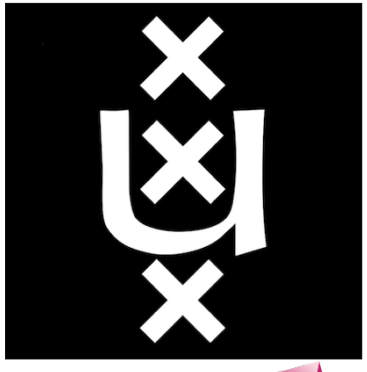
Reddit users unleashed - understanding user behaviour and their impact on meme stocks

Simon Trimborn

Inez Zwetsloot



University of Amsterdam

Tinbergen Institute

City University of Hong Kong

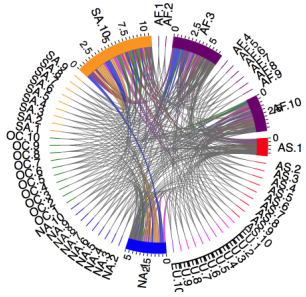
https://www.simontrimborn.de/

https://www.uva.nl/en/profile/z/w/i.m.zwetsloot/i.m.z...sloot.html

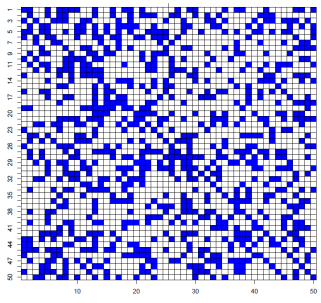
CityU
香港城市大學
City University of Hong Kong

How this project fits into my work

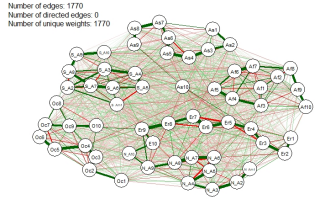
(a) Network Models & Complex Systems ✓



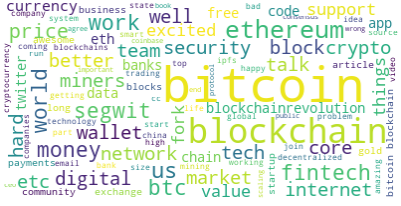
(b) Dimension Reduction techniques ✓



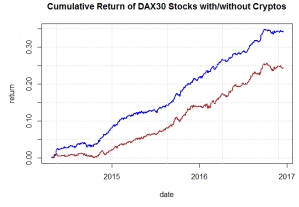
(c) FinTech & Blockchain Analytics ✓



(d) Social Media Analytics ✓



(e) Investment Methodologies ✗



(f) Software creation ✗

What are meme stocks?

- Stocks targeted by the internet crowd
- Believe them to be undervalued, activism, etc.
- Hype them up and cause market excesses

