COMMITTEE ON DATA CODATA INTERNATIONAL SCIENCE COUNCIL

Social Media Impact on the 'Cosmos' Blockchain Ecosystem: State and Prospect

RESEARCH PAPER

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ABSTRACT

The proliferation of blockchain technology heralds transformative impacts across various sectors, offering decentralization, transparency, and enhanced security. This paper explores the unique case of Cosmos, a scalable blockchain ecosystem designed to address the challenges of isolation and interoperability among existing blockchains. With its implementation of Tendermint consensus and the Inter-Blockchain Communication protocol, Cosmos stands out in facilitating seamless cross-blockchain interactions. The ATOM token serves a dual role as the network's currency and a governance tool, empowering stakeholders in decision-making processes.

Significantly, this study investigates the intricate relationship between Cosmos and social media platforms, examining how online sentiment influences voting on governance proposals, with a detailed analysis of two specific proposals. Furthermore, the paper delves into Cosmos' integral role in the burgeoning Decentralized Finance sector, underscoring how its modular architecture fosters financial innovation.

In the broader context, there are numerous PoS (Proof of Stake) networks. Cosmos, one of the foundational and longstanding projects, exemplifies a classic blockchain economic model, making it an ideal subject for this analysis. Finally, the paper assesses Cosmos' contribution to the overarching Web3 vision, asserting its significance as a foundational element for a decentralized, user-oriented digital framework. Our findings illuminate Cosmos' multifaceted impact, from technological innovation to reshaping societal structures, reaffirming blockchain's potential in redefining modern paradigms.

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1. INTRODUCTION

The art of blockchain has garnered considerable notice and uptake across diverse domains owing to its capacity to transform age-old paradigms of data logging, dealings, and data administration. Fundamentally, it stands as a dispersed and decentralized digital chronicle that dutifully notes transactions across numerous machines in a manner that radiates transparency, resists tampering, and invites scrutiny.

Cosmos is a scalable and cross-network blockchain ecosystem designed to simplify development, deployment, and cross-blockchain interoperability (Cosmos Whitepaper 2023). Created to address the isolation and incompatibility challenges among blockchains, it offers unique tools for secure and managed blockchain interaction (Cosmos Network 2023). The core technology is the Tendermint consensus, an innovative Proof of Stake (PoS) algorithm that enhances security and scalability (Haber & Stornetta 1991). Cosmos also incorporates the Inter-Blockchain Communication (IBC) protocol, enabling various blockchains to exchange messages and values (Grinberg 2011).

The ATOM token serves as the central currency, used for consensus within the Cosmos Hub blockchain. ATOM holders can stake their tokens to maintain network security and also use them for transaction fees (Cosmos Network 2023). Importantly, ATOM holders can participate in network governance, thereby influencing the ecosystem's future (Hayes 2019).

Cosmos engagement with social media significantly impacts its growth and influence. Social platforms disseminate information, attract new users, and facilitate community participation in decision making (Crane & Sornette, 2008). Discussions on social media contribute to shaping the ecosystem's future and direct attention to new opportunities (Bamert et al. 2013). Overall, Cosmos is a continually evolving ecosystem that leverages active participant interaction across various platforms, including social media, to grow and innovate (Antonopoulos & Wood 2018).

The concept of decentralized finance (DeFi) also finds a compatible environment within the Cosmos ecosystem. The modular architecture and customizable modules for smart contracts, liquidity protocols, and decentralized exchanges make it easier for developers to create DeFi applications (Cosmos Network 2023). This serves as a catalyst for financial innovation, as it enables a variety of use-cases that are not only confined to payments or transactions but also extend to lending, borrowing, asset management, and more. Through Cosmos, DeFi projects can tap into a robust, secure, and interoperable network that helps them scale and connect with other blockchains.

Looking ahead, Cosmos aims to become a cornerstone in a decentralized internet architecture, often referred to as Web3. This revolutionary concept proposes a new internet layer that is free from centralized control and enhances user sovereignty (Guan et al. 2022). With features like data portability, user-owned databases, and peer-to-peer interactions, Web3 aspires to distribute power back to individual users (Nakamoto 2008). Cosmos, with its technology stack and philosophy, aligns well with this vision, acting as an essential building block for a more democratic, transparent, and efficient digital world. Overall, the impact of Cosmos extends beyond mere technological innovation; it contributes to the larger narrative of how blockchain can reshape societal structures and empower individuals (Maurer et al. 2013).

2. LITERATURE REVIEW

As you can see, similar approaches that were developed earlier can be used in different spheres once we review the results of further research of the following publications. In modern literature, there is a lot of research related to social media's impact on the blockchain ecosystem. Additionally, this research aligns with various theoretical perspectives on the nature of the interactions between social media and the blockchain ecosystem, highlighting different ways to apply the findings of these studies. In other words, each study of such events and corresponding hypotheses have a different interpretation depending on the original goals.

For instance, Mankala et al. (2023) researched and reported that increasing public concerns about the environment have led to many studies that have explored current issues and approaches towards its protection. Much less studied, however, is the topic of public opinion surrounding the social media impact that cryptocurrencies are having on the environment. The

cryptocurrency market and blockchain ecosystem—in particular, Bitcoin—currently rivals other top well-known assets such as precious metals and exchanged traded funds in market value, and the market is growing. Their work (Mankala et al. 2023) examines public opinion expressed about the environmental impacts of Bitcoin derived from Twitter feeds. Three primary research questions were addressed in this work related to topics of public interest, their location, and people and places involved. Their findings show that factions of the public are interested in protecting the environment, with topics that resonate mainly related to energy.

Another publication (Guinda & Bhattacharyya 2021) presents an updated correlation analysis of 31 crypto assets, among them and with some equity and gold indices. Furthermore, they conducted a PCA to identify the group of cryptos that present different correlation patterns and may help us build a diversified portfolio. The correlation update shows that these cryptoassets, which account for approximately 80% of the market, have been positively correlated since 2017 and Ether has been the asset with the highest results. These correlations increase during bear markets, especially in the current bear period started in April 2021. When analyzing Bitcoin against equity markets, they confirmed that correlation is very volatile and swings from positive to negative continuously, which makes it very difficult to use Bitcoin as an equity hedge. As a closing, they have observed that the only times that Bitcoin presented negative correlation with equity indexes coincides with times when gold also showed negative correlation, which could reveal the use of the digital asset as a store of value.

Enough interesting statistical data research has been shown by Wike et al. (2022), and this analysis focuses on technology use and views of internet and social media in the context of democracy and society. The survey was conducted in 19 advanced economies in North America, Europe, the Middle East, and the Asia-Pacific region. For non-US data, this report draws on nationally representative surveys of 20,944 adults from Feb. 14 to June 3, 2022. The survey is weighted to be representative of the US adult population by gender, race, ethnicity, partisan affiliation, education, and other categories. Respondents who took part in the telephone survey had somewhat higher rates of internet use, smartphone ownership, and social media use.

As can be seen, the social media impact can have some different implementations in other spheres. For example, Kanchan and Gaidhane (2023) could show their research aimed to conduct an introductory study of the existing published literature on why to choose and how to use social media to obtain population health information and to gain knowledge about various health sectors like disease surveillance, health education, health research, health and behavioral modification, influence policy, and enhance professional development and doctor-patient relation development. They searched for publications using databases like PubMed, NCBI, and Google Scholar, and combined 2022 social media usage statistics from PWC, Infographics Archive, and Statista online websites. The American Medical Association (AMA) policy about Professionalism in Social Media Use, American College of Physicians-Federations of State Medical Boards (ACP-FSMB) guidelines for Online Medical Professionalism, and Health Insurance Portability and Accountability Act (HIPAA) social media violations were also briefly reviewed. Their findings reflect the benefits and drawbacks of using web platforms and how they impact public health ethically, professionally, and socially. During their research, they discovered that social media's impact on public health concerns is both positive and negative, and we attempted to explain how social networks are assisting people in achieving health, which is still a source of much debate.

Venturing into the Depths of Downvoting: Insights from Blockchain-based Social Media Networks – Commencing our journey, we delve into the intricate realm of user behavior within blockchain-driven social media ecosystems. Authored by R. Sun, C. Li, J. Liu, and X. Sun, this illuminating piece, published on 1 May 2023, draws from a reservoir of four years' worth of data sourced from Steemit. At the heart of this exploration lies an unraveling of the enigmatic influence wielded by automated entities on the ebb and flow of voting dynamics. An intriguing revelation emerges—a substantial contingent of these mechanized agents purposefully cast their votes in opposition to the prevailing content.

Pioneering a Media Revolution: The Fusion of Blockchain Tech and Media Transformation—Embarking on an odyssey of transformation, this article penned by Momčilo Bajac and M. Vojinović, and unveiled on August 28, 2022, unearths the impact of groundbreaking Distributed Ledger Technologies (DLTs), colloquially known as blockchain technologies, on the evolving visage of media landscapes. As we navigate through the narrative, we witness the profound

influence that these innovative technologies have cast upon the traditional bastions of news dissemination and the journalism profession itself.

Bridging the Democratic Deficit with Blockchain: Navigating the Crossroads of Social and News Media—Our expedition continues with a piece authored by N. Nicoli, S. Louca, and P. Iosifidis, released on August 19, 2022, inviting contemplation on the potential of blockchain technology to reshape the trajectory of democratic deficits pervasive within the realm of information and communication. Amidst these pages, we encounter a thoughtful exploration of the dual role that blockchain may undertake—either as a remedy to prevailing challenges or as an exacerbating force amplifying existing issues.

Unveiling Blockchain's Role in Enriching Social Media: A Methodical Literature Review—Embarking on a scholarly voyage, crafted by the adept hands of M. A. Hisseine, D. Chen, and X. Yang, and unveiled on June 28, 2022, we find a comprehensive and systematic review of literature centered around the fusion of blockchain technology and the social media landscape. Through this analysis, a prevailing theme emerges—earlier scholarly efforts have predominantly fixated on combating the proliferation of misinformation and reinforcing the fortress of data privacy within these interconnected digital realms.

