Cryptocurrency Market Movement and Tendency Forecasting using Twitter Emotion and Information Quantity

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ABSTRACT

Bitcoin was initially described to the public in a paper released in 2008 under the identity Satoshi Nakamoto. The first ever Bitcoin transaction took place on January 3, 2009. Its success paved the way for the development of similar digital currencies in the years that followed. There are more than 12,500 different cryptocurrencies, according to CoinMarketcap 2021. This is mostly owing to the extraordinary volatility of the market, which drew many individuals to take an interest and participate in it in the hopes of making money. Twitter has emerged as a common meeting place for those interested in cryptocurrencies. In a noteworthy move, Twitter announced on September 23, 2021, a new feature that would enable users to tip other users using their Bitcoin Lightning wallets. In spite of the fact that this new technology may have far-reaching effects on our lives in the future, there is not a great deal of writing on the subject of cryptocurrencies. Even if there aren't many rules in place yet for trading cryptocurrencies, a social media sentiment study might help fill in the gaps in our understanding of what influences bitcoin prices. In this study, we examine whether or not analyzing Twitter sentiment can reliably foretell changes in the value digital currencies. Seven of the most widely used cryptocurrencies have their own Twitter discussions and price histories gathered. After that was done, the Valence Aware Dictionary for Sentiment Reasoning was used to conduct an analysis of the data's emotional content (VADER). We used the Augmented Dicky Fuller (ADF), Kwiatkowski Phillips, Schmidt, and Shin (KPSS), and Granger Causality tests to identify time series that were stationary. However, the bullishness ratio revealed that Ethereum and Polkadot prices were predicted despite the fact that swings in Bitcoin, Cardano, XRP, and DOGE prices tend to vary attitude. At last, we use Vector Autoregression (VAR) to look at the predictability of price returns, and we discover that two of the seven cryptocurrencies can have their prices predicted with a high degree of accuracy. Exactness of price forecasts for Polkadot and Ethereum, respectively, was 99.17% and 99.67%.

KEYWORDS: *Bitcoin, Augmented DisckyFilter, Coin markup*

1. INTRODUCTION:

It's no secret that the popularity of cryptocurrencies has exploded recently (Corbet et al., 2019; Kraaijeveld & De Smedt, 2020; Rane & Dhage, 2019; Sattarov et al., 2020).

This is in part because their innovative blockchain-based technology was developed with the aim of decentralizing finance and eliminating the mediation requirements of the current financial system, which are virtually exclusively delivered by banks and other institutional providers (Corbet et al., 2019; Nakamoto, 2008). For examples, see (Corbet et al., 2019) and (Nakamoto, 2008).

However, cryptocurrency investments have been deemed risky because of the potential for it to be utilized in illegal activities like money laundering and Ponzi schemes (Kethineni & Cao, 2020).

In addition, the extreme absence of regulations and the ever-changing nature of new technology combine to

provide a very unstable setting (Corbet et al., 2019; Kethineni & Cao, 2020; Kraaijeveld & De Smedt, 2020). Some examples of these studies may be found in (Corbet et al., 2019; Kethineni & Cao, 2020; Kraaijeveld & De Smedt, 2020).

A constant stream of information and social media posts is produced in this frenetic environment. Cryptocurrency enthusiasts and investors alike often turn to microblogging services like Twitter and Reddit for news and updates. To cite this article: Kraaijeveld, R., and De Smedt,

To this end, it has been determined that the sentiment of social media sites like Twitter and Reddit may be used as a reliable indicator of future changes in the price of bitcoin.

Sattarov et al. (2020); Shen, Urquhart, and Wang (2019); Smuts (2019); Wooley et al. (2019); Gao, Huang, and Wang (2021); Kraaijeveld and De Smedt (2020); Lamon, Nielsen, and Redondo (2016); Sattarov et al.

Finally, research evaluating the link between social media sentiment and price fluctuations need to account for the growing usage of automated systems to post to social media.

Reference: (Rebholz, Wise, & Xiao, 2018) (Rebholz, Wise, & Xiao, 2018)

2. Literature Review
This section explains what cryptocurrency are and how they have evolved to this point, including relevant historical context and the most recent findings in the area. We also discuss the possible utility of Twitter sentiment classification for forecasting market movements.