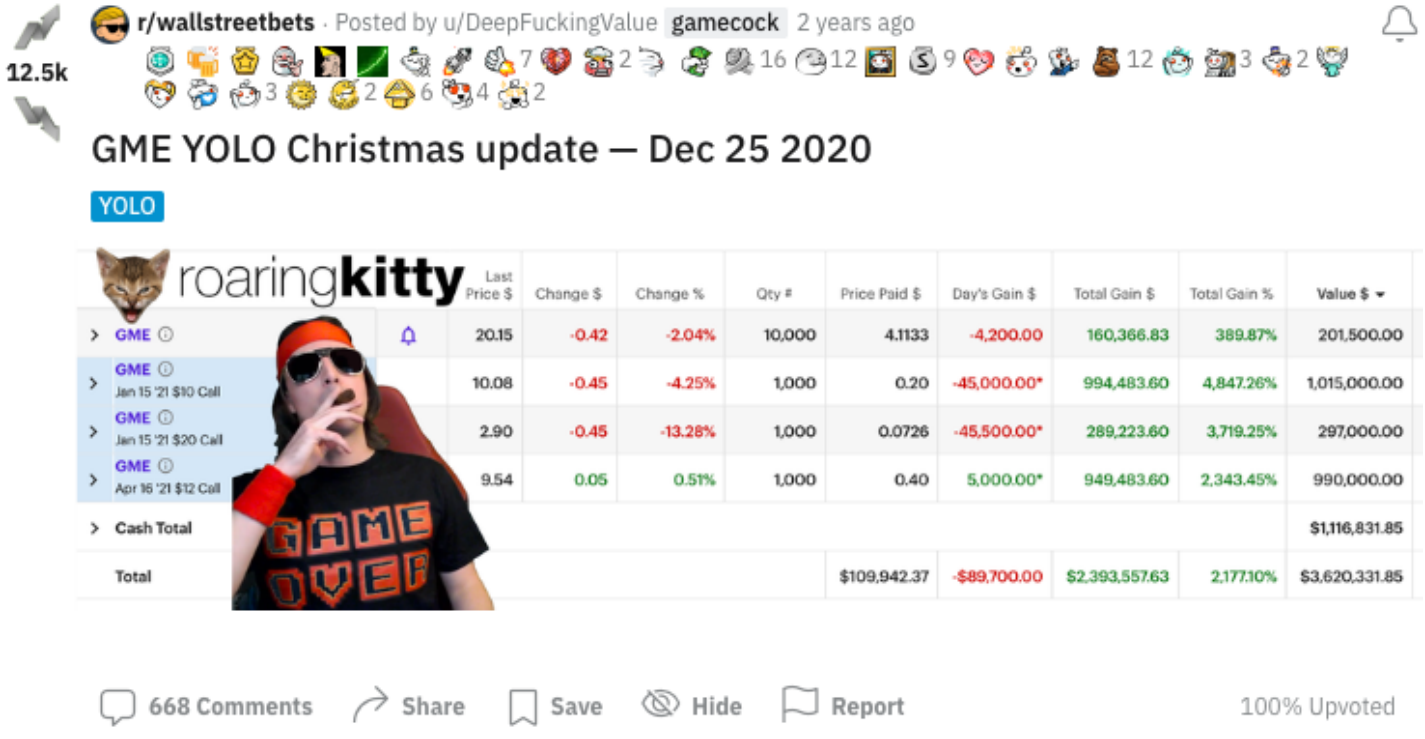
Why should we care?

- Internet crowd entered wallstreet
- Can cause huge market excesses
- Communication via memes on public forums
- How did it all start?

Wallstreetbets & GME

- GameStop (GME) posts continued losses for years
- Hard hit by Covid-19 due to store closures
- From 2019: User Keith Gill posts about investment in GameStop (GME)
- Hedgefunds bet on a falling price
- Wallstreetbets investors short squeeze hedgefunds, causing market disturbances

Typical post by Keith Gill



	Last Price $	Change $	Change %	Qty #	Price Paid $	Day's Gain $	Total Gain $	Total Gain %	Value $
GME	20.15	-0.42	-2.04%	10,000	4.1133	-4,200.00	160,366.83	389.87%	201,500.00
GME Jan 15 '21 $10 Call	10.08	-0.45	-4.25%	1,000	0.20	-45,000.00*	994,483.60	4,847.26%	1,015,000.00
GME Jan 15 '21 $20 Call	2.90	-0.45	-13.28%	1,000	0.0726	-45,500.00*	289,223.60	3,719.25%	297,000.00
GME Apr 16 '21 $12 Call	9.54	0.05	0.51%	1,000	0.40	5,000.00*	949,483.60	2,343.45%	990,000.00
Cash Total									$1,116,831.85
Total					$109,942.37	-$89,700.00	$2,393,557.63	2,177.10%	$3,620,331.85

So was it just a one-hit wonder? - No!

The Motley Fool | Our Services | Investing Basics | Stock Market | Retirement | Money

What are meme stocks?