In addition, we plan to consider some other cases in the blockchain ecosystem. Nowadays in the globalized world, there is an ongoing process of evaluation of the development level of characteristics and usage possibilities of the blockchain ecosystem analyzed by Kotenko et al. (2020) and Kryshtanovych et al. (2021). According to Kavun, Zavgorodnia, and Petrenko (2020), as well as Potii et al. (2019) and Pavlyshyn I. (2016), the creation of broad opportunities for the exchange of knowledge processes significantly enhances the competitiveness of these entities in both domestic and foreign markets.

A perusal of academic literature reveals that the interrelation between blockchain technology and social media is a burgeoning research domain. Yet, the majority of these investigations address overarching themes, such as the influence of social media on the dissemination of blockchain and cryptocurrency intel, and the employment of blockchain to augment security and transparency in social media platforms.

3. PROBLEM STATEMENT

Despite the vast potential and opportunities, there remains a significant challenge in comprehensively understanding and evaluating the influence of social media on blockchain ecosystems, such as Cosmos (Cosmos Network 2023; Hayes 2019). Given the integral role that social media now plays in people's lives (Crane & Sornette 2008), its impact on the evolution of cryptocurrencies and blockchain technologies warrants thorough exploration (Bonneau et al. 2015). Currently, there is a significant knowledge gap regarding how information disseminated via social media shapes the perception and adoption of blockchain technology, especially within the Cosmos ecosystem (Antonopoulos & Wood 2018; Bamert et al. 2013). Understanding how various forms of social media influence changes in Cosmos' financial metrics can aid in devising strategies to bolster this ecosystem further (Grinberg 2011). Thus, the central inquiry of this paper is: to what degree, and in what manner, does social media influence the Cosmos blockchain ecosystem and its financial performance? This exploration encompasses a review of the current state of research in this domain (Bonneau et al. 2015; Hayes 2019), an investigation into the repercussions of social media on Cosmos' financial metrics (Antonopoulos & Wood 2018), and a discourse on potential trajectories and perspectives for future research (Cosmos Network 2023).

Despite the expansive promise and opportunities that come with integrating blockchain and social media, there is a notable gap in our understanding of how these two spheres interact, especially within specific blockchain ecosystems like Cosmos (Cosmos Network 2023; Hayes 2019). Given the pervasive role of social media in contemporary life (Crane & Sornette 2008), an exhaustive examination of its impact on the maturation of cryptocurrencies and blockchain technologies is imperative (Bonneau et al. 2015). At present, the lacuna in our knowledge pertains to how information propagation via social media influences both public perception and subsequent adoption of blockchain technologies, particularly within the Cosmos ecosystem (Antonopoulos & Wood 2018; Bamert et al. 2013). A nuanced understanding of how different social media platforms affect variations in Cosmos' financial metrics could assist in formulating strategies to fortify the ecosystem further (Grinberg 2011).

Therefore, the focal question of this paper is: To what extent, and in what ways, does social media exert influence on the financial performance and general dynamics of the Cosmos blockchain ecosystem? Our investigation will include a synthesis of the extant literature in this field (Bonneau et al. 2015; Hayes 2019), an empirical analysis of the impact of social media on Cosmos' financial indicators (Antonopoulos & Wood 2018), and a contemplative discussion on potential directions for future scholarly inquiry (Cosmos Network 2023).

Specifically, the research tasks we aim to address in our study are as follows:

1. Identification of key social media platforms that have a tangible impact on the Cosmos blockchain ecosystem.
2. Examination of the mechanisms through which social media influences voting outcomes within the blockchain ecosystem, and the metrics that may be affected.
3. Assessment of the correlation, if any, between Twitter sentiment and voting results within the Cosmos ecosystem.

These tasks are designed to offer a comprehensive perspective on the interaction between social media and the Cosmos blockchain, thereby contributing to the broader understanding of the dynamic interplay between digital technologies and financial ecosystems.

4. RESEARCH APPROACH

The selection of the Twitter platform as a data source is underpinned by several considerations. Primarily, Twitter is extensively utilized by members of the cryptocurrency community, rendering it an optimal medium for examining the interplay between social media and blockchain initiatives. Moreover, Twitter's API offers robust tools for the systematic collection and processing of data, thereby enhancing the reliability and precision of our analysis. Our research is delineated as follows (Figure 4.1).

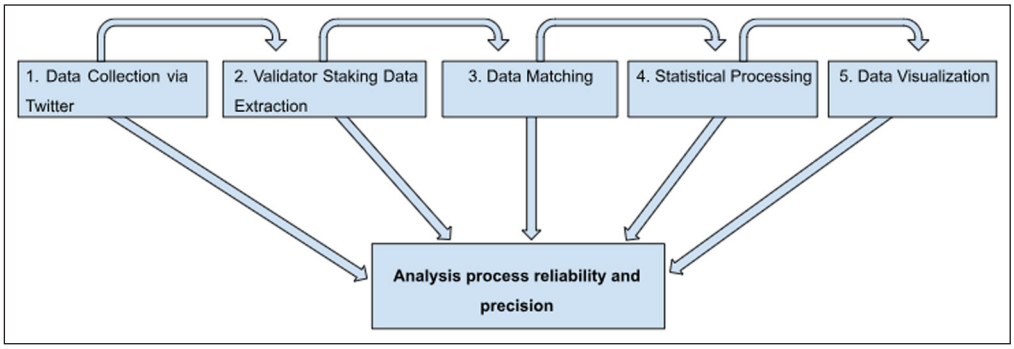

Figure 4.1 Research Process Structure.

Through a holistic approach and the deployment of advanced analytical tools, our research furnishes a profound comprehension of the nexus between social media activity and blockchain project dynamics.

5. RESULTS AND ANALYSES

5.1 RELATIONSHIP, PERCENTAGE OF STACKED TOKENS, INFLATION, AND APR

As part of our research, we assessed the three-dimensional relationship between the following key metrics in the Cosmos blockchain protocol network: token staking percentage (staked_ratio), inflation rate, and APR. Within the blockchain network, 'inflation' refers to the programmed increase in the total supply of tokens over time. This is a strategic mechanism in Cosmos designed to encourage participation and maintain network security. Unlike conventional economic inflation, which is often seen as a decrease in purchasing power, inflation in the blockchain context serves a functional purpose. It incentivizes users to engage in staking by rewarding them with newly created tokens. This dynamic rate of token creation is adjusted based on the staking ratio, ensuring a balanced ecosystem where active participation is rewarded and network integrity is upheld (Everstake, 2023a, b).

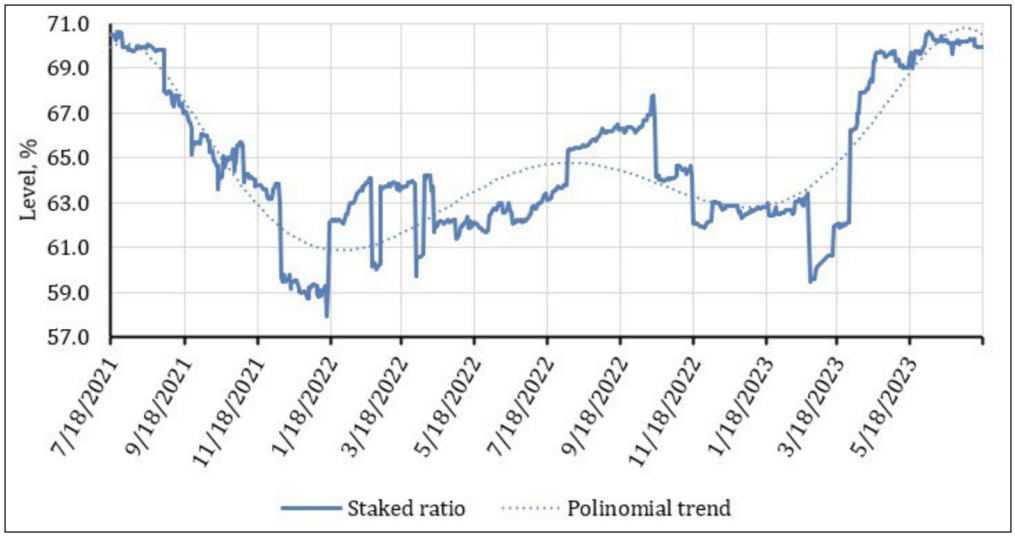

Figure 5.1 Dynamics of changes in staked ratio over time.

According to the insights drawn from Figures 5.1 and 5.2, there's a straightforward relationship between the rate of tokens being staked and the inflation rate within the blockchain network. Specifically, when the staking rate falls below the threshold of 67% during the period from 09.18.21 to 03.18.23 on Figure 5.1, the inflation rate experiences an uptick during the same period. Conversely, an increase in the staking rate above 67% during the period from 03.18.23 to 05.18.23 on Figure 5.1 leads to a decrease in the inflation rate during the same period as shown in Figure 5.2.

