A new wolf in town? Pump-and-dump manipulation in cryptocurrency markets

Anirudh Dhawan and Talis Putnins

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Cryptocurrency markets

- Markets to buy and sell blockchain-based digital instruments such as Bitcoin, Ethereum, etc.

- Cryptocurrency (crypto) markets –
  - Primary market (ICOs) → $29 billion raised for >1500 projects
  - Secondary market → $10.8 trillion trading volume in 2019

Crypto pump-and-dumps

- Pump-and-dump manipulation (P&D) is a big concern in crypto markets
  - P&D → manipulators take long positions → artificially inflate prices ("pump") → sell at inflated prices ("dump")
  - PumpAnalysis.com (PA) → 1,692 pumps by 632 "pump groups" between Jan-May 2018
    - 657 coins affected
    - As many as 23.3 million participants
  - Wall Street Journal → 175 pumps on Binance (one of the largest crypto exchanges)
    - 121 coins affected
    - $800 mil volume created

Crypto pump-and-dumps

- Why should we care?
  - Crypto markets are becoming more important
  - Naïve retail investors are getting exploited → pumps are small money bets
  - Manipulation inhibits growth of crypto markets → institutions likely to stay away
  - Unique lab to study manipulation
    - Manipulators operate in the open → little/no regulation
    - Easy to identify when pumps start → manipulators send a "pump signal"
    - Crypto pumps are fast → fewer confounding factors

Crypto pump-and-dumps

- Manipulators run groups on Telegram and Discord (chat platforms) → send "pump signals"
- Anyone can join the group but only admins can send messages
- Admins explicit about "pumping" coins → as opposed to discussing rumors → pump group identification
- Admins announce exchange and time of pump well in advance
- Coin announced when the pump starts
- Let's have a look at a specific pump →

Big Pump Signal 58331 subscribers Show recent messages

Big Pump Signal 16K 7:00:41 PM

This week was a week full of action for a lot of crypto currencies. A lot of good projects like $xrp and $vibe spiked up. Also $eth was doing well. But there was one coin that is still missing on the top gainer list.

The coin we pick is $NAV (Nav coin). This coin has a lot of news coming up and is going to have a great surge up soon. This pump, we will see a big spike (30-60%) After the spike there will be a small drop. Be sure to buy that dip and continue riding the waves.

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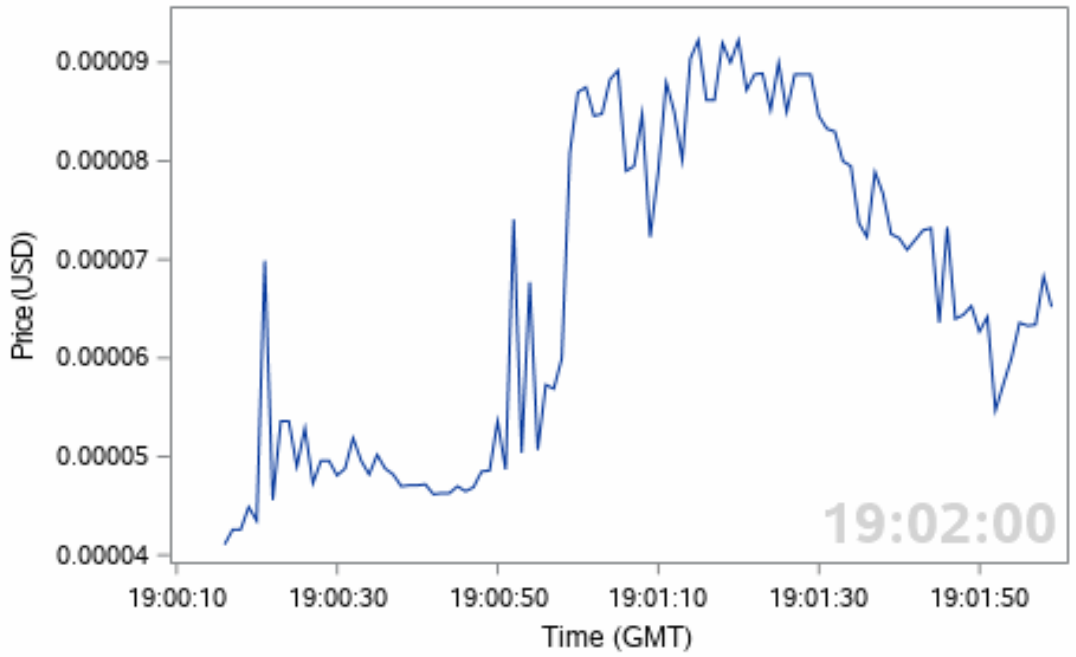


Research questions

- Why do people join these pumps?
  - Zero-sum games with manipulators at clear advantage → know coin beforehand
  - Negative-sum games for non-manipulators
- How does pump participation affect pump outcomes?