What exactly are meme stocks?

Top meme stocks right now

What started the meme stock movement?

Pros of meme stocks

Cons of meme stocks

How to identify a good long-term meme stock

Investing in meme stocks and ETFs

Top meme stocks right now

Now in year three of the movement, new meme stocks are being created all the time as individual investors look for new ways to beat the stock market. Here are five to do some more digging on (beyond arguably the two most famous meme stocks — video game retailer **GameStop** (GME -4.37%) and the world's largest movie theater chain **AMC** (AMC -13.68%).

COMPANY	MARKET CAP	COMPANY DESCRIPTION
RIVIAN AUTOMOTIVE (NASDAQ:RIVN)	$13.3 billion	EV company ramping up sales of its electric SUV and pickup trucks.
BLACKBERRY (NYSE:BB)	$3.05 billion	Smartphone darling of the 2000s turned software company.
SOFI TECHNOLOGIES (NASDAQ:SOFI)	$5 billion	Fast growing online banking, lending, and investment services.
PALANTIR (NYSE:PLTR)	$26.75 billion	Software company specializing in big data, AI, and digital transformation.
VIRGIN GALACTIC (NYSE:SPCE)	$1.36 billion	A former SPAC stock and aspiring pioneer in space tourism and travel.

Market cap as of May 22, 2023. Data source: YCharts.

