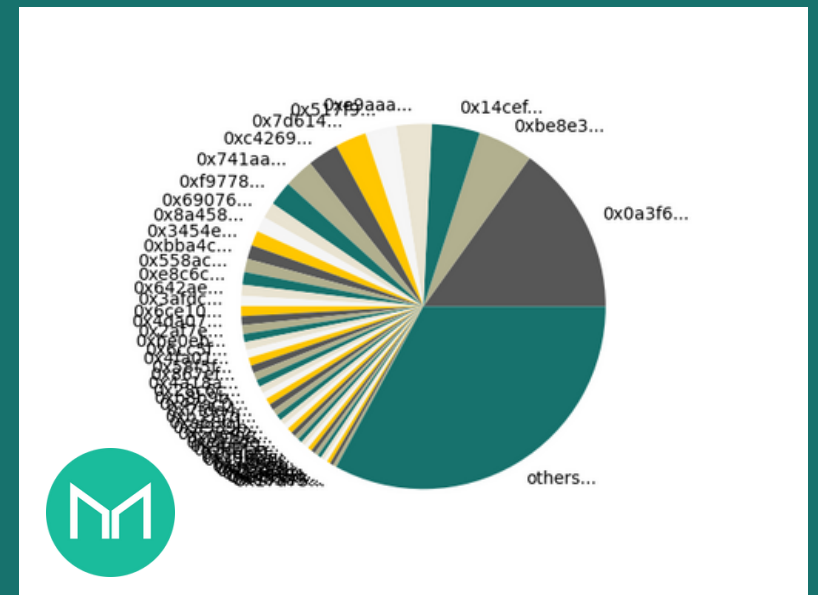
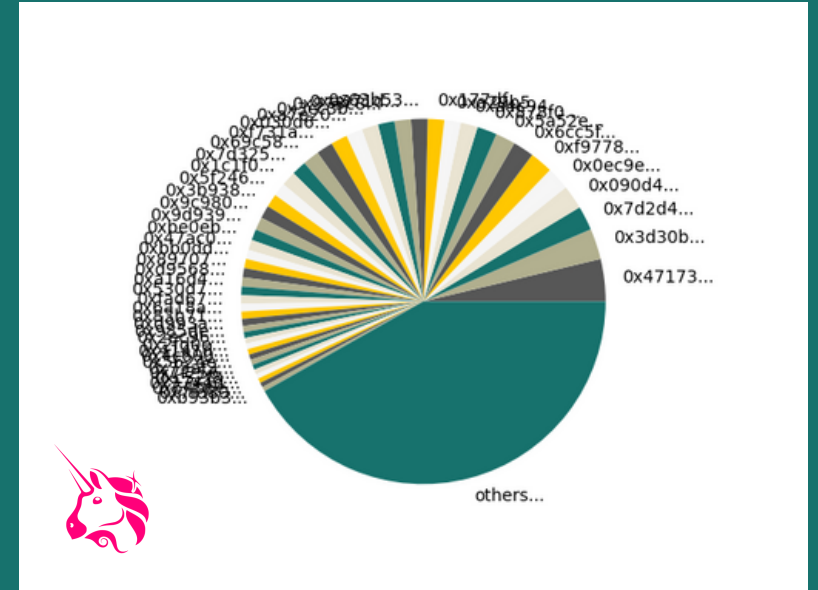
## Three scripts

- `read_data.py`:
  - query Infura API
  - use multiple threads
  - automatically determines start block for analysis
- `preprocess_data.py`:
  - compute address balances
  - compute transfer frequencies + incoming and outgoing tokens per address
  - annotate addresses with CEX labels
- `analyze_data.py`:
  - methods for statistics (pie charts, timelines, calculations, etc.)



# CONCLUSION

- Tokens are not well distributed upon all addresses
- ... but: Tokens are distributed quite equally in top 100 holders
- Token distribution differences
  - UNI is distributed more equally
  - LDO has most unequal distribution
- A small core community is more active than the rest
  - LDO Top 10 hold 52.94% of all tokens
  - Top 1,000 hold >95% for all gov tokens
- CEX are big players in governance, especially
  - Binance
  - Coinbase



# FUTURE WORK




















- 01

Further refine framework (extend Blockchain support)
- 02

Analyze more governance tokens
- 03

Investigate other types of tokens (e.g., USDT, USDC, etc...)
- 04

Extend address labeling (more CEX data, other entities)

☆	1	 Ethereum ETH	\$3,360.43	▼0.09%	▼4.22%	▼5.40%	\$410,898,737,874
☆	2	 Shiba Inu SHIB	\$0.00001692	▼0.46%	▼6.64%	▼16.16%	\$9,970,551,563
☆	3	 Dai DAI	\$0.9999	▲0.00%	▼0.00%	▲0.01%	\$5,347,493,882
☆	4	 Render RNDR	\$6.84	▼0.65%	▼7.69%	▼13.46%	\$2,659,985,573
☆	5	 Arbitrum ARB	\$0.7717	▲0.22%	▼5.09%	▼13.01%	\$2,493,957,558
☆	6	 Mantle MNT	\$0.7623	▲0.16%	▼5.97%	▼11.74%	\$2,490,335,698
☆	7	 First Digital USD FDUSD	\$0.9991	▼0.05%	▼0.07%	▼0.01%	\$2,268,661,372
☆	8	 Ondo ONDO	\$1.07	▲0.36%	▼8.66%	▼3.50%	\$1,491,869,699
☆	9	 JasmyCoin JASMY	\$0.02911	▼0.03%	▼9.24%	▼19.86%	\$1,435,066,522
☆	10	 Starknet STRK	\$0.6751	▼0.19%	▼8.54%	▼22.32%	\$877,820,778
☆	11	 Beam BEAM	\$0.01575	▼0.36%	▼7.69%	▼17.89%	\$779,120,325
☆	12	 The Sandbox SAND	\$0.3145	▼0.85%	▼5.74%	▼13.60%	\$717,524,873
☆	13	 Worldcoin WLD	\$2.72	▼0.28%	▼9.86%	▼17.30%	\$685,606,686
☆	14	 Wormhole W	\$0.3299	▼0.84%	▼6.50%	▼21.25%	\$593,891,674
☆	15	 Aevo AEVO	\$0.4536	▼1.80%	▼8.99%	▼24.77%	\$381,271,330
☆	16	 Axelar AXL	\$0.5439	▼1.77%	▼13.05%	▼26.02%	\$380,435,039
☆	17	 Aragon ANT	\$8.57	▼0.08%	▼4.08%	▼7.80%	\$370,168,566
☆	18	 Arkham ARKM	\$1.72	▲1.29%	▼9.46%	▼3.45%	\$351,553,832
☆	19	 SafePal SFP	\$0.731	▲0.03%	▼1.18%	▼9.85%	\$338,085,758
☆	20	Manta Network MANTA	\$0.9376	▲0.03%	▼8.87%	▼23.47%	\$305,024,176

