Does Elon Musk's tweets influence Bitcoin market value? : A sentiment anaylsis approach

Beatrice Stocco - Federico Piazza - Luigi Negro

04/04/2022

Agenda

- Conceptual Background and Research Questions
- Explanatory Data Analysis
- Sentiment Analysis
- Testing for Stationarity
- Conclusion

Agenda

Conceptual background

Our work is based on the following conceptual fundamentals:

- ▶ Individuals tweets' have tangible impact on stock market returns. *(Kinyua et. al, 2021)*
- ▶ Emotions have been proved to be key drivers in the process of investing. *(Philippas et al., 2019)*
- ▶ Twitter can be used as a predictor of real world landscape. *(Huaye and Yasuaki, 2015)*

Research questions

RQ1: DO Elon Musk's cryptocurrency-related tweets sentiments have an effect on the pricing and trading volume of cryptocurrency?

RQ2: Do sentiments and polarity of Musk's cryptocurrency-related tweets differs by considering different time-frames and currencies

RQ3: Is there a linkage between changes in Bitcoin prices and Elon Musk's crpyto-related tweets?

Elon Musk's tweets make Bitcoin price skyrocket

" Bitcoin's structure is very ingenious. The paper money disappears, and crypto-currencies are a much better way to transfer values than a piece of paper, that's for sure "

"I think bitcoin is on the verge of getting broad acceptance by conventional finance people"

Elon's tweet making BTC sky

..as well as going down

Cryptocurrency is a good idea on many level[s] and we believe it has a promising future, but this cannot come at great cost to the environment.

Tesla will not be selling any Bitcoin and we intend to use it for transactions as soon as mining transitions to more sustainable energ[y] We are also looking at other cryptocurrencie[s] that use <1% of Bitcoin's energy/transaction.

Indeed

Agenda

EDA: Popularity

Exploiting twitter APIs, Tesla's CEO tweets from 2011 to 2021 were extracted. The following variables were used as proxy to investigate Elon Musks's growing popularity: number of *retweets*, number of *likes* and number of *replies* per year, together with a comparison with the total tweets activity. Results are shown in the following chart:
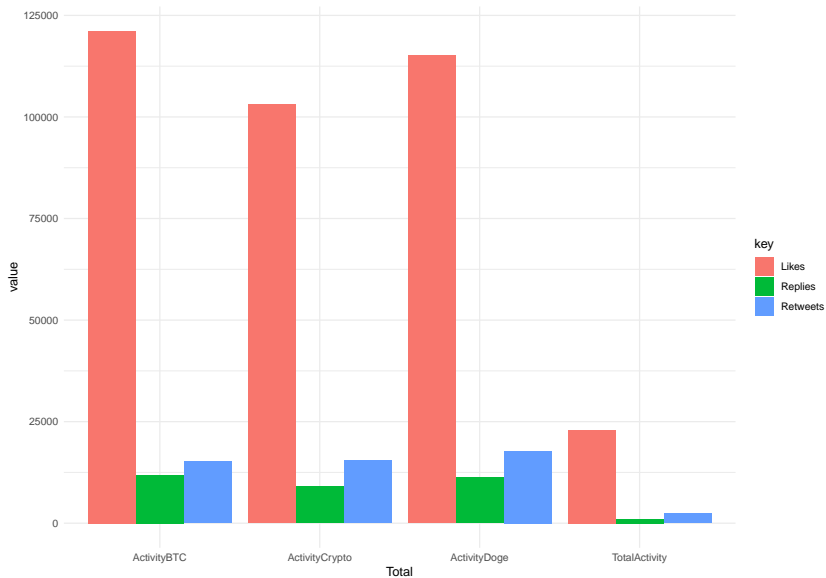
EDA: Popularity
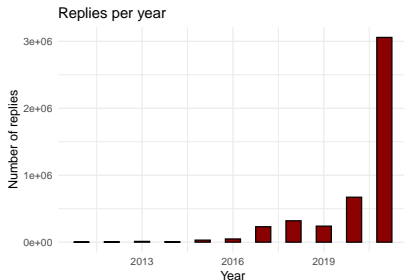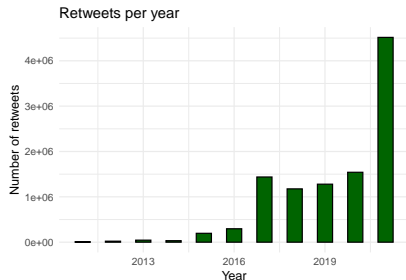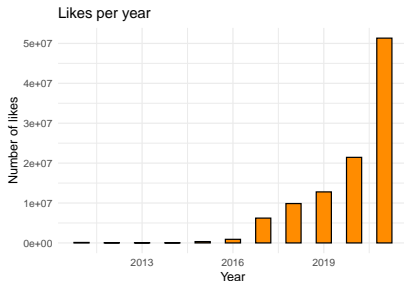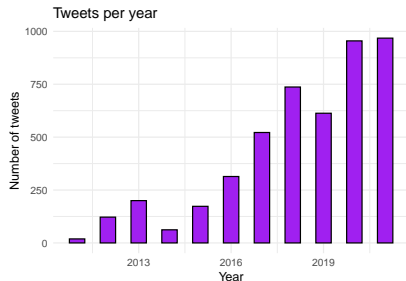
Crypto-related tweets

