

Market Design with Blockchain Technology

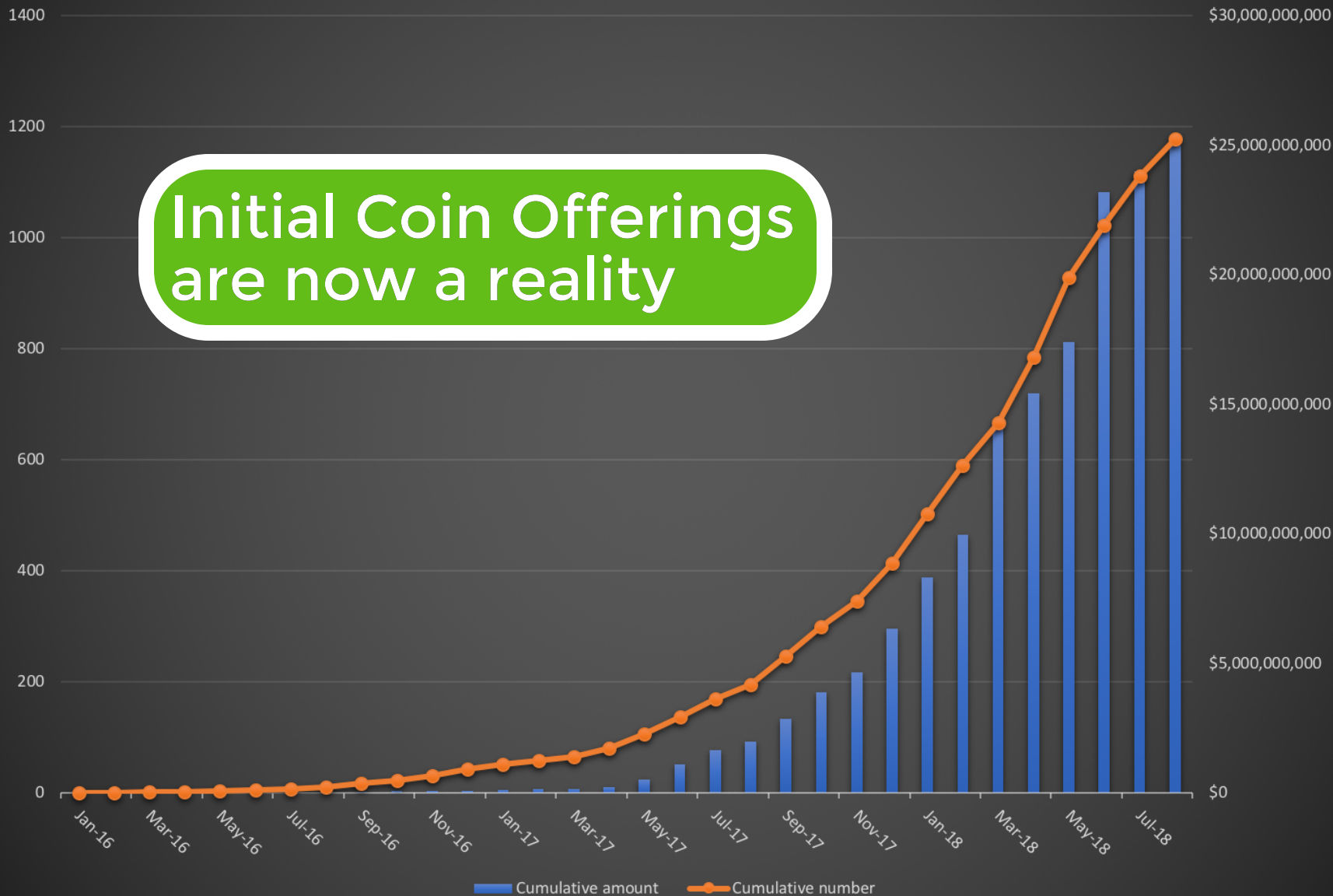
Katya Malinova
Andreas Park

DeGroote
SCHOOL OF BUSINESS
EDUCATION WITH PURPOSE

McMaster
University 

Cumulative ICOs: \$US and total number

Initial Coin Offerings are now a reality



What is different?

1. Multiple Trading Protocols are possible

BALANCE

Deposit	Withdraw	Transfer
Please select an account using the account dropdown in the upper right.		

