

# The Effects of Central Bank Digital Currency Communication and Associated Social Media Sentiment on Cryptocurrency Markets

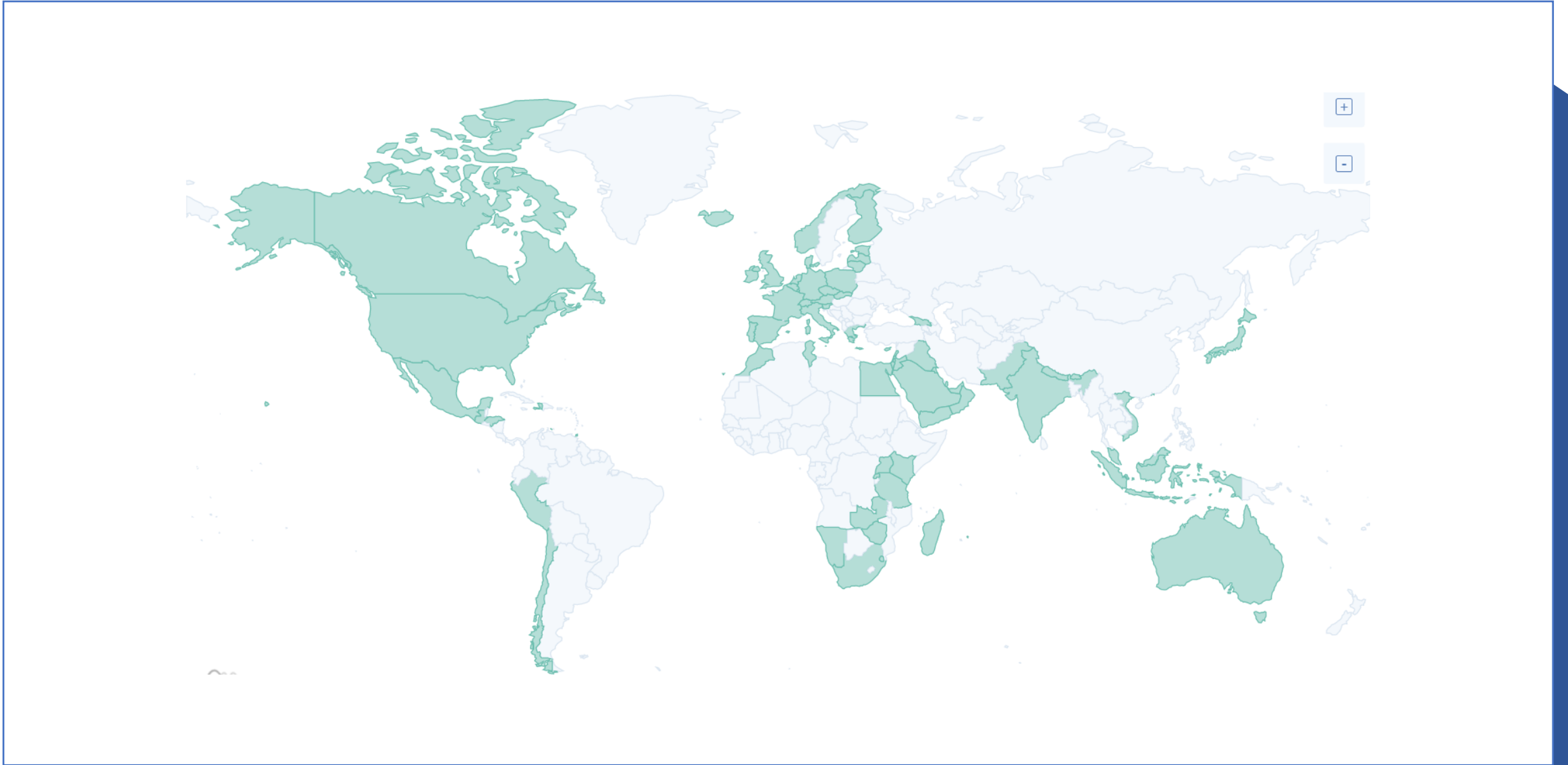
---

Iulia Cioroianu, University of Bath

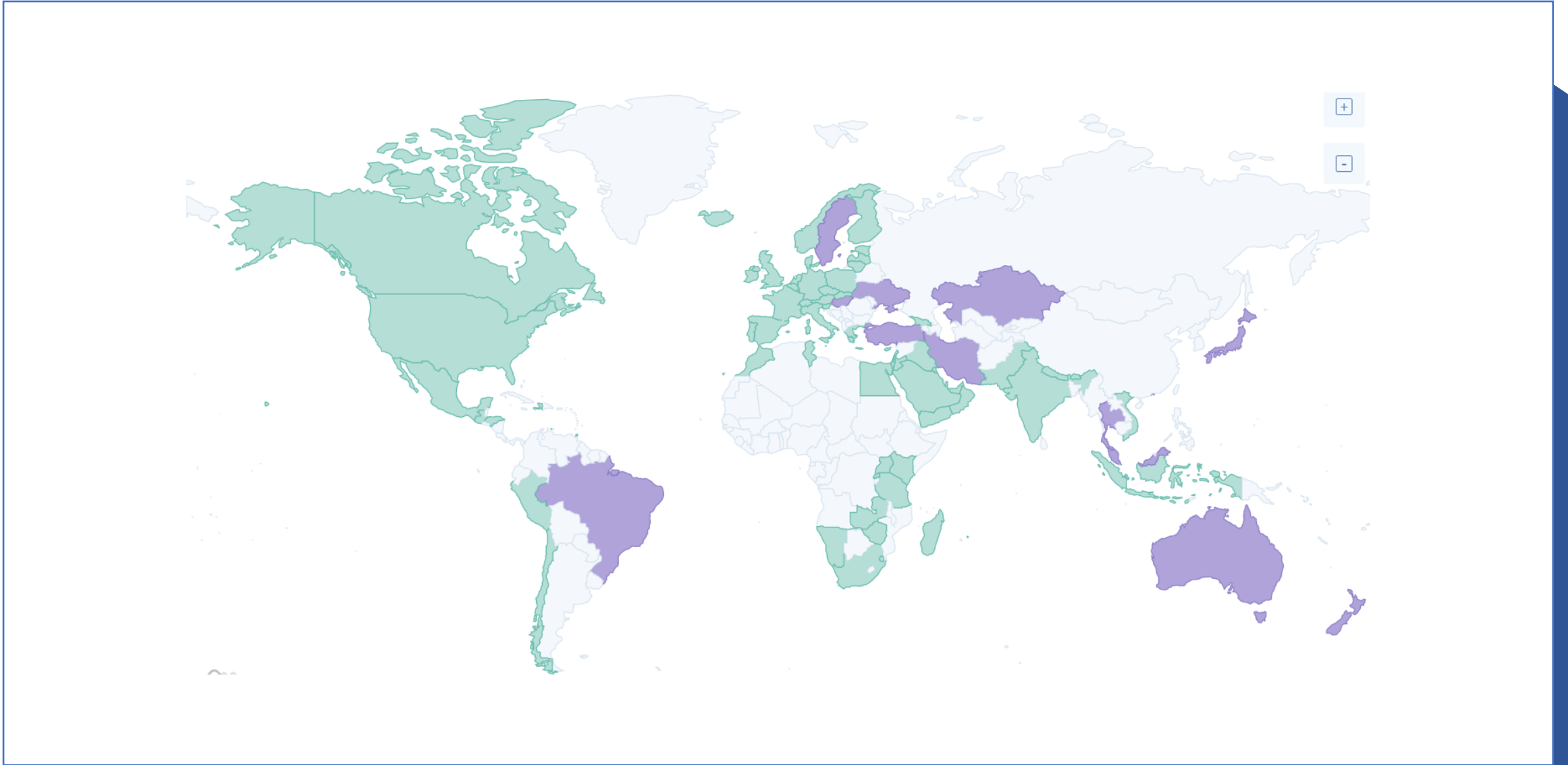
Shaen Corbet, Dublin City University & University of Waikato