Contribution

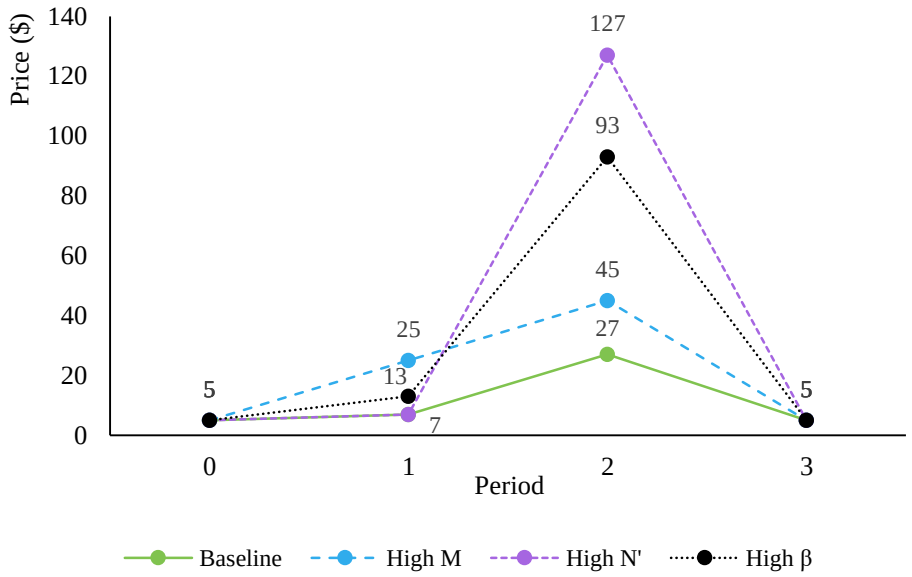
- Contributes to market manipulation literature
  - New theoretical mechanism → overconfidence + gambling preferences
  - Empirical insights more reliable → clean identification + few confounding factors
- Contributes to cryptocurrency literature
  - Studies nature and effects of crypto P&Ds → a systemic issue in crypto markets
  - Informs market participants about the risks in crypto markets
- Contributes incrementally over other crypto P&D papers
  - Examines mechanism behind crypto pumps theoretically + empirically

Theory model

- Manipulation theories that assume rationality cannot explain crypto pumps
  - Info-based → pump signal doesn't contain false information about coin
  - Trade-based → pump initiated through signal release and not manipulator's trades
- Model → overconfidence + gambling preference (but not rationality) can explain participation
- Key assumptions –
  - Buy/sell orders placed in a queue + executed sequentially → represents latency in order submission + execution
  - Pricing function → $P_t = P_0 + \beta X_t$
  - No short-selling

Theory model

- 4-period, simultaneous-move trading game
  - Period 0 → Manipulators decide to pump
  - Period 1 → Manipulators buy M units + announce pump
  - Period 2 → Manipulators send signal + N players decide whether to participate by buying 1 unit
  - Period 3 → Manipulators + participating players sell