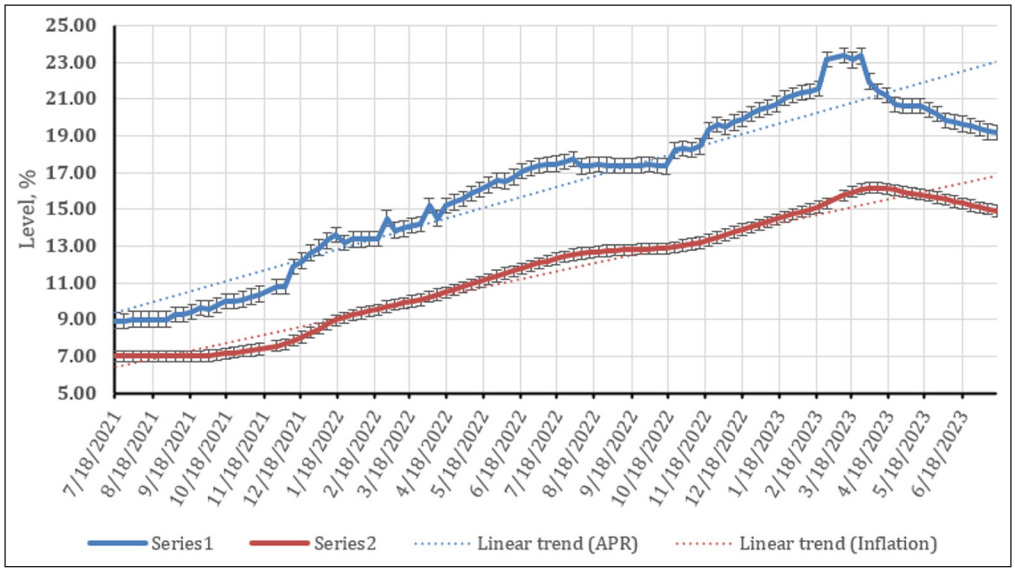

Figure 5.2 Dynamics of changes in APR and inflation over time.

The study also uncovers a directly proportional relationship between the Annual Percentage Rate (APR) and the inflation rate. Within the blockchain protocol for ATOM, the APR is determined by a formula that takes into account both the inflation rate and the staking ratio. The formula is given as Equation 5.1:

$$APR = inflation \div staked\ ratio \times NetFactor \tag{5.1}$$

Here, the variables are defined as follows:

APR: Annual Percentage Rate

inflation: Current inflation rate

staked ratio: Percentage of tokens currently staked

NetFactor: A constant factor, defined as 90%, which adjusts the APR by reducing the total value by 10%.

This empirical evidence lends credence to the initial hypothesis, suggesting a direct correlation between APR and the inflation rate. Importantly, the ATOM blockchain protocol sets the inflation rate within a range of 7% to 20%. Therefore, any variations in APR are exclusively attributed to changes in the inflation rate and staking ratio; other external or internal variables do not impact this particular metric.

Based on the analysis of the data presented in Figure 5.2, we can conclude that there is a weak inverse correlation between the percentage of token staking and APR with a coefficient of –0.04. The graph shows that even with significant changes in the staking percentage, the APR can remain relatively stable or vary in a different direction. This could be due to the fact that the APR depends not only on the staking percentage but also on the inflation rate, which in turn can be subject to its own dynamic changes. However, a strong direct correlation with a coefficient of 0.98 is observed between inflation rate and APR.

Overall, our analysis highlights the importance of understanding the relationship between key metrics when analyzing the blockchain ecosystem. The most important is to understand the relationship between inflation rate and staking percentage, as these parameters directly affect such an important metric as APR.

Based on our research, we confirmed the hypothesis that there is a relationship between token staking percentage, inflation, and the APR in the Cosmos blockchain ecosystem. The analysis showed that when the token-stacking percentage drops to the 67% mark, inflation starts to rise. In the context of the ATOM protocol, inflation varies between 7% and 20%. A change in parameters such as token staking or inflation directly affects the APR. For example, the correlation between inflation rate and APR is 98%, indicating that these metrics are closely related.

5.2 RELATIONSHIP BETWEEN TOTAL STAKING VOLUME AND ATOM PRICE

In addition to the previous analysis, we examined the relationship between total staking volume and the price of the ATOM token in the Cosmos blockchain ecosystem.

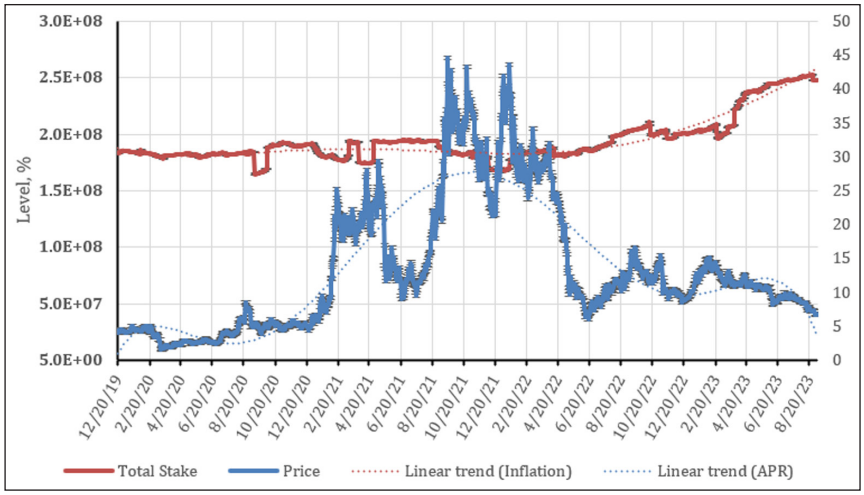

Figure 5.3 Dynamics of total stake and ATOM price change over time.

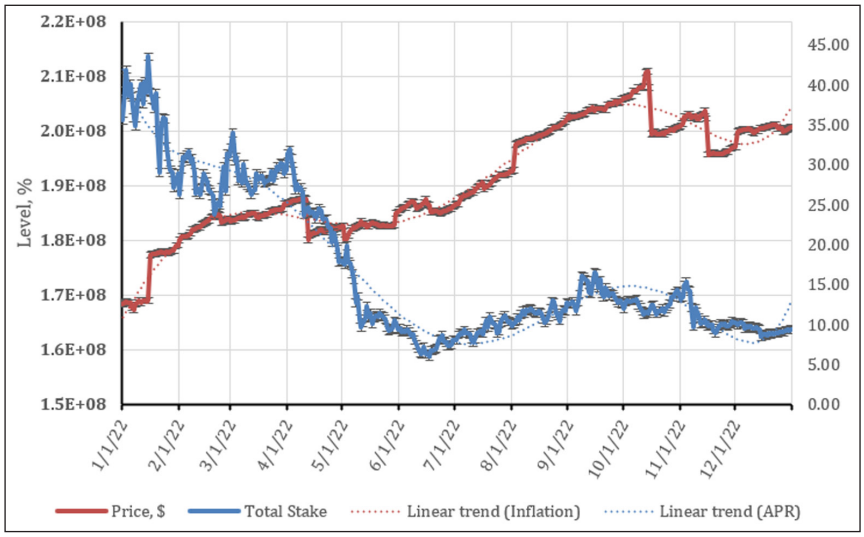

Figure 5.4 Dynamics of total stake and ATOM price change for the period of 2022.

In a visual analysis of the charts (Figure 5.3), we find that the total staking volume and the ATOM price tend to increase over time. The total amount of staked funds increased strongly in April 2023, which can also be linked to the fall in inflation in the charts in the last section. In the price chart for the period described, no particular changes are observed.

If we limit our analysis to the data for a single year, taking the year 2022 as a reference (Figure 5.4), we can observe a decrease in prices from the beginning of the year until the summer of 2022, after which the price becomes more stable. Concurrently, the value of the total stake consistently increases throughout the interval over the course of the year.

In our correlation analysis, we found that there is a weak inverse relationship between total staking volume and ATOM price, with a correlation coefficient of –0.18. This may imply that as total staking volume increases, ATOM price tends to decrease, and vice versa. However, given the weakness of this relationship, this trend may be unstable and subject to change due to other factors.

The Pearson correlation coefficient between ATOM price and total stake for 2022 (Figure 5.4) is approximately –0.65. This indicates a moderate inverse relationship between these two variables: when ATOM price increases, total stake tends to decrease, and vice versa.

Since the ATOM blockchain protocol has a condition that delegates cannot make an unstake from the time of staking their savings for 21 days, consider the correlation with a shift of 21 days (Figure 5.5).

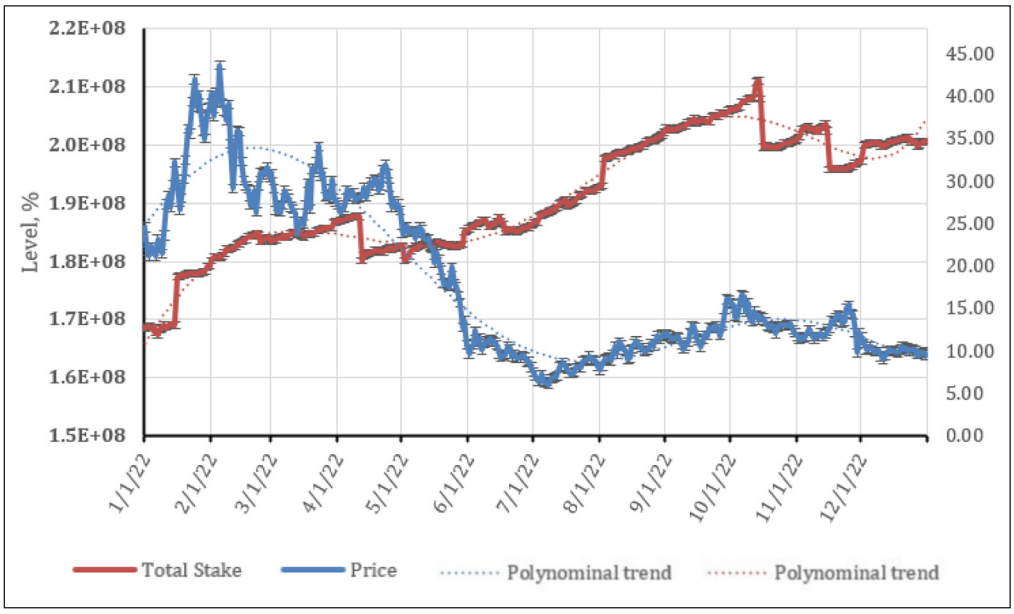

Figure 5.5 Dynamics of total stake change (21-day shift) and ATOM price change over the period 2022.

The correlation between ATOM price and total stake, taking into account the shift of total stake data 21 days into the future, is approximately –0.53. As the correlation became weaker, we decided to calculate a rolling correlation with a window of 30 days (Figure 5.6).