Cyptocurrencies

The landscape of Cryptocurrencies
Over the last few weeks, cryptocurrencies have skyrocketed in popularity as governments and big corporations across the world have begun to accept them. Examples of their widespread use include El Salvador's 7 September 2021 adoption of Bitcoin as legal cash and Twitter's 23 the ability to tip other users using Bitcoin Lightning wallets will be introduced in September 2021..

In 2008, a document defining and describing Bitcoin was released under the alias Satoshi Nakamoto. Due to its Proof-of-Work user-consensus method, Bitcoin is secure and free from threats like double spending and hacking. And this peer-to-peer approach was meant to do away with the time and money spent on middlemen like banks. According to (Nakamoto, 2008)

A clear definition of cryptocurrencies is crucial for grasping the phenomenon's rise and explaining it to nonbelievers.

"An electronic method of payment based on cryptographic proof, instead of trust, that allows any two willing participants to directly engage with each other without the requirement for trusted third party," Nakamoto said in the Bitcoin whitepaper. So far as I can tell (Nakamoto, 2008, p.1)

Lansky (2018) offers an alternative definition of cryptocurrencies as distributed digital currencies that satisfy the following six criteria:

1. As a result, (1) the system may reach agreement without relying on any one person or body to do so.

2. The units of bitcoin are tracked and recorded as belonging to certain individuals.

3. The system determines the parameters for generating and owning new bitcoin units if this feature is enabled.

4. The ownership of cryptocurrency units can only be proven cryptographically.

5. It is acceptable to engage in the transfer of ownership of cryptocurrency units via trading. A statement of the transaction cannot be produced without evidence of ownership of the units.

6. If more than one transaction using the same cryptography units is planned to take place at the same time, the system will only execute one of those transactions.

Since Bitcoin's debut in 2009, the Cryptocurrency Market has seen an explosion of investment, as seen by the enormous growth in its market capitalization and number of transactions. One more aspect to consider is that there will only ever be a maximum of 21 million Bitcoins in circulation (issued by miners) until the year 2140. However, it may be divided into smaller amounts called "Satoshis" (SATS), with 1 Satoshi equaling 0.00000001 Bitcoin. The market capitalization of all cryptocurrencies in 2021 (according to CoinMarketCap)

According to CoinMarketCap, the total value of the cryptocurrencies rose from $5.5 billion at the beginning of the year to $820,2 billion on Jan 7, 2018. (2021). The total market value of all cryptocurrencies was predicted to surpass $2.3 trillion on November 9th, 2021, an increase of more than 418%.
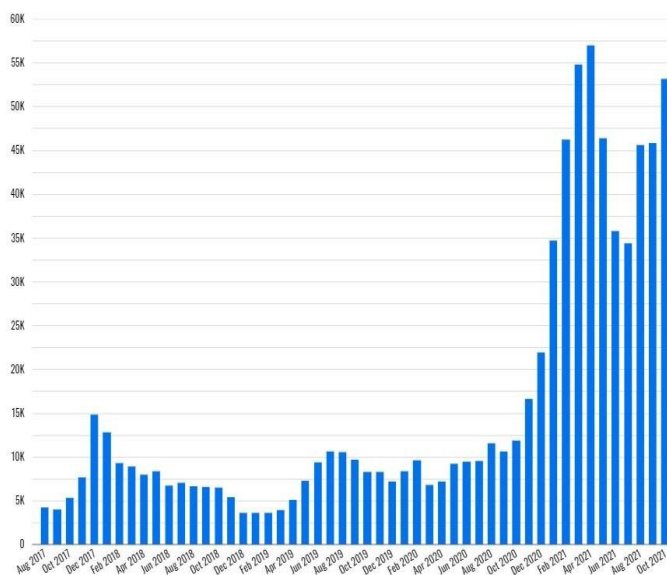
Figure 1: Value of Bitcoin in US Dollar Coins. Binance Application Program Interface (API).

