A Model of the Optimal Selection of Crypto Assets

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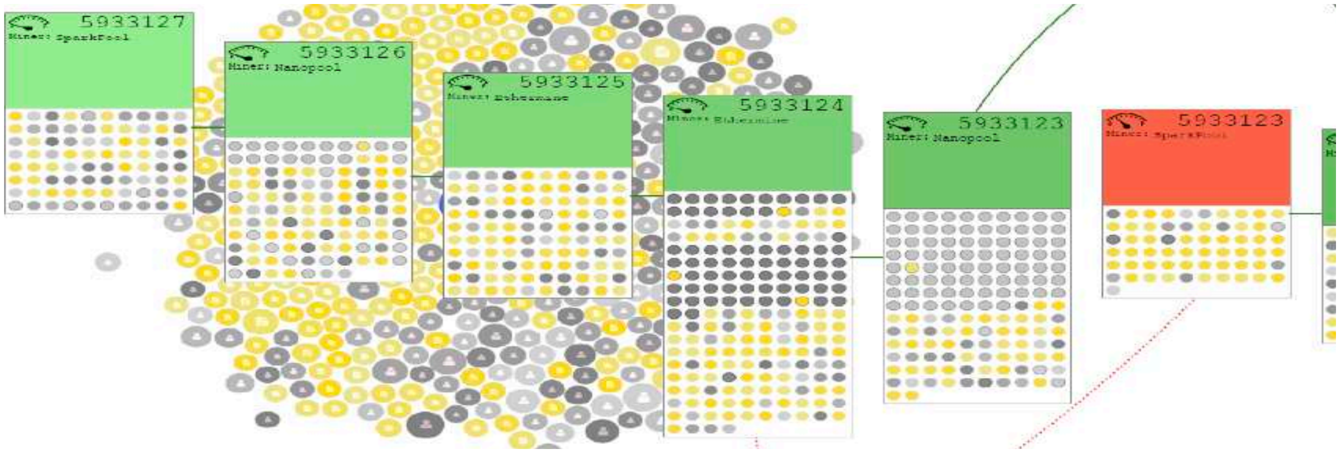
Some definitions

A *crypto asset* is an intangible digital asset whose issuance, sale or transfer are secured by cryptography and shared electronically via a distributed ledger.

A *distributed ledger* (blockchain) is a database of issuance and transaction records.



Each crypto asset has its own blockchain supported by its own network of nodes.

An intangible digital asset, but not a liability

A crypto asset is an intangible digital *asset* as it is

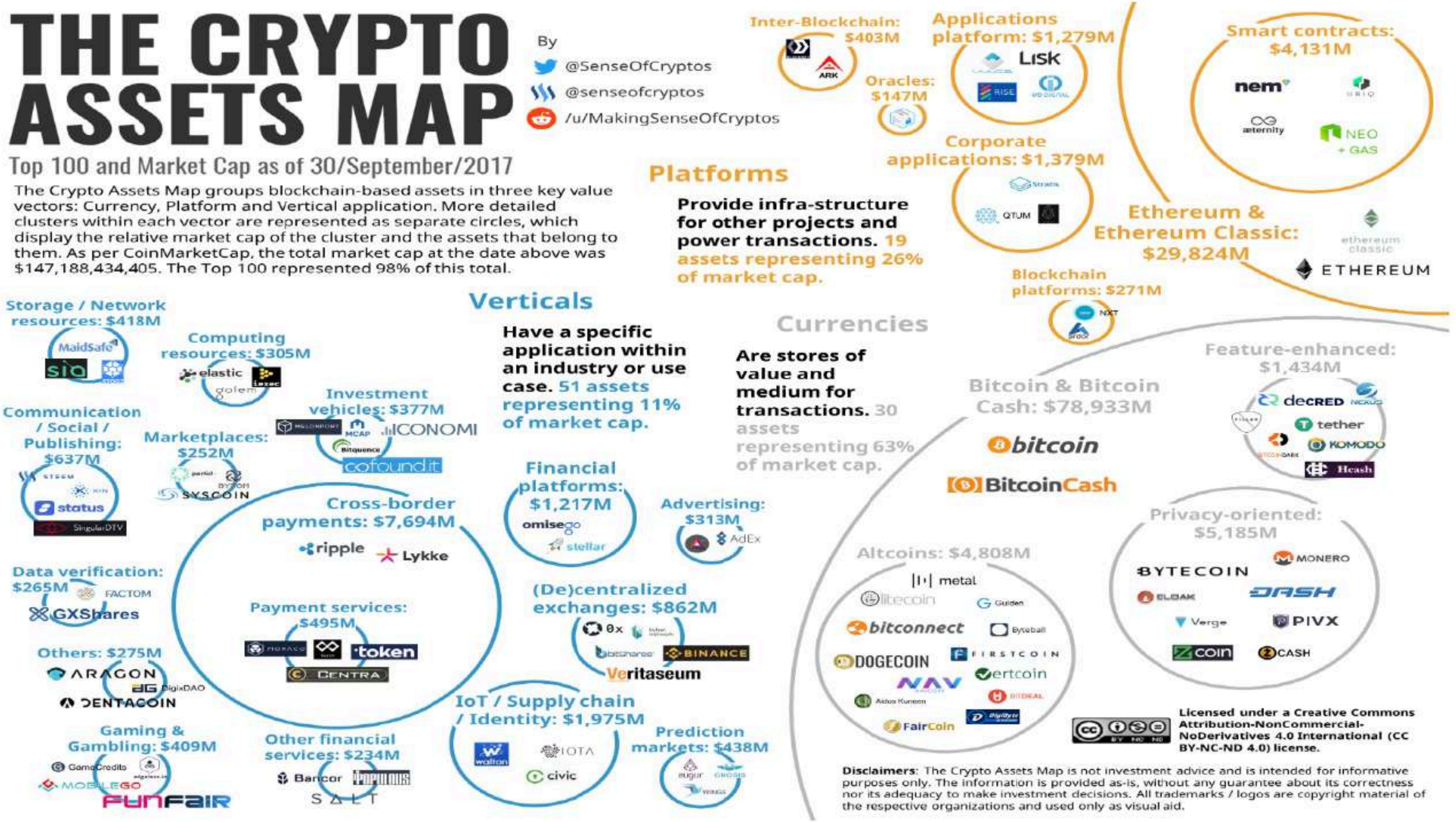
without physical substance (intangible),

