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A Comparative Study of Bitcoin's Price Fluctuations and Twitter Sentiments

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Abstract

This study is going to determine whether the sentiments in Twitter discourse about Bitcoin have an influence on the overall market and pricing of Bitcoin trades. The study aims to reveal the correlation between the volatility of the price of Bitcoin and how it relates to the sentiments in Twitter discourse. A large dataset of tweets mentioning Bitcoin has been amassed from the Twitter API between the months of February and July 2021, which will then be analysed against the Bitcoin trade performance. For this study, different predictive and descriptive models were applied that are equally important for data analysis. The sentiment for overall daily discourse has been categorised into three polarities, i.e., positive, neutral and negative using the VADER sentiment analysis. The overall polarity is then derived from a compounded and normalised dataset of each of the above-mentioned valencies for any given day. By utilising this study, it is hoped that potential Bitcoin buyers may make better and informed decisions about their purchases and that this study could be generalised to a broader analysis of social media discourse and how such means of communication could be used to drive consumer choice. Our results unequivocally prove that Twitter sentiments have a slight impact on the price and trading volumes of Bitcoin but the cryptocurrency has a unique way of sailing the storm of negative sentiments.

Keywords: blockchain, bitcoin, twitter, sentiment analysis, social media, cryptocurrencies

1. Introduction

During the last few years, the scrutiny of Bitcoin and other cryptocurrencies as legally regulated components of financial systems has been increasing significantly. Bitcoin is one of the biggest cryptocurrencies in terms of capital market share and trading volumes. Cryptocurrency is shrouded in uncertainty and volatility, even if the technology used to create these decentralised financial systems, i.e., the Blockchain, is objectively trustworthy, secure and sound. Nevertheless, much akin to Satoshi Nakamoto, the shadowy mysterious figurehead credited with creating the technology, not many people know how the technology works. It is this scepticism that inevitably deters people from embracing this technology fully. Coupled also with the fact that Blockchain technology and its initial application in the Bitcoin cryptocurrency vehemently challenges the monolithic centralised and highly regulated world of traditional finance, it already harbours animosity in the financial spheres. When the cryptocurrency picked up trade, not many saw the potential in this budding technology and as a decade went by Bitcoin was the hottest commodity to trade.As a result, this study gives an understanding of price fluctuation in Bitcoin

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trade in comparison with contemporary Twitter sentiments. Since the data is largely curated to produce a crude relationship between Bitcoin trading price and the overall Twitter sentiment contemporary to the trade, it foregoes several other factors that may affect trade thereby incurring limitations that may otherwise hint at a relatively deeper correlation.

Bitcoin grew to its highest value in November 2021, trading at over $68,000. With such returns, even with its highly volatile nature, the cryptocurrency attracted just as many adopters. With its monumental growth, the cryptocurrency has its naysayers and has attracted several legislative and regulatory structures to be relegated around its use and trade. Yet, there are several factors that make it easily malleable to outside intervention, of which *hearsay* is most pertinent.

For much of its course, Bitcoin has always been fueled by market dynamics that seldom make sense. In fact, the price for trades of the cryptocurrency fluctuates so dramatically that the commodity is seen as a risky investment. What incites these conspicuous rises and falls is a subject of several studies. Keeping in line with those studies, this research focuses on whether sentiments in social discourse on platforms like Twitter contribute in any way to this volatility as well. Draper (2012) seems to be of the opinion that it is the power of collective discourse and the "group power" that largely drives consumer behaviour.

2. Discourse and the crypto markets

It has been observed that cryptocurrency markets are inherently volatile, often as a result of outside interference and influences, e.g., through governmental legislation. There are suggestions that comments made about crypto markets, and fintech in general, by influential people, such as Elon Musk or Donald Trump, have shown to have significantly made an impact on trade volumes of several cryptocurrencies in the moments that followed their opinionated comments. This impact of outside actors seems tangentially impertinent considering that many of the influencers studied in this regard seemed to have no real alignment to or stakes in the markets they inevitably influenced in the most dramatic fashion.