Consequently, we compare how Elon Musk's audience react to different type of tweets containing respectevely words related only to *dogecoin*, *Bitcoin* and *cypto*. The same proxies as before have been used.

Crypto-related tweets

Bitcoin trend

Which is the width of Bitcoin price volatility once a crypto-related tweets is published? We managed to extract the tweets which only cointained the words *bitcoin* and *crypto* and connected their time-stamp to the Bitcoin market capitalization trend. The pink points on the graphic represent the moment in time when a crpyto-related tweet was published.

Can we infere something? Maybe..

Maybe not?

Elon Musk's Tweets and Bitcoin Volatility
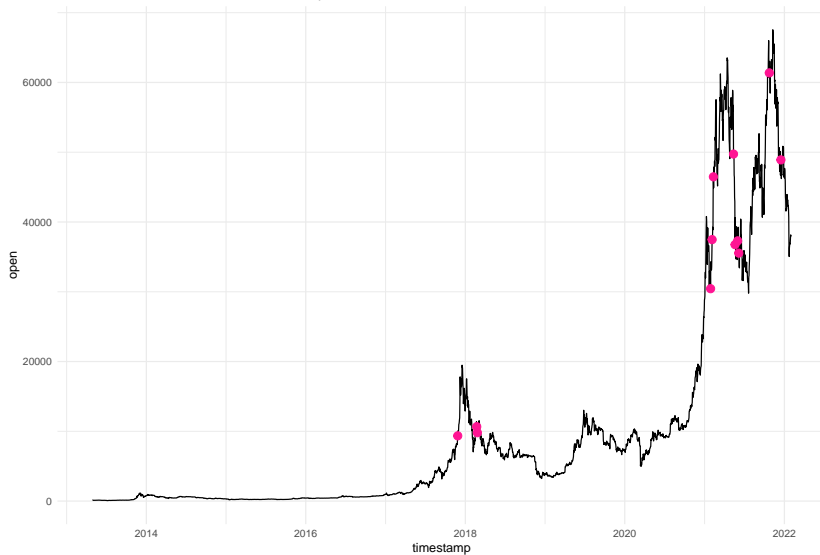
Agenda

Sentiment Analysis

Once quantified Elon Musk's influence, it is essential to understand the extent of this influence on the cryptomarket. We will try to answer the following questions:

▶ Which are the sentiments expressed by Elon Musk's tweets?
▶ Which are the most frequent words?
▶ Which is the polarity of this sentiments?

We will use two subsets and consequently two models:

▶ Model I: investigation conducted on the entire dataset containing all Elon Musk's tweets from 2011 to 2021.
▶ Model II: investigation conducted on a subset according to the following criteria:
  ▶ Temporal subset: we select the tweets published from January 2020 on, in order to assess results related to a maturity-stage Elon Musk's popularity
  ▶ Most frequent word removal: we removed the most frequent word *AMP* resulted from **Model I**

This will be the first step to gather more information in order to

Sentiment analysis

While the market may interpret Musk's tweets about Tesla as "accurate news", his tweets about cryptocurrency at least to some degree represent moods or personal sentiment. In this slide we show the nature of this sentiments, the most frequent words and the emotions associated to them for each of the models.