ORDER BOOK

Price	Depth	BNT/ETH	BNT	ETH
0.01500000	506.452	7.597		
0.01500000	10.000	0.150		
0.01400000	10.000	0.140		
0.01350000	10.000	0.135		
0.01300000	10.000	0.130		
0.01250000	500.000	6.250		
0.01240000	1000.000	12.400		
0.01239000	270.000	3.348		
0.01230000	10.000	0.123		
0.01229000	123.000	1.513		
0.01190000	10.000	0.119		
0.01188000	3500.000	41.580		
0.01180000	10.000	0.118		

PRICE CHART

Price vs. Depth

TRADES

BNT/ETH	BNT	ETH
0.008000000	9.969	0.080
0.008910490	90.052	0.802
0.008000000	92.851	0.743
0.008000000	0.239	0.002
0.012400000	2.066	0.026
0.012300000	10.000	0.123
0.008000000	39.000	0.332

Note: EtherDelta will only show recent transactions.

VOLUME

Pair	Daily	Bid	Offer
ZRX/ETH	7341374	0.001830000	0.001600000
CDT/ETH	17985448	0.000441000	0.000490000
PPT/ETH	114323	0.015410000	0.015700000
DNT/ETH	3552638	0.000550000	0.000548000
VER/ETH	2386	0.413000000	0.424999999
STX/ETH	93923	0.007750000	0.008000000
IXT/ETH	477267	0.001440000	0.001588000
CAT/ETH	101786	0.005023000	0.005100000
PLR/ETH	969024	0.000551000	0.000560000
TXW/ETH	312178	0.001700000	0.001800000
XRL/ETH	294595	0.001424000	0.001500000
DENT/ETH	99743738	0.000004800	0.000004999
PAY/ETH	26977	0.011202200	0.011938990
ADX/ETH	67897	0.004202000	0.004488900
QMG/ETH	11103	0.022680003	0.025000000
QAX/ETH	24291	0.006600000	0.007000000
CVC/ETH	77575	0.001550003	0.001800000
EOS/ETH	19693	0.004600100	0.004990000
RLT/ETH	102760	0.000370000	0.000713000

NEW ORDER

Buy | Sell

BNT | Amount to buy

BNT/ETH | Price

ETH | Total

Expires | 10000

Buy

MY TRANSACTIONS

Trades | Orders

Transaction | Type

Note: EtherDelta will only show recent transactions.



What is different?

1. Multiple Trading Protocols are possible

- current world peer-to-peer -- through intermediaries
 - a dealer/market maker is on one side of trade
 - parties know who they are trading with
- technology enables frictionless value transfer

The screenshot displays the EtherDelta trading interface with several data tables:

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What is different?

2. High Level of Transparency

- See transactions *between* "addresses" (= "IDs")
 - may be able to see frequent "traders"

A Total of 79580 events found

First Prev Page 1 of 1592 Next Last

TxHash	Age	From	To	Quantity
0xc68e75284311c4...	2 mins ago	0x3b0899f81f2dc9d...	0x1f573d6fb3f13d6...	1443
0x6b7f845687265d...	4 mins ago	0x5e575279bf9f4ac...	0xbf829e136ce3f66...	77.72585794
0x7b51a5654fdc7d...	4 mins ago	0x5e575279bf9f4ac...	0x3b0899f81f2dc9d...	650.43420543
0xaf41da965d47f7c...	4 mins ago	0x3107c141c57c20...	0xcbe27c50302e33...	9.95
0x39e8b127a87cd3...	5 mins ago	0x7ac34681f6aaeb6...	0x1f573d6fb3f13d6...	412.694
0xc74078efcacf17...	8 mins ago	0xfbb1b73c4f0bda4...	0x2ba0cdf747432c...	239.04744045

What is different?