Charles Larkin, University of Bath & Johns Hopkins University

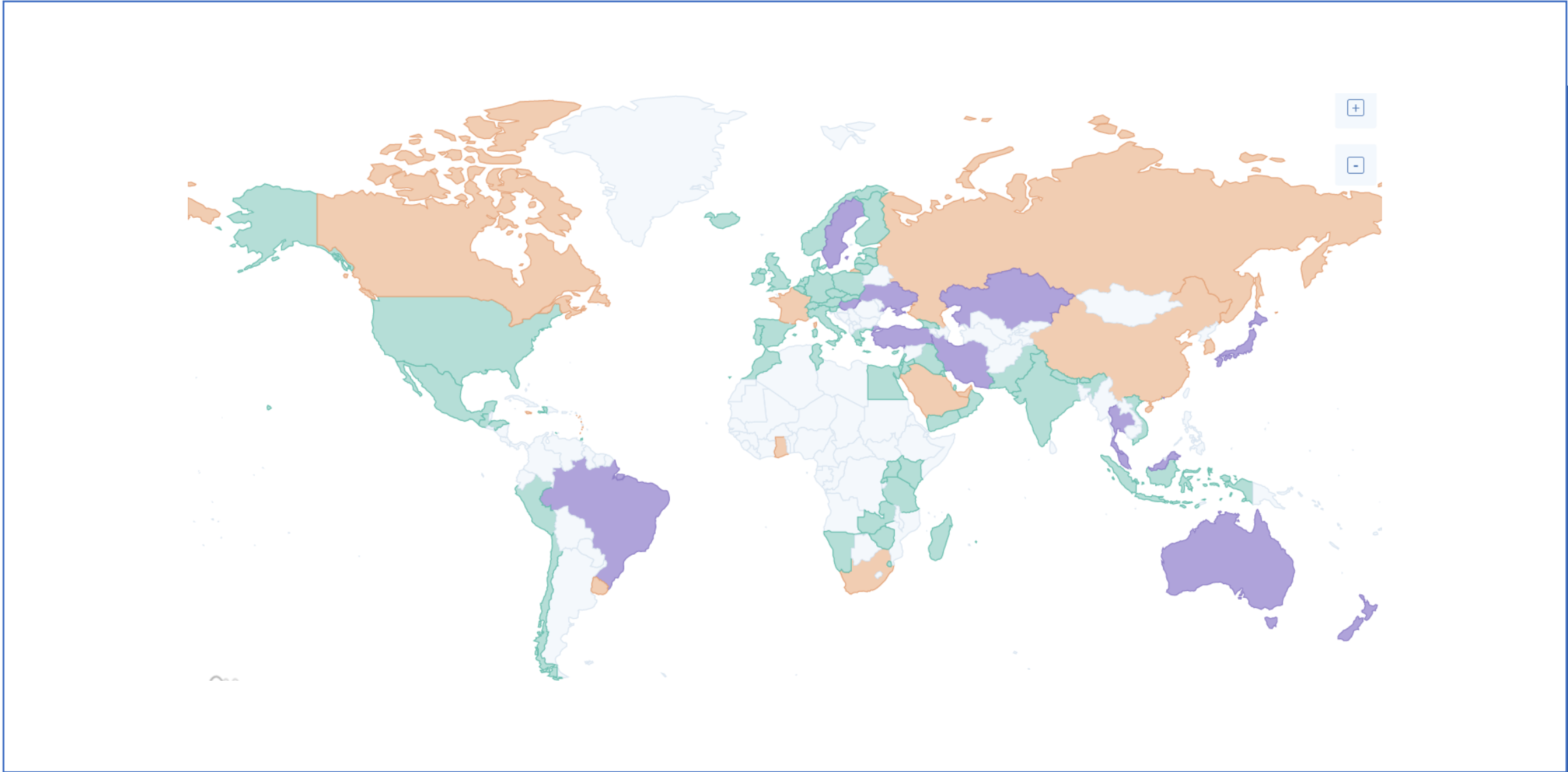
Les Oxley, University of Waikato



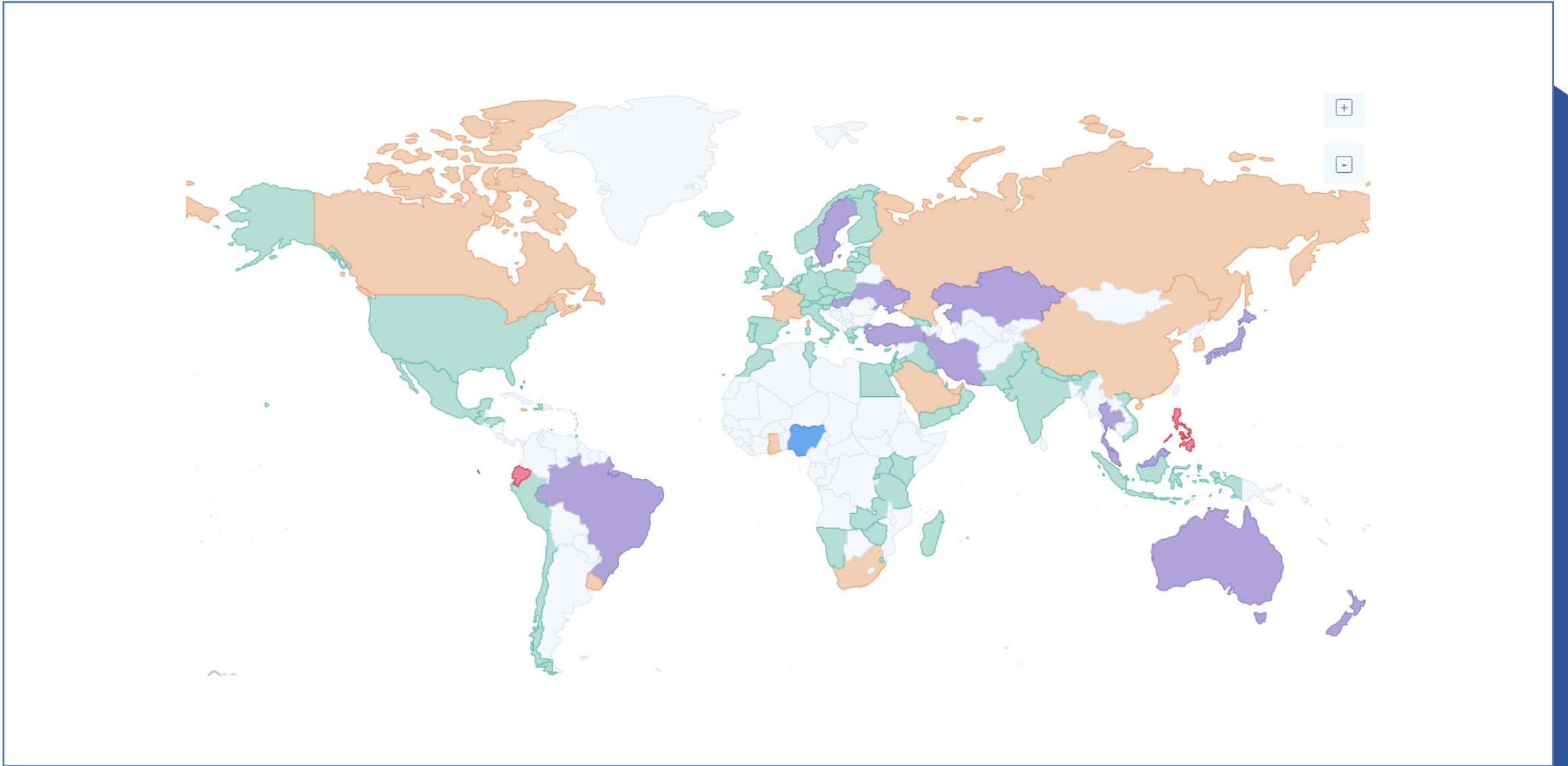
<https://cbdtracker.org/>



<https://cbdtracker.org/>



<https://cbdtracker.org/>



<https://cbdtracker.org/>



# CBDCs and cryptocurrencies

- CBDCs seen as key disrupting forces against largely unchallenged cryptocurrency growth and development.
  - Removing channels of illicit behaviour.
  - Reducing non-transparent transactions.
- Does the development of CBDCs also imply increased regulation of cryptocurrency markets?
  - Not necessarily - can in fact be seen as a direct and efficient alternative to regulatory provisions and legal enforcement.
- But research papers often link the need for increased regulation of digital money to the successful implementation of CBDCs.
- Also, countries have taken marked regulatory steps which coincided with CBDC pilot releases.
  - The People's Bank of China outlawed the issuance of all private digital currencies before piloting its national digital currency.



# Research question and hypotheses

- We therefore expect CBDC announcements to have an impact on cryptocurrency markets.

RQ1: Do central bank announcements generate significant effects in relation to cryptocurrency returns and volatility?

- Based on market participant expectations, which previous research showed to be strongly driven by social media sentiment.

RQ2: Does the sentiment of social media posts about CBDCs have an impact on cryptocurrency products?

