

# Intraday Herding and Attention around the Clock

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# Investor Herding

- Herding describes the inclination of investors to mimic the investment decisions of other investors
- When herding, investors potentially disregard private information and instead follow the market
- Various reasons & explanations
  - Rational
  - Behavioral Bias
- Might lead to irrational price bubbles



# Literature

## Herding has been documented in many markets

- Across asset classes: Equities (Christie and Huang, 1995), ETFs (Gleason et al., 2004), FX (Park, 2011), Corporate Bonds (Cai et al., 2019), and Options (Bernales et al., 2020)
- In various countries (Chang et al., 2000)
- In different industries and sectors (Choi and Sias, 2009; Gebka and Wohar, 2013)
- For retail (Hsieh et al., 2020) and institutional investors (Sias, 2004; Kremer and Nautz, 2013)
- Using daily and higher frequency data (Gleason et al., 2004; Hsieh, 2013; Andrikopoulos et al., 2017; Cai et al., 2019)
- And also in the cryptocurrency market, though there is no agreement on the size or even direction of the effect (Bouri et al., 2019; Vidal-Tomás et al., 2019; da Gama Silva et al., 2019; Kallinterakis and Wang, 2019; Ballis and Drakos, 2020; Kaiser and Stöckl, 2020)

# Contribution

## **We reconsider investor herding in the cryptocurrency market**

- The crypto market is particularly interesting in the context of herding
  - Decentralized, global, and open around the clock
  - Relatively little fundamental information available
  - Young and developing, potentially more inefficiencies
  - Different investor base, many retail traders
- Using intraday data, we ...
  - ... pick up potential short term herding
  - ... document intraday patterns in herding and trading
  - ... analyze the hardly investigated determinants of investor herding

# Contribution

## **We link intraday herding to investor attention**

- Internet search volume captures the attention of retail investors (Da et al., 2011; Joseph et al., 2011; Meshcheryakov and Winters, 2020)
- Social media data proxies for investor sentiment, e.g. Twitter (Behrendt and Schmidt, 2018)
- While most studies focus on the level of attention, we additionally investigate attention dispersion
  - Attention co-movement is positively related to stock returns (Drake et al., 2017)
  - Sentiment dispersion within tweets is related to volatility (See-To and Yang, 2017)
  - No such study on the crypto market

# Empirical Approach

- Calculate cross-sectional absolute deviation from market index

$$\text{CSAD}_t = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{m,t}|$$

- Regress CSAD on absolute and squared market returns

$$\text{CSAD}_t = \alpha + \beta_1 |R_{m,t}| + \beta_2 R_{m,t}^2 + \beta_3 X_t + \varepsilon_t$$

- Include interactions with hourly indicator variables to analyze intraday herding

$$\text{CSAD}_t = \alpha + \sum_{h=0}^{23} \beta_{1,h} |R_{m,t}| D_{h,t} + \sum_{h=0}^{23} \beta_{2,h} R_{m,t}^2 D_{h,t} + \varepsilon_t$$

- Negative  $\beta_2$  indicates herding around the market
- Repeat for subsamples, using day/intraday FE, ...

# Data

- 13 cryptocurrencies, prices against USD
- Sample period: June 2017 – November 2020
- All data in hourly resolution
- Cryptocurrency exchange rate data from Bittrex (Kraken for robustness)
- # Transactions recorded on each blockchain
- Attention proxies
  - Google search volume (Information demand)
  - Reddit submissions and comments (Information supply)

$$\text{MarketLevel}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} \ln(1 + S_{i,t})$$

$$\text{MarketDispersion}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} |\ln(1 + S_{i,t}) - \text{MarketLevel}_t|$$