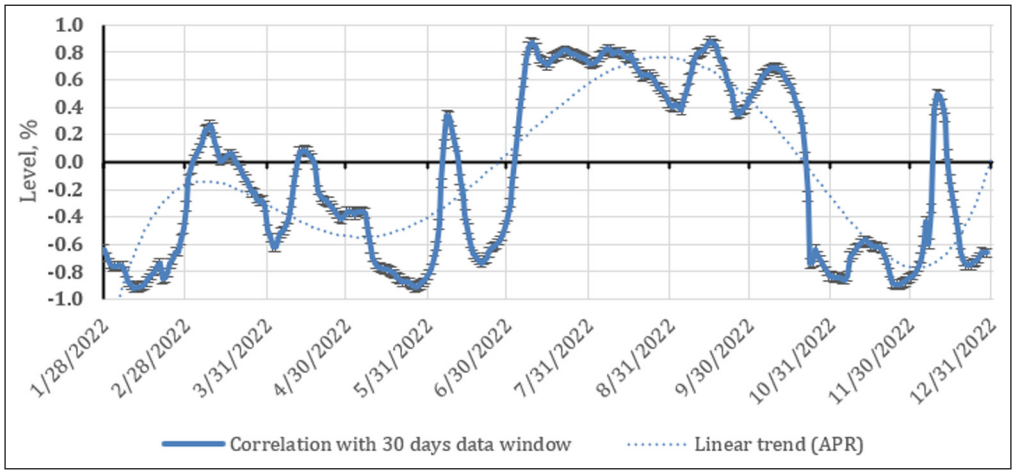

Figure 5.6 Dynamics of change in the correlation with 30 days data window of total stake and ATOM price change over the period of 2022.

Correlation with 30 days data window is a technique that measures the degree of relationship between two variables over time. In this case, we see that the correlation ranges from –0.8 to 0.8, indicating a moderate and almost fairly stable negative relationship between ATOM price and total stake.

To confirm the obtained results, we will similarly calculate the data for the whole period with a window of a month and a quarter.

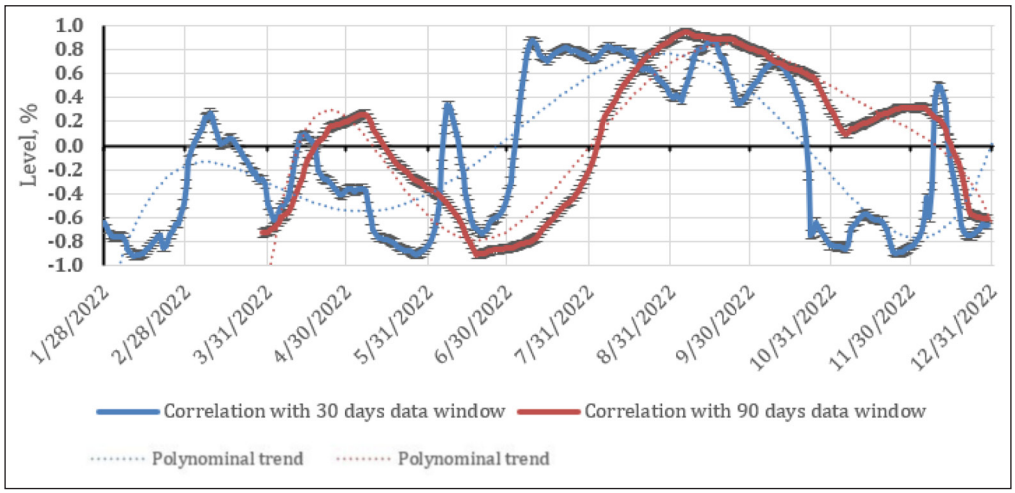

Figure 5.7 Evolution of the correlation (with a monthly and quarterly window) of total stake and ATOM price change over the period 2022.

This chart (Figure 5.7) shows the correlation between ATOM price and total stake over two windows: 30 days (green line) and 90 days (red line), which roughly corresponds to one quarter.

Both correlation windows show that there is a moderate negative correlation between ATOM price and Total stake. This means that during the whole period considered, when ATOM price increased, Total stake tended to decrease, and vice versa.

It is important to note that the correlation with a 90-day window provides a smoother line, indicating less sensitivity to short-term fluctuations, compared to the correlation with a 30-day window.

Overall Analysis: There is a weak inverse relationship between total staking volume and ATOM price with a correlation coefficient of –0.18.

Analysis for Year 2022: The correlation for this period is –0.65, indicating a moderate inverse relationship.

Analysis with 21-Day Delay: The correlation with the 21-day forward bias of the total stake data is approximately –0.53.

Correlation with 30-Day Window for Year 2022: Varies from –0.8 to 0.8, indicating a moderate and almost fairly stable negative relationship.

Analysis with a monthly and quarterly window shows a moderate negative correlation between ATOM price and total stake, with a smoother line when using a 90-day window.

Thus, all the data suggest that there is a moderate inverse correlation between ATOM price and staking volume. This correlation may indicate a tendency for ATOM price to decrease with increasing staking volume and vice versa. However, it should be taken into account that this relationship may be unstable and change under the influence of other factors.

5.3 THE IMPACT OF SOCIAL MEDIA ON BLOCKCHAIN VOTING OUTCOMES

Social media has emerged as a powerful tool for the dissemination of information and the formation of public opinion, especially in rapidly evolving technological landscapes like blockchain. The advent of blockchain-based voting systems has introduced a new dynamic to governance, allowing community members to vote on proposals in a transparent and secure manner. Given that these blockchain systems often handle decisions that can influence the future trajectory and even the value of the respective ecosystems, understanding the influence of social media on voting outcomes becomes paramount.

In this section, we aim to explore this dynamic by focusing not just on one, but multiple proposals within different blockchain systems, starting with Proposal #797 in the Cosmos Hub as a case study. Social media sentiment, especially on platforms like Twitter, can act as a barometer for public sentiment and potentially even predict the outcomes of these proposals. By examining multiple proposals, we aim to draw generalized conclusions about the overarching trends and effects of social media on blockchain-based decision-making processes.

5.3.1. Voting 797 sentiment score of tweets

Social media plays a significant role in shaping public opinion and can have an important impact on the decision-making process within blockchain systems. In this research, we conducted a sentiment analysis of tweets to gauge public opinion on the proposal.

Proposal #797 offers to increase from 175 to 180 the number of validators in Cosmos Hub.

As part of our research, we analyzed over 100,000 tweets related to Cosmos Hub and Proposal #797. Among them, we identified and scrutinized tweets from key influencers and blockchain experts who have thousands of followers and whose opinions are often considered authoritative in the community.

Tweets were also selected based on their popularity, taking into account the number of retweets, likes, and impressions. This allowed us to gauge not only the sentiments of individuals, but also the broader audience reaction to Proposal #797.

Using such a funnel, we successfully filtered 143 tweets from the existing tweets that related to Proposal #797. Below is a graph (Figure 5.8) of the sentiment distribution among these particular tweets.

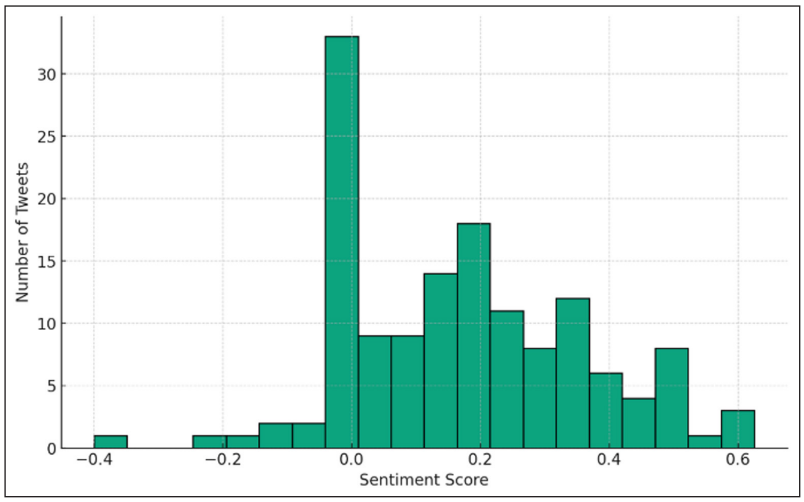

Figure 5.8 Distribution of sentiment score for tweets related to the vote on Proposal #797.

The average sentiment for tweets related to the vote on Proposal #797 is approximately 0.1734. This value indicates an overall neutral or slightly positive coloring of the discussion. Further categorized into positive, neutral, and negative sentiment. For this purpose we set the threshold for neutral sentiment from –0.1 to 0.1, for positive sentiment from 0.1 to 1 and for neutral sentiment from –1 to –0.1 (Figure 5.9).

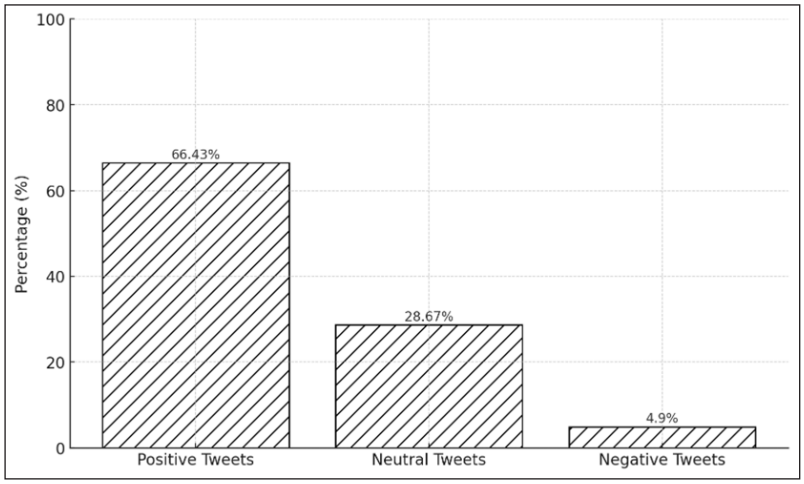

Figure 5.9 Distribution of sentiment classification for tweets related to the vote on Proposal #797.