- We expect CBDC announcements and the sentiment of social media posts about CBDCs to be associated with:
  - reduced cryptocurrency returns
  - overall increases in volatility



# Methodological approach

- Link data from three sources:
  - 210 blockchain and cryptocurrency-related ETF products
  - the release dates of CBDC-based research - as circulated by six of the largest international central banks
  - social media coverage relating to CBDCs - as measured by the polarity of Twitter posts mentioning CBDCs
- Test the scale and direction of market response in terms of
  - returns
  - volatilityusing a generalized autoregressive conditionally heteroscedastic (GARCH) model.

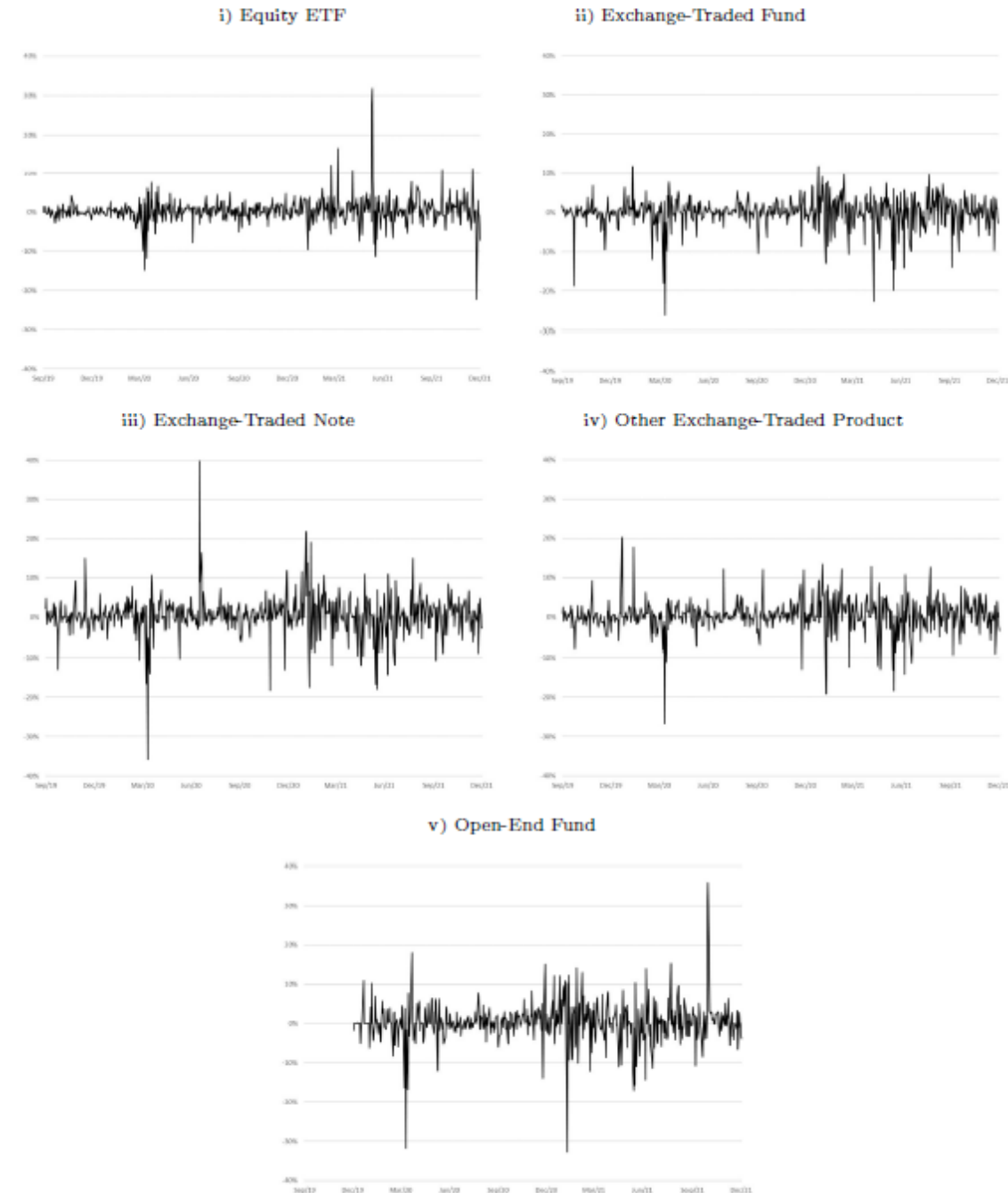




Figure 1: Asset performance as separated by fund type

# Cryptocurrency data

- Thomson Reuters Eikon - 210 funds based on either blockchain or cryptocurrency investment, 1 January 2017 - 30 September 2021
- Returns measured as the daily log changes.
- Volatility measured as the five-day standard deviation.