Could this mean that something as simple as social discourse, a conversation in a social media thread or a tweet can significantly alter the perceptions of potential users of a product or offering even if they're not necessarily trying to imbue perceptual and behavioural change? Can words hold such sway in trying to influence potential users en masse? Or is it the subsequent buildup of a collective sentiment that steers consumer choice?

2.1. Influencing consumer behaviour through discourse

In January 2021, Reddit posters on the subreddit *r/wallstreetbets* identified hedge funds short selling stocks for a video game retailer GameStop Inc., largely because they'd identified the business collapsing due to the ready availability of online retailers in the space. A discourse soon broke out over the subreddit space and within a matter of weeks resulted in a short squeeze of the stock spelling out major financial consequences for the short sellers and enterprises hedging their bets against GameStop. This small discourse brought about a 30 times increase in the stock price for the retailer's individual stock offerings (Chohan, 2021).

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There is certainly no doubt that social discourse on the internet has the potential to sway consumer choice as is evident in another case where Elon Musk merely tweeting the hashtag #bitcoin in one of his tweets the same month ushered in an increase of about $5,000 in the price of Bitcoin, increasing the overall market capitalization for the entire crypto market (Huynh, 2022).

It was also seen that the US stock markets responded negatively whenever Donald Trump tweeted the word "tariff", thereby painting a direct correlation between the discourse on Twitter and the financial markets (Gjerstad et al., 2021).

2.2. Volatility of Bitcoin in line with the Twitter discourse

As already mentioned above, Twitter has gained notoriety as a platform where simple discourse has led influencers and celebrities to hold sway in influencing consumer choice. Twitter gives the opportunity for people to express their desires in a short, concise format that appeals to any number of people in as little a time as possible. This makes Twitter, one such ideal communication channel that can mobilise a collective/group sentiment leading to a dominant consumer choice (Draper, 2012).

Musk's tweet was one of many that changed the course of trade in Bitcoin. In one tweet he observed that he has been late in recognising the potential of cryptocurrencies and Bitcoin in general, prompting his company Tesla to allow Bitcoin to be used as a legitimate alternative for the sale of his electric vehicles. This greatly influenced the demand for cryptocurrency in the days to follow. However, it was not merely Musk whose tweet garnered such mass consumer behaviour; it is argued that it may be the discourse following the tweet that found much appeal in the community (Ante, 2022).

Coupled with the inability to shop at retail stores and the lack of mobility of average consumers during the Coronavirus outbreak and the lockdowns that followed, the discourse that followed this one event in time led to a compounding effect in inflating the value of Bitcoin. Although researchers like Ante (2022) and Huynh (2022) have tried to correlate Musk’s ability to sway Bitcoin trade as the singular and admirable quality of the billionaire, what they’ve largely failed to realise is that his tweets do not account for much more than the ignition for a much broader discourse that then builds an overarching sentiment driving consumer choice.

2.3. Sentiments as drivers of consumer choice

It is an established fact that sentiments expressed by potential consumers or seasoned users of a product or offering may consequently alter the perception of others in driving their choices to opt for that same product or offer. With the wealth of media available for people to engage in discourse about products or offerings, the internet hosts a vast cacophony of data that can be used to derive meaningful relationships between the users' sentiments and their unwittingly innate nature to drive consumer choice en masse. This is precisely the objective that we plan to derive in this study whereby we’ll discuss in simple ways how public social discourse can be analysed to predict consumer behaviours.

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As already discussed above, trade in cryptocurrencies has always been a subject of scepticism and uncertainty and no one's the wiser when it comes to understanding how contemporary public sentiment is shaping up about a certain cryptocurrency and whether these sentiments hold sway in disrupting the trade volumes and prices of these cryptocurrencies. While studies suggest that public discourse indeed has steered public opinion about cryptocurrencies and eventually their trades, no study has conducted an objective study observing the public sentiment en masse.