# Herding at high(er) Frequency and Investor Attention

	(1)	(2)	(3)	(4)	(5)	(6)
Market Return	0.266*** (34.88)	0.206*** (26.60)	0.148*** (22.72)	0.178*** (27.83)	0.148*** (23.27)	0.142*** (22.28)
Market Return <sup>2</sup>	-1.539*** (-8.40)	-1.530*** (-7.30)	-0.738*** (-4.03)	-1.026*** (-5.80)	-0.748*** (-4.21)	-0.676*** (-3.83)
Trading Vol.		0.036*** (21.50)	0.025*** (11.13)	0.018*** (10.88)	0.023*** (10.99)	0.023*** (10.93)
Blockchain Trans.		-0.155*** (-11.26)	0.142*** (8.30)	-0.105*** (-10.28)	0.130*** (7.39)	0.099*** (4.38)
Search Vol. <sub>Level</sub>				0.195*** (20.69)	0.281*** (12.50)	0.364*** (14.69)
Search Vol. <sub>Dispersion</sub>				0.526*** (17.17)	0.281*** (10.23)	0.345*** (11.88)
Reddit Posts <sub>Level</sub>				0.022*** (4.70)	0.021*** (4.79)	0.007 (1.44)
Reddit Posts <sub>Dispersion</sub>				0.068*** (6.78)	0.040*** (4.49)	0.027*** (2.73)
Date FE	—	—	✓	—	✓	✓
Intraday FE	—	—	—	—	—	✓
Observations	29083	29083	29083	29083	29083	29083
Adj. R <sup>2</sup>	0.239	0.394	0.574	0.470	0.582	0.588

→ There is herding in cryptocurrency markets at the daily and intraday level

→ Herding is negatively related to both level and dispersion of attention



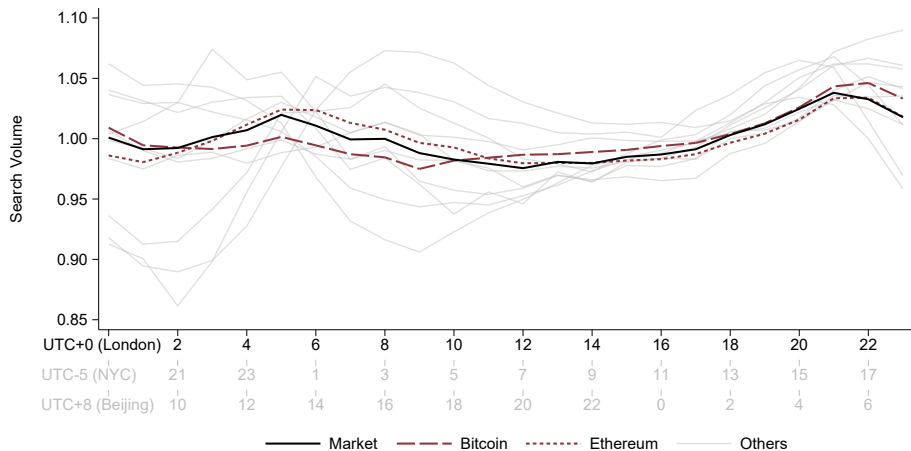
# Herding in Different Market States

	Up Markets	Down Markets	High Market Volatility	Low Market Volatility
Market Return	0.183*** (18.49)	0.120*** (14.47)	0.137*** (15.78)	0.169*** (16.37)
Market Return <sup>2</sup>	-1.081*** (-2.97)	-0.433** (-2.05)	-0.498** (-2.27)	-1.582*** (-4.14)
Trading Vol.	0.029*** (10.50)	0.020*** (7.47)	0.020*** (7.49)	0.027*** (7.89)
Blockchain Trans.	0.158*** (6.73)	0.104*** (4.55)	0.187*** (5.95)	0.105*** (5.68)
Search Vol. <sub>Level</sub>	0.274*** (9.66)	0.279*** (10.60)	0.336*** (7.61)	0.233*** (9.78)
Search Vol. <sub>Dispersion</sub>	0.259*** (7.10)	0.282*** (8.77)	0.369*** (6.52)	0.213*** (8.04)
Reddit Posts <sub>Level</sub>	0.018*** (2.83)	0.022*** (4.08)	0.018** (2.22)	0.019*** (3.44)
Reddit Posts <sub>Dispersion</sub>	0.041*** (3.16)	0.036*** (3.25)	0.037** (2.42)	0.034*** (3.01)
Date FE	✓	✓	✓	✓
Observations	14989	14091	11411	17590
Adj. R <sup>2</sup>	0.563	0.615	0.552	0.589