Theory model

- Rational actors –

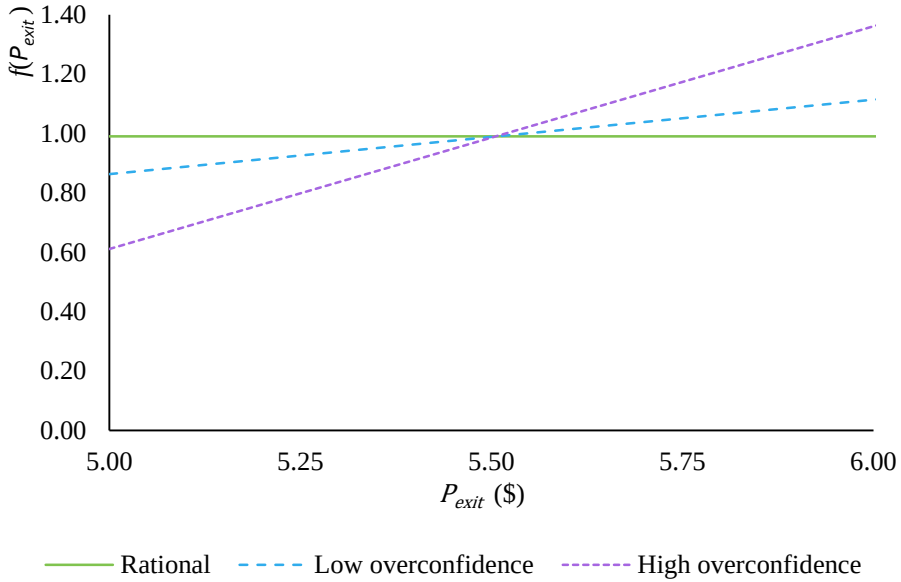
$$P_{entry} \sim U\left(P_0 + \beta(M+1), P_0 + \beta(N+M)\right)$$

$$P_{exit} \sim U\left(P_0, P_0 + \beta(M+N-1)\right)$$

$\mathbb{E}[\pi_i] = -\frac{\beta(M+2)}{2}$ → strictly negative

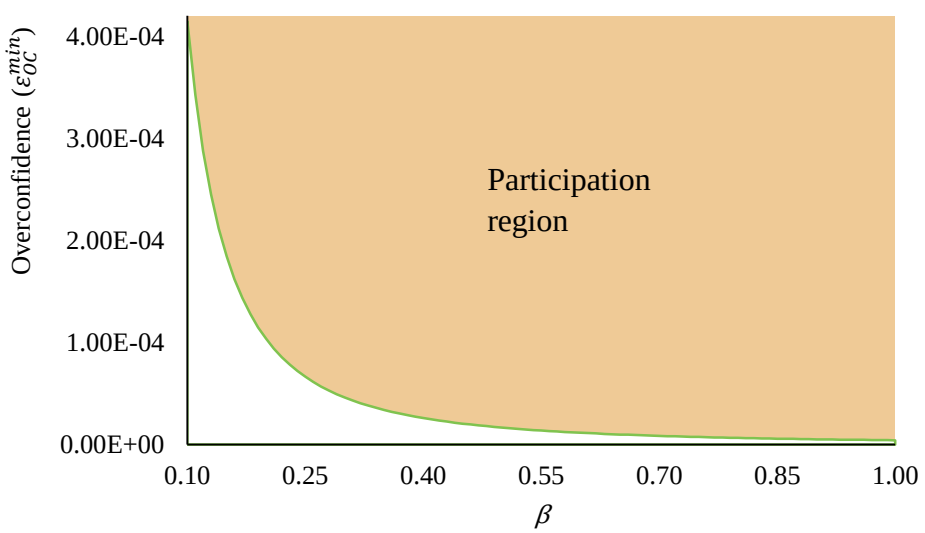
- Overconfident actors –
  - Better-than-average (BTA) effect → overconfident agents believe their own ability is better than the average person's ability
  - Model → BTA actors overestimate prob. of receiving high prices at exit
    - Transformed pdf for P_{exit}