but is digitally-identifiable (digital)

and held in expectation of future economic benefits (asset).

Under the current standards, a crypto asset does not meet the definition of either cash or a financial instrument because it does not represent a claim or contractual relationship that results in a monetary or financial *liability* on any identifiable entity.

Many assets



THE CRYPTO ASSETS MAP
By
@SenseOfCryptos
@senseofcryptos
/u/MakingSenseOfCryptos
Top 100 and Market Cap as of 30/September/2017
The Crypto Assets Map groups blockchain-based assets in three key value vectors: Currency, Platform and Vertical application. More detailed clusters within each vector are represented as separate circles, which display the relative market cap of the cluster and the assets that belong to them. As per CoinMarketCap, the total market cap at the date above was $147,188,434,405. The Top 100 represented 98% of this total.
Inter-Blockchain: $403M
ARK
Applications platform: $1,279M
Lisk
RISE
Oracles: $147M
Smart contracts: $4,131M
nem
æternity
NEO + GAS
Corporate applications: $1,379M
QTUM
Platforms
Provide infra-structure for other projects and power transactions. 19 assets representing 26% of market cap.
Ethereum & Ethereum Classic: $29,824M
ethereum classic
ETHEREUM
Blockchain platforms: $271M
NXT
Verticals
Have a specific application within an industry or use case. 51 assets representing 11% of market cap.
Storage / Network resources: $418M
MaidSafe
sia
Computing resources: $305M
elastic
golem
Investment vehicles: $377M
ICONOMI
cofound.it
Communication / Social / Publishing: $637M
status
SingularDTV
Marketplaces: $252M
SYSCOIN
Cross-border payments: $7,694M
ripple
Lykke
Financial platforms: $1,217M
omisego
stellar
Advertising: $313M
AdEx
Data verification: $265M
FACTOM
GXShares
Payment services: $495M
token
CENTRA
(De)centralized exchanges: $862M
0x
bitshares
BINANCE
Veritaseum
Others: $275M
ARAGON
DigixDAO
DENTACOIN
IoT / Supply chain / Identity: $1,975M
walton
IOTA
civic
Gaming & Gambling: $409M
GameCredits
MOBILEGO
FUNFAIR
Other financial services: $234M
Bancor
SALT
Prediction markets: $438M
augur
GNOSIS
Currencies
Are stores of value and medium for transactions. 30 assets representing 63% of market cap.
Bitcoin & Bitcoin Cash: $78,933M
bitcoin
BitcoinCash
Feature-enhanced: $1,434M
decred
tether
KOMODO
Hcash
Privacy-oriented: $5,185M
BYTECOIN
MONERO
DASH
Verge
PIVX
Zcoin
ZCASH
Altcoins: $4,808M
metal
litecoin
Gulden
bitconnect
Byteball
DOGECOIN
FIRSTCOIN
NAV
Vertcoin
FairCoin
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Many features, protocols and uses

Source: Autonomous NEXT

Only a few will be adopted

Successful adoption of crypto assets hinges on network effects.