The World Gold Council puts the value of gold at about US$11.3 trillion, a figure that may be used to get a sense of the scope of the market. It's interesting to see how other cryptocurrencies have flourished as Bitcoin's competitors. There are now over 12,500 distinct cryptocurrencies (CoinMarketCap, 2021). The Proof-of-Work consensus technique used by Bitcoin requires a lot of resources, however these alternatives aim to solve other issues or give more efficient solutions. Vitalik Buterin, the creator of Ethereum, has identified three key challenges that must be overcome in the development of blockchain networks. The 'Blockchain Trilemma' describes the interplay between decentralization, security, and scalability in the blockchain ecosystem. There is still no clear answer to the problem of how to accomplish all of these goals without incurring unnecessary costs. The market capitalization of all cryptocurrencies in 2021 (according to CoinMarketCap).
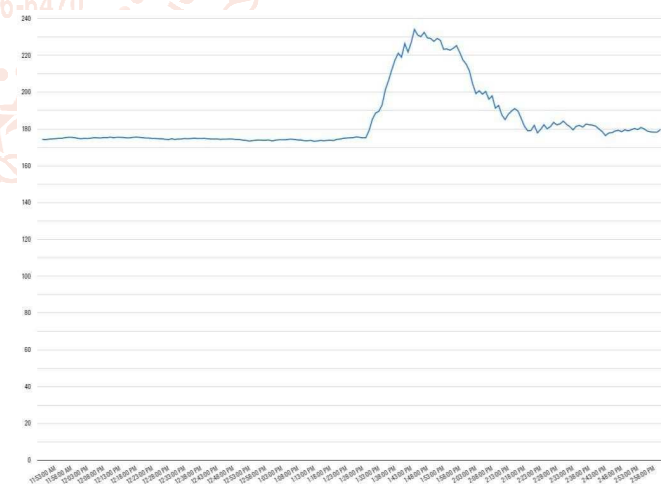

Figure 2: As of October 2021, these are the three cryptocurrencies with the most market capitalization. CoinMarketCap is the data source.

Despite the undeniable rise in popularity of cryptocurrencies, some have voiced concerns that their anonymity-promoting aspects make them vulnerable to abuse in illegal contexts including financing terrorism, tax fraud, such as Ponzi schemes (Kethineni & Cao, 2020). To back this up, users don't have to provide any private data to use the system., that they are not restricted in the number of accounts that they may have, and that they have access to tools that make their identification difficult (Dyntu & Dykyi, 2019).

Coincheck, a prominent cryptocurrency exchange, was hacked for $530 million in 2018, while Mt. Gox was hacked for $400 million in 2014, demonstrating the need for increased security.

Media announcements add to the unpredictability of cryptocurrency values in the present market climate, as studied by Corbet et al. (2019), who track how the announcement of plans to construct KODAKCoin raised the company's stock price.This was similarly the case when a purported cooperation between Walmart and Litecoin was announced on September 13, 2021, but swiftly debunked as false. The announcements were first shared on the official Litecoin Twitter account and then published by a communication services business. Shortly after the announcement, the price of Litecoin jumped by more than 30 percent, only to sink again once the hoax was exposed (New York Times, 2021). The entire thing lasted little more than twenty minutes, and Walmart quickly published a statement denying the validity of the news.

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3. Methodology
Research Model
Specifically, the study followed the stages in Figure 4 to conduct their investigation.

Using Twint for collecting tweets and the Binance API for collecting cryptocurrency values, the first datasets were acquired as part of the data gathering process.