The histogram of sentiment distribution shows the following:

Positive Tweets (66.43%): The majority of tweets had a positive sentiment, reflecting general support for the proposal.

Neutral tweets (28.67%): A significant proportion of tweets were neutral, perhaps reflecting a neutral or reserved reaction to the proposal.

Negative tweets (4.90%): A small proportion of tweets were negative, indicating limited opposition to the proposal.

This distribution is consistent with the poll result, where 86.07% voted FOR.

Next, let's look at the distribution of tweets by categories such as number of retweets, likes, quotes, bookmarks and impressions (Figures 5.10[a], 5.10[b], 5.11[a]):

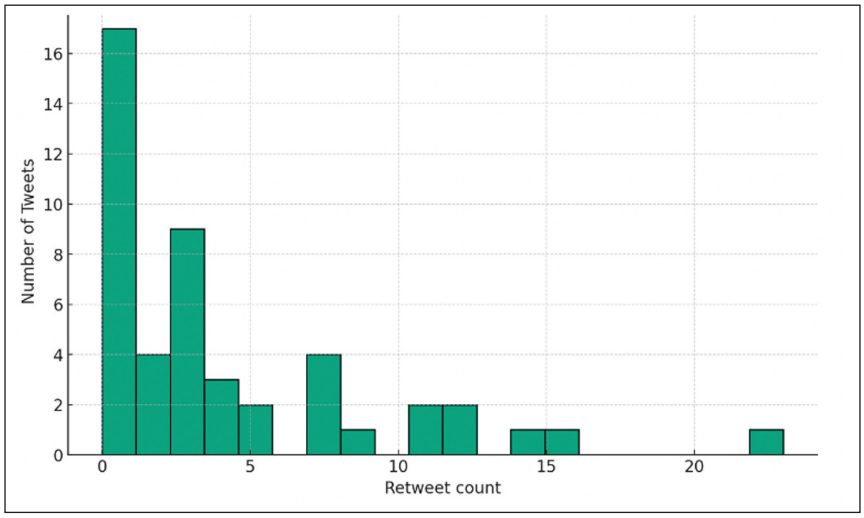

Figure 5.10[a] Distribution of retweets for tweets related to the vote on Proposal #797.

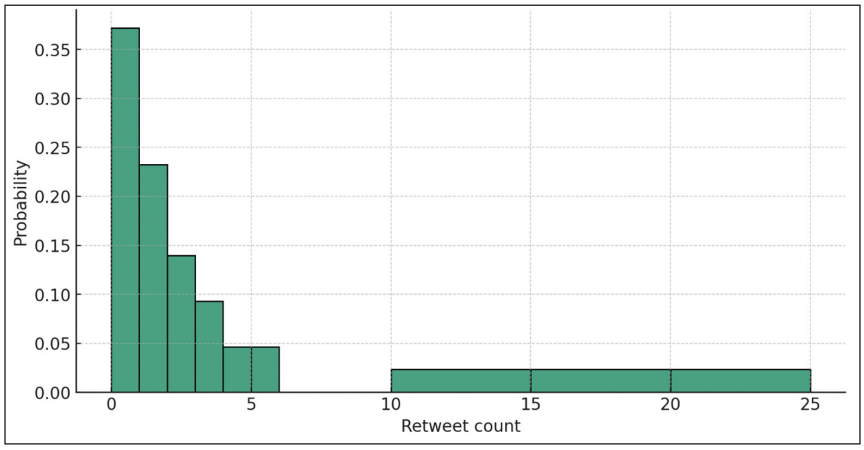

Figure 5.10[b] Normalized distribution of retweets for tweets related to the vote on Proposal #797.

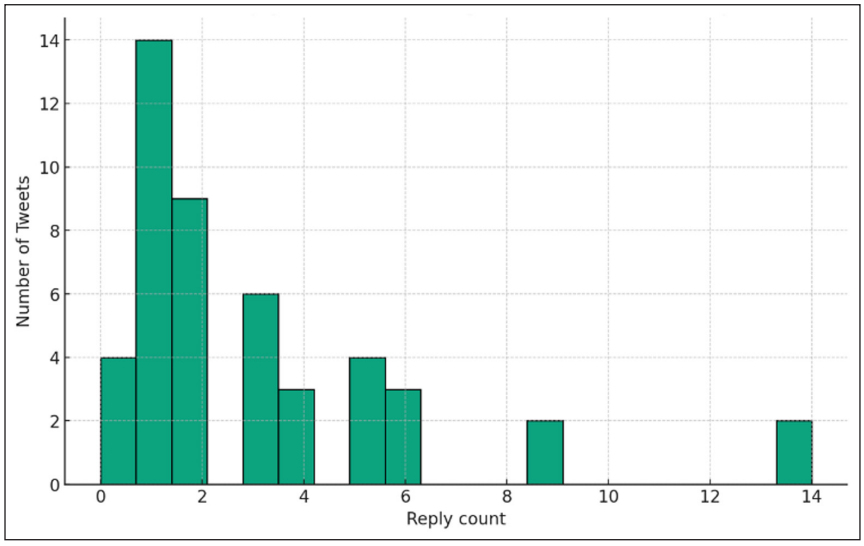

Figure 5.11[a] Distribution of reply for tweets related to the vote on Proposal #797.

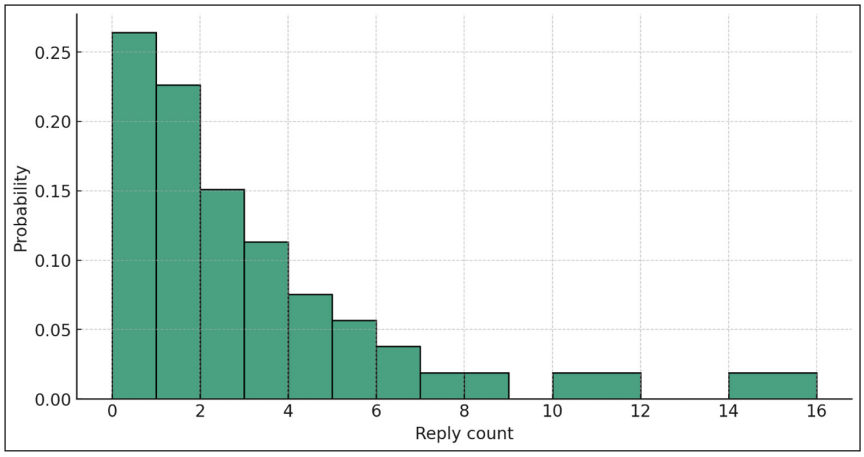

Figure 5.11[b] Normalized distribution of reply for tweets related to the vote on Proposal #797.

The distribution of retweets and replies on Twitter reveals an interesting pattern: the majority of tweets receive a relatively small number of retweets, averaging around 4.23 per tweet. Additionally, there is a significant number of tweets that go unnoticed, garnering zero likes. However, there are a few outliers that manage to amass more than 100 retweets, indicating that while most tweets have limited reach, some break through and achieve widespread attention. Similarly, on a normalized graph (Figure 5.11[b]) along the Y-axis, a similar distribution pattern can be observed. However, here it is evident that the majority of tweets have a number of replies equal to zero.

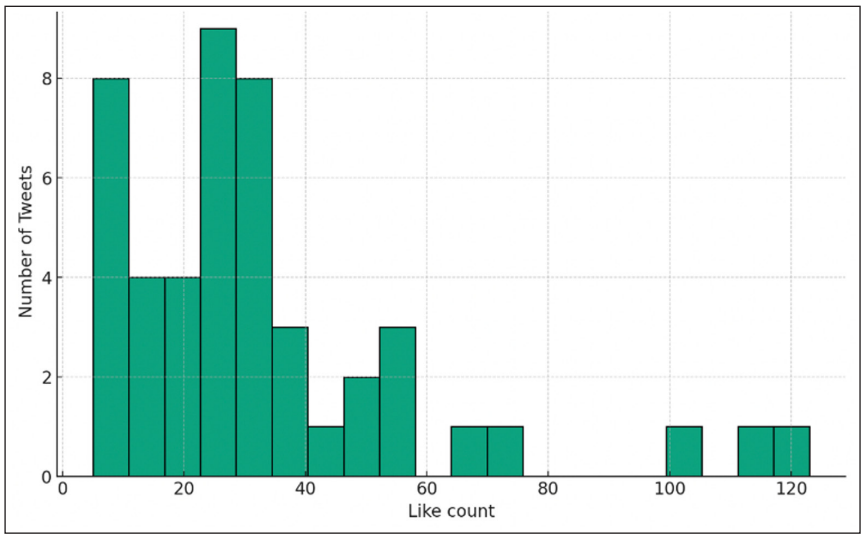

Figure 5.12[a] Distribution of likes for tweets related to the vote on Proposal #797.

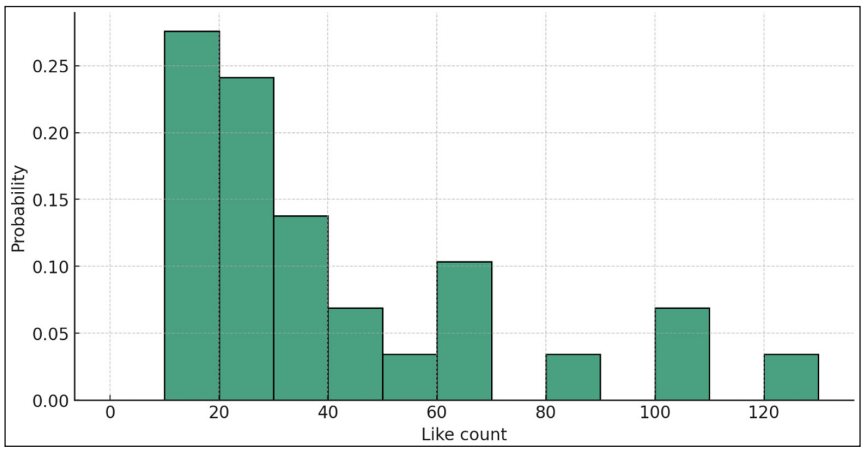

Figure 5.12[b] Normalized distribution of likes for tweets related to the vote on Proposal #797.

