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

Agenda

- Literature Review and Conceptual Background
- Explanatory Data Analysis
- Sentiment Analysis
- Testing for Stationarity
- Conclusion

Agenda

Literature review

Conceptual background

Our work is based on the following conceptual fundamentals:

▶ "Prices fully represent all available information," according to the efficient market hypothesis (EMH) (Fama, 1970).

▶ The adaptive markets hypothesis (AMH), a variant of the EMH, claims that the degree to which information is represented in prices is determined by market conditions as well as the quantity and characteristics of market participants: market effiency is context-dependent.

▶ Signaling theory: a signal must usually be coupled with direct or indirect expenses in order to be trustworthy or credible (Connelly et al., 2011).

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"
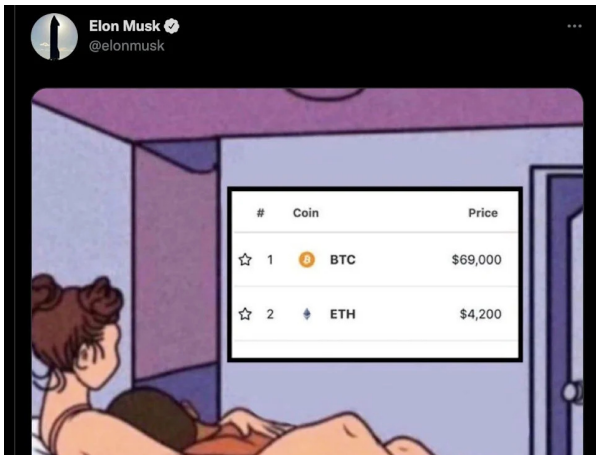
Tesla has suspended vehicle purchases using Bitcoin. We are concerned about rapidly increasing use of fossil fuels for Bitcoin mining and transactions, especially coal, which has the worst emissions of any fuel.

Cryptocurrency is a good idea on many levels 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 energy. We are also looking at other cryptocurrencies

Indeed

image:

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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:

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.

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..

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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?
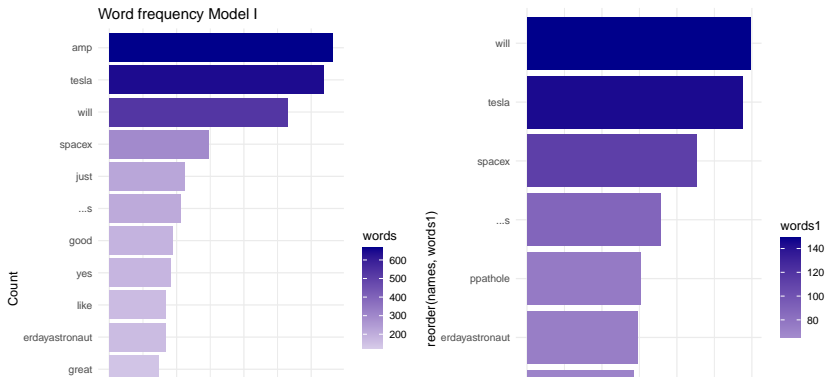- ▶ Which is the polarity of this sentiments?

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.
  - ▶ bullet 1
  - ▶ bullet 2
- ▶ 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**

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]
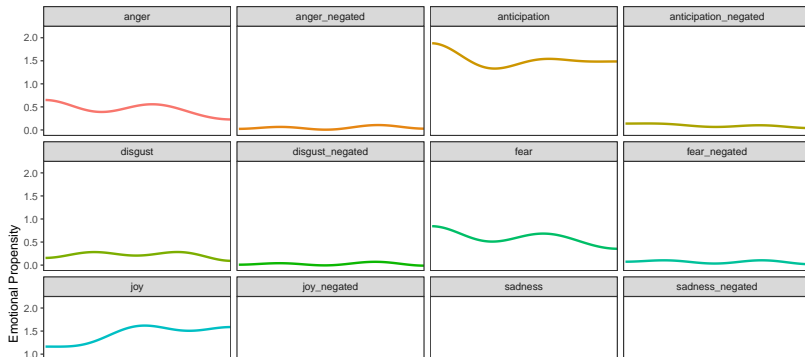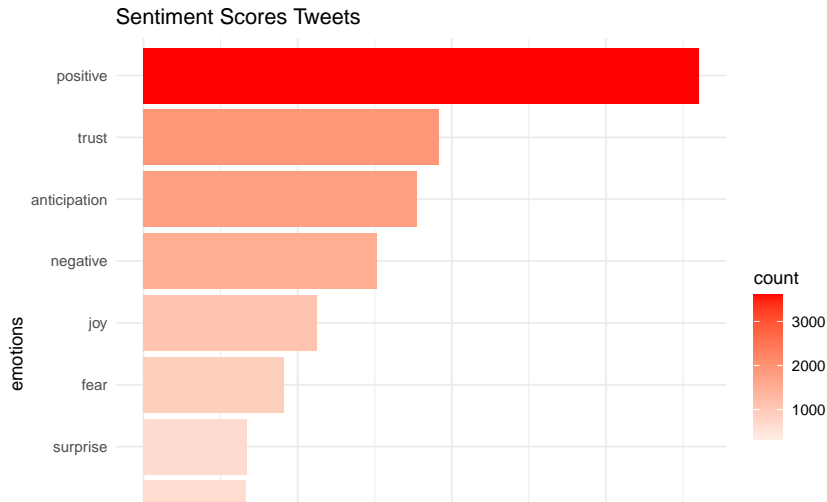
Plots code

```
# plot emotions


e<-emotion_by(get_sentences(txt),drop.unused.emotions=TRUE)
plot(e)
```

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

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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
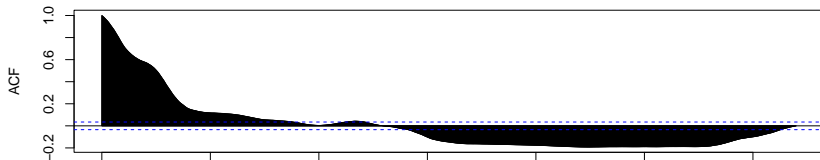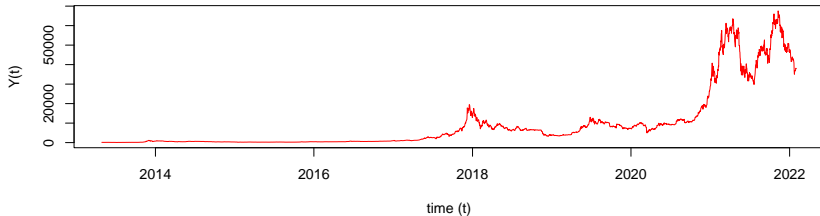
Stationarity

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.

```r
# bitcoin

BTC_TREND_BR= plot(btc_hist$timestamp[2:3200],logdiff,
     type='l',col='red',
     xlab = "time (t)",
     ylab = "Y(t)",
     main = "Trend signal")
```


Trend signal

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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:

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  - ▶ bullet 1
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Investigations:

- ▶ Popularity assessment

Annex ?

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