Varian (2017): “ [A] good exhibits network effects if the value to a new user from adopting the good is increasing in the number of users who have already adopted it.

This generates a positive feedback loop: the more users who adopt the good, the more valuable it becomes to potential adopters. This positive feedback loop also works in reverse: if adoption fails to reach a critical mass of users, the good or service may fall into a “death spiral” and ultimately disappear.”

Benedetti, H., & Kostovetsky, L. (2018). Digital tulips? Returns to investors in initial coin offerings.

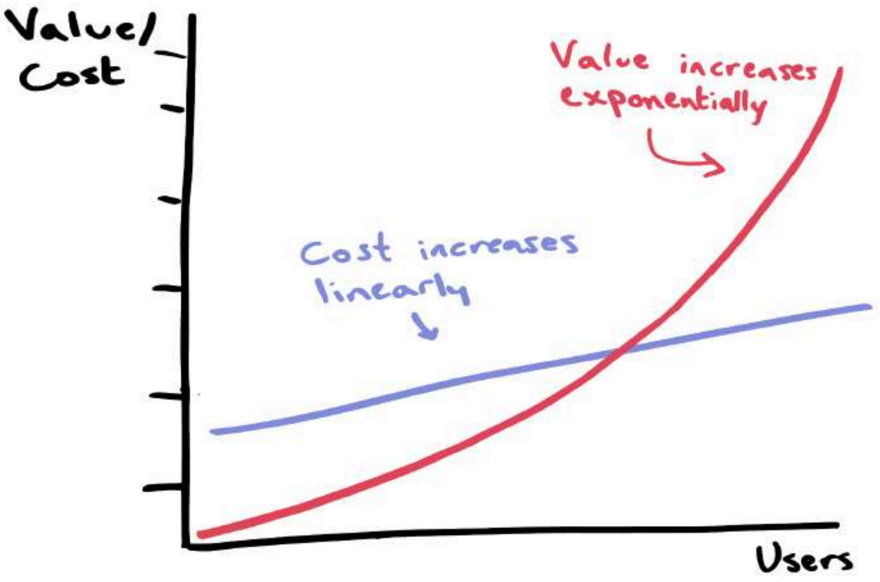
The majority of crypto assets will become worthless.

Some could end up being adopted widely enough to ensure their survival.

A very small number of them could become preferred *assets to store and transfer wealth to the future*.

Network effects come from demand side

Network effects are a demand-side rather than a supply-side, transactions costs or learning phenomena.



Varian (2017): “Network effects are due to value increasing with the number of units *sold*, while increasing returns to scale have to do with the cost declining or the quality improving with the number of units *produced*.”

Buterin (2014): “Network effects are actually split up into several categories: blockchain-specific network effects, platform-specific network effects, currency-specific network effects, and general network effects.”

Questions

* How are investors going to be making selection decisions over many available crypto assets?
  Possibilities: A. Same as over the existing (not digitally-native) assets – stocks, bonds, derivatives, commodities.
  B. Differently.

* Which features of these intangible digital assets would drive investment (demand) choices?
  Possibilities: A. Same as for the existing (not digitally-native) assets, e.g., correlation with future consumption.
  B. Plus or only digitally-native asset features.

* Which types of (supplied) assets will survive and which will go extinct?
  Possibilities: A. Same as for the existing (not digitally-native) assets, e.g., how well is an investment governed.
  B. Plus or only digitally-native governance features.

Our framework: Supply of crypto assets

We propose a unifying framework where crypto assets can be classified according to two main intrinsic features:

Security: technological vulnerability to risks of fraud, manipulation, abuse, and attack.

Stability: vulnerability to risks related to potentially faulty governance.

Increasing Stability

Increasing Security

Security/ Stability	**High Stability** $\xi \geq 0.5$	**Low Stability** $\xi < 0.5$
High Security $s \geq 0.5$	Central Bank Digital Currencies	Cryptocurrencies
Low Security $s < 0.5$	Stablecoins	Crypto tokens

Security is a *cross-sectional* attribute of a crypto asset.
It reflects its ability to retain value relative to other crypto assets at a point in time.

Stability is a *time series* attribute of a crypto asset that reflects its ability to retain value across time for a given level of security.

Security vs. Stability

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Our framework: Demand for crypto assets

* The demand for and adoption of crypto assets is inherently different from that of standard financial assets due to *low frictions*.

* We assume that investors "interact" with crypto assets over a digital platform: the crypto app.