Likes: Likes follow a similar distribution, with most tweets having a relatively small number of likes (Figures 5.12[a], 5.12[b]).

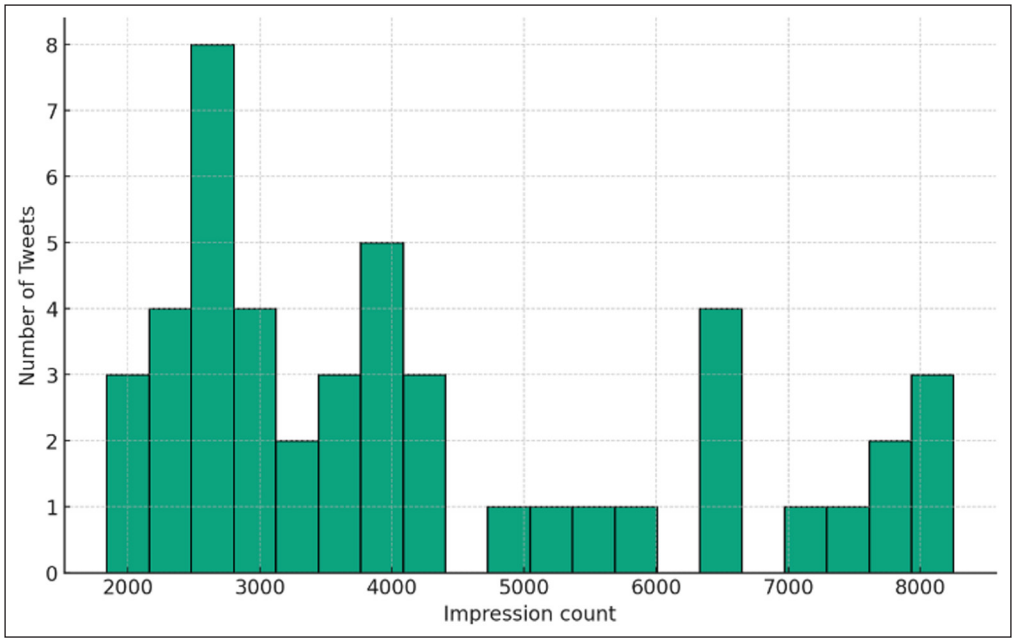

Figure 5.13[a] Distribution of impressions for tweets related to the vote on Proposal #797.

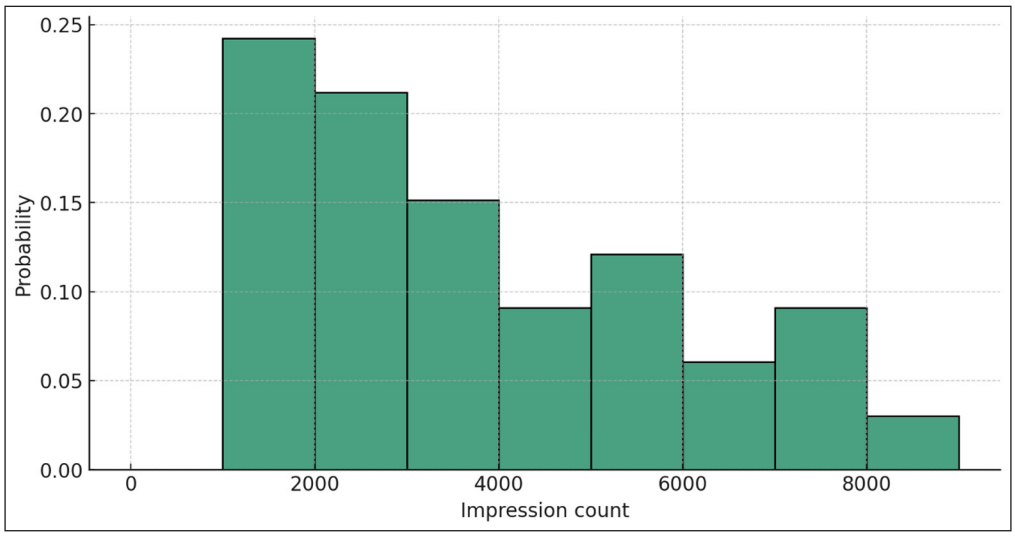

Figure 5.13[b] Normalized distribution of impressions for tweets related to the vote on Proposal #797.

Impressions: Impressions have a more even distribution, indicating diversity in the number of impressions between different tweets (Figures 5.13[a], 5.13[b]).

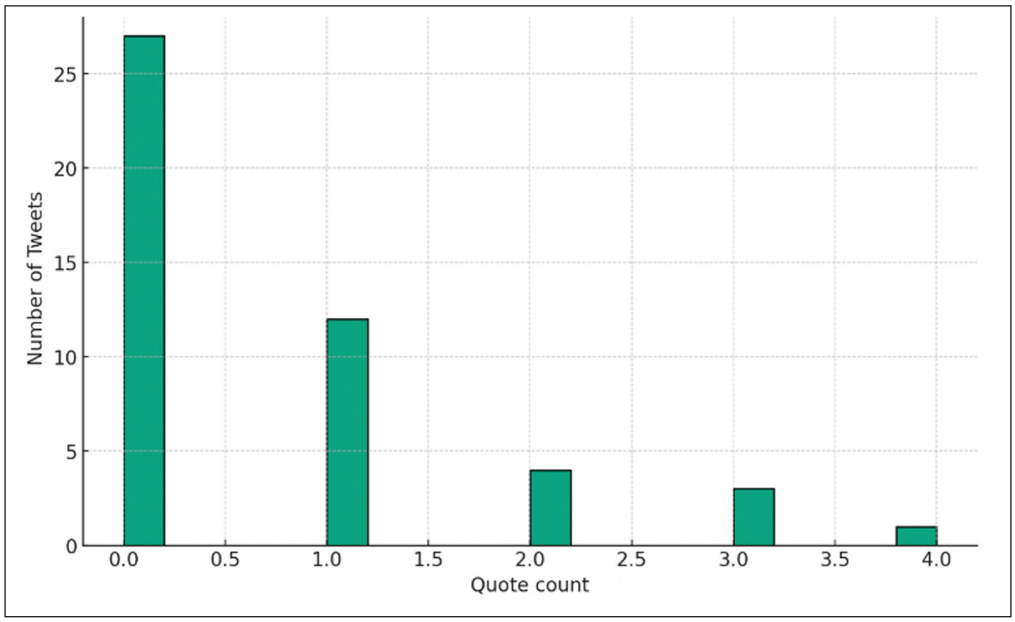

Figure 5.14 Distribution of quotes for tweets related to the vote on Proposal #797.

Quotes: These metrics also follow a similar distribution, with most tweets having low values (Figure 5.14).

Based on the analysis of over 100,000 tweets related to Cosmos Hub and Proposal #797 from key influencers and the general public, the following conclusions can be drawn.

Sentiment Towards Proposal #797:

The average sentiment score of 0.1734 indicates a generally neutral to slightly positive view toward the proposal, mirroring the 86.07% 'FOR' vote in the actual poll. This strong correlation between sentiment and voting behavior suggests that social media sentiment can be a reliable indicator of community perspective.

Engagement Metrics:

The similar distribution patterns in retweets, likes, and quotes indicate a level of uniformity in how tweets, regardless of sentiment, engage the audience. This could imply that the Twitter community is equally willing to engage with differing viewpoints on Proposal #797.

Sentiment Categories (Table 5.1):

- Positive Tweets: Making up 66.43% of the total, the high percentage of positive tweets demonstrates a broad base of support for the proposal.
- Neutral Tweets: At 28.67%, the proportion of neutral tweets may represent a section of the community that is either indifferent or awaiting more information before forming a strong opinion.
- Negative Tweets: Comprising just 4.90% of the tweets, negative sentiment was minimal, corroborating the overwhelming support indicated in the poll.

Audience Reach (Table 5.2):

The impressions, which were more uniformly distributed both on standard and normalized graphs, suggest that tweets about Proposal #797 reached a broad and varied audience. This adds depth to the understanding of engagement metrics. It shows that the issue garnered widespread discussion but did not consistently receive high levels of active engagement, such as retweets or likes.

Overall Community Involvement (Table 5.3):

The general consistency between high positive sentiment, a significant number of neutral tweets, and the poll results indicates an engaged and generally supportive community. However, the varied engagement metrics hint that this support may not be universally intense, as the community appears to engage similarly with tweets of differing sentiments.

Avg. sentiment	0.1734
Positive tweets	66.43%
Neutral tweets	28.67%
Negative tweets	4.90%

Table 5.1 Analyzing sentiment of tweets related to Proposal #797.

Avg. number of retweets	4.23
Avg. number of answers	3.57
Avg. number of likes	41.21
Avg. number of citations	0.78
Avg. number of impressions	4521.94

Table 5.2 Interaction analysis of tweets related to Proposal #797.

Votes 'FOR'	86.07% (101,237,334 ATOM)
Votes 'AGAINST'	13.92% (16,374,473 ATOM)
VETO votes	0.01% (6,738 ATOM)
Abstentions	12.53% (16,847,684 ATOM)
Turnout	54.7% (134,466,229 ATOM)

Table 5.3 Comparison with voting results of Proposal #797.

Positive response: The analysis confirms a positive response to the proposal on Twitter, which is consistent with the high level of support in the voting results.

Engagement: Tweets show active engagement with users, which may indicate widespread support for the proposal among active users.