3. The intricacies of language semantics and natural language processing

Natural language processing (NLP) is a relatively new field of statistical heuristics and analytical study of written language to derive meaning. Nevertheless, it is a largely domain-specific problem, whereby NLP platforms trained for one media are inherently incapable of understanding and deriving meaning from the written content on another media (Kho, et al., 2019). Thereby, it is often seen that one NLP model often works well with one media and collapses entirely on another, e.g., analysing social media posts in contrast to deriving meaning out of news articles. In researching this topic, we analysed several NLP models, e.g., custom-build neural networks, VADER and SparkNLP, etc.

3.1. Why use VADER?

Out of several NLP models, we decided to use the Valence Aware Dictionary for sEntiment Reasoning (VADER) model, which is completely dependent on a lexicological sentiment analysis whereby an entire lexicon is handcrafted, selected and annotated by human classifiers. The way in which VADER derives a sentiment for any given text is by corresponding the many associations of words in a sentence to their associated weights in the valence-aware dictionary indicating the overall positivity, neutrality and negativity of the same.

In essence, VADER maps its lexicon weights to individual words within a sentence. Although, analysing words in any given sentence on their own merit without taking into account the contextual information that the overall sentence signifies may not benefit our research. As such, VADER comes built in with a group of several heuristic algorithms that are designed to infer contextual congruence in order to effectively derive the polarity of the overall sentence.

VADER outweighs several NLP offerings, particularly many that have been constructed using deep-learning algorithms and neural networks in such a way that it provides fast and accurate results without much processing involved and thereby found a natural fit in producing the results and findings for this study.

4. Methodology

In order to understand the correlation between sentiments in the discourse on Twitter and its implications on the actual trading of the Bitcoin cryptocurrency, we gathered a wide variety of tweets referencing the cryptocurrency in a given timeframe thus initiating research that is based entirely on a cross-sectional time horizon. The times chosen for analysis in this study are largely consequential due to their significance in the Bitcoin trade where either the cryptocurrency prospered or languished in dramatic ways. It would serve the purpose well to understand how discourse in social media mediated these dramatic changes.

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In order to derive an understanding of such discourse, we selected the timeframe between Feb 5 and Jul 4, 2021. A dataset of tweets all corresponding to reference to Bitcoin in all manners and forms were amassed in a comma-separated values (CSV) file which was then analysed using the VADER sentiment analysis. The data for all tweets corresponding to Bitcoin technology was derived from the dataset curated by Kash (2022).

The VADER algorithm produces the sentiment analysis confined to three distinct classes, i.e., a score for positive valence (*pos*), neutral valence (*neu*) and negative valence (*neg*). These scores are probabilistic percentages for the mentioned sentiment classes and therefore needed to be compounded using an algorithm to normalise the values in a range from -1 for mostly negative to 1 for mostly positive. Thereby, tweets were stacked by day alongside the computed compound valence that presented the overall sentiment score for that day.

In order to correlate these computed sentiments against the actual trade performance for Bitcoin, we superimposed the data from a popular Bitcoin exchange for those given days with the sentiment analysis to see a visualisation of how and if the Twitter-based sentiment holds any relation with the Bitcoin trade. The data for the historical prices for Bitcoin was derived from the dataset curated by SRK (2021).

5. Findings

This research largely focuses on the singular variable of sentiment polarity and its relationship with Bitcoin trade, although it may not be entirely sufficient in understanding the various other factors that can affect trade. Contrary to our initial hypothesis whereby it was assumed that the collective sentiment would have a greater impact on Bitcoin trade volumes and prices, it can clearly be seen that Bitcoin prices almost always weather negative sentiments.