[L'IDEA E' DI METTERE I DUE GRAFICI DELLE MOST FREQUENT WORD INSIEME IN QUESTA SLIDE]
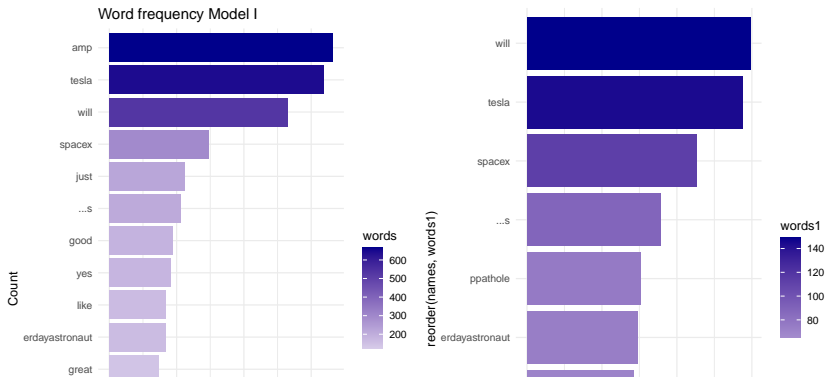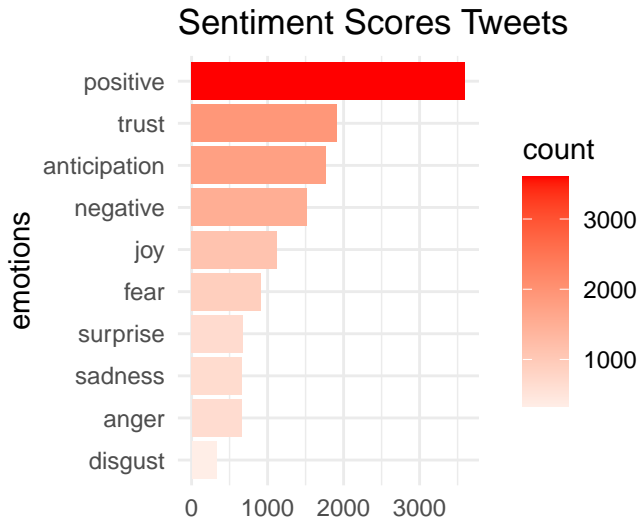
Emotions
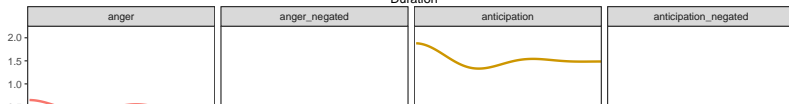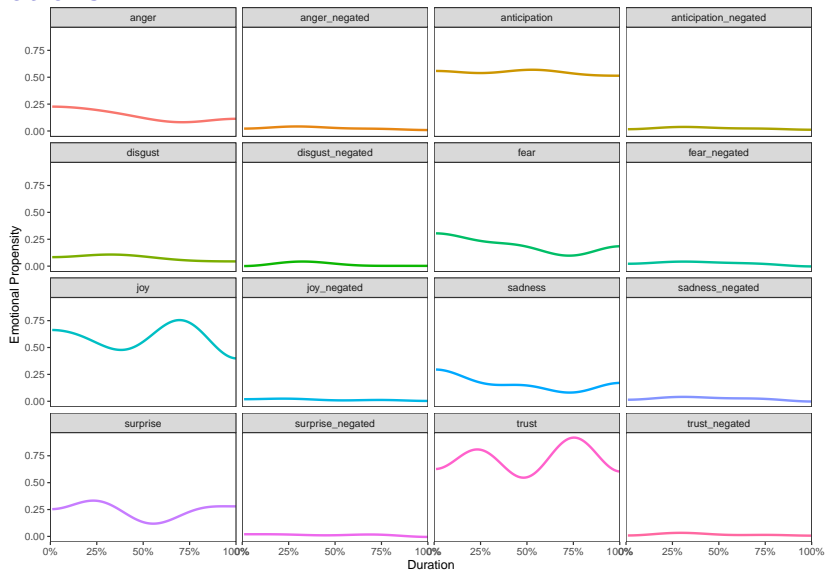
Sentiment scores and density

Based on the following results of the Sentiment Analysis of Elon Musk's tweets, it appears clear that *positive*, *trust* and *anticipation* are the most frequent emotions

Sentiment Scores Tweets

Agenda

- Conceptual Background and Research Questions
- Explanatory Data Analysis
- Sentiment Analysis
- **Testing for Stationarity**
- Conclusion

Stationarity

In this section we show the results obtained when testing for Bitcoin and Dogecoin trend stationarity. We recall the hypothesis:

Null Hypothesis (H0 : Null hypothesis of the test is that the time series can be represented by a unit root that is not stationary.
Alternative Hypothesis (H1): Alternative Hypothesis of the test is that the time series is stationary. The following plot, represent our study focus.