* The crypto app:

    * Stores info about available crypto assets.
    * Collects data about users' adoption preferences and the global market state.
    * Provides investors-specific recommendations.

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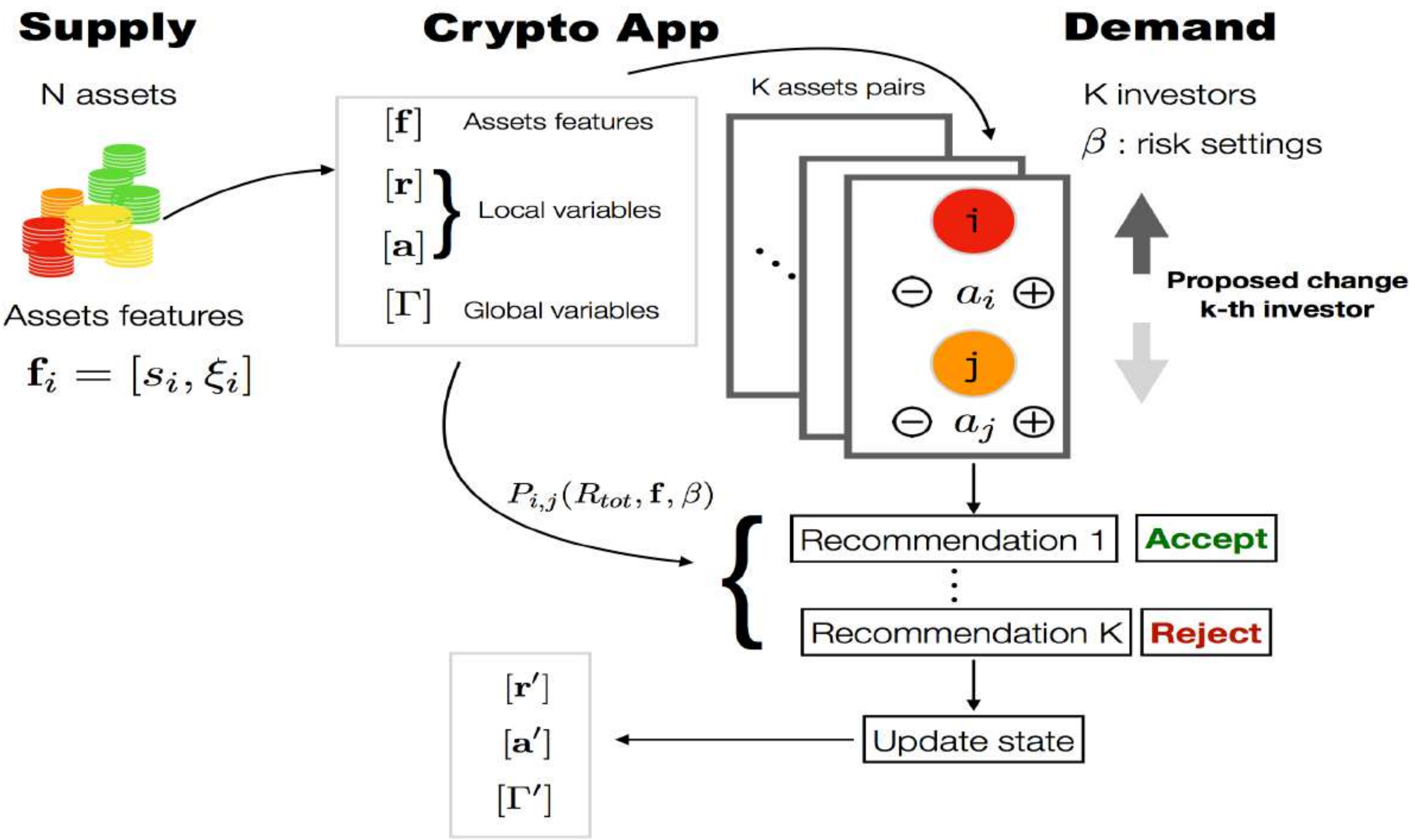
The crypto app: Cinder?



Expected returns and adoption

* *Crypto assets generation and initialisation of adoption and returns*

Features $s_i, \xi_i, i = 1, \ldots, N$

Global quantity $R_{tot}(t) = \sum_{i=1}^{N} a_i(t) r_i(t)$

* *Each investor compares two assets and proposes a change in adoption*

$$a_i(t+1) = \max(a_i(t) - \delta, 0)$$ *Decrease adoption*

$$a_j(t+1) = \min(a_j(t) + \delta, 1)$$ *Increase adoption*

* *The app calculates the probability of accepting the change based on the (i) assets' essential features, (ii) information about the adoption choices of all other investors, and (iii) expected future economic benefits of adoption*

$$P(a_i \to \tilde{a}_i, a_j \to \tilde{a}_j) = \frac{1}{(1 + e^{\beta_0 \Delta R_{tot}})(1 + e^{\beta_1 \Delta s})(1 + e^{\beta_2 \Delta \xi})}$$

Acceptance Probability

A choice between security, stability, and total returns given preference (beta parameters).