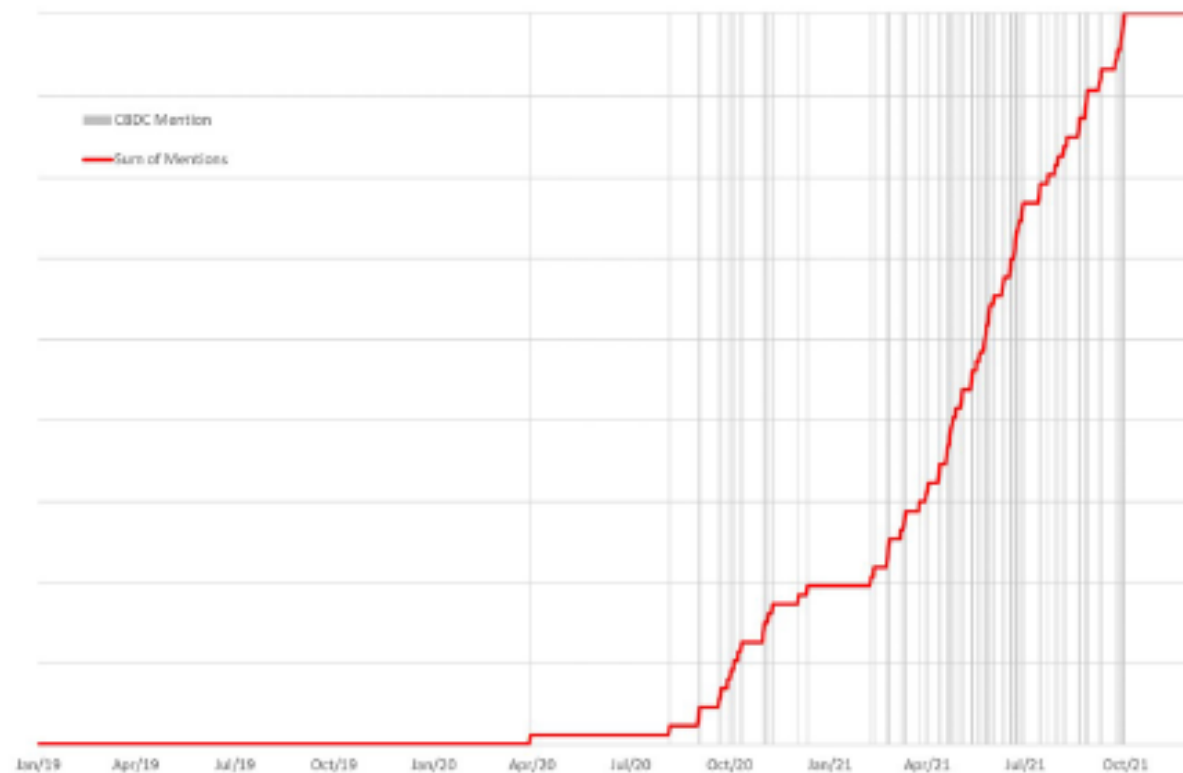
| <i>Fund Type</i>              | Mean   | Variance | Skewness | Kurtosis | Minimum | Maximum |
|-------------------------------|--------|----------|----------|----------|---------|---------|
| Equity ETF                    | 0.0040 | 0.0011   | 1.7306   | 25.1412  | -0.2227 | 0.3178  |
| Exchange-Traded Fund          | 0.0005 | 0.0016   | -1.7714  | 8.1630   | -0.2608 | 0.1173  |
| Exchange-Traded Note          | 0.0045 | 0.0024   | 0.0120   | 13.8792  | -0.3572 | 0.3983  |
| Other Exchange-Traded Product | 0.0039 | 0.0016   | -0.6596  | 7.5798   | -0.2675 | 0.2026  |
| Open-End Fund                 | 0.0037 | 0.0027   | -0.0715  | 12.3390  | -0.3262 | 0.3573  |
| <i>Geographic Region</i>      | Mean   | Variance | Skewness | Kurtosis | Minimum | Maximum |
| Australia                     | 0.0023 | 0.0037   | -1.3619  | 9.9994   | -0.3679 | 0.2786  |
| Brazil                        | 0.0033 | 0.0028   | 3.2498   | 27.7896  | -0.1369 | 0.4344  |
| Canada                        | 0.0007 | 0.0023   | 1.1965   | 10.3929  | -0.1401 | 0.3098  |
| Germany                       | 0.0036 | 0.0020   | -0.8217  | 6.7561   | -0.2942 | 0.2348  |
| Netherlands                   | 0.0024 | 0.0020   | 0.0131   | 1.7053   | -0.1416 | 0.1561  |
| Switzerland                   | 0.0035 | 0.0018   | -0.4419  | 14.8155  | -0.3362 | 0.2877  |
| United Kingdom                | 0.0103 | 0.0044   | 3.9241   | 24.1095  | -0.1154 | 0.4815  |
| United States                 | 0.0039 | 0.0011   | 2.8285   | 37.3573  | -0.2225 | 0.3488  |



# Central bank communication data

- Studied the websites of the U.S. Federal Reserve, the European Central Bank, the Bank of England, the Bank of Japan, the Swiss National Bank, and the Bank of Canada
- Manually coded the dates of all releases relating explicitly to either CBDC or central bank-denoted cryptocurrencies.
- Time series relating to these announcements.

Figure 4: Major central bank mentions with regards to CBDC (2019-2021)