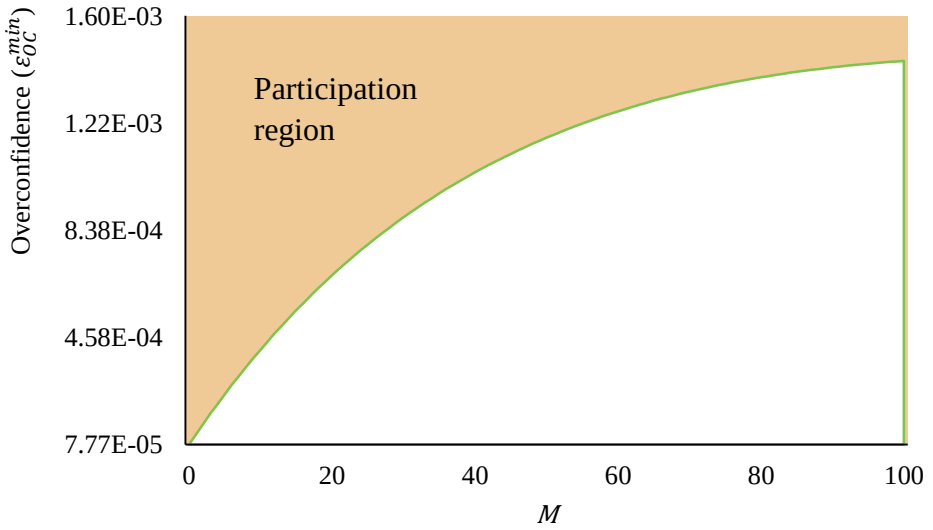
Theory model

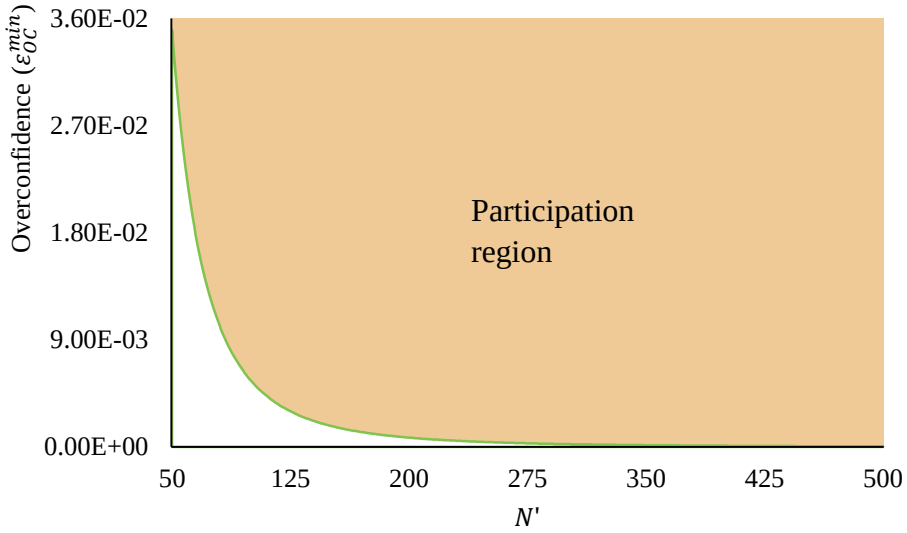


- Overconfident player i participates if $\varepsilon_{OC}^{i} > \frac{6(m+2)}{\beta^2(m+N_P-1)^3} = \varepsilon_{OC}^{min}$

Theory model







Theory model

- Gamblers –
  - Value positively skewed (lottery-like) payoff structures (Kumar, 2009)
  - Individual pumps not right-skewed
  - Gamblers value series of gambles rather than single gamble (Dickerson, 1984)
  - Barberis (2012) → gamblers create right-skewed payoff structure from symmetric 50:50 gambles by playing a series of bets
    - Stop playing if total losses exceed maximum threshold
    - Value payoffs using Cumulative Prospect Theory (CPT) preferences
  - Assume gamblers start with $\$a$ wealth + play indefinitely until wealth reaches loss threshold $\$b$ ($b < a$) or gain threshold $\$c$ ($c > a$)

Theory model

- Effectively playing single gamble

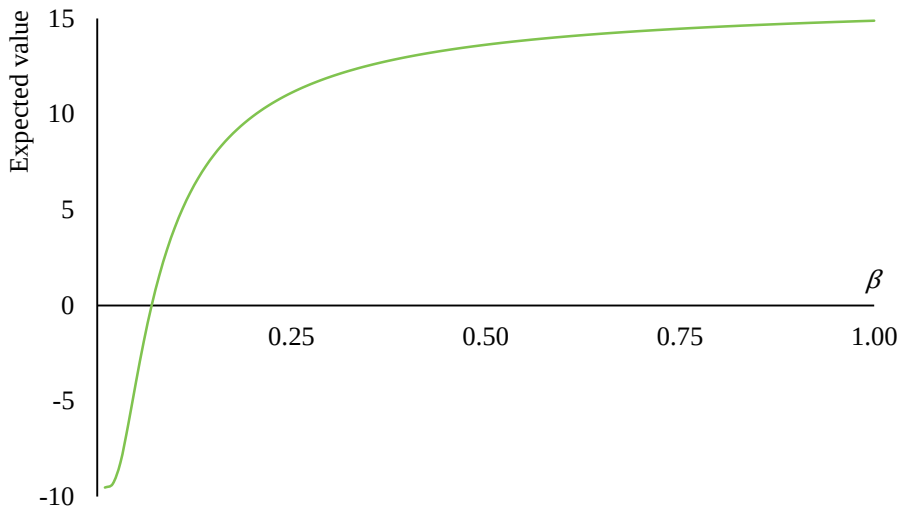
$$\tilde{G}_s \sim ((c-a), P_{c-a}; -(a-b), P_{-(a-b)})$$