Beta-parameters represent the investors' attitudes towards both the global state of the system and asset-specific features.

Expected returns and adoption

- *Updating the expected returns*

Noise

$$r_i(t) = r_i(t-1) + \Delta a_i(t) + \eta_i(t) \quad \text{with} \quad \eta \sim \mathcal{N}(0, f(\xi))$$

Function of stability

Change in adoption

- *Optimal recommendations per asset class κ to minimise expected returns volatility*

$$\min_{a_i, r_i, i \in \kappa} \sqrt{(a_i - \bar{a}^\star)^2 + (r_i - \bar{r}^\star)^2}$$

$$\text{s.t.} \sum_{i \in \kappa} r_i a_i \geq \sum_{i \in \kappa} r_i^\star a_i^\star$$

Minimise the distances of each asset from the "centre of mass" of their respective clusters in the adoption-return space

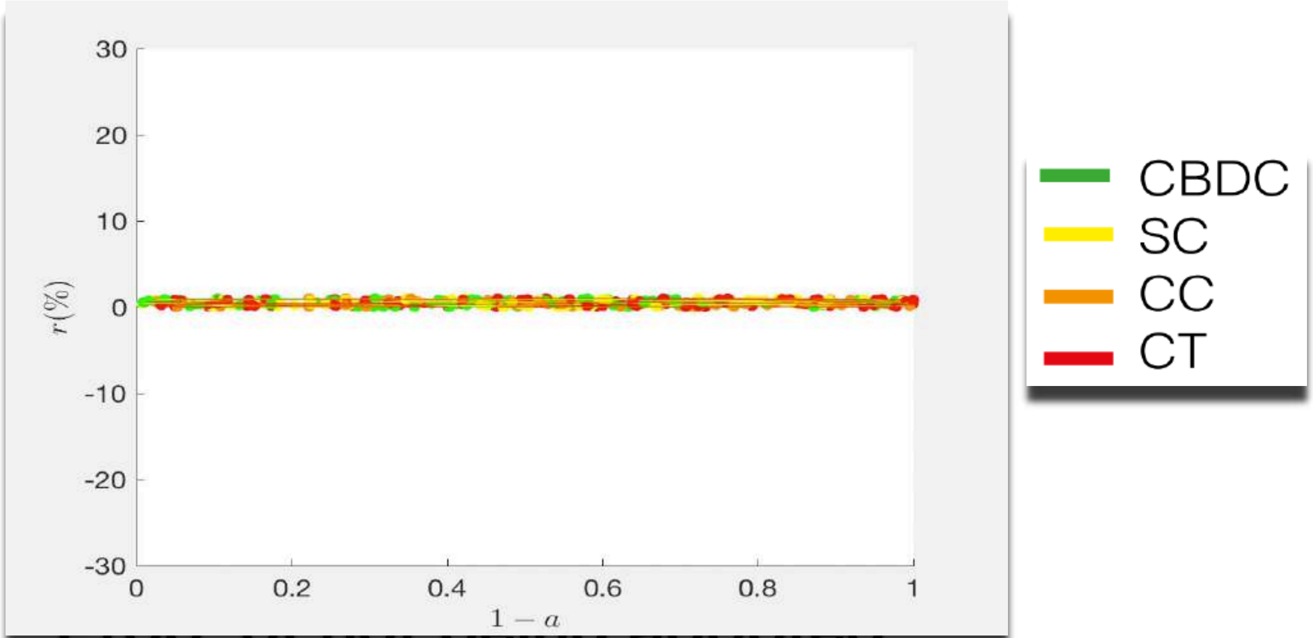
Maximise the total expected return of each sub-class