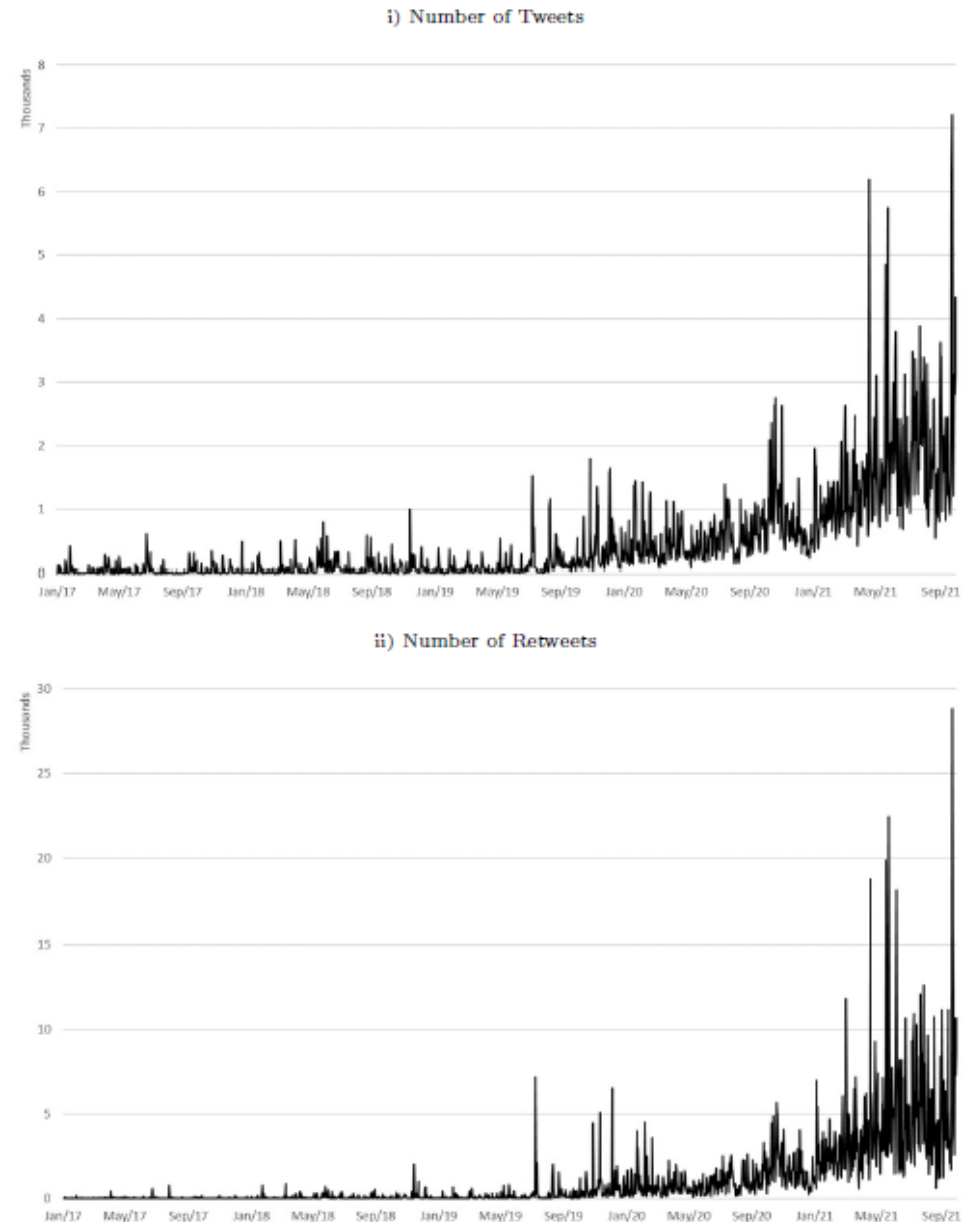




# Twitter CBDC posts

- Twitter is one of the main platforms for cryptocurrency related discussion.
- Tweets mentioning the terms “CBDC”, “#CBDC” and “central AND bank AND digital AND currency” were computationally collected through the Twitter v2 API