Consistency of online community: The overall positive sentiment according to the voting results indicates consistency between online community and formal voting. It is important to note that our analyses are limited to the data that was available in the tweets. Some community members may have expressed their opinions through other channels or may have chosen not to express them publicly at all. Nevertheless, our results indicate that social media analysis can serve as an important tool for understanding community sentiment and predicting voting outcomes. This can help community members better understand and take into account different perspectives when making decisions.

5.3.1.2 Vote 797, impact of voting results on economic performance

Next, consider the impact of voting results on the economic performance of the ATOM blockchain.

During the voting period running from May 1, 2023, to July 1, 2023, we have seen some momentum in the economic performance of the ATOM blockchain (Figures 5.15–5.16).

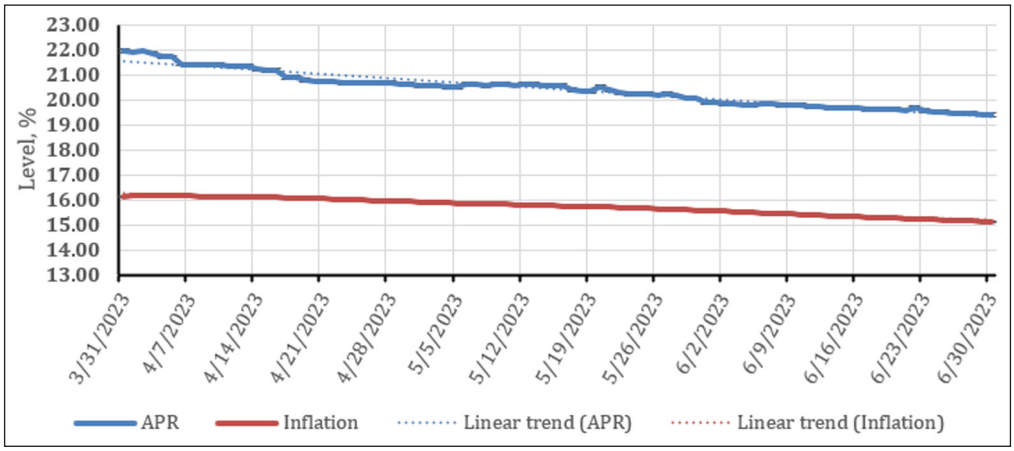

Figure 5.15 Dynamics of changes in APR and inflation over time.

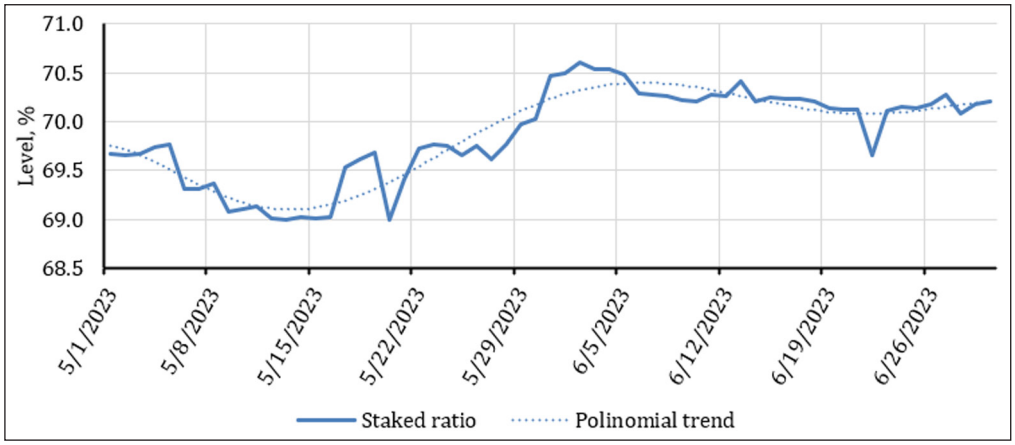

Figure 5.16 Dynamics of changes in staked ratio over time.

One of the key metrics we analyzed was the staked ratio—the percentage of total tokens that are currently participating in staking. After increasing the number of validators as a result of voting, the staked ratio showed a slight increase. This indicates that the new validators have successfully attracted additional resources in the form of staked tokens.

This increase in the staked ratio also had an impact on another important metric, Inflation. As a result of the increase in the staked ratio we observed a moderate decrease in the inflation rate. This is consistent with the mechanisms of the protocol, according to which an increase in the share of staked tokens leads to a decrease in inflationary pressure.

The APR, or annual percentage rate that participants receive for participating in staking, also depends on the inflation rate and the proportion of staked tokens.

According to the formula 5.1, an increase in staked ratio and a decrease in inflation leads to a change in APR.

Thus, during the voting period, we observed a complex interplay of economic indicators, where each change in one indicator triggers a chain of changes in others. These dynamics emphasize the close relationship between voting, validator activity and the blockchain economic environment.

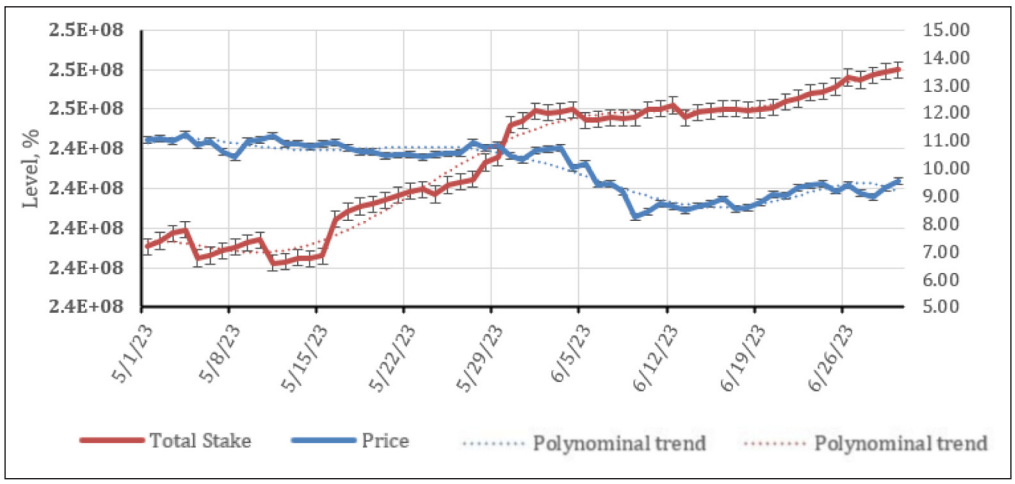

Figure 5.17 Dynamics of total stake and ATOM price change.

The graphs (Figure 5.17) above show the changes in total stake and ATOM price during the voting period from May 1, 2023, to July 1, 2023.

1. Total Stake: This graph shows the total volume of tokens that were staked on the blockchain during the specified period. As can be seen, the total stake shows a steady growth throughout the period. This is likely due to the increase in the number of post-vote validators, which resulted in additional resources for staking.
2. ATOM Price: This chart shows the changes in the price of the ATOM token during the period in question. Here we can see that the ATOM price also shows a relatively stable state during this period. The increase in the number of validators may have contributed to some changes.

Based on the analysis of the economic performance of the ATOM blockchain during the voting period from May 1, 2023, to July 1, 2023, the following conclusions can be drawn.

Changes in Staking: There was a slight increase in the staked ratio following the increase in the number of validators as a result of voting. This supports the hypothesis that the new validators helped to attract additional resources to the blockchain.

Impact on Inflation: The increase in the staked ratio led to a moderate decrease in the inflation rate, which is consistent with the mechanisms of the blockchain protocol ATOM.

APR dynamics: The Annual Percentage Rate (APR) for staking participants has also undergone changes due to fluctuations in staked ratio and inflation.

Total Stake: The 'total stake' graph showed a steady increase over the entire period analyzed, indicating active participation of participants in staking, especially after the vote.

ATOM Price Dynamics: Despite changes in the blockchain structure and an increase in the number of validators, the price of the ATOM token has remained relatively stable. This suggests that the factors influencing the price were more complex than just changes in the validator ecosystem.

5.3.2 Voting 88 evaluating the sentiment of tweets

To gauge public opinion on Proposal #88 to raise the community pool rate from the current 2% to 10%, we conducted a sentiment analysis of tweets.

The graph below shows the distribution of sentiment for tweets related to the vote. We can see that the majority of tweets have a positive sentiment, which is consistent with the overwhelming majority of 'FOR' votes in the voting results. However, there are also a significant number of tweets with neutral and negative sentiment, indicating that there is a diversity of opinion and discussion around this proposal (Figure 5.18).

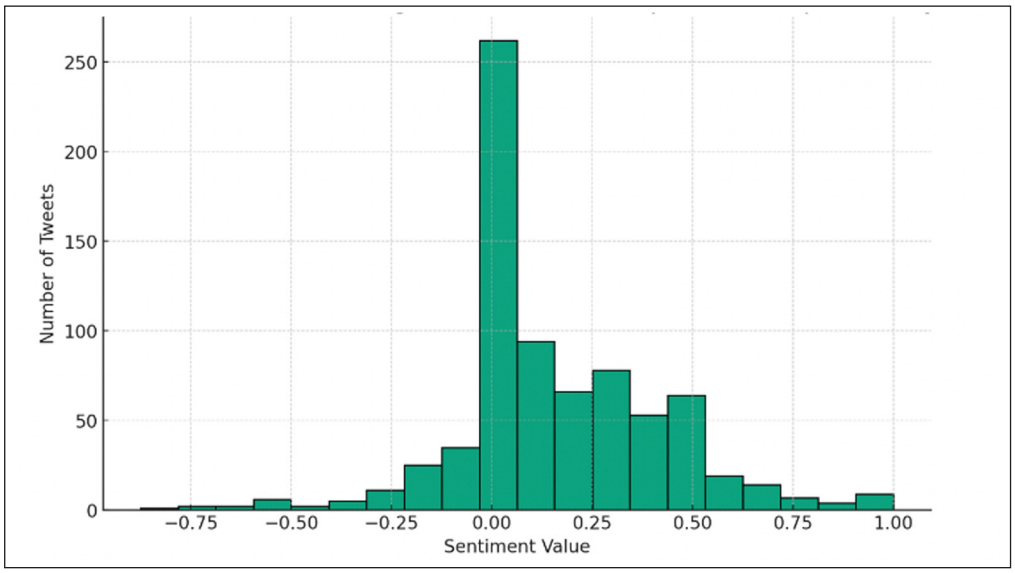

Figure 5.18 Distribution of sentiment score for tweets related to the vote on Proposal #88.