We perform an augmented Dickey–Fuller test (ADF) to test the null hypothesis that a unit root is present in a time series sample. In our case Bitcoin Sample and Dogecoin sample, respectevely.

Result

Satisfying results have been achieved on a *logdiff()* transformation of the trend: the difference between two consecutive values, in *log* terms.

Bitcoin's ADF test results are shown below:

Trend signal
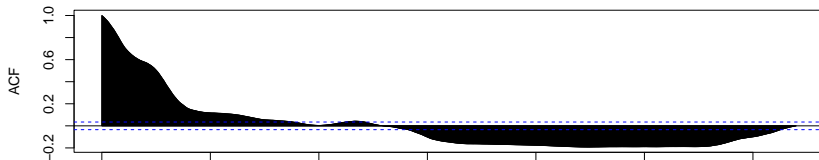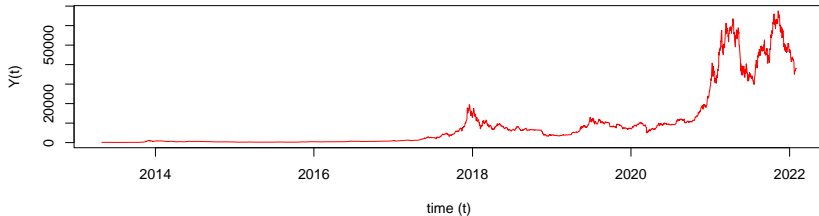
Stationarity

Once stated the non-stationarity of the two trends, we managed to investigate and locate *breaking points* where the average mean of the cryptocurrency's value undergoes sudden change as well as display the time stamp of Elon Musk's crypto-related tweets. The two plots below show those features on the Bitcoin and Dogecoin trends, respectevely.
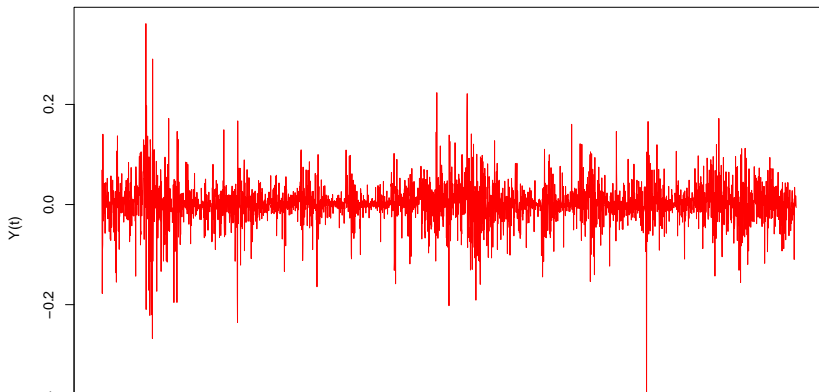
Trend signal

Agenda

- ▶ Conceptual Background and Research Questions
- ▶ Explanatory Data Analysis
- ▶ Sentiment Analysis
- ▶ Testing for Stationarity
- ▶ **Conclusion**

Conclusion

We have extracted a total of 4787 tweets containing 68676 words from Elon Musk's twitter profile: we investigate the impact of 26 Twitter events by Elon Musk on the trading volume and price of the cryptocurrencies he comments on.

Two models:

▶ Model I: investigation conducted on the entire dataset containing all Elon Musk's tweets from 2011 to 2021.

▶ Model II: investigation conducted on a subset according to the following criteria:

  ▶ Temporal subset: we select the tweets published from January 2020 on, in order to assess results related to a maturity-stage Elon Musk's popularity

  ▶ Most frequent word removal: we removed the most frequent word *AMP* resulted from **Model I**

Conclusion

- ▶ Popularity assessment
- ▶ Sentiment analysis
- ▶ Testing for stationarity
- ▶ Breaking points and tweets timestamp

Key conclusions:

- ▶ Elon Musk influence has grown up exponentially throughout the years and its activity's volume show that his tweets are seen as valuable market's signal by investors
- ▶ Its sentiments are overall positive, full of confidence and boldness
- ▶ No linkage can be found in its tweet activity and crypto-currency (Bitcoin and Doge) volatility