# QUESTIONS ?

## ● GOVERNANCE TOKEN FLOWS - GROUP 1

# BACKUP SLIDES



# RQ2

## WHO AND HOW OFTEN TRADES THEM?

MKR

### Top senders:

	address	amount_out	balance	cex
1	NaN	2684474174103003253719040	46051723732922684298025	binance
138722	0x642ae78fafbb8032da552d619ad43f1d81e4dd7c	1999565638836304056680448	10010037521254843416576	NaN
219770	0x9ef05f7f6deb616fd37ac3c959a2ddd25a54e4f5	1134028905590136770793721	77695907563979112448	NaN
14705	0x0a3f6849f78076aefadf113f5bed87720274ddc0	1111405403030477327360036	153998044112777295833409	NaN
6	NaN	1059760576498675706408562	899416500460108906496	coinbasepro
321271	0xe8c6c9227491c0a8156a0106a0204d881bb7e531	861309708694141863460864	11358873576643288367104	NaN
283385	0xcd531ae9efcce479654c4926dec5f6209531ca7b	666747638217112681447424	466081756590025211904	NaN
196697	0x8e2a84d6ade1e7fffee039a35ef5f19f13057152	608315041689144369468811	1805613168429906526208	NaN
339884	0xf65475e74c1ed6d004d5240b06e3088724dfda5d	600996586437487341076480	2282210762009635979264	NaN
206968	0x95a9bd206ae52c4ba8eecfc93d18eacdd41c88cc	510290759750892673446167	1159990850740227072	NaN

### Top receivers:

	address	amount_in	balance	cex
1	NaN	2730525897835925983367977	46051723732922684298025	binance
138722	0x642ae78fafbb8032da552d619ad43f1d81e4dd7c	2009575676357558627260974	10010037521254843416576	NaN
14705	0x0a3f6849f78076aefadf113f5bed87720274ddc0	1265403447143254623193445	153998044112777295833409	NaN
219770	0x9ef05f7f6deb616fd37ac3c959a2ddd25a54e4f5	1134106601497700749917429	77695907563979112448	NaN
6	NaN	1060659992999135815315037	899416500460108906496	coinbasepro
321271	0xe8c6c9227491c0a8156a0106a0204d881bb7e531	872668582270785252491264	11358873576643288367104	NaN
283385	0xcd531ae9efcce479654c4926dec5f6209531ca7b	667213719973702731300864	466081756590025211904	NaN
196697	0x8e2a84d6ade1e7fffee039a35ef5f19f13057152	610120654857574275868488	1805613168429906526208	NaN
339884	0xf65475e74c1ed6d004d5240b06e3088724dfda5d	603278797199496945074176	2282210762009635979264	NaN
206968	0x95a9bd206ae52c4ba8eecfc93d18eacdd41c88cc	510291919741743413673455	1159990850740227072	NaN



# RQ2

## WHO AND HOW OFTEN TRADES THEM?

MKR - Contd.

Most active senders:

	address	transfer_frequency_out	balance	cex
268877	0xc2adda861f89bbb333c90c492cb837741916a225	0.005218	412309678135476748288	NaN
61883	0x2c4bd064b998838076fa341a83d007fc2fa50957	0.005121	74696300245816430085.25	NaN
80040	0x39755357759ce0d7f32dc8dc45414cca409ae24e	0.004872	30049961083067633664	NaN
1	NaN	0.004371	46051723732922684298025.0	binance
321271	0xe8c6c9227491c0a8156a0106a0204d881bb7e531	0.004026	11358873576643288367104	NaN
29622	0x14fbca95be7e99c15cc2996c6c9d841e54b79425	0.002944	100000000000581732.0	NaN
230221	0xa69babef1ca67a37ffaf7a485dfff3382056e78c	0.002108	74505893361812832256	NaN
112947	0x517f9dd285e75b599234f7221227339478d0fcc8	0.001904	28290830501492144734208	NaN
206968	0x95a9bd206ae52c4ba8eecfc93d18eacdd41c88cc	0.001876	1159990850740227072	NaN
289848	0xd2045edc40199019e221d71c0913343f7908d0d5	0.001742	52321.25	NaN

Most active receivers:

	address	transfer_frequency_in	balance	cex
268877	0xc2adda861f89bbb333c90c492cb837741916a225	0.005216	412309678135476748288	NaN
145509	0x69076e44a9c70a67d5b79d95795aba299083c275	0.004478	14389351938051431989248	NaN
321271	0xe8c6c9227491c0a8156a0106a0204d881bb7e531	0.004234	11358873576643288367104	NaN
61883	0x2c4bd064b998838076fa341a83d007fc2fa50957	0.003802	74696300245816430085.25	NaN
80040	0x39755357759ce0d7f32dc8dc45414cca409ae24e	0.002484	30049961083067633664	NaN
112947	0x517f9dd285e75b599234f7221227339478d0fcc8	0.002115	28290830501492144734208	NaN
1	NaN	0.002091	46051723732922684298025.0	binance
230221	0xa69babef1ca67a37ffaf7a485dfff3382056e78c	0.002054	74505893361812832256	NaN
289848	0xd2045edc40199019e221d71c0913343f7908d0d5	0.001742	52321.25	NaN
256883	0xba13afecda9beb75de5c56bbaf696b880a5a50dd	0.001631	107839158800807477248	NaN

# RQ2

## WHO AND HOW OFTEN TRADES THEM?

LDO

### Top senders:

	address	amount_out	balance	cex
1	NaN	1721105410837780480000000000	68108806024237262903881771	binance
74783	0xa3f558aebaecaf0e11ca4b2199cc5ed341edfd74	1147154243291906991849373241	2588549098016500368587269	NaN
5	NaN	515142628229704836287316708	641160949322622392617200	coinbasepro
93139	0xcd531ae9efcce479654c4926dec5f6209531ca7b	502889900714615428100624735	532649314165584727299100	NaN
89636	0xc558f600b34a5f69dd2f0d06cb8a88d829b7420a	374508845009921568487179504	26896046942688315807777	NaN
28503	0x3e40d73eb977dc6a537af587d48316fee66e9c8c	358009247340639482603694078	107622410252245548438504228	NaN
75963	0xa69babef1ca67a37ffaf7a485dfff3382056e78c	224768198098267952398502471	42956583096111324394459	NaN
65604	0x9008d19f58aabd9ed0d60971565aa8510560ab41	201019956836601266296075659	4462417641453688500055	NaN
110861	0xf4ad61db72f114be877e87d62dc5e7bd52df4d9b	195731480857113989378661405	214294547684153304156243	NaN
56	0x00000000dfde7deaf24138722987c9a6991e2d4	171754022026867237461170761	102909427530407834921207	NaN