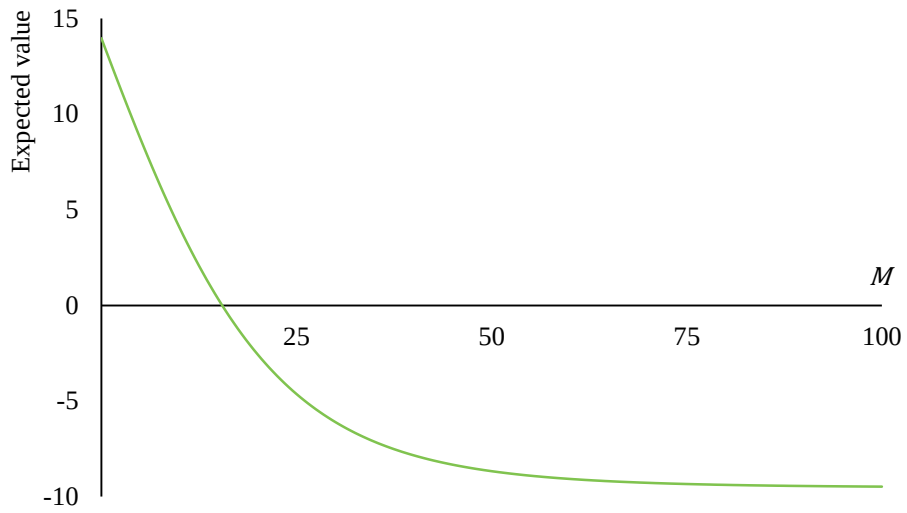
- Approximate wealth as a Brownian motion starting at $\$a$ and terminating upon reaching absorbing barriers on either side, $\$b$ and $\$c$

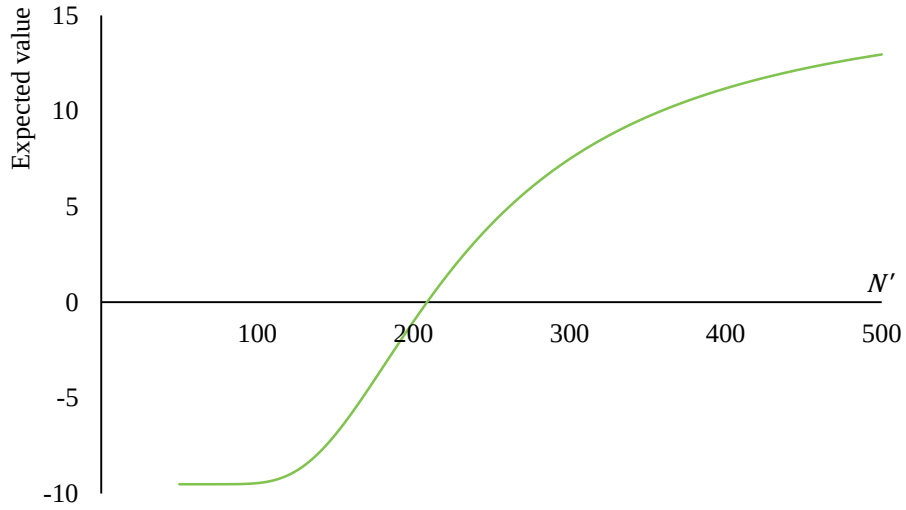
$$P_{c-a} = \frac{\exp\left(-\frac{2a\mu}{\sigma^2}\right) - 1}{\exp\left(-\frac{2c\mu}{\sigma^2}\right) - 1}$$

- Set model parameter values ($P_0 = \$5$, $\beta = 0.01$, $M = 10$, $N_P = 1000$, $a = \$6$) + CPT parameters as per Barberis (2012) –
  - Optimal $\$b = \$0$
  - Optimal $\$c = \$245$

Theory model







Data

- Pumps data
  - Telegram chat groups
  - Info → coin name, exchange name, pump date, and time
  - Start time → signal sent on group
  - End time → price peak (within 3 hrs of signal)
  - Yobit → PA website
  - Binance → hand-collected from chat groups

