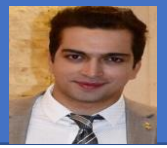
Crypto-CAPM: The Role of Speculative and Fundamental Demand in Cryptocurrency Pricing



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Introduction:

- We offer a CAPM-like equilibrium pricing model for cryptocurrencies
- There is an overlapping generation of investors with dispersed beliefs
- Investors can endogenously control the utility gain from transactional benefits

Takeaway:

- We identify three priced components in each crypto asset:
  1. Systematic exposure to the crypto market
  2. Belief heterogeneity
  3. Transactional benefits
- The "optimism coefficient" quantifies the magnitude of belief heterogeneity in each crypto asset.
- There is a bilateral relationship between belief dispersion and transactional benefits
- We demonstrate that in boom episodes, over-optimism destabilizes crypto market and might lead to crash.

Theory:

- **Two states** and **two types** of investors:

$$\begin{cases} r_t^U : \text{Vector of returns in up state at date t} \\ r_t^D : \text{Vector of returns in down state at date t} \end{cases} \quad \begin{cases} \theta^C = \xi_1 \theta^R \\ 1-\theta^C = \xi_2(1-\theta^R) \end{cases}$$

- Crypto-CAPM Relation:

$$E_t(r_{t+1}) = \underbrace{\beta E_t(r_{M(t+1)})}_{Term\ 1} + \underbrace{\frac{\xi_1 - 1}{\gamma + \xi_1} r^D_{t+1}}_{Term\ 2} + \underbrace{\frac{\gamma+1}{\gamma+\xi_1}(\mu - \frac{b}{A}\lambda)}_{Term\ 3}$$

$$Where\ \beta = \frac{\sum X^M}{X'^M \sum X^M} = \frac{\sum X^M}{\sigma^2_M}$$

- Optimal Transactional Motive:

$$D_b = \underbrace{N^{-1}\Sigma_y^{-1}\lambda}_{Term\ 1} + \underbrace{A\Sigma_y^{-1}\Sigma_{fy}}_{Term\ 2} - \underbrace{A\Sigma_y^{-1}\Sigma_{ry}}_{Term\ 3}$$

- The market model return residual follows:

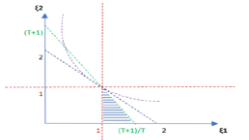
$$\ln(E[r] - \beta E[r_m]) = \ln(\gamma(\gamma+1)) + \ln(\mu - \frac{b}{A}\lambda) + B(Z - E[Z])$$

$$Where \quad B = \frac{\omega r^D}{(\gamma+1)(\mu - \frac{b}{A}\lambda)} + \frac{\omega}{1+\gamma}$$

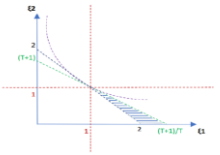
Market Stability:

- Over-optimism destabilizes the crypto market
- We develop intuition by explaining the following 4 cases

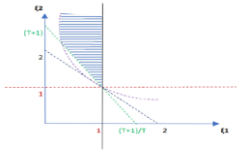
- **Case 1:** Over-confident investors are optimistic, and the crypto market is in boom



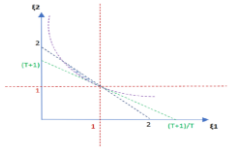
- **Case 2:** Over-confident investors are optimistic, and the crypto market is in downturn



- **Case 3:** Over-confident investors are pessimistic, and the crypto market is in boom



- **Case 4:** Over-confident investors are pessimistic, and the crypto market is in downturn



Empirical Findings:

- $r_{it} = \beta_i r_{mt} + \gamma_{it} r^D_{it} + \sum_j \kappa^j_i Comp^j_{it} + \varepsilon_{it}$

	(1) ETH return	(2) ETH return	(3) ETH return
Market return	1.088*** (33.77)	1.090*** (33.68)	1.085*** (33.24)
ETH Down return	-0.103*** (-2.70)	-0.0973** (-2.52)	-0.0954** (-2.17)
Control variable		0.253 (0.73)	-1.025 (-1.35)
eth tx benefit 1			-0.0005826*** (-3.52)
eth tx benefit 2			-0.0016697 (-0.82)
eth tx benefit 3			0.00203 (0.60)
eth tx benefit 4			0.00102 (0.76)
Constant	-0.00269 (-1.26)	-0.00433 (-1.39)	0.00519 (0.91)
Observations	365	365	365
R^2	0.764	0.764	0.771

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- May 2021 Market Crash
- Musk's tweet alters investors' belief
- It was an exogenous shock
- Optimism coefficient captures belief change from optimism to pessimism

	(1) Crypto Return (Before)	(2) Crypto Return (After)
Market Return	0.9765** (2.21)	0.9842*** (3.84)
Down-State Return	-0.4838**** (-6.84)	0.3587**** (9.59)
TX Benefit	-1.02e-6*** (-2.67)	0.0173*** (3.80)
Constant	-0.0072 (-1.12)	0.0151**** (6.79)
Observations	117	286
R^2	0.092	0.096

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$