### Top receivers:

	address	amount_in	balance	cex
1	NaN	1789214216862017742903881771	68108806024237262903881771	binance
74783	0xa3f558aebaecaf0e11ca4b2199cc5ed341edfd74	1149742792389923492217960510	2588549098016500368587269	NaN
5	NaN	515783789179027458679933908	641160949322622392617200	coinbasepro
93139	0xcd531ae9efcce479654c4926dec5f6209531ca7b	503422550028781012827923835	532649314165584727299100	NaN
28503	0x3e40d73eb977dc6a537af587d48316fee66e9c8c	465631657592885031042198306	107622410252245548438504228	NaN
89636	0xc558f600b34a5f69dd2f0d06cb8a88d829b7420a	374535741056864256802987281	26896046942688315807777	NaN
75963	0xa69babef1ca67a37ffaf7a485dfff3382056e78c	224811154681364063722896930	42956583096111324394459	NaN
65604	0x9008d19f58aabd9ed0d60971565aa8510560ab41	201024419254242719984575714	4462417641453688500055	NaN
110861	0xf4ad61db72f114be877e87d62dc5e7bd52df4d9b	195945775404798142682817648	214294547684153304156243	NaN
52482	0x735fd3c55a8be1aeb3544c7e29eba3ea23500a1c	172731417189931805629610335	8273066060621675629610335	NaN



# RQ2

## WHO AND HOW OFTEN TRADES THEM?

LDO - Contd.