3. You can tell who owns what

TokenTracker Summary

Reputation OK 🟢

Total Supply: 78,119,117.3153 BNT (\$193,860,401.53)

Value per Token: \$2.4816 @ 0.008665 Eth (-7.61%)

Token Holders: 12842 addresses

No.Of.Transfers: 79580

Contract Address: [0x1f573d6fb3f13d689ff844b4ce37794d79a7ff1c](#)

Token Decimals: 18

Official Links: [🌐](#) [✉](#) [📄](#) [📺](#) [⚙](#) [🐦](#) [₿](#)


Search/Filter By:

Token Transfers

Token Holders

Read Smart Contract

Comments

 TokenHolders Chart

A total of 12842 Token Holders found

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Rank	Address	Quantity	Percentage
1	0x5894110995b8c8401bd38262ba0c8ee41d4e4658	15865957	20.3103%
2	0x79e7ccb8e7a61ad4781c98864c40e380bb10dd26	14312616.4803711	18.3218%
3	0xad04835b1129c08be6093d683d725ff82cd24036	10539657.098791	13.4920%
4	0x7af1362060ec77ca30be2508cce10169210393ee	7853648.22	10.0536%
5	0xfbb1b73c4f0bda4f67dca266ce6ef42f520fbb98	4227754.51610493	5.4120%
6	0x7bb42206cddc93380ed1115d15fb1e65a1d754fc	1312102.22092	1.6796%
7	0x0c43eb0b18774a15bca2e639ba470796147b8d24	1207481.05212123	1.5457%
8	0x31fc2dbe295a8570b69c09c5aaec33459fc1a1b3	750000	0.9601%
9	0x696618b03604354787b631695bfc9d14c203360a	659100.152343954	0.8437%
10	0x86842054dd8802519dc7dcc458dc9311c1434639	426100	0.5455%

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Token Address or TxHash

Token Transfers

Token Holders

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1	0x5894110995b8c8401bd38262ba0c8ee41d4e4t
2	0x79e7ccb8e7a61ad4781c98864c40e380bb10dd26
3	0xad04835b1129c08be6093d683d725ff82cd24036
4	0x7af1362060ec77ca30be2508cce10169210393ee
5	0xfbb1b73c4f0bda4f67dca266ce6ef42f520fbb98
6	0x7bb42206cddc93380ed1115d15fb1e65a1d754fc
7	0x0c43eb0b18774a15bca2e639ba470796147b8d24
8	0x31fc2dbe295a8570b69c09c5aaec33459fc1a1b3
9	0x696618b03604354787b631695bfc9d14c203360a
10	0x86842054dd8802519dc7dcc458dc9311c1434639

you can tell
if someone
owns a lot

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	Percentage
	20.3103%
003711	18.3218%
10539657.098791	13.4920%
7853648.22	10.0536%
4227754.51610493	5.4120%
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Frictionless peer-to-peer trading

+

Informational environment changes drastically

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Key: wallets/addresses = IDs but NOT = traders

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Key: wallets/addresses = IDs but NOT = traders

Research Question

How does the design of ledger transparency and identifier-usage with possible P2P interactions affect trading behavior and economic outcomes?

Literature

- Economics of blockchain protocols and transaction costs
 - there is a large literature in computer science, e.g., Eyal and Sirer (2014)
 - Gans and Halaburda (2015); and Halaburda and Gandel (2016)
 - Budish (2018), Saleh (2017), Biais, Bidiere, Bouvard, Casamatta (2018)
 - Huberman, Leshno, and Moallemi (2017), Easley, O'Hara, Basu (2018)
- Smart contracts and other uses of blockchain
 - Cong and He [2017], Yermack (2017)
- *Blockchain and financial securities/markets*
 - Boehm et al [2015]; Harvey [2016], Raskin and Yermack [2016; 2017]; Aune, Krellenstein, O'Hara, and Slama [2017]

Model Ingredients

- Risky asset, normally distributed
- Two large investors, one hit by liquidity shock, repeated interactions
- Continuum of small investors, half buys, half sells
- Shocked **"liquidity trader" (LT)** may trade
 - peer-to-peer with other large
 - with many small
 - with risk-averse intermediary

