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

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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
The next pump will be scheduled:

Details for the next pump:
Exchange: Binance
Date: 22-09-2018
Time: 7PM GMT
A new wolf in town? Pump-and-dump manipulation in cryptocurrency markets

This week was a week full of action for a lot of crypto currencies. A lot of good projects like $XRP and $XIVe 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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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.
Research questions

• Why do people join these pumps?
  • Zero-sum games with manipulators at clear advantage \(\rightarrow\) 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

![Graph showing price movement over periods with different scenarios: Baseline, High M, High N', High \( \beta \).]
Theory model

• Rational actors –

\[ P_{\text{entry}} \sim U\left(P_0 + \beta(M + 1), P_0 + \beta(N + M)\right) \]
\[ P_{\text{exit}} \sim U\left(P_0, P_0 + \beta(M + N - 1)\right) \]

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

• Overconfident actors –
  
  • Better-than-average (BTA) effect \( \rightarrow \) overconfident agents believe their own ability is better than the average person’s ability
  
  • Model \( \rightarrow \) BTA actors overestimate prob. of receiving high prices at exit
    
    • Transformed pdf for \( P_{\text{exit}} \)
Overconfident player $i$ participates if $\varepsilon_{OC}^i > \frac{6(m+2)}{\beta^2(m+N_P-1)^3} = \varepsilon_{OC}^{\text{min}}$
Theory model

Participation region

Overconfidence ($\varepsilon_{OC_{min}}$)

$\beta$

Participation region

Overconfidence ($\varepsilon_{OC}$)

$M$

Overconfidence ($\varepsilon_{OC}$)

$N'$

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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

\[ \tilde{S}_s \sim ((c - a), P_{c-a}; -(a - b), P_{-(a-b)}) \]

• 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

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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

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

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

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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 \( t \).

- \( Participation_{j,i,t} \rightarrow \) Log trading volume ($) generated from pump start till 3 hrs after peak

- \( Overconfidence_t \rightarrow \) Avg daily return (%) for all coins between day \( t - 5 \) and day \( t \)

- \( Gambling_t \rightarrow \) Log gambling volume ($) using Bitcoin

- \( Volatility_{i,t} \rightarrow \) Log intraday volatility

- \( Manipulators_{j,i,t} \rightarrow \) Log number of Telegram groups in the pump
What affects pump participation?

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dependent variable = Participation(_{j,i,t})</th>
</tr>
</thead>
</table>
| 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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dependent variable =</th>
<th>ManProfit$_{j,i}$</th>
<th>PrePump$_{j,i}$</th>
<th>Return$_{j,i}$</th>
<th>Duration$_{j,i}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation$_{j,i}$</td>
<td>0.96***</td>
<td>0.44***</td>
<td>0.24***</td>
<td>-0.15*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(14.57)</td>
<td>(6.55)</td>
<td>(6.26)</td>
<td>(-1.80)</td>
<td></td>
</tr>
<tr>
<td>Experience$_{j,i}$</td>
<td>0.21**</td>
<td>0.17*</td>
<td>0.06</td>
<td>-0.33***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.36)</td>
<td>(1.71)</td>
<td>(1.10)</td>
<td>(-2.87)</td>
<td></td>
</tr>
<tr>
<td>Liquidity$_{i}$</td>
<td>-0.08</td>
<td>0.47***</td>
<td>-0.23***</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-1.55)</td>
<td>(8.66)</td>
<td>(-7.53)</td>
<td>(0.91)</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>84.74%</td>
<td>86.58%</td>
<td>26.54%</td>
<td>7.13%</td>
<td></td>
</tr>
<tr>
<td>No. of pump obs.</td>
<td>181</td>
<td>174</td>
<td>189</td>
<td>189</td>
<td></td>
</tr>
</tbody>
</table>
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