Expected returns and adoption

Simulations

Expected Return

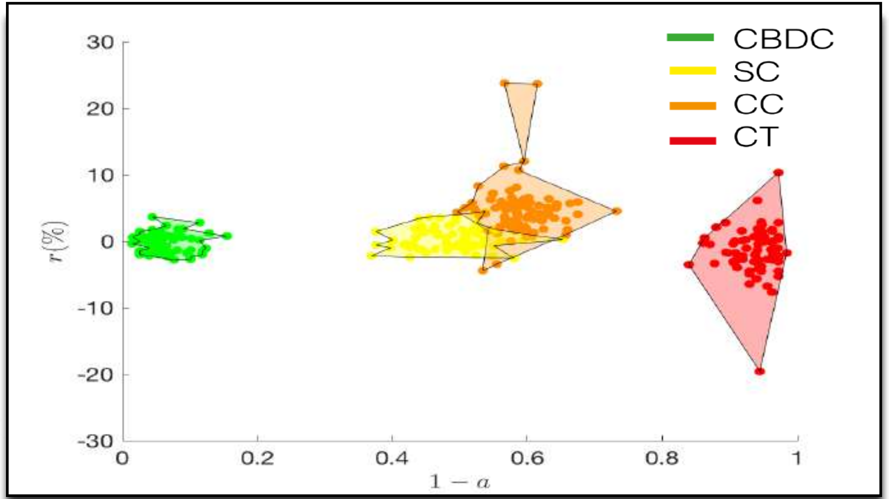
$\beta_0 = \beta_1 = \beta_2 = 1$



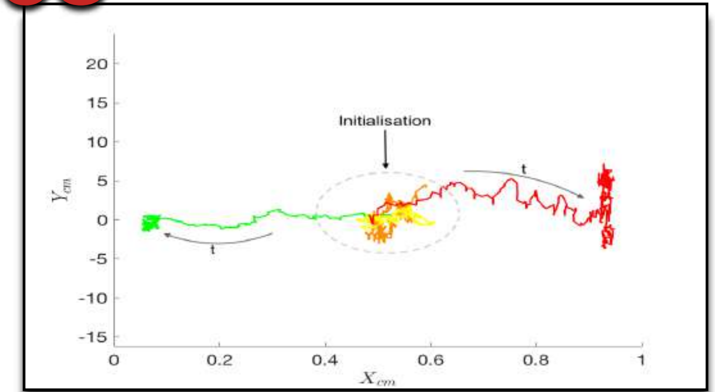
Expected returns and adoption dynamics

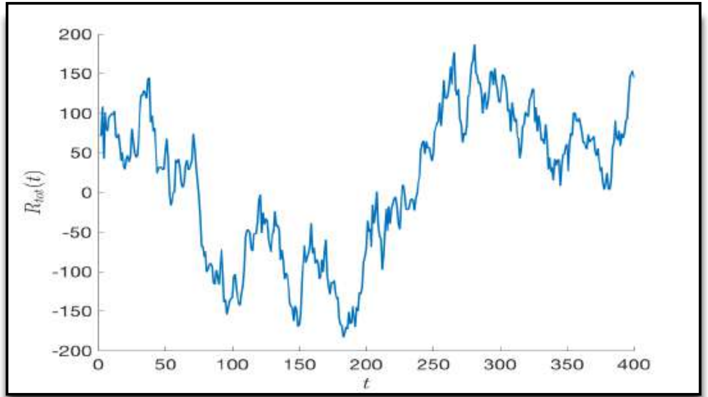
$$\beta_0 = \beta_1 = \beta_2 = 1$$

Expected Return

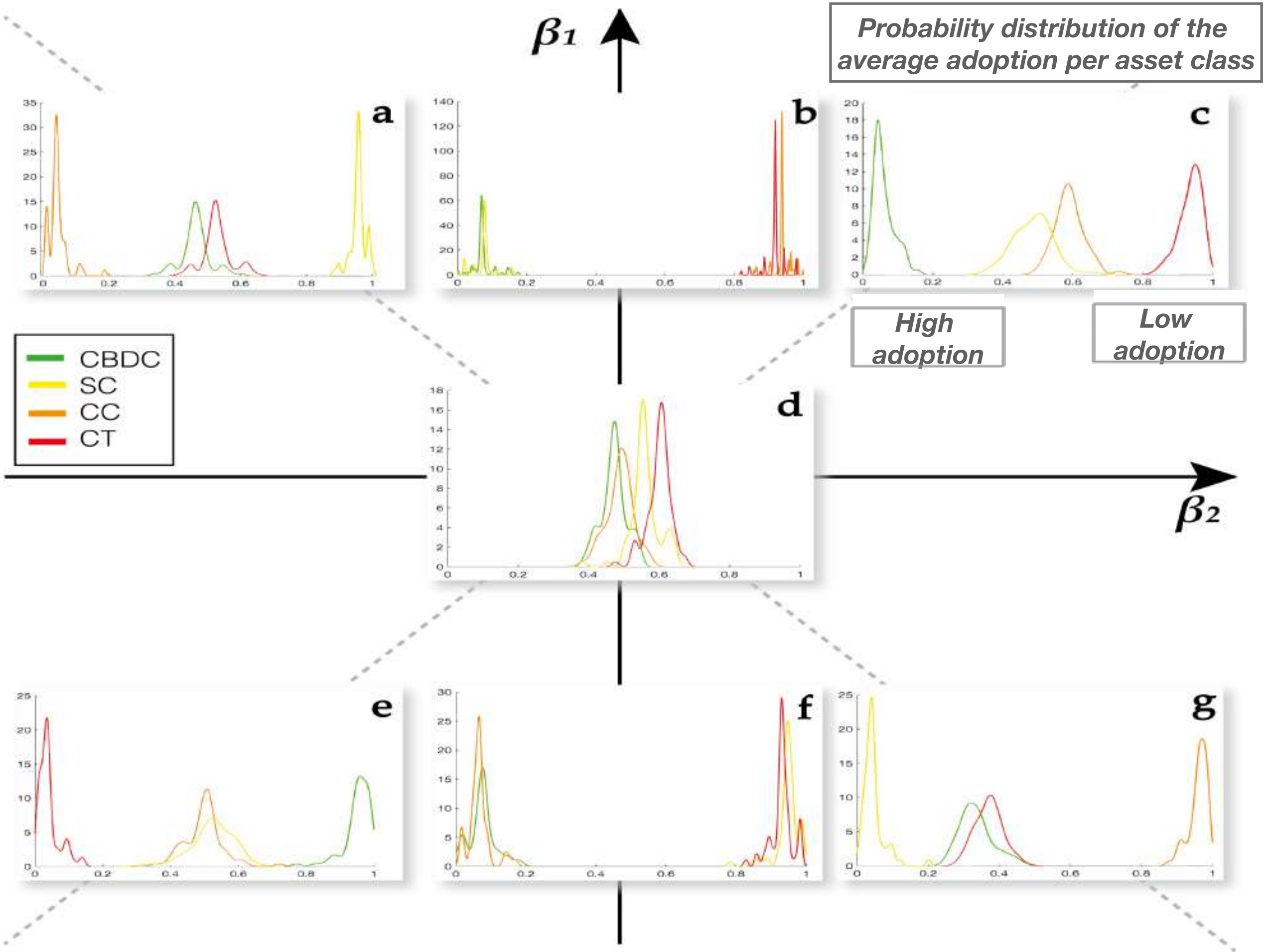


Prob. of not being adopted





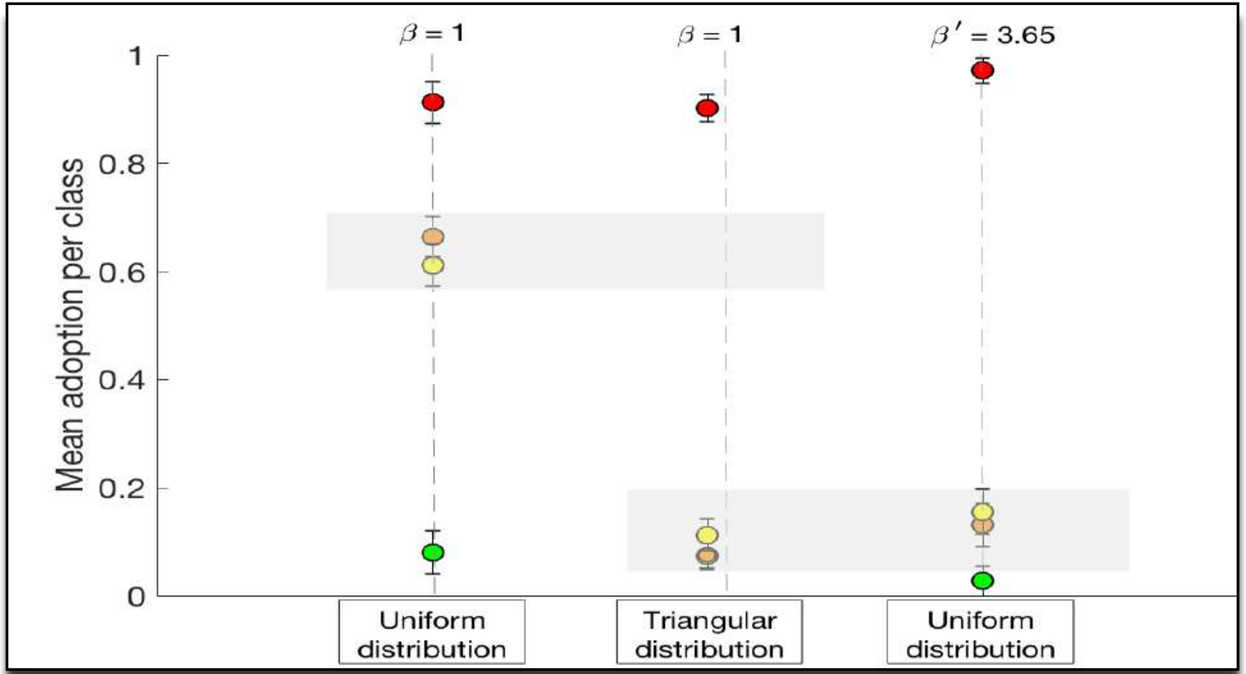
Changing investors' preferences



Changes in the ecosystem

A different composition of the crypto-ecosystem (e.g. number of assets per class) may affect investment decisions.