- 761,704 unique tweets
- Data aggregated by date
  - sums of the quantitative variables
  - aggregating the text

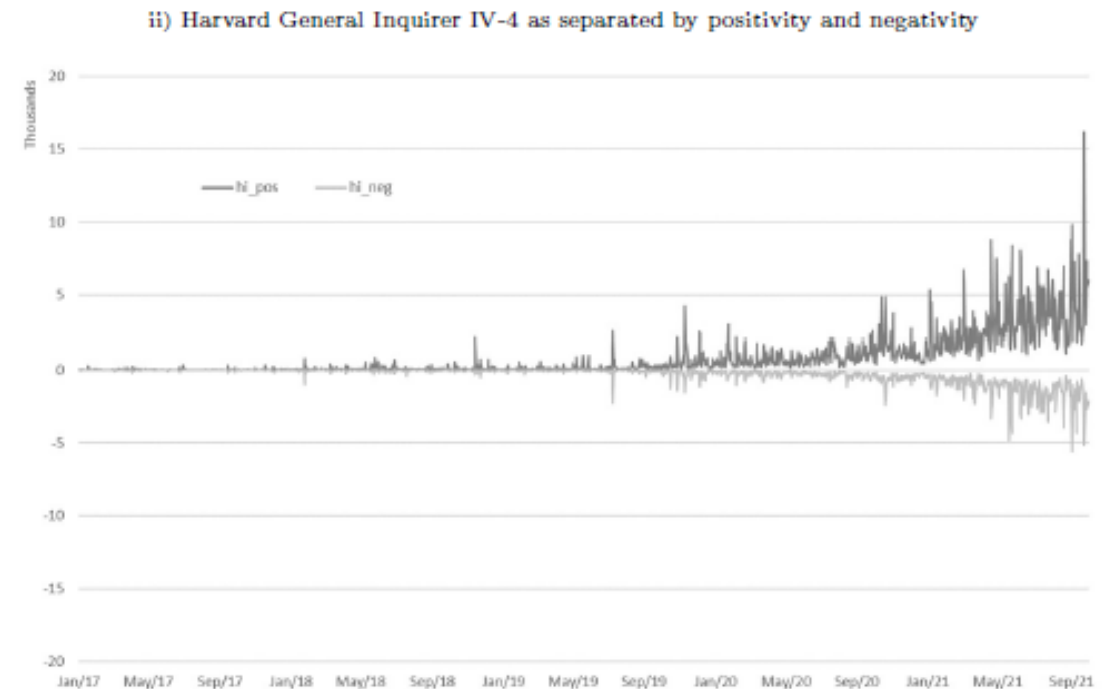
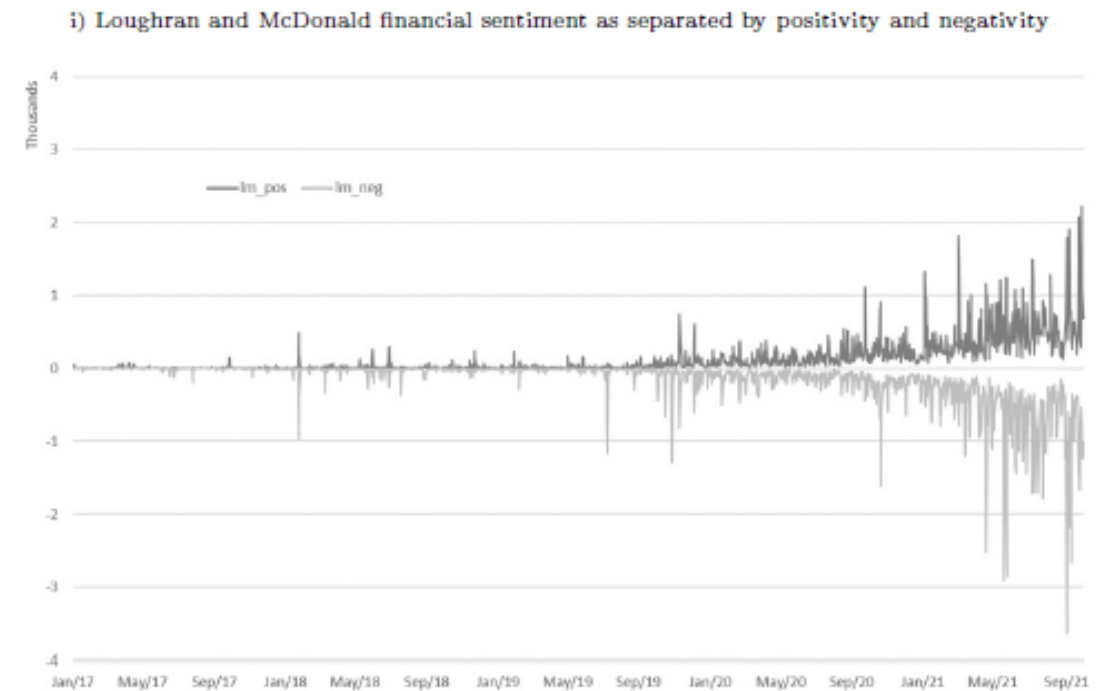
Figure 2: Social media data relating to CBDC