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Direct Costs

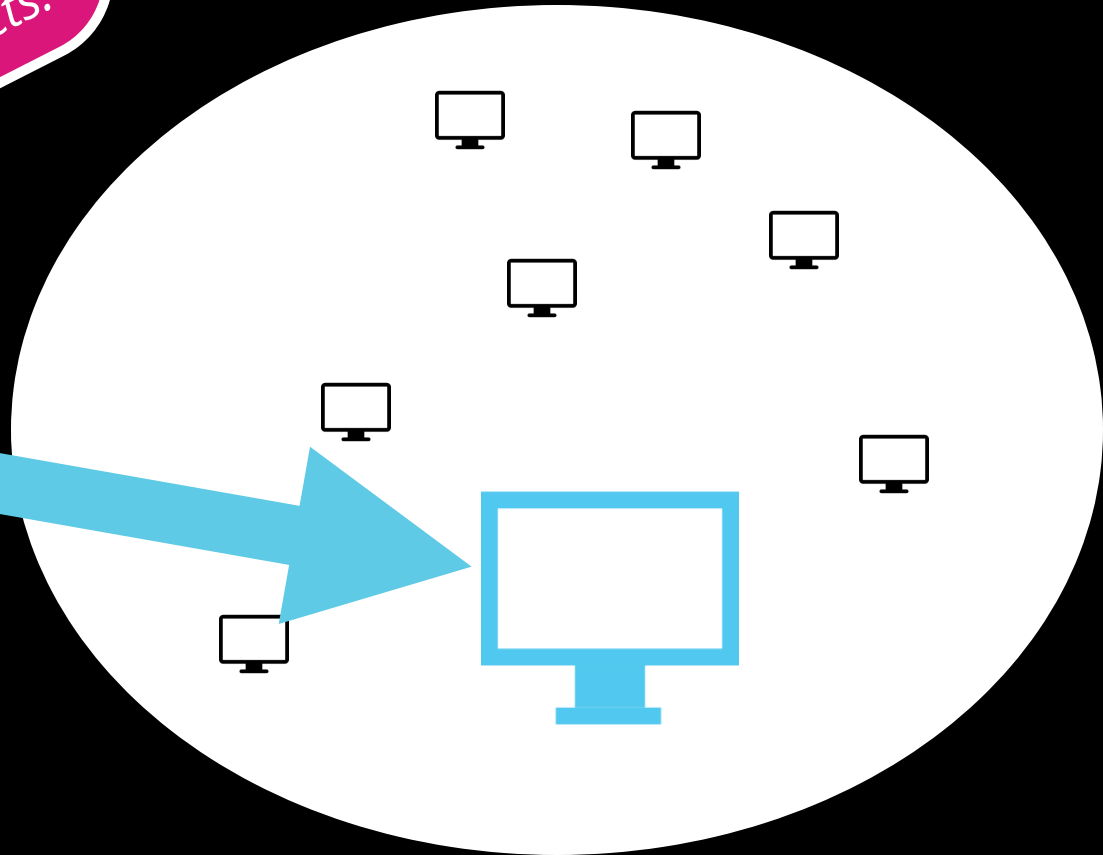
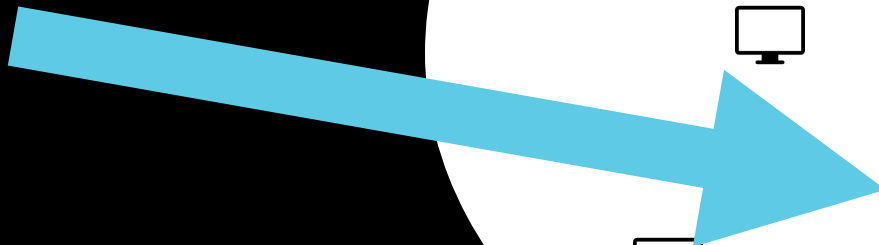
- Data processing to contact small
- Linear *mining/validation* cost

Indirect Costs

Liquidity Providing peer may front-run **Liquidity Trader**

Benchmark: fully transparent (single ID) ownership

- Requires a system design choice:
- allow an entity (individual, investment fund) only a single ID per instrument
 - possible with private blockchain or ICO contracts.



Options for **the** Large Liquidity Trader ("LT")

Trade with small investors
and intermediary

Trade with the large
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 - complexity + validation
 - intermediation

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Single shot:
LP extracts all surplus

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Single shot:

LP extracts all surplus

Repeated setting:

Front-running is punished by "grim trigger"