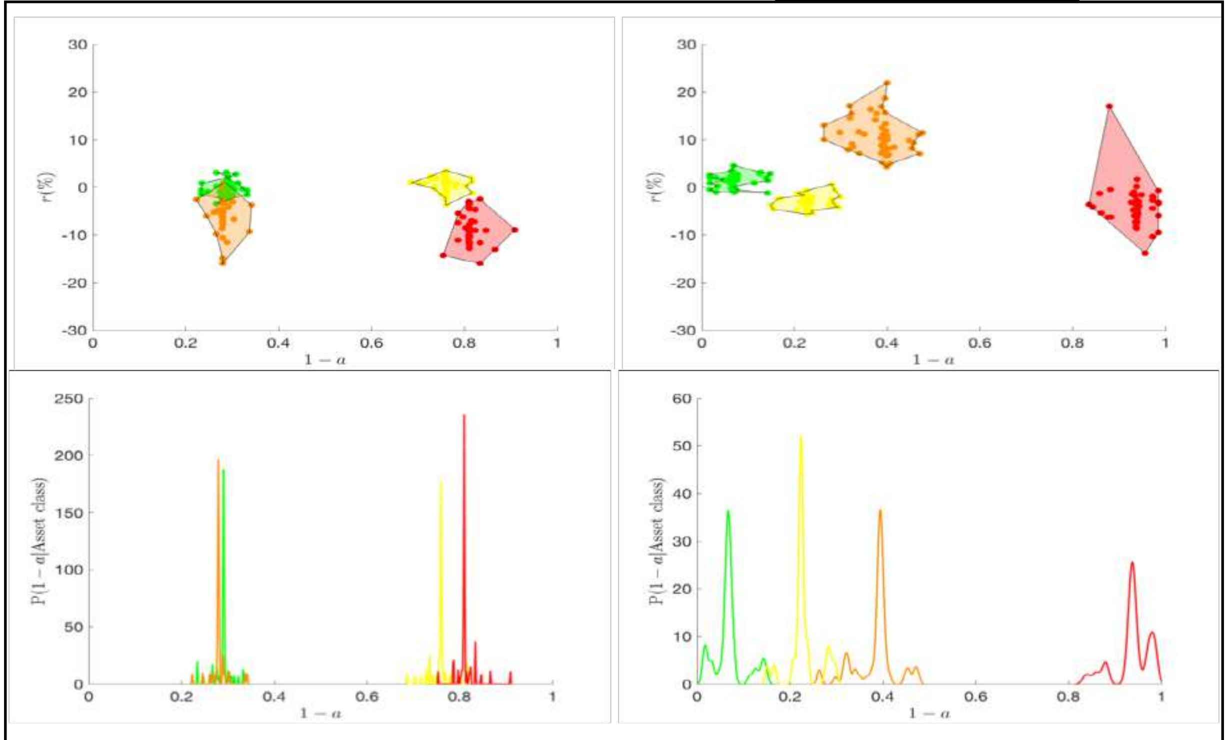
We can show that changes in the composition of the crypto-market can be rebalanced by modifying the investors' β parameters.



Heterogeneous investors

Introducing misaligned investors with opposite strategies determines a non-trivial behaviour in the system together with the emergence of new stable configurations, but may also destabilise the system.

Heterogeneous **Homogeneous**



Summary

* Investors interact with crypto assets over a crypto app providing optimal adoption recommendations.

* We characterise the dynamics of crypto assets adoption and observe the emergence of *multiple stable configurations*.

* The *composition of the ecosystem* affects investors' decisions and final optimal configurations.

* *Heterogeneous investors*: disseminating contrasting views, which may affect investors' opinions on the assets and the associated risks, may destabilise the ecosystem.

Thank you!

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S. Bartolucci & A. Kirilenko (2019) arXiv: 1906.09632

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