# Twitter CBDC sentiment

- Sentiment expressed in the Twitter data measured using
  - Harvard General Inquirer IV-4 lexicon
  - Loughran and McDonald Financial Sentiment lexicon
- Measures computed for the daily-aggregated text of the tweets:
  - polarity - number of positive terms minus the number of negative terms divided by the sum of positive and negative terms
  - subjectivity (affect) - proportion of negative and positive terms relative to the total number of terms in the text.





# Econometric model

$$R_t = a_0 + \sum_{j=1}^5 b_j R_{t-j} + b_2 DJ_t + b_3 S_t + D_{reg} + \varepsilon_t \quad (1)$$

$$\varepsilon_t | \Omega_t \sim i.i.d. \quad N(0, h_t) \quad (2)$$

$$h_t = \omega + \alpha_1 h_{t-1} + \beta_1 u_{t-1}^2 \quad (3)$$

- GARCH (1,1) evaluating the concomitant influence of both sentiment and central banking announcements relating to CBDC.
  - $R_{t-j}$  - lagged value of the selected cryptocurrency-based fund returns,  $j$  number of periods before  $R_t$
  - $D_{reg}$  - announcements made by major central banks
  - $S_t$  - sentiment.
    - Each of the two lexicons (LM and HI), using both the polarity and subjectivity measures.
  - $DJ_t$  - Dow Jones Industrial Average
- Identical model for volatility.
- Bonferroni corrections.