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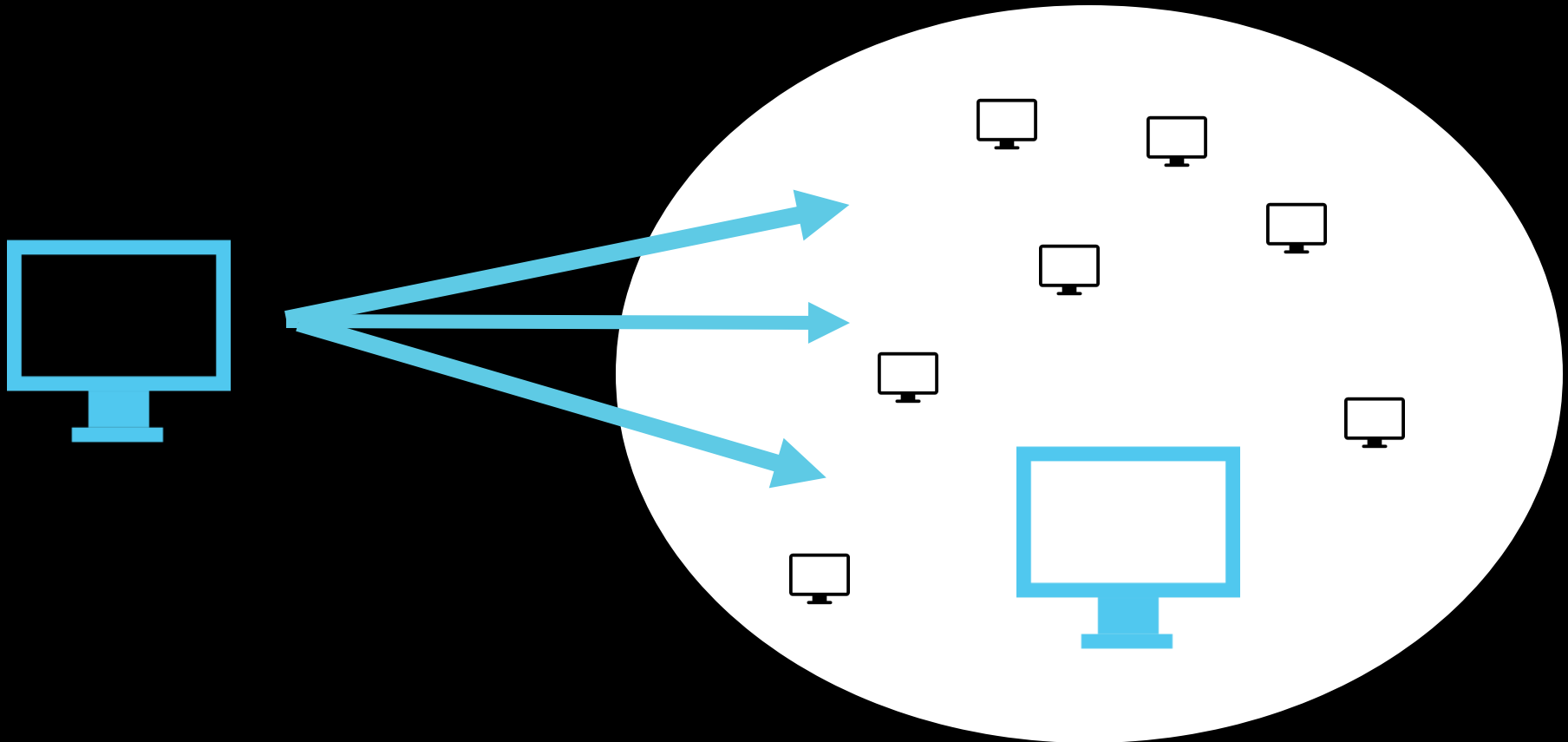
Equilibrium

- "social norms" have bite: **LT** always trades with **LP**; share cost savings.
- Price concession: none for frequent interactions (=large enough discount factor)