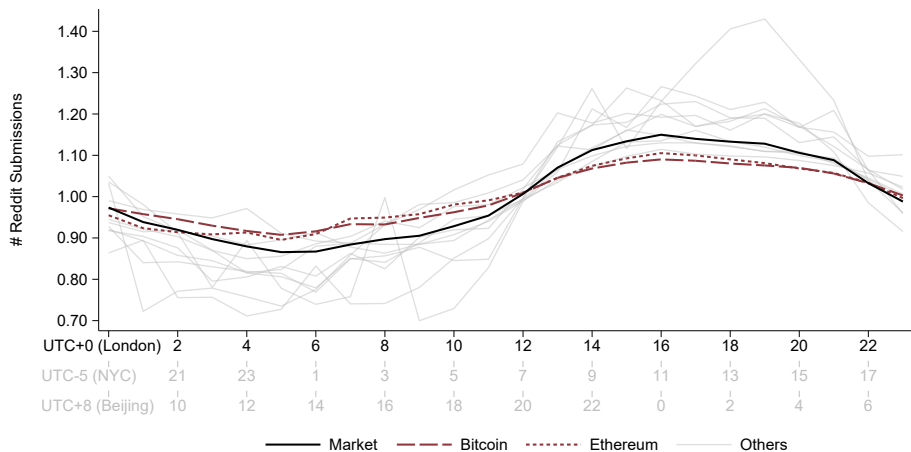
→ We find significant herding in all market states

→ Herding is stronger in up markets and when market volatility is low

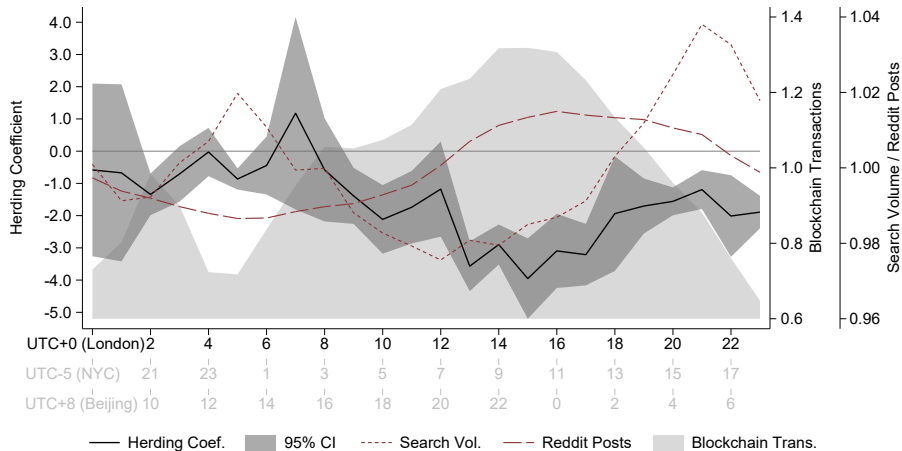
# Intraday Patterns in Search Volume



# Intraday Patterns in Reddit Posts



# Intraday Patterns in Herding Behavior



# Robustness Tests

- There is herding both during weekdays and on the weekend
- Results are robust to different market index weighting schemes
  - Value weighting
  - Only BTC as market (transfer currency)
- Including signed market returns or market volatility likewise does not change the results

# Conclusion

We document significant return herding in cryptocurrencies that . . .

- . . . is stronger during up markets
- . . . is stronger during markets with low volatility
- . . . is positively related to the level and dispersion of investor attention
- . . . fluctuates throughout the day
- . . . is consistent with the presence of retail traders

**Thank You!**

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## Backup: Herding and Investor Attention I

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Market Return	0.184*** (27.38)	0.203*** (26.93)	0.179*** (27.93)	0.200*** (26.64)	0.207*** (26.62)	0.198*** (26.65)	0.178*** (27.83)
Market Return <sup>2</sup>	-1.063*** (-5.92)	-1.542*** (-7.31)	-1.043*** (-5.91)	-1.397*** (-6.91)	-1.536*** (-7.30)	-1.361*** (-6.75)	-1.026*** (-5.80)
Trading Vol.	0.016*** (8.97)	0.040*** (22.53)	0.018*** (10.92)	0.031*** (17.74)	0.037*** (21.37)	0.030*** (17.63)	0.018*** (10.88)
Blockchain Trans.	-0.133*** (-11.20)	-0.135*** (-11.62)	-0.110*** (-10.78)	-0.139*** (-10.17)	-0.154*** (-11.30)	-0.132*** (-9.97)	-0.105*** (-10.28)
Search Vol. <sub>Level</sub>	0.191*** (19.08)		0.205*** (22.53)				0.195*** (20.69)
Search Vol. <sub>Dispersion</sub>		0.477*** (14.19)	0.535*** (17.34)				0.526*** (17.17)
Reddit Posts <sub>Level</sub>				0.059*** (10.65)		0.083*** (12.34)	0.022*** (4.70)
Reddit Posts <sub>Dispersion</sub>					0.050*** (4.70)	0.130*** (9.82)	0.068*** (6.78)
Date FE	-	-	-	-	-	-	-
Observations	29083	29083	29083	29083	29083	29083	29083
Adj. R <sup>2</sup>	0.438	0.418	0.468	0.402	0.395	0.408	0.470