# Significant estimates

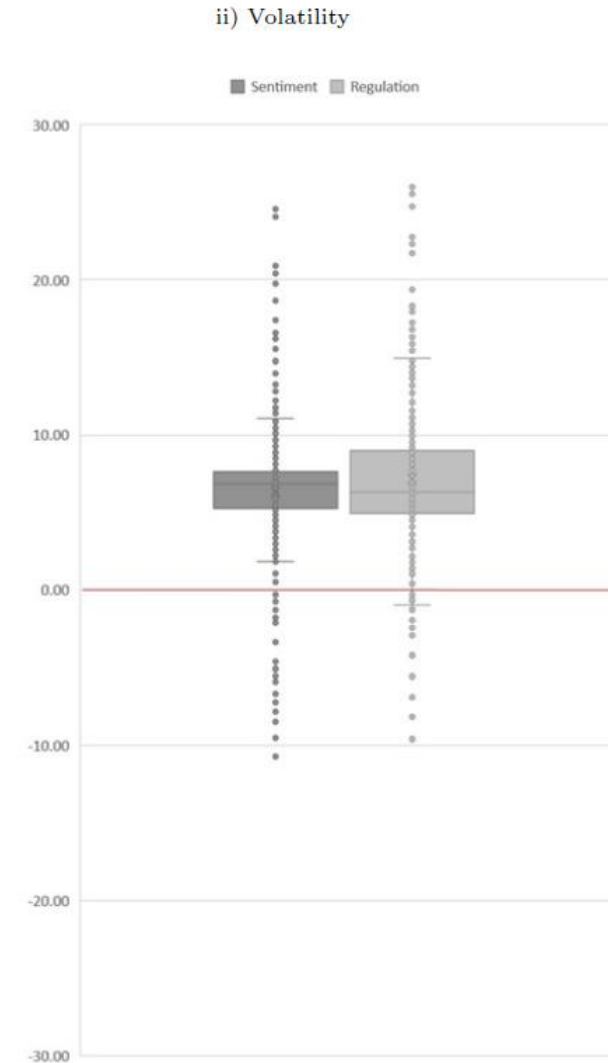
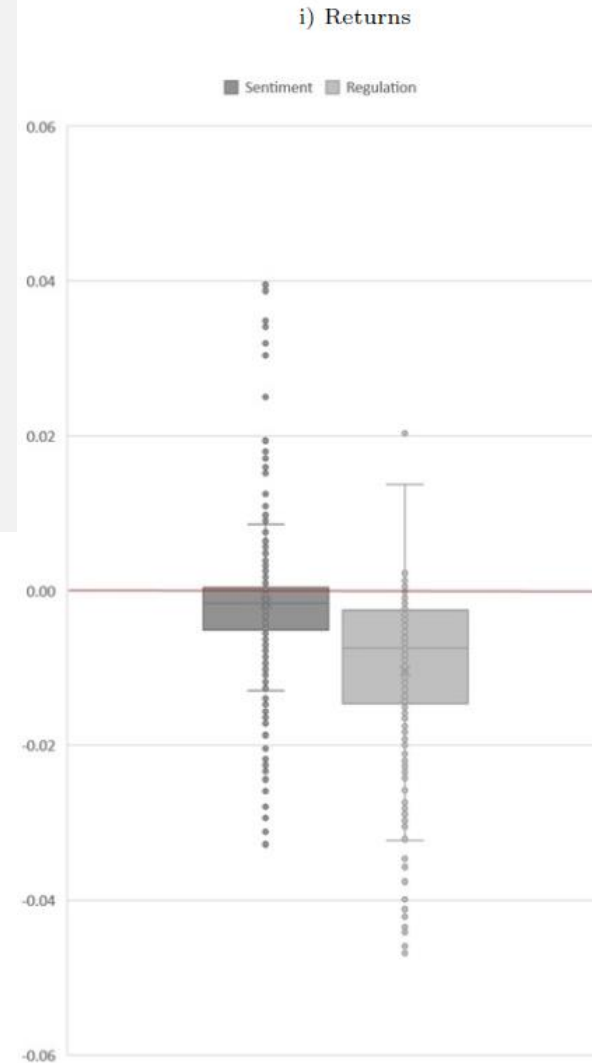
| <i>Fund Type</i>           | <i>Returns</i> |         |       |          |          |       | <i>Volatility</i> |         |       |          |          |       |
|----------------------------|----------------|---------|-------|----------|----------|-------|-------------------|---------|-------|----------|----------|-------|
|                            | LM Pol.        | HI Pol. | Reg.  | LM Subj. | HI Subj. | Reg.  | LM Pol.           | HI Pol. | Reg.  | LM Subj. | HI Subj. | Reg.  |
| Equity ETF                 | 40.4%          | 41.2%   | 46.7% | 48.1%    | 44.6%    | 56.9% | 49.0%             | 53.1%   | 54.2% | 55.2%    | 57.3%    | 52.1% |
| Exchange-Traded Fund       | 16.7%          | 33.3%   | 33.3% | 66.7%    | 16.7%    | 66.7% | 33.3%             | 16.7%   | 50.0% | 50.0%    | 50.0%    | 83.3% |
| Exchange-Traded Note       | 34.3%          | 41.1%   | 46.0% | 34.9%    | 47.6%    | 60.3% | 34.9%             | 47.6%   | 60.3% | 31.7%    | 68.3%    | 54.0% |
| Other Exch-Traded Products | 61.9%          | 76.2%   | 61.9% | 78.6%    | 59.5%    | 85.7% | 78.6%             | 59.5%   | 85.7% | 59.5%    | 73.8%    | 66.7% |
| <i>Geographic Region</i>   | LM Pol.        | HI Pol. | Reg.  | LM Subj. | HI Subj. | Reg.  | LM Pol.           | HI Pol. | Reg.  | LM Subj. | HI Subj. | Reg.  |
| Germany                    | 42.6%          | 50.0%   | 63.2% | 51.5%    | 58.8%    | 77.9% | 51.5%             | 58.8%   | 77.9% | 70.6%    | 83.8%    | 72.1% |
| Switzerland                | 81.0%          | 71.4%   | 95.2% | 95.2%    | 71.4%    | 71.4% | 95.2%             | 71.4%   | 71.4% | 61.9%    | 81.0%    | 76.2% |
| United States              | 5.6%           | 7.2%    | 7.8%  | 7.8%     | 7.2%     | 13.9% | 7.8%              | 7.2%    | 13.9% | 15.6%    | 14.4%    | 17.8% |
| Other                      | 56.5%          | 53.2%   | 65.8% | 66.5%    | 64.5%    | 77.4% | 65.0%             | 64.5%   | 59.0% | 54.8%    | 58.2%    | 87.1% |

- We find a statistically significant response to both returns and volatility at the 1% level in the aftermath of central bank announcements relating to CBDC in over half of all analysed funds.
- For sentiment:
  - highest proportion of statistically significant effects are for returns relating to other types of exchange-traded products, followed by equity ETFs
  - substantial volatility effects throughout.
- Significant regional differentials of response
  - Very large numbers of significant coefficients for Germany and Switzerland
  - Very low numbers of significant coefficients for the United States
    - Perceived weakness of any potential regulatory intervention?



# Coefficient values

- Majority of estimates for polarity, as well as central bank announcements in the returns model are negative.
- Stronger observed average effects for central bank announcements.
- Both sentiment and central bank announcements relating to CBDC are found to significantly increase the volatility of analysed ETF-products (6.95% and 6.26%).





# Conclusion



The sentiment of social media discussions surrounding CBDCs significantly reduces cryptocurrency-related ETF returns and increases short-term price volatility.



The influence of central bank announcements relating to CBDCs is even more pronounced.



Suggesting that the threat of future regulation, or third-party oversight, can generate significant concern among cryptocurrency investors.

Central bank coordination and announcements in this space perceived by market participants as a signal that the use of cryptocurrencies for non-transparent transactions may become more difficult.