surplus

grim trigger

Opaque single ID ownership

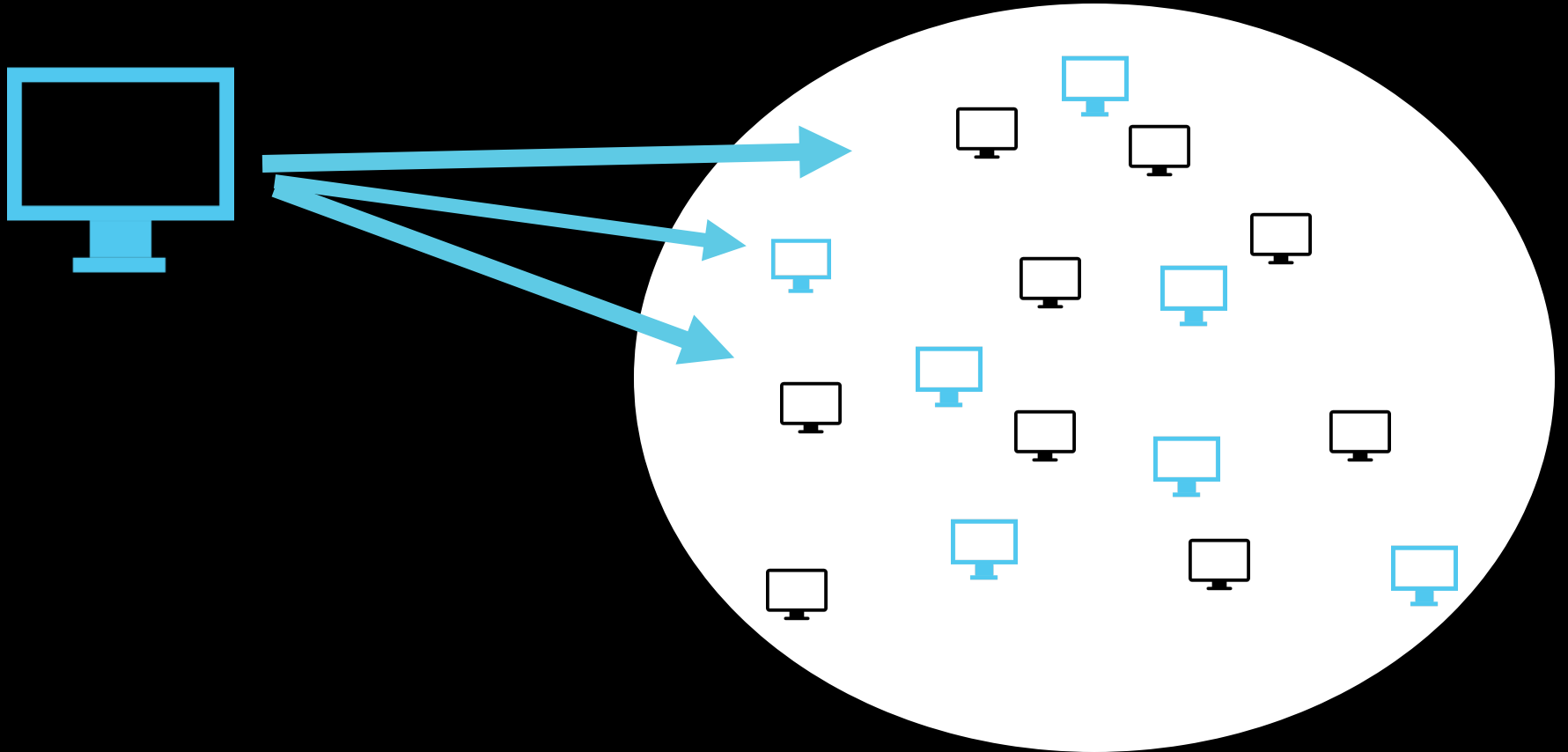


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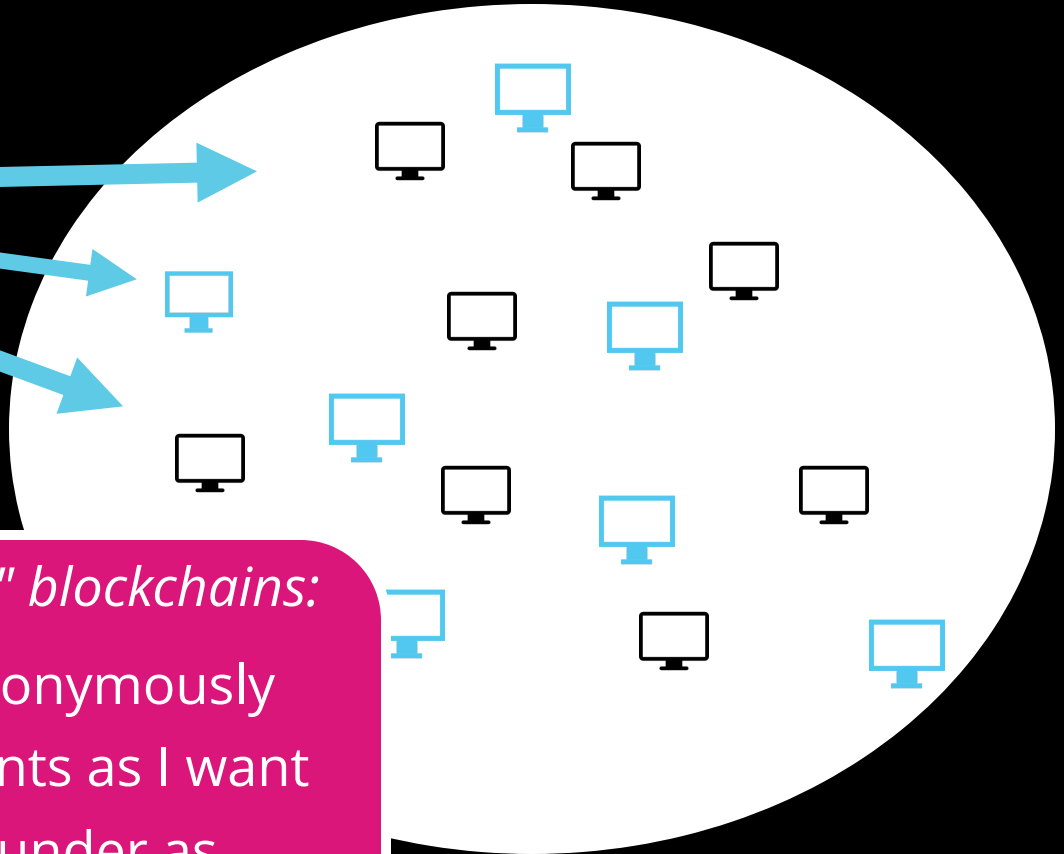
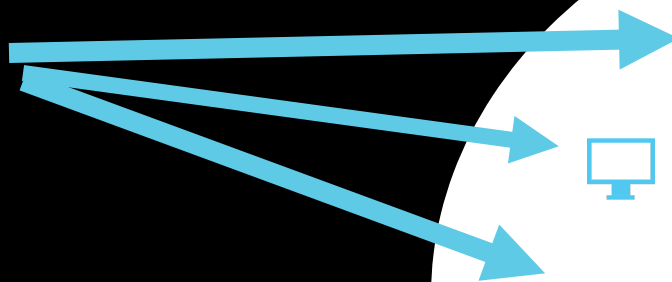
Equilibrium

- %IDs contacted independent of intermediary's inventories, but depends on:
 - probability of small accepting
 - (il-)liquidity of intermediated market
 - complexity/data processing costs.
- For non-large validation cost, **LT** trades with small (and intermediary)