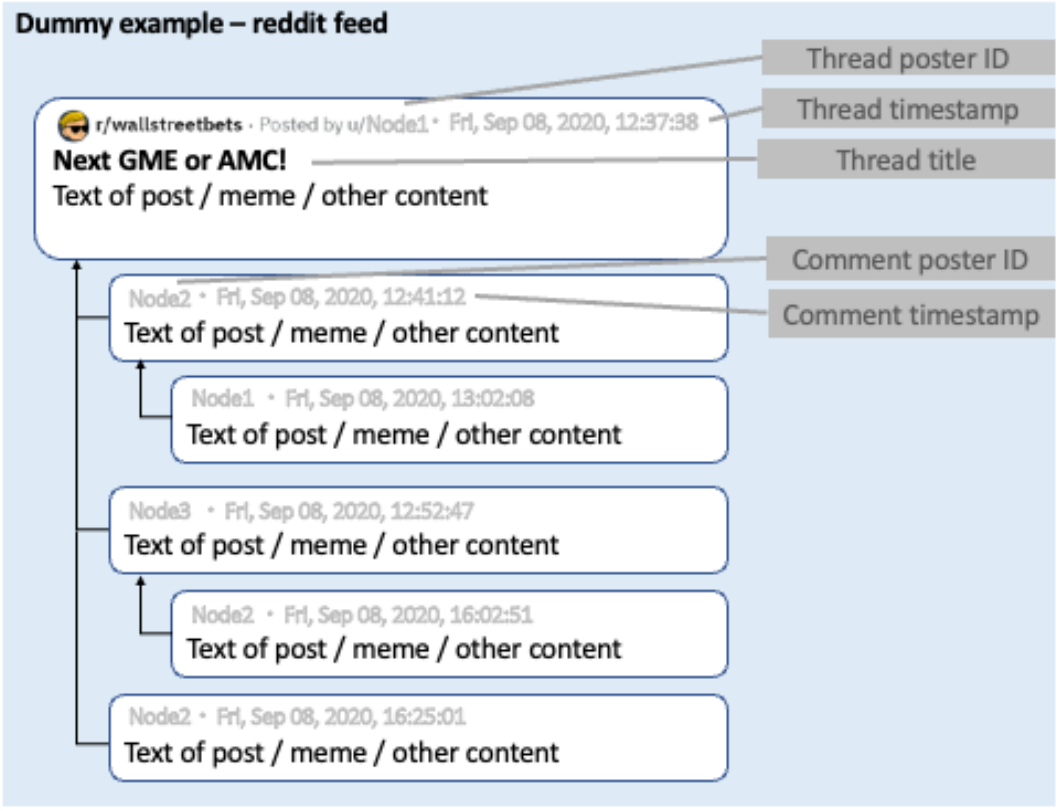
Outline

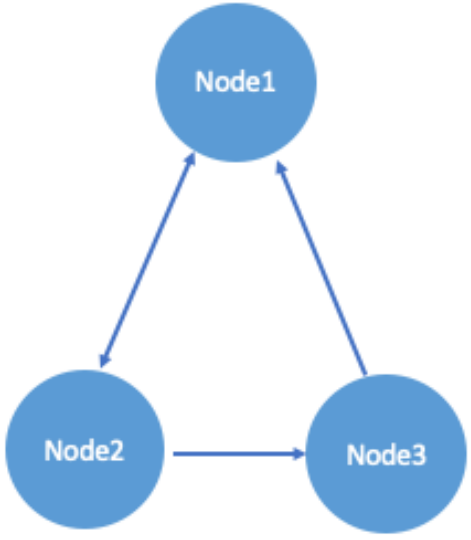
1. Motivation ✓
2. Reddit structure and data
3. Meme stock modelling
4. Market impact
5. Implications & what is next

The Financial Economics view

- DeGroot network model: Users change their believes via an online social network
- Finance: Investors change their believes about an asset which results in price changes
- When does the social network affect an asset? When the online social network is part of the assets pricing equation (Pedersen (2022) JFE)
- What is missing? Empirical validation for this theory

Reddit structure





WSB dataset

- Threads & posts containing ‘GME’ or ‘GameStop’ in title
- Time period: 01.06.2020 - 31.05.2021
- 502,668 users
- 116,231 threads
- 3,715,053 comments
-
  - Focus on GME because it is the first meme stock
  - Discussion on Reddit not distorted by media coverage

Node analysis

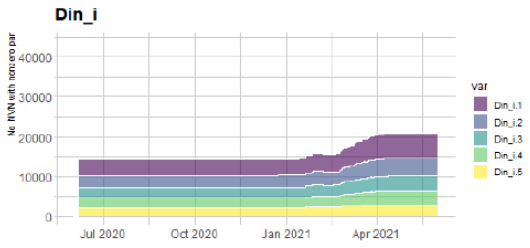
- Target: Model posting behaviour of each node i in a time series fashion