## Backup: Herding and Investor Attention II

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Market Return	0.149*** (23.05)	0.148*** (22.78)	0.148*** (23.24)	0.148*** (22.77)	0.148*** (22.71)	0.148*** (22.78)	0.148*** (23.27)
Market Return <sup>2</sup>	-0.755*** (-4.18)	-0.735*** (-4.04)	-0.755*** (-4.24)	-0.736*** (-4.03)	-0.735*** (-4.02)	-0.730*** (-4.00)	-0.748*** (-4.21)
Trading Vol.	0.024*** (11.02)	0.025*** (11.13)	0.023*** (10.99)	0.025*** (11.15)	0.025*** (11.11)	0.024*** (11.14)	0.023*** (10.99)
Blockchain Trans.	0.147*** (8.68)	0.141*** (8.30)	0.147*** (8.79)	0.131*** (7.50)	0.141*** (8.29)	0.121*** (6.84)	0.130*** (7.39)
Search Vol. <sub>Level</sub>	0.223*** (11.28)		0.285*** (12.57)				0.281*** (12.50)
Search Vol. <sub>Dispersion</sub>		0.144*** (6.19)	0.282*** (10.24)				0.281*** (10.23)
Reddit Posts <sub>Level</sub>				0.014*** (3.31)		0.025*** (5.38)	0.021*** (4.79)
Reddit Posts <sub>Dispersion</sub>					0.024*** (2.82)	0.045*** (4.86)	0.040*** (4.49)
Date FE	✓	✓	✓	✓	✓	✓	✓
Observations	29083	29083	29083	29083	29083	29083	29083
Adj. R <sup>2</sup>	0.579	0.575	0.581	0.574	0.574	0.575	0.582

## Backup: Herding and Investor Attention III

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Market Return	0.143*** (22.09)	0.143*** (22.01)	0.142*** (22.28)	0.144*** (21.96)	0.143*** (21.94)	0.143*** (21.98)	0.142*** (22.28)
Market Return <sup>2</sup>	-0.687*** (-3.81)	-0.689*** (-3.81)	-0.678*** (-3.84)	-0.692*** (-3.80)	-0.690*** (-3.79)	-0.690*** (-3.79)	-0.676*** (-3.83)
Trading Vol.	0.023*** (10.96)	0.024*** (11.07)	0.023*** (10.94)	0.024*** (11.06)	0.024*** (11.03)	0.024*** (11.05)	0.023*** (10.93)
Blockchain Trans.	0.122*** (5.28)	0.165*** (7.08)	0.099*** (4.36)	0.167*** (7.12)	0.169*** (7.19)	0.165*** (7.06)	0.099*** (4.38)
Search Vol. <sub>Level</sub>	0.268*** (12.92)		0.366*** (14.72)				0.364*** (14.69)
Search Vol. <sub>Dispersion</sub>		0.163*** (6.91)	0.349*** (12.00)				0.345*** (11.88)
Reddit Posts <sub>Level</sub>				0.004 (0.89)		0.018*** (3.33)	0.007 (1.44)
Reddit Posts <sub>Dispersion</sub>					0.022*** (2.63)	0.039*** (3.83)	0.027*** (2.73)
Date FE	✓	✓	✓	✓	✓	✓	✓
Intraday FE	✓	✓	✓	✓	✓	✓	✓
Observations	29083	29083	29083	29083	29083	29083	29083
Adj. R <sup>2</sup>	0.584	0.580	0.588	0.579	0.579	0.579	0.588