The data was then cleaned, and VADER was used to analyze the opinions contained within. Next, we combined tweets and price data and ran stationarity tests using the ADF and the KPSS.
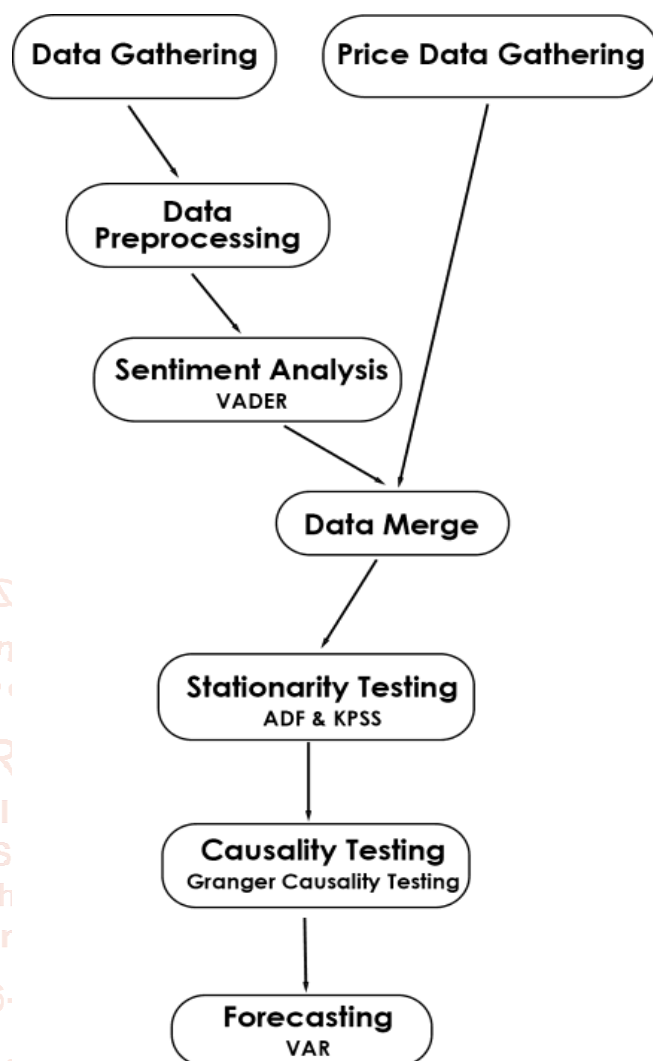
Granger Causality testing was carried out to examine the timing of events in a set of data. When all was said and done, VAR was used to make the final predictions.

Figure 4: An Outline of the Research Methodology

4. Collection of Data
Data Mining on Twitter
Initially, tweets on the most talked-about cryptocurrency were collected via programmatic interface for Twitter. Twint is an open-source library that utilized because it is one of several Python libraries that can be used to gather data from Twitter and because it can be used to circumvent restrictions imposed by the Twitter API. This allowed for a large quantity of data to be gathered over a period of two months (01/09/21 - 01/11/21) pertaining to seven of the most widely used cryptocurrencies. Several cryptocurrencies were chosen, including Bitcoin, Ethereum, Cardano, Xrp, Solano, Doge, and Polkadot.

.csv files were created for each dataset. There was an option to change the language, and English was chosen.

Cryptosystem	Tweets for Raw Data	Data for Retweets
Bitcoin (BTC)	1.467.271	7.608.410
Ethereum (ETH)	575.773	1.484.263
Solana (SOL)	675.730	2.784.462
Cardano (ADA)	266.789	1.527.898
XRP (XRP)	268.284	864.578
Doge (DOGE)	353.573	1.085.648
Polkadot (DOT)	75.397	184.748
Total	**3,682.817**	**15.540.007**

Table 1: Total Tweets Collected

Date	time	open	high	low	close	Volume
19/11/2021	0:00:00	56891.62	57019.57	56876.99	57009.11	88.74734
19/11/2021	0:01:00	57005.07	57195.28	56999	57125.71	157.3485
19/11/2021	0:02:00	57120.01	57200	56885.16	56933.46	135.808
19/11/2021	0:03:00	56933.47	56942.8	56764.5	56803.89	52.84977
19/11/2021	0:04:00	56787.11	56829.43	56674	56763.4	47.95302
19/11/2021	0:05:00	56763.41	56850	56703.71	56743.24	58.1874
19/11/2021	0:06:00	56743.24	56867.83	56682.26	56839.7	48.90058
19/11/2021	0:07:00	56839.7	56954.53	56803.25	56921.21	26.23455
19/11/2021	0:08:00	56921.2	56931.47	56831.59	56915.53	21.98144
19/11/2021	0:09:00	56915.53	57150	56915.53	57143.95	43.94016

Table 2: Bitcoin Price Data sample

Id	int64
conversation_id	int64
created_at	object
Date	object
Time	object
Timezone	int64
user_id	int64
Username	object
Name	object
Place	object
Tweet	object

Table 3: Columns in Twitter Datasets

5. Results and Discussions
VADER Sentiment Analysis
The tone of tweets is determined by using VADER sentiment analysis in this research.

The "Valence Aware Dictionary for Sentiment Reasoning" is an example of a rule-based dictionary and sentiment analysis tool that focuses on social media sentiment.

To reach its conclusion, VADER uses a sentiment dictionary, a collection of words that are often classified as positive or negative based on their semantic orientation, as well as punctuation and emojis. VADER determines the positivity and negativity ratings, as well as the intensity with which an emotion is positive or negative..