- Input: Network variables
  - Past in- & out-degree
  - Network activity
  - Thread activity
- Microview: One model per edge between nodes
- Differentiation: Vital vs. Non-Vital Nodes (Influential users)

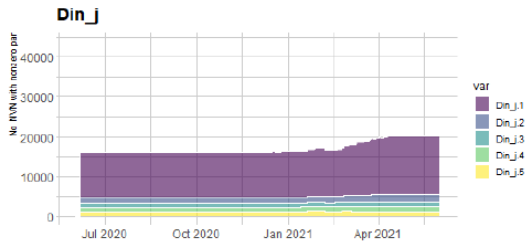
Node modelling

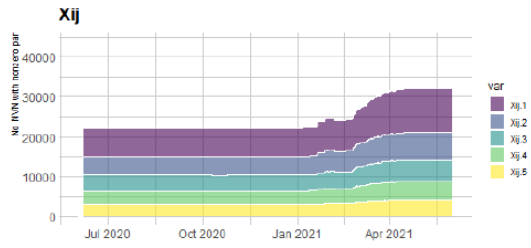
Type	Variable	Description	VN and/or ANVN model
Dependent	$x_{ij,t}$	Comment send from i to j	both
Micro-structure	$D^{in}_{i,t}$	In-degree of i: number of comments send to i	both
	$D^{out}_{i,t}$	Out-degree of i: number of comments send by i	both
	$D^{in}_{j,t}$	In-degree of j: number of comments send to j	ANVN
	$D^{out}_{j,t}$	Out-degree of j: number of submits by j	ANVN
	$AC^{vn}_{j,t}$	No. of submits by all other vital nodes (excluding j)	both
	$AC^{post}_{j,t}$	No. of comments within any post of VN j	both
Macro-structure	AC_t	Overall network activity	both
	AC^{24}_k	Overall network activity k days prior to time t	both
Control	Dum_{wls}	Dummy indicating trading hours	both
	Dum_{hour}	24 dummies for each hour	both