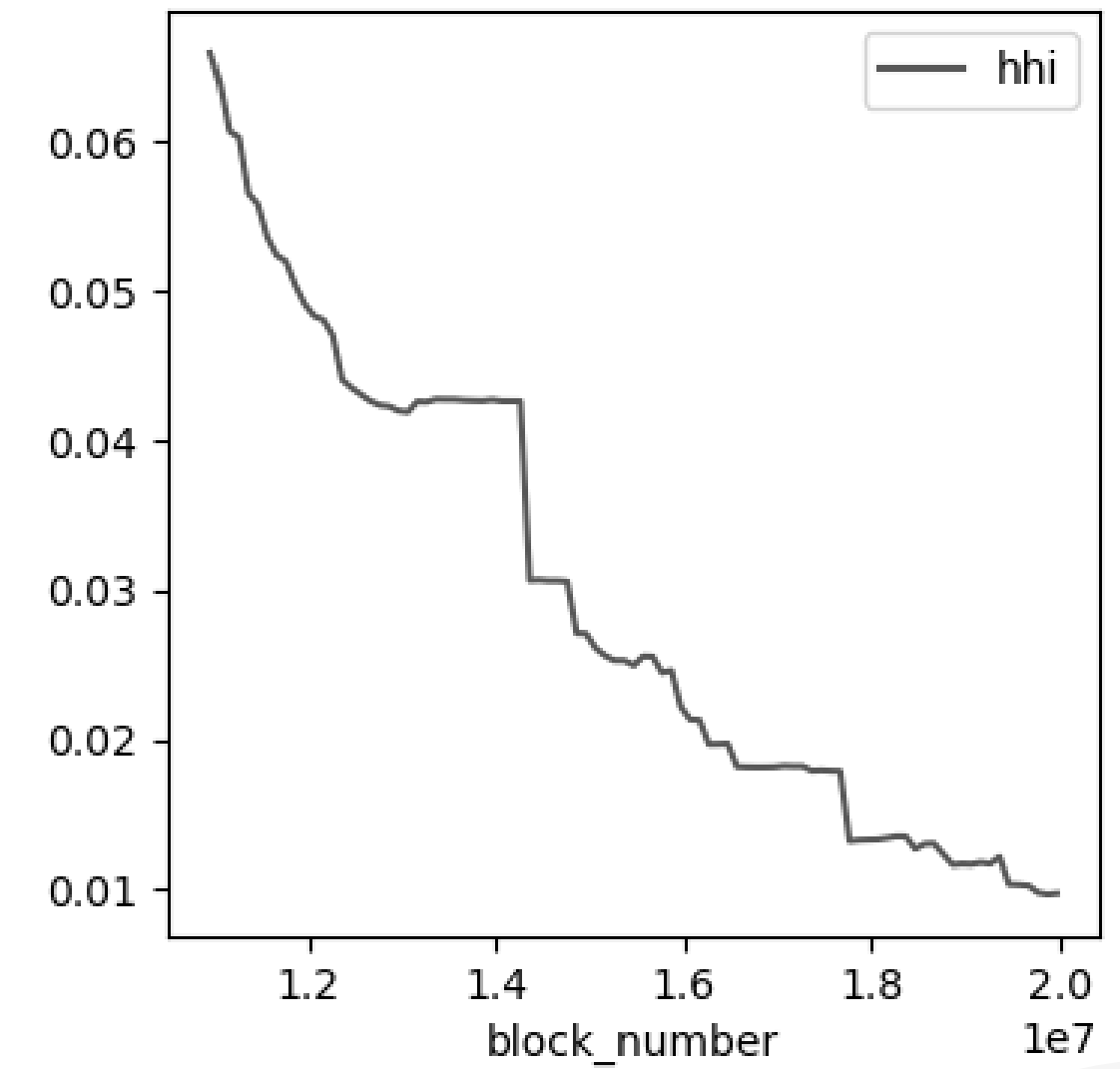
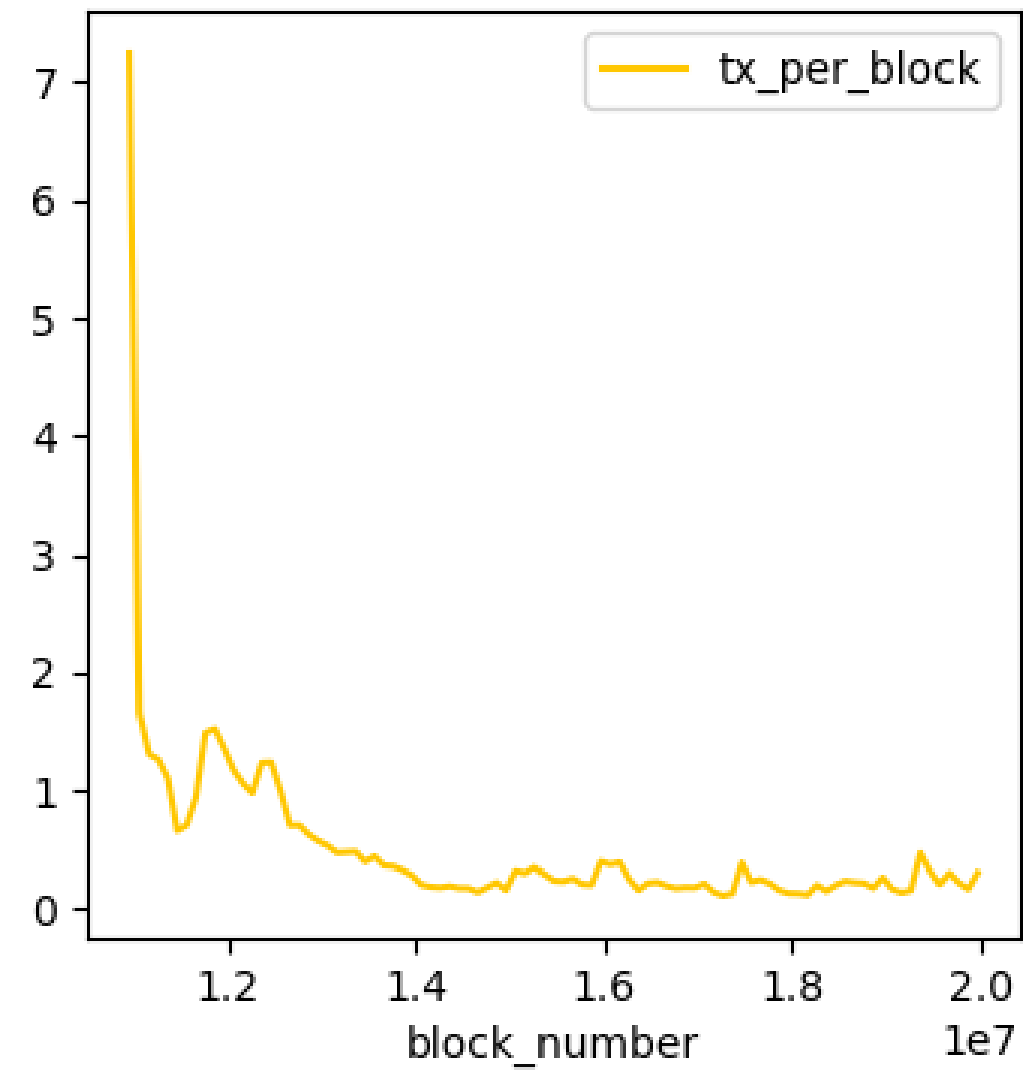
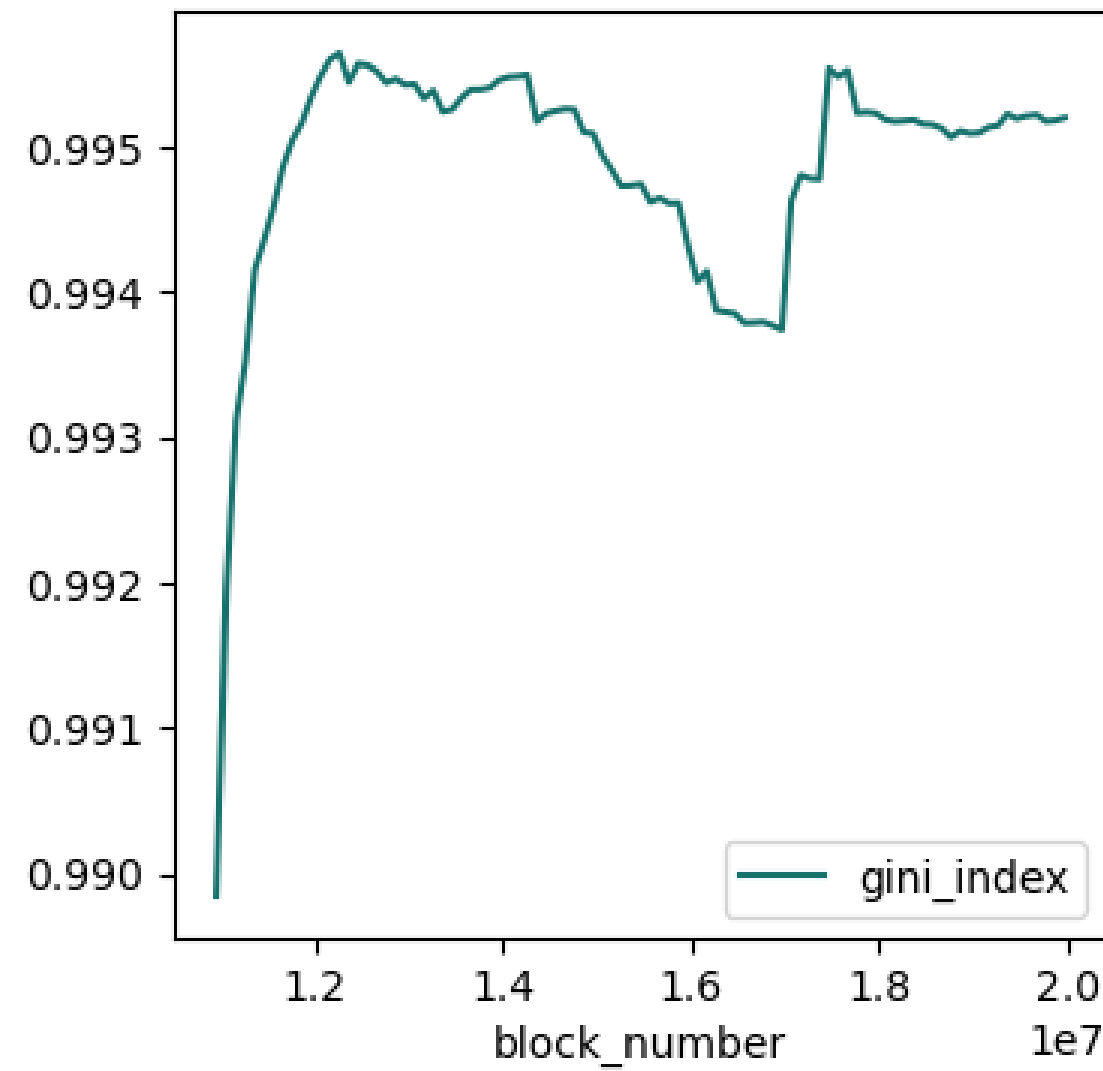
Most active senders:

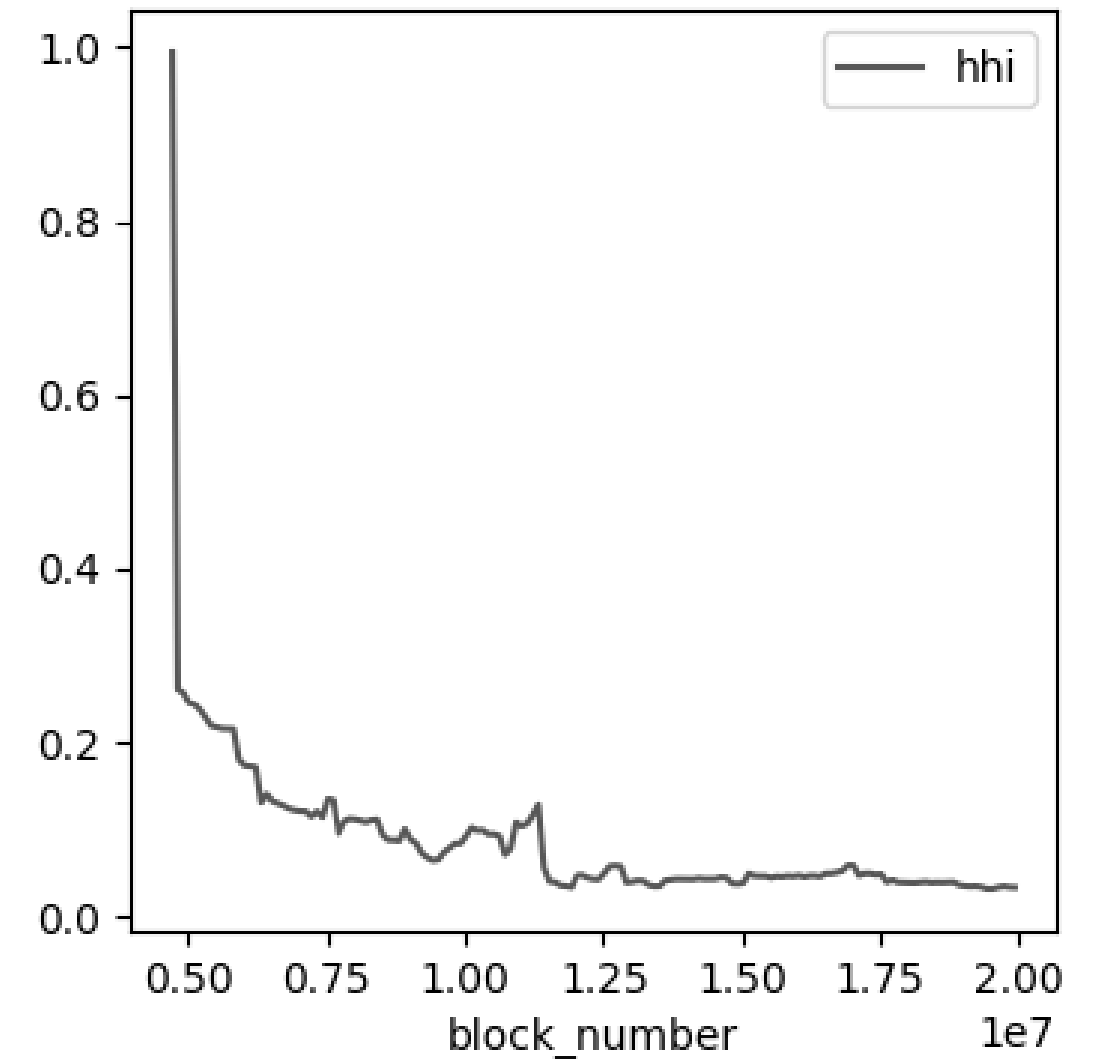
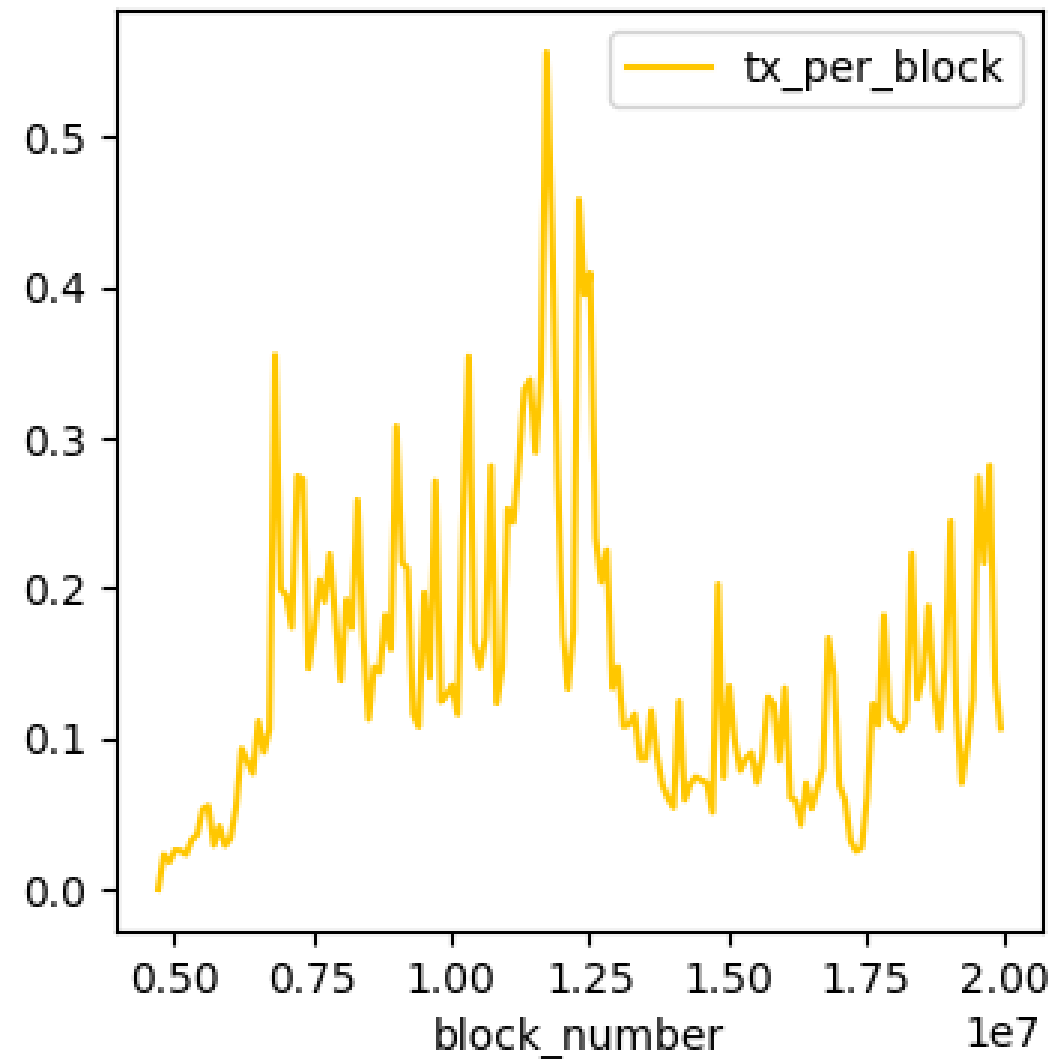
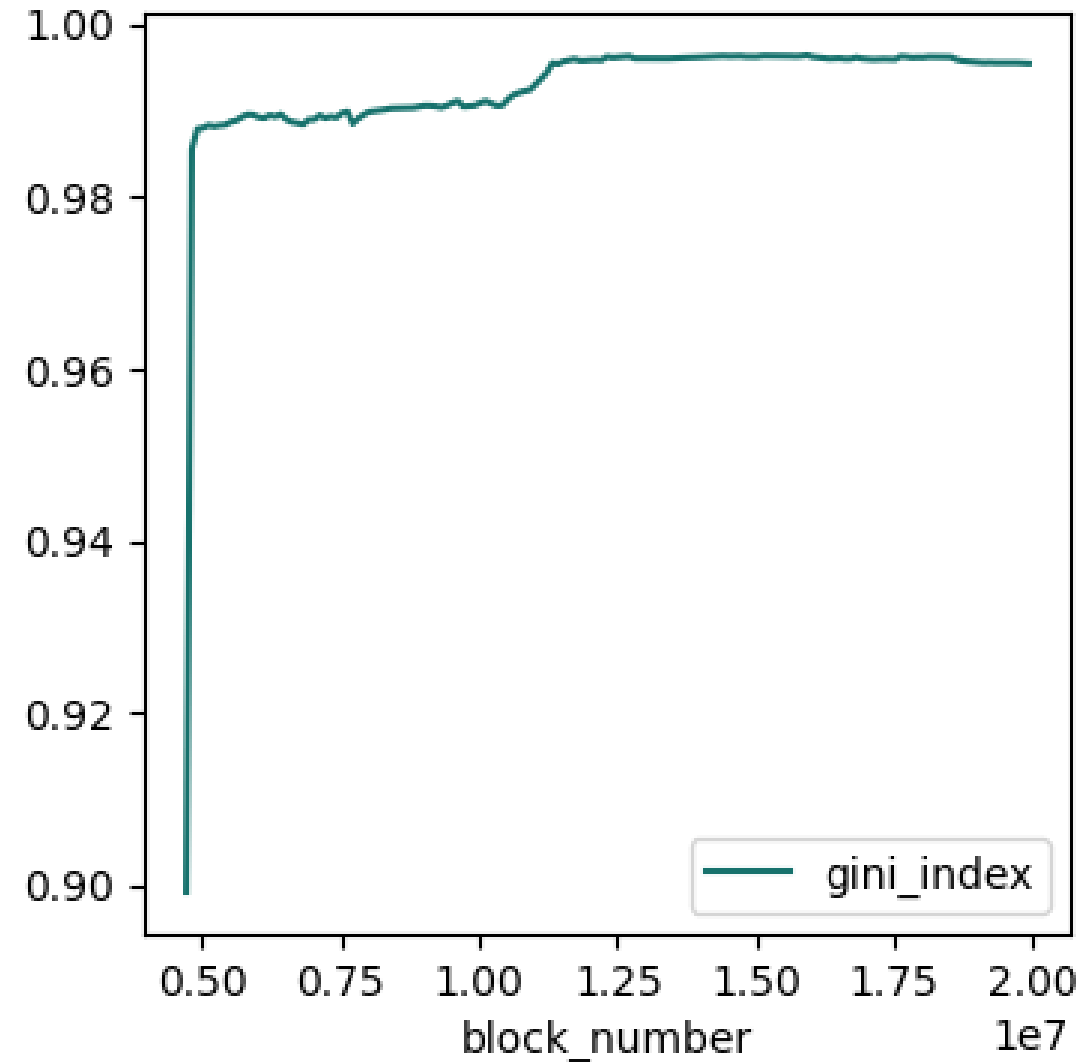
	address	transfer_frequency_out	balance	cex
74783	0xa3f558aebaecaf0e11ca4b2199cc5ed341edfd74	0.009951	2588549098016500368587269	NaN
89636	0xc558f600b34a5f69dd2f0d06cb8a88d829b7420a	0.007680	26896046942688315807777	NaN
1	NaN	0.006225	68108806024237262903881771	binance
70073	0x99ac10631f69c753ddb595d074422a0922d9056b	0.005050	17424140943	NaN
11328	0x182b723a58739a9c974cfdb385ceadb237453c28	0.004319	282202885357391426572784	NaN
110861	0xf4ad61db72f114be877e87d62dc5e7bd52df4d9b	0.003287	214294547684153304156243	NaN
31641	0x454f11d58e27858926d7a4ece8bfea2c33e97b13	0.002538	14713794892164496427066	NaN
84580	0xba1222222228d8ba445958a75a0704d566bf2c8	0.002453	328059086752516440295663	NaN
53117	0x74de5d4fcfbf63e00296fd95d33236b9794016631	0.001866	840	NaN
69667	0x98c3d3183c4b8a650614ad179a1a98be0a8d6b8e	0.001810	9463329014373542946242	NaN