- Additional data
  - Yobit trades → Kaiko Data
  - Binance trades → Binance API
  - Market capitalization, prices → Coinmarketcap
  - Gambling → WalletExplorer

- Sample size → 64 pumps on Binance and 291 pumps on Yobit

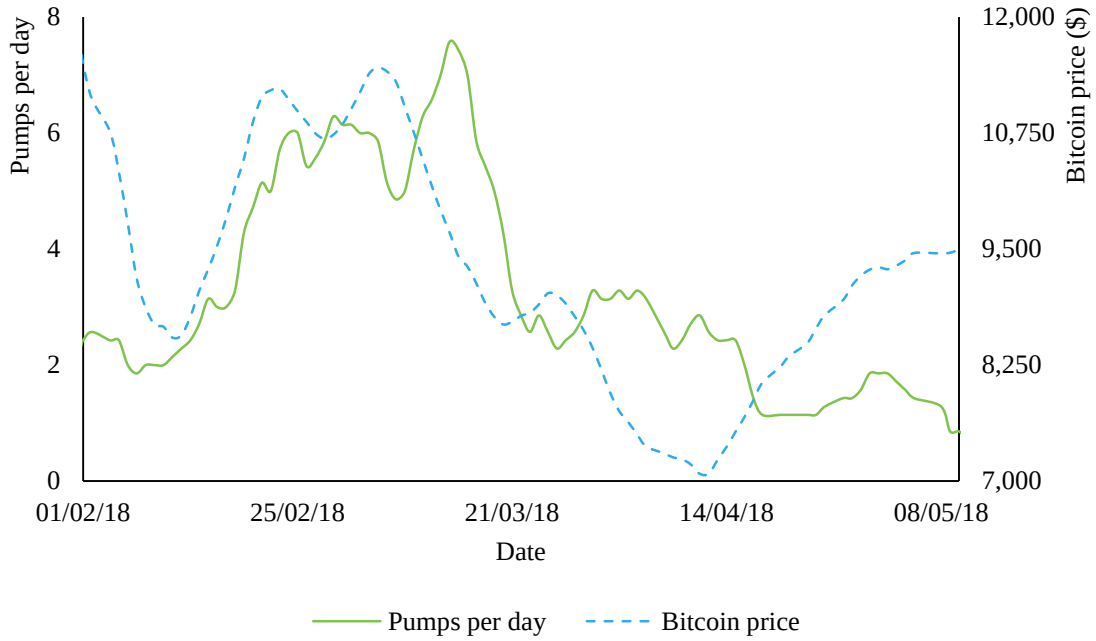
- Sample period → Dec 2017 – June 2018

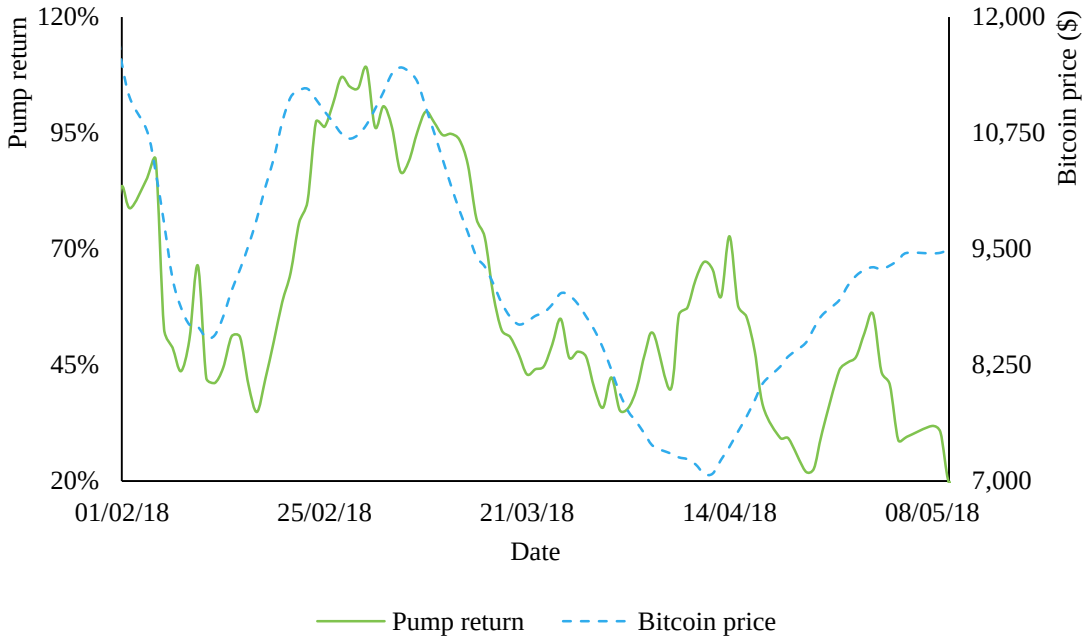
Summary statistics

Description	Statistic
No. of pumps	355
No. of pumped coins	197
No. of pump-days	133
Avg duration (minutes)	8.07
Pump-day volume ($ million)	350.77
Pump-day trading vol as % of coin's avg daily vol	1,351.20%
Avg pump return (start to peak)	65.47%
Avg pump rtn as % of one std dev of coin's daily rtn	401.29%
Manipulators' aggregate profit ($ million)	6.04
Manipulators' percentage profit	24.77%

- Highest daily return for Bitcoin → 22.72%; S&P 500 → 2.72%

Pumps and Bitcoin price





What affects pump participation?

$$Participation_{j,i,t}$$

$$= \beta_1 Overconfidence_t + \beta_2 Gambling_t + \beta_3 Manipulators_{j,i,t} + \beta_4 Volatility_{i,t-1} + \beta_{5-6} Controls$$

observations for pump j on coin i in day t.

- $Participation_{j,i,t}$ → Log trading volume ($) generated from pump start till 3 hrs after peak
- $Overconfidence_t$ → Avg daily return (%) for all coins between day $t-5$ and day t
- $Gambling_t$ → Log gambling volume ($) using Bitcoin
- $Volatility_{i,t}$ → Log intraday volatility
- $Manipulators_{j,i,t}$ → Log number of Telegram groups in the pump

What affects pump participation?

Variable	Dependent variable = $Participation_{j,i,t}$				
$Overconfidence_t$	6.47*** (2.70)				1.93 (0.64)
$Gambling_t$		0.48*** (4.11)			0.33* (1.93)
$Manipulators_{j,i,t}$			-0.20* (-1.88)		-0.18 (-1.55)
$Volatility_{i,t}$				0.02 (0.56)	0.01 (0.31)
Controls?	Yes	Yes	Yes	Yes	Yes
R^2	77.52%	74.04%	4.45%	46.18%	4.02%
No. of pump obs.	355	355	291	242	237