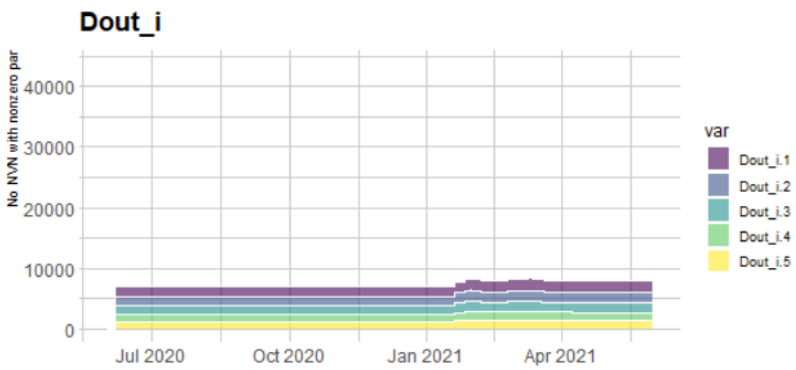
Functional form: logit model with time dependent parameters

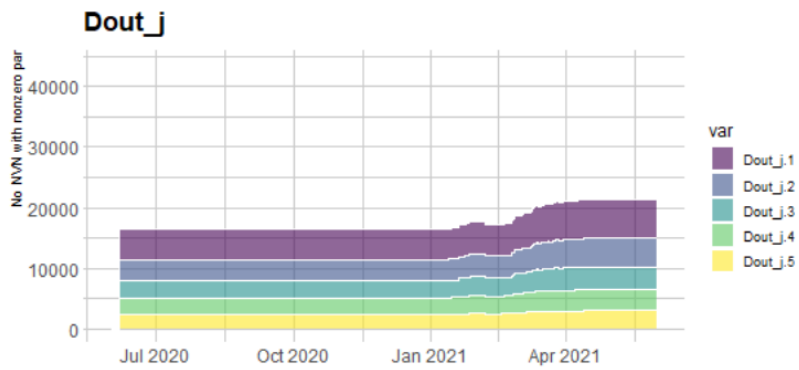
Determinants of posting behaviour



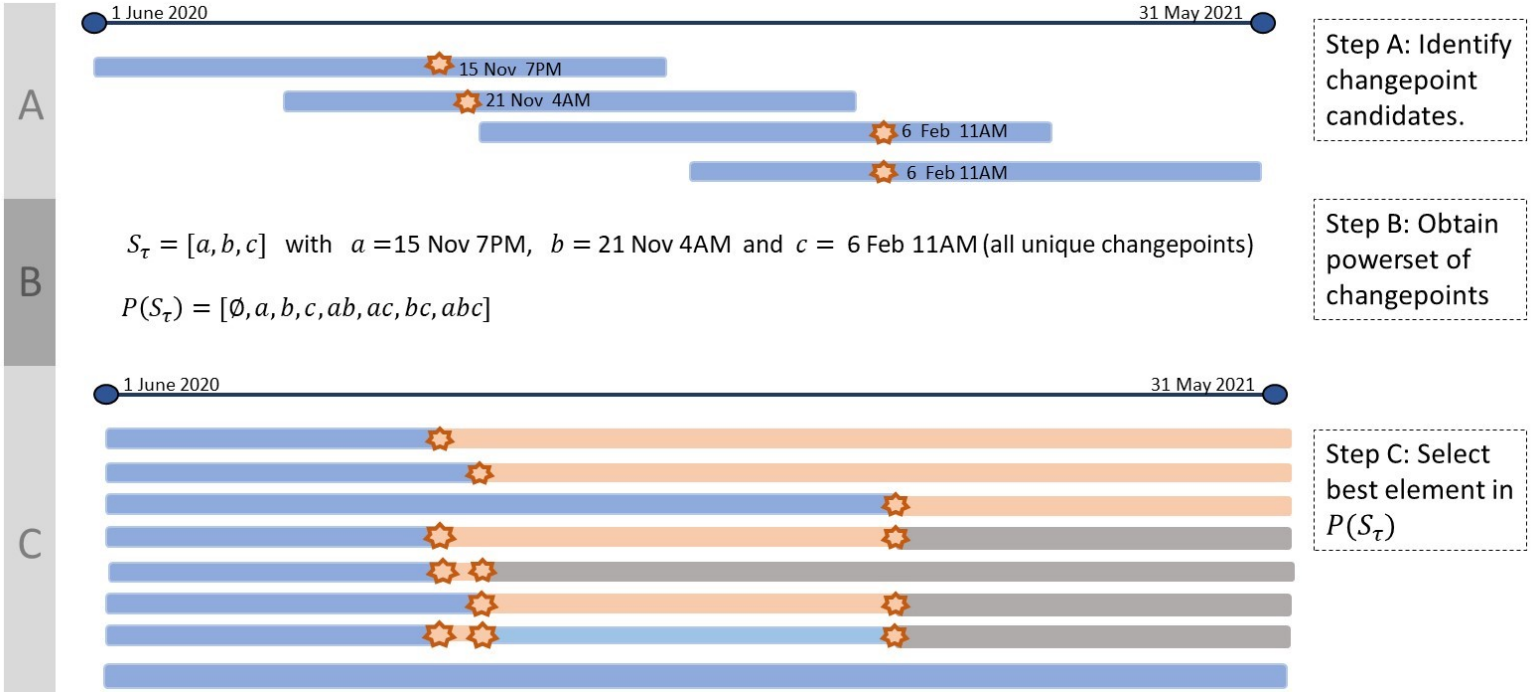








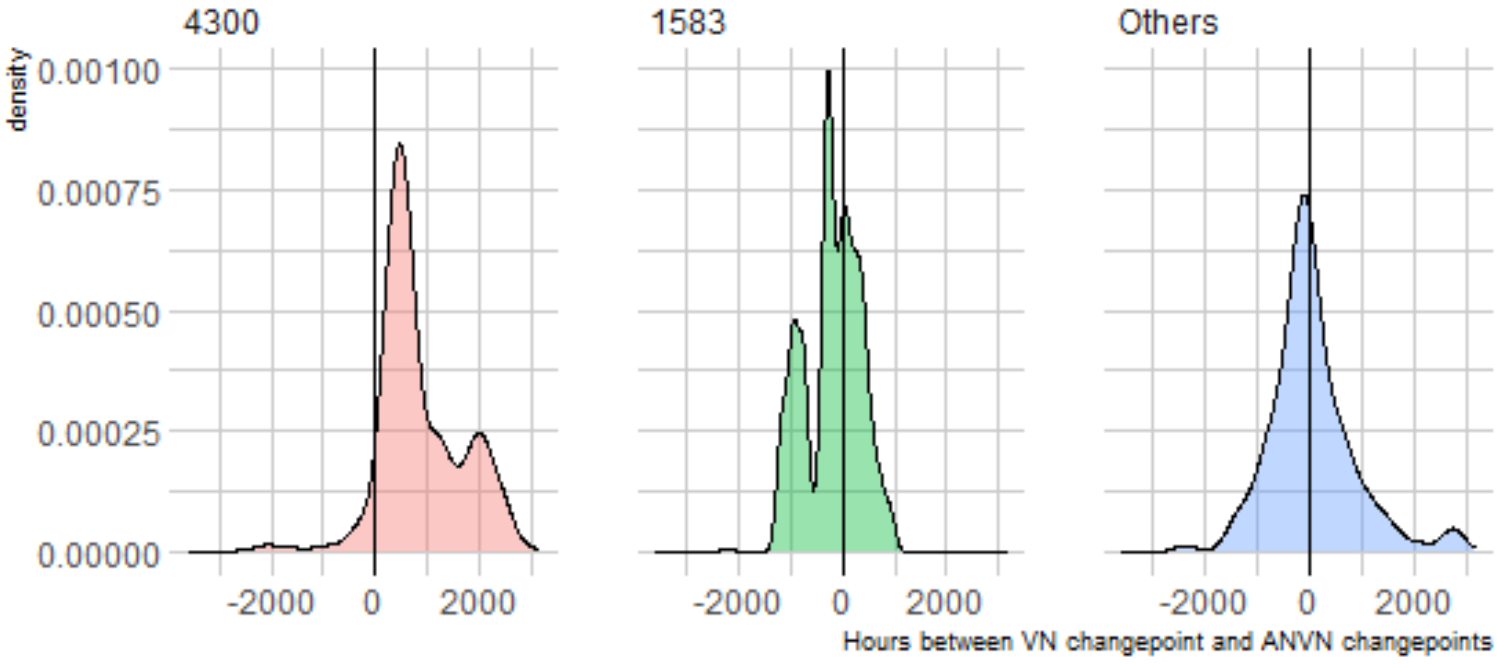
Search for change points - algorithm



Bai et al. 2022. Our settings: window 1440 hours (2 month), step size 168 hours (1 week), 5 Lags

We only consider changepoints significant on 5% significance level

Change in behaviour



Change in users behaviour & market impact

- Analysis on:
  - Entire dataset (hourly observations)
  - Market frenzy (5 minute observations)
- Target variables
  - Return
  - Integrated variance
  - Jump component of variance
- Input variables
  - Own past
  - Changepoint count variable
  - Network activity, mean distance/degree, betweenness, # active nodes