Opaque multi-ID ownership



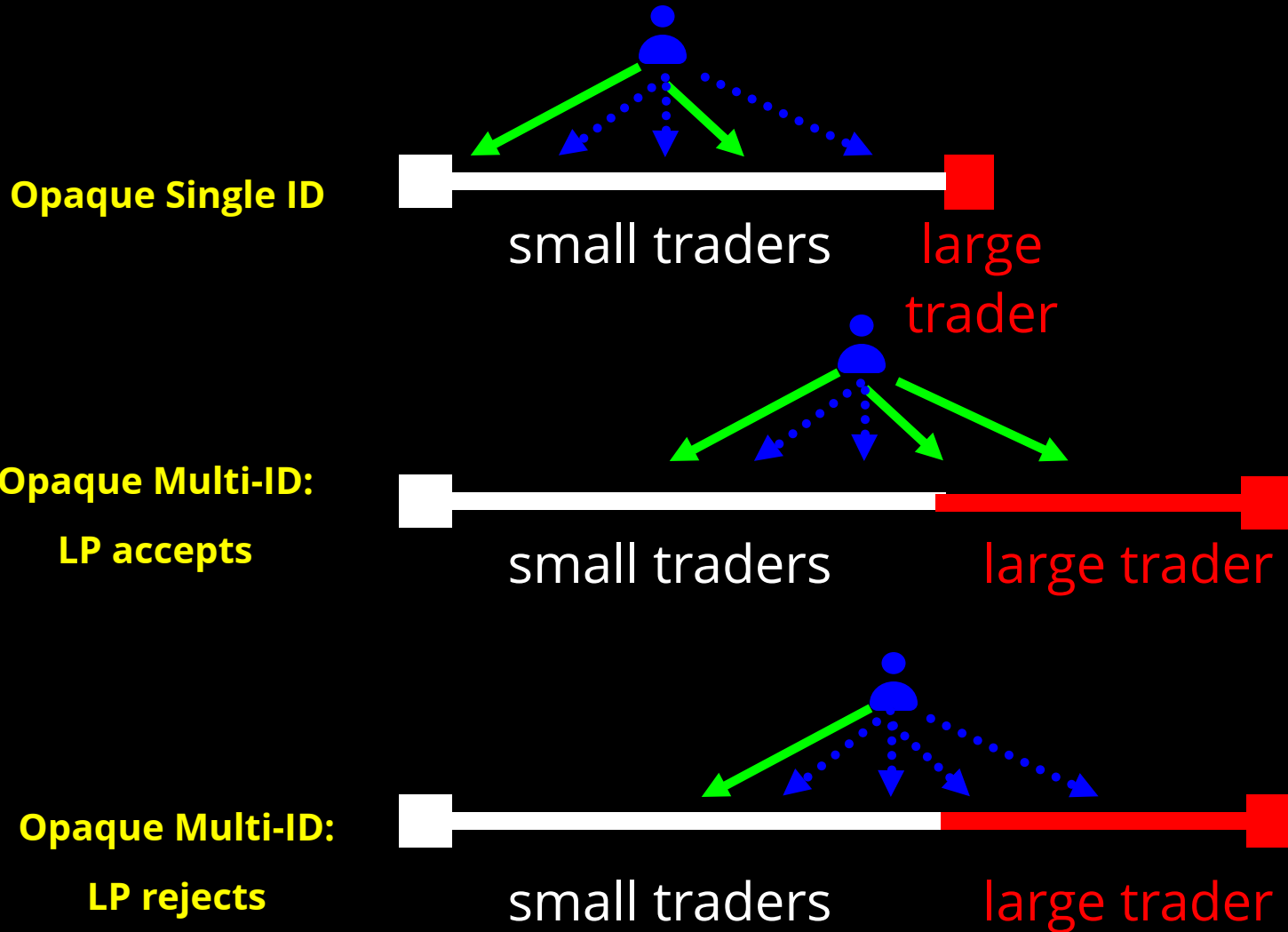
Opaque multi-ID ownership



Closest and native to "public" blockchains:

- anyone can participate anonymously
- can create as many accounts as I want
- described by Ethereum founder as simple solution to achieve privacy
- private blockchains can choose to organize like this

Acceptance Probabilities in Opaque Settings



filled
unfilled

Decision problem **LT**

"target" IDs of both:
large and small

- price concession "wasted" on small
- complexity costs: high
- intermediary costs: low

"target" small
investors only

- no price concession
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Decision problem **LP**

accept offer

front-run

- validation fees

Equilibrium & More

Theorem: There exists an equilibrium with no front-running where:

- **LP** accepts
- price concession = 0

provided:

- frequent interactions
- or very liquid intermediated market (front running hard)
- or high validation costs (front running expensive)

Equilibrium & More

Theorem: There exists an equilibrium with no front-running where:

- **LP** accepts
- price concession = 0

Result 2 (numerical): For infrequent interactions, the equilibrium with no front-running where **LP** accept does *not* exist. Then:

- In equilibrium, **LT** offers $p = 0$ to the continuum, and
- **LP's** IDs reject the offer.

=> "over-trading" with intermediary

- Note: an increase in the validation cost may curb front-running.

Comparing designs

Observations

- Intermediary involved \Rightarrow social inefficiency
- Small with large traders \Rightarrow complexity costs
- \Rightarrow Best if large interact
- payoffs under the full transparency highest *by construction*.

Comparing designs

1. *Large traders do interact:*

- *welfare single ID < welfare multi-ID*
- *payoff to large multi-ID (assume price=0) > payoff large single ID*

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3. (Numerical) \exists *parametric configurations with*

- *large interact in multi-ID & $p > 0$ s.t.*
 - *payoff to large with single ID > payoff large multi-ID*

Summary

1. Blockchain="Back office" tech **with front office implications!**
 - with peer-to-peer there are critical design choices
 - Who can see the ledger?
 - How are virtual identities managed?
2. Findings:
 - Transparent ledger with single IDs is welfare optimal and has lowest wealth redistribution (almost by construction)
 - Between (A) public blockchain solution with multiple IDs and (B) private, non-transparent ledger with single IDs:
 - **public blockchain privacy solution** has higher aggregate welfare
 - but does not necessarily lead to higher payoffs for large investors.