Most active receivers:

	address	transfer_frequency_in	balance	cex
74783	0xa3f558aebaecaf0e11ca4b2199cc5ed341edfd74	0.009591	2588549098016500368587269	NaN
89636	0xc558f600b34a5f69dd2f0d06cb8a88d829b7420a	0.007405	26896046942688315807777	NaN
11328	0x182b723a58739a9c974cfdb385ceadb237453c28	0.005015	282202885357391426572784	NaN
1	NaN	0.003465	68108806024237262903881771	binance
110861	0xf4ad61db72f114be877e87d62dc5e7bd52df4d9b	0.002900	214294547684153304156243	NaN
84580	0xba1222222228d8ba445958a75a0704d566bf2c8	0.002414	328059086752516440295663	NaN
31641	0x454f11d58e27858926d7a4ece8bfea2c33e97b13	0.002357	14713794892164496427066	NaN
69667	0x98c3d3183c4b8a650614ad179a1a98be0a8d6b8e	0.001892	9463329014373542946242	NaN
75963	0xa69babef1ca67a37ffaf7a485dfff3382056e78c	0.001597	42956583096111324394459	NaN
53117	0x74de5d4fcfbf63e00296fd95d33236b9794016631	0.001530	840	NaN

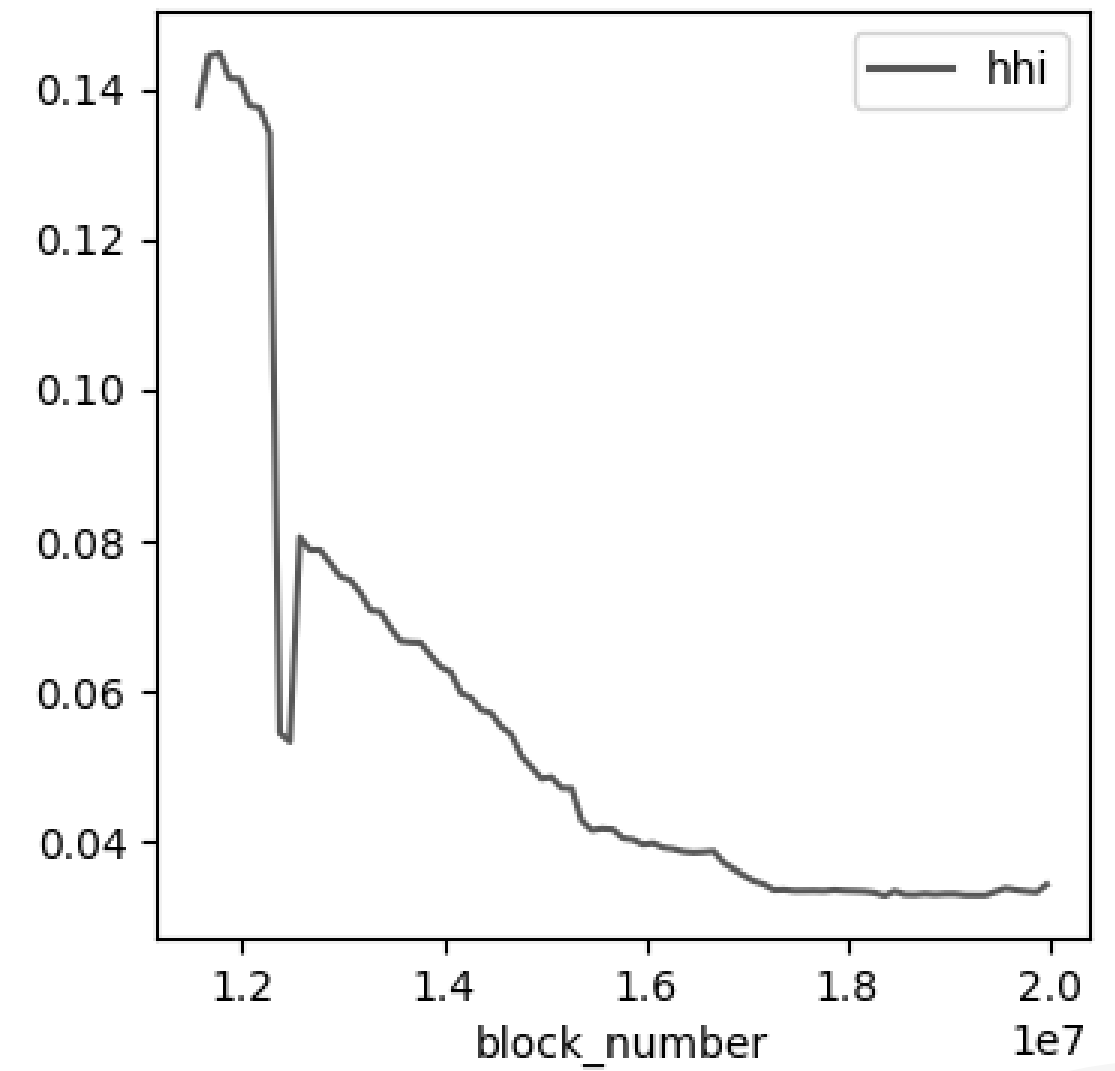
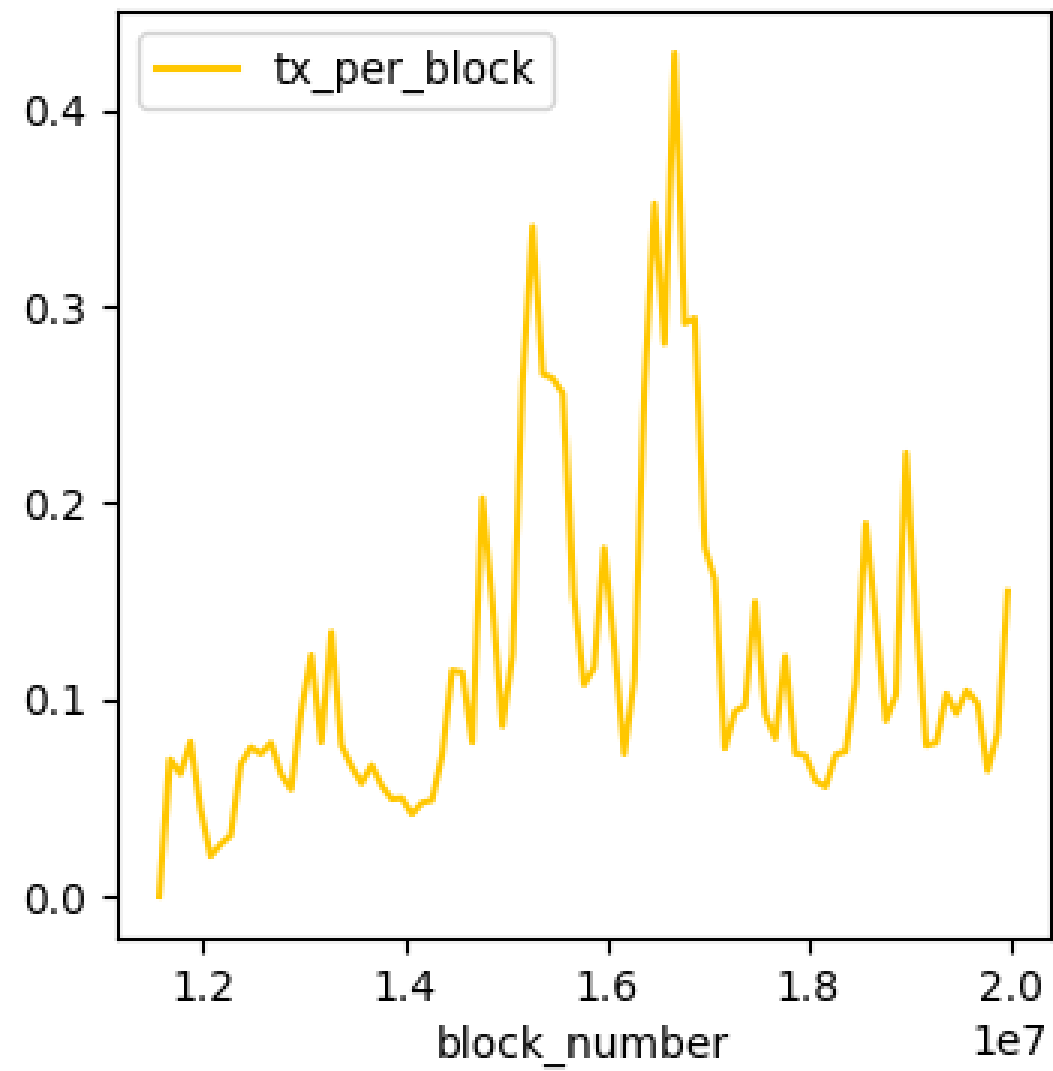
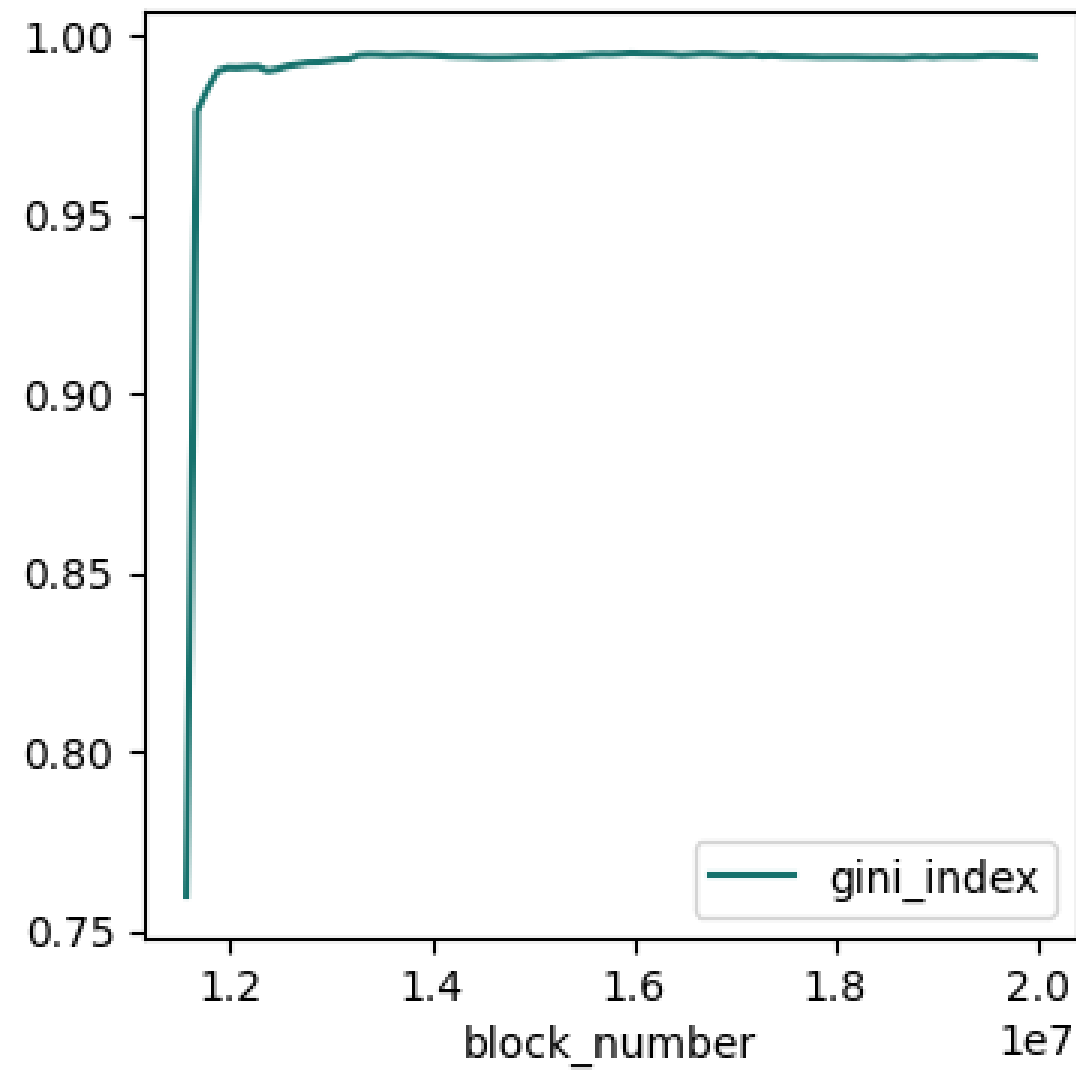






# LDO

## Timelines: Gini index, HHI & Transfers per block



# GINI INDEX AND HHI

## Gini Index

$$G = \frac{2 \sum_{i=1}^n i y_i}{n \sum_{i=1}^n y_i} - \frac{n+1}{n}$$

The Gini coefficient measures the inequality among the values of a frequency distribution.

- Ranges from 0 (total equality) to 1 (absolute inequality)
- used for income inequality & wealth inequality

## Herfindahl-Hirschman-Index (HHI)

$$H := \sum_{i=1}^N a_i^2 \quad \text{with} \quad a_i := \frac{x_i}{\sum_{j=1}^N x_j}$$

The HHI is an indicator of the amount of competition among firms in a given industry.

- Ranges from 0.0 to 1.0
- Sometimes limited to the x largest firms
- Higher value means less competition
- Values >0.25 are considered anti competitive