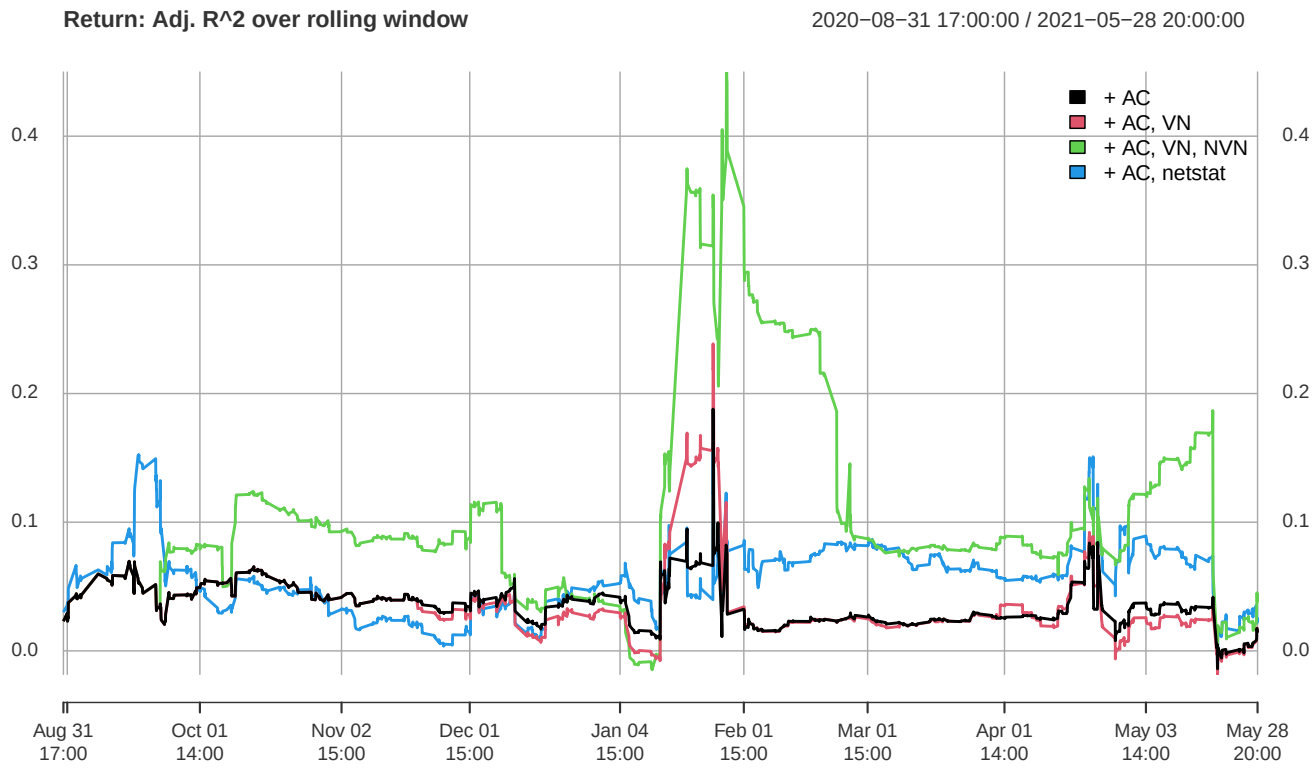
Return

	Dependent variable:					
	return					
	(1)	(2)	(3)	(4)	(5)	(6)
Return lagged	Yes	Yes	Yes	Yes	Yes	Yes
Vital nodes	No	No	Yes	Yes	No	Yes
Non-vital nodes	No	No	No	Yes	No	Yes
Network activity	No	Yes	Yes	Yes	Yes	Yes
Network statistics	No	No	No	No	Yes	Yes
Observations	1,633	1,633	1,633	1,633	1,633	1,633
R^2	0.009	0.020	0.028	0.088	0.045	0.115
Adjusted R^2	0.004	0.011	0.014	0.070	0.021	0.084

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Return - rolling window

Figure 2: Adj. R^2 for return models with rolling window over 3 months with step width 1 hour.



Reverse Causality? - No!

	Dependent variable:	
	VN	ANVN
return_{t-1}	−0.074	−0.067
return_{t-2}	0.062	0.067
return_{t-3}	−0.084	−0.081
return_{t-4}	0.148	0.150
return_{t-5}	−0.134	−0.129
return_{t-6}	0.211	0.211
return_{t-7}	−0.063	−0.063
Constant	−0.00003	0.005***
Observations	1,633	1,633
R^2	0.004	0.004
Note:	*p<0.1; **p<0.05; ***p<0.01	

Financial & economic implications

- Change in behaviour explains market movements: Necessity to quantify individual users behaviour
- Meme stock early warning system:
  - Influential users change in behaviour impacts markets with 6 hours delay
  - Many influential users changed behaviour 1-2 months ahead of market frenzy
- Explaining market movement: Lesser influential users change in behaviour explains largest portion of market dynamics

Managerial implications

- Fund and portfolio managers
  - Meme stocks have real impacts on markets: monitoring network evolution and the determinants for users change in behaviour matters for portfolio management
- Regulators:
  - Online social networks matter for the economy
  - Monitor social networks to prevent market manipulation

What is next?

- Growing number of meme stocks: Determining the next frenzy
- Meme coins: Determining the next Doge coin
- Finfluencer detection: Who is the next Keith Gill?

Reddit users unleashed - understanding user behaviour and their impact on mem ks

Simon Trimborn

Inez Zwetsloot

University of Amsterdam

Tinbergen Institute

City University of Hong Kong

CityU
香港城市大學
City University of Hong Kong