➢ A compound score is the total of individual lexical scores, scaled from -1 (very negative) to +1 (highly positive) (extremely positive).

➢ If the sum of the scores is more than or equal to 0.05, then the mood is optimistic.

➢ The middle ground is "Neutral Sentiment," defined as a composite score of 0.05 or above that includes both "compound score <-0.05" and "compound score -0.05."

➢ Pessimistic Opinions: (Overall Score = -0.05)

In Table-8, you'll see VADER-scored tweets that have been cleaned using the aforementioned method. For accurate scoring, tweets are tokenized and lemmatized before they are sent.

Table 8

Tweet(tokenized/lemmatized)	Compound	negative	neutral	positive
['!', '!', 'big', 'fake', 'bubble', 'crash']	-0.7494	0.615	0.385	0
['disaster', 'waiting', 'happen', 'featured', 'news']	-0.6249	0.406	0.594	0
['following', 'closely', 'possible', 'bullish', 'opportunity', 'month','.']	0.4215	0	0.714	0.286
['future', 'wrapped', 'token', 'layer']	0	0	1	0
['good', 'strong', 'project', '.']	0.7351	0	0.326	0.674
['hard', 'ignore', 'even', 'though', 'bleeding', 'bit', ',', 'many', 'top', 'strong', '.', 'good', 'sign', 'entire', 'market', '(', ')', '.']	0.6249	0.151	0.541	0.309
['market', 'top', 'yet', '', '', '', '', '""', 'saying', '""', '', '', '', '', '']	0.7783	0	0.755	0.245
['true', 'believe', 'tap', 'get', 'extra', 'save', 'next', 'bullish','trend']	0.7184	0	0.571	0.429
[':', 'dead', ',', 'bearish', 'month']	-0.6486	0.518	0.482	0

Table 8: VADER tweet scores

To compile the data for the sentiment analysis, we used the '.describe()' function, the results of which are displayed in Table 9. In the Appendix, you'll find additional details about the final dataset used for each cryptocurrency, daily graphs displaying their cumulative score. Following figure represents the day-day plot of bitcoin.

Using a composite score between zero and one hundred, the tweets were sorted into the positive, negative, and neutral categories. You can get a feel for the daily volume of Bitcoin-related tweets and the mood of the audience from Figure 13, which displays the tweet volume and the tweet categories in which they appear. Added to the Appendix are additional bar charts displaying the final rankings of each cryptocurrency.
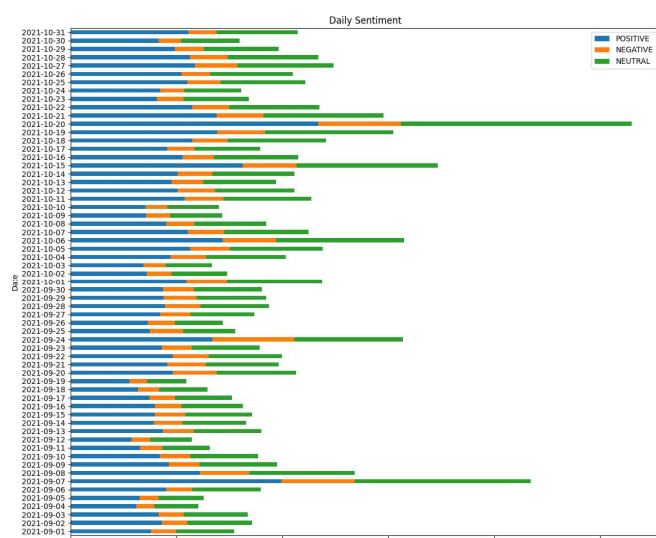
Figure 13: Bitcoin Sentiment by Day