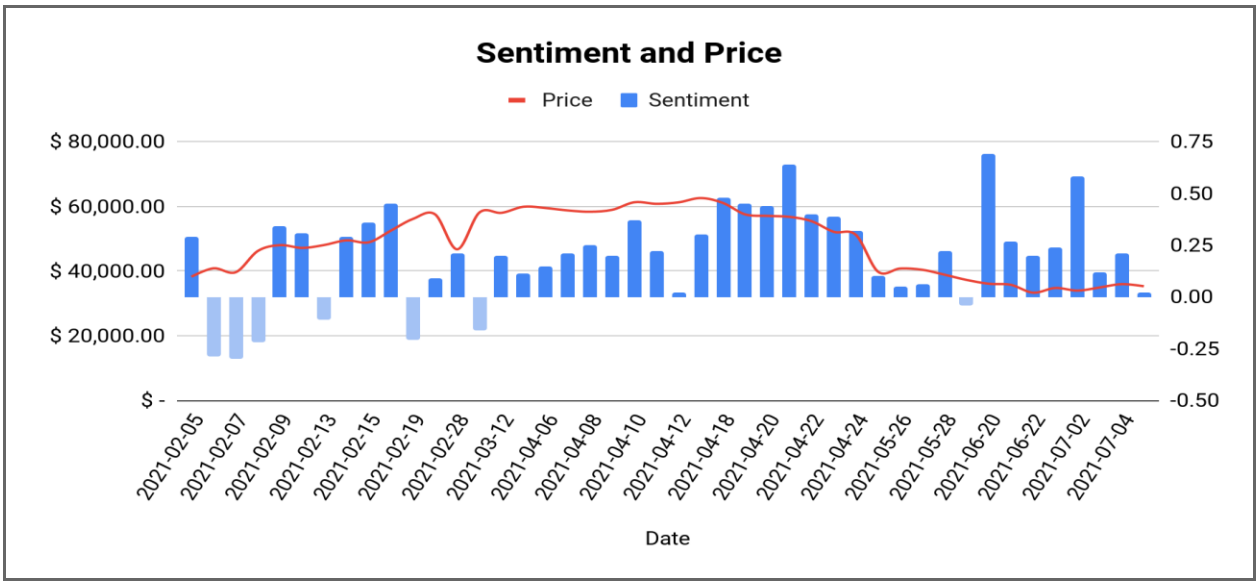

Figure 1. Sentiment and Price data

Although if the sentiments are continuously positive for a consecutive period of a few days, the prices slowly start to decline. It is as if the community falls trap to the too-good-to-be-true syndrome. Perhaps the cryptocurrency is shrouded in so much uncertainty that people usually sell their Bitcoins if the outlook seems positive for a certain number of consecutive days.

Negative sentiments are few but are almost always a result of the Bitcoin prices following, and it is seen that trading volumes are seldom hurt by negative sentiments on social discourse. It also seems rather odd that for a technology that has sceptics everywhere, there are just a handful of days in a period of five days where its users actually displayed a negative sentiment.

5.1. Limitations and further recommendations

This research largely focuses on the singular variable of sentiment polarity and its relationship with Bitcoin trade, although it may not be entirely sufficient in understanding the various other factors that can affect trade.

The findings derived for this study are primarily based on data collected for the Bitcoin cryptocurrency. In order for this research to be more generalised, it is important that the reproducibility of this study be tested with other cryptocurrencies as well. Doing so will prove unequivocally a direct correlation between social discourse and consumer behaviour particularly in terms of crypto markets.

6. Conclusion

Communication channels like Twitter are an effective tool in inculcating discourse and creating the factors to foster consumer behaviour. Through this research, it could be demonstrated that consumer choice is influenced to a certain extent through social media discourse, however in the case of Bitcoin there are several other factors that come into play as well. Certainly the uncertainty surrounding the cryptocurrency makes it all the more difficult to steer a collective perception of its users even if there are positive sentiments over a sequence of days or a certain period of time. However, it was also noted that the Bitcoin market quite remarkably manages to garner a positive sentiment among its investors even when the cryptocurrency itself is on a downward trajectory. This is certainly a good indicator that investor confidence in the commodity is unwavering.

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