What affects pump participation?

- Pump participation ↑ when aggregate overconfidence + gambling preferences ↑
- Pump participation ↓ when no. of manipulators ↑
- Uncertainty about coin value doesn't affect pump participation
- Gambling effect is the strongest → pump participants are mainly crypto gamblers

Participation, experience, and pump outcomes

Variable	Dependent variable =			
	$ManProfit_{j,i}$	$PrePump_{j,i}$	$Return_{j,i}$	$Duration_{j,i}$
$Participation_{j,i}$	0.96*** (14.57)	0.44*** (6.55)	0.24*** (6.26)	-0.15* (-1.80)
$Experience_{j,i}$	0.21** (2.36)	0.17* (1.71)	0.06 (1.10)	-0.33*** (-2.87)
$Liquidity_i$	-0.08 (-1.55)	0.47*** (8.66)	-0.23*** (-7.53)	0.06 (0.91)
R^2	84.74%	86.58%	26.54%	7.13%
No. of pump obs.	181	174	189	189

Number of participants and pump outcomes

- 1% ↑ in pump participation (pump volume)
  - Manipulators' profit ↑ by 0.96%
  - Pre-pump inventory ↑ by 0.44%
  - Pump return ↑ by 0.24%
- 50% ↑ in participant experience (3 prev. pumps vs 2 prev. pumps)
  - Pump duration ↓ by 16.50%
- Results robust to alternative pump participation proxy (total no. of members in participating Telegram groups)
- High participation → attractive to manipulators + non-manipulators → crucial for pump sustainability

Conclusion

- Crypto pumps → coordinated trading games → sharp price jumps + subsequent reversals
  - Manipulators → natural advantage → take positions before sending signal
  - Who doesn't participate? → rational investors
  - Who participates? → overconfident investors + gamblers
- Other key insights –
  - Pumps with high participation → high price jumps + manipulators' profit
  - Pumps with experienced participants → shorter
- Regulators + exchanges → manipulation + pump participation more lucrative as more people join crypto markets → better market surveillance needed to curb this manipulation activity