6. Discussion

While this study's sample size was adequate, a higher number of tweets would have increased confidence in the results and aided in the discovery of any obvious regularity. The data set utilized in this study was decreased by 59.3 percentage points owing to the removal of irrelevant information and repetitions of postings that were likely generated by automated software.
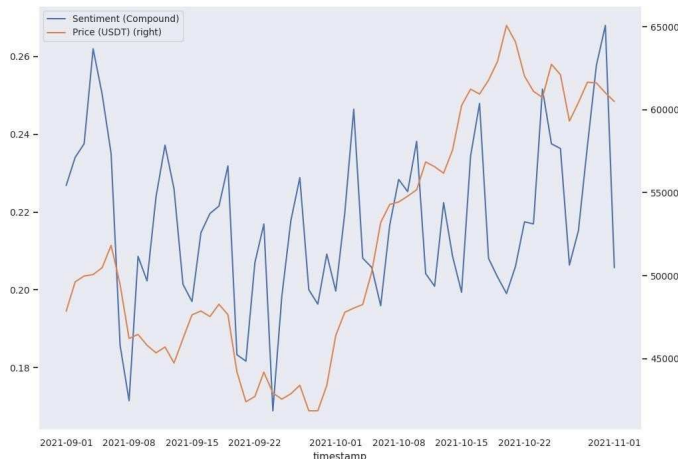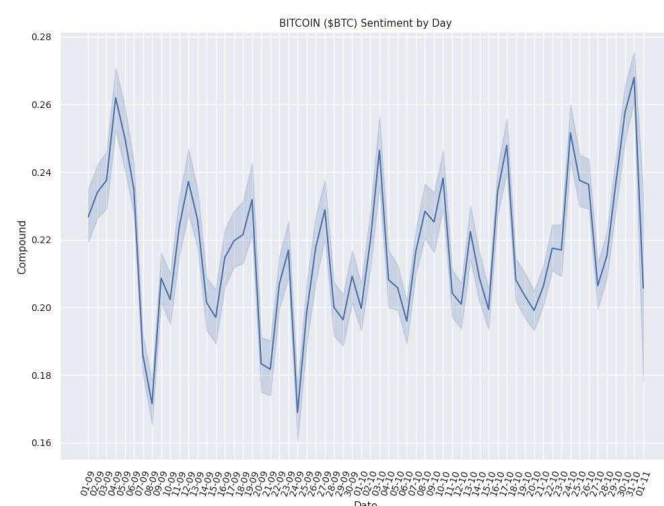
This study's datasets suggest that 28% of tweets are automated, hence this factor must be taken into consideration when doing sentiment analysis.

VADER, a sentiment analysis tool, proven to be competent and capable of handling tweets, albeit custom-made vocabulary, including regularly used acronyms, had to be constructed to perform more accurate sentiment analysis.

For the best outcomes, examine both the language used and any cryptocurrency-specific acronyms.

The Granger Causality test findings demonstrate the link between market mood and the cost of cryptocurrencies. More study is needed to determine the direction of causation between changes in price and changes in emotion.

If a study reveals major discrepancies, it is important to consider the unpredictability and incalculability of market manipulation.

Despite the fact that this study's use of Vector Autoregression (VAR) only produced predictions that were quite close to the mark for two of the eight cryptocurrencies analyzed, further analysis of the time series using different methods could reveal useful insights into which system is best suited to dealing with cryptocurrency data.

Future research might benefit from looking at other cryptocurrencies using a broader data sample that draws from a variety of social media platforms and time periods.

Moreover, assessing user sentiment and pricing as a means to detect probable market manipulation would be an intriguing avenue to investigate.

7. Conclusion

Investors are drawn to the bitcoin market because it represents a new and promising technology.

An effective analysis of user sentiment and research into its predictive capacity is crucial in today's fast-paced, data-driven society. Thus, the volatility of this market, along with the widespread interest in

cryptocurrencies among social media users, presents a rare opportunity.

In this study, we contribute to the few prior research on the topic by doing a literature review, sentiment analysis, and an inquiry of the relationship between social media data and price..

The given methodology accounts for the fact that Twitter bots make up roughly 28% of all tweets. These aided in the preprocessing of the tweets, along with the special vocabulary that was developed to deal with abbreviations.

The short-term forecasts produced by this research are also quite accurate for two of the seven cryptocurrency marketplaces analyzed. Using a Vector Autoregression (VAR) model trained on Ethereum and Polkadot datasets spanning (2) months, we produce an accurate forecast of 99.62% and 99.17%, respectively, over the course of 12 hours.

The research already shows that social media sentiment affects the bitcoin market, and our findings add to that.

If further developed, the approach used in this research might be utilized to generate prediction models specific to marketplaces for cryptocurrencies more generally, or any market with similar features.

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