The average sentiment for tweets related to voting is 0.154 on a scale of –1 to 1. This value indicates an overall positive sentiment in tweets related to this vote.

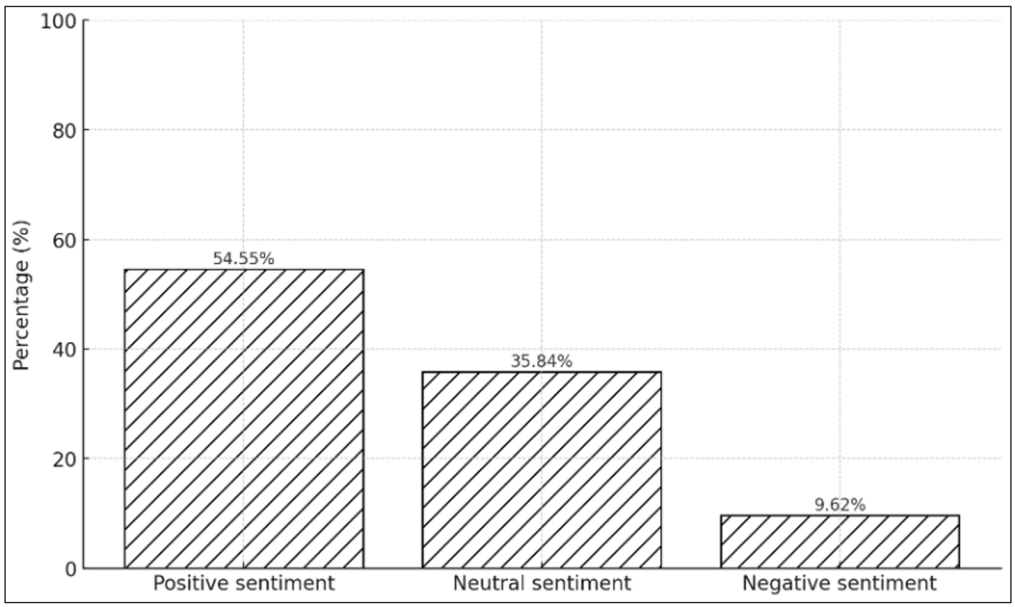

Figure 5.19 Distribution of sentiment classification for tweets related to the vote on Proposal #88.

The distribution chart above (Figure 5.19) shows the sentiment classes for tweets related to voting:

For this purpose, we arranged the threshold for neutral sentiment from –0.1 to 0.1, for positive sentiment from 0.1 to 1 and for neutral sentiment from –1 to –0.1.

Positive sentiment: 54.55% of tweets

Neutral sentiment: 35.84% of tweets

Negative sentiment: 9.62% of tweets

This distribution reflects an overall positive attitude towards voting, but also indicates some neutral and negative views.

Next, let's look at the distribution of tweets by categories such as number of retweets, likes, quotes, bookmarks, and impressions.

Distribution of the number of retweets.

Most average positive tweets have less than 10 retweets (Figures 5.20[a], 5.20[b]).

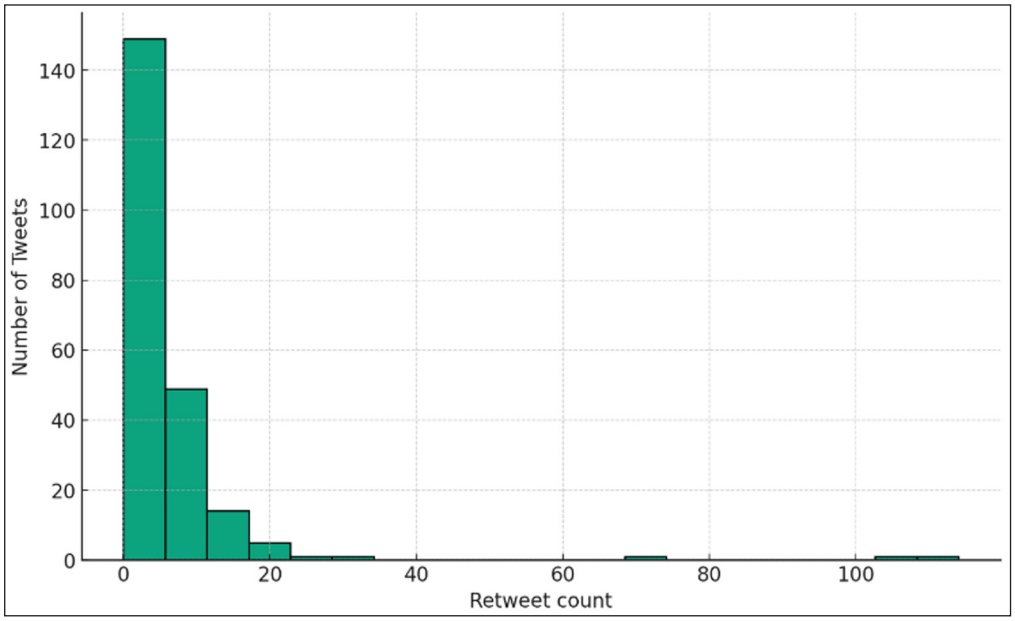

Figure 5.20[a] Distribution of retweets for tweets related to the vote on Proposal #88.

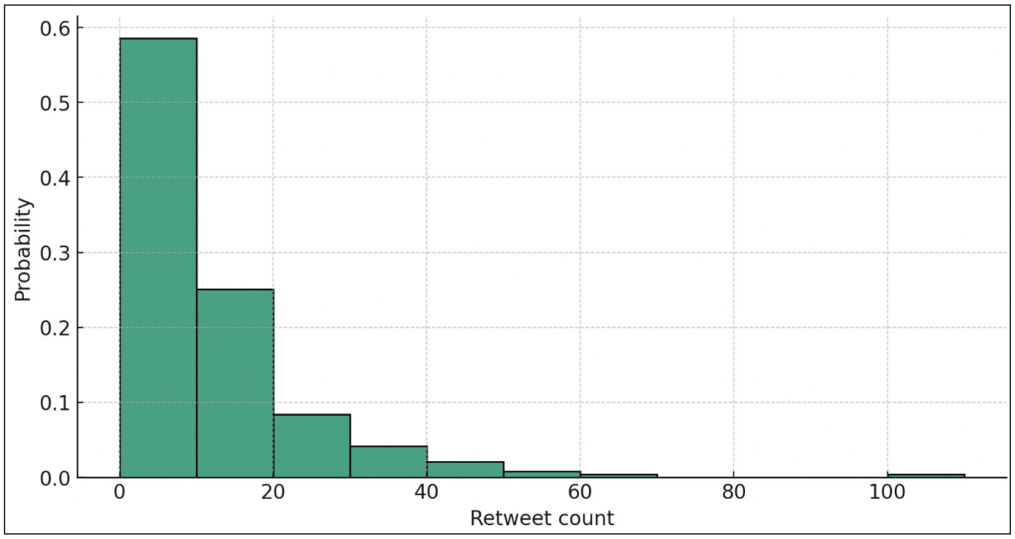

Figure 5.20[b] Normalized distribution of retweets for tweets related to the vote on Proposal #88.

Distribution of the number of replies: Most tweets have less than 10 replies (Figures 5.21[a], 5.21[b]).

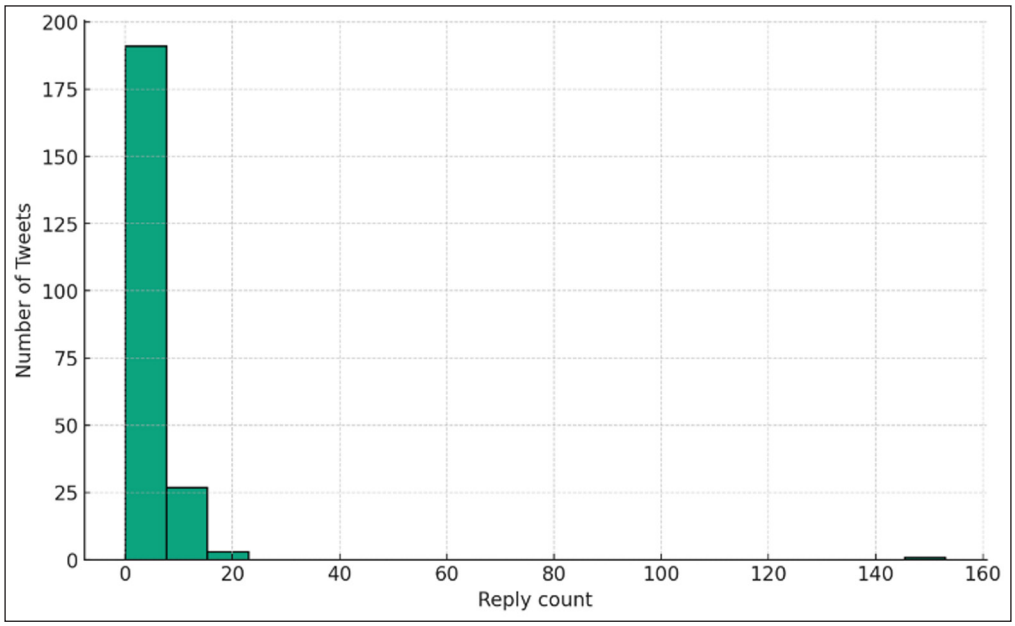

Figure 5.21[a] Distribution of replies for tweets releated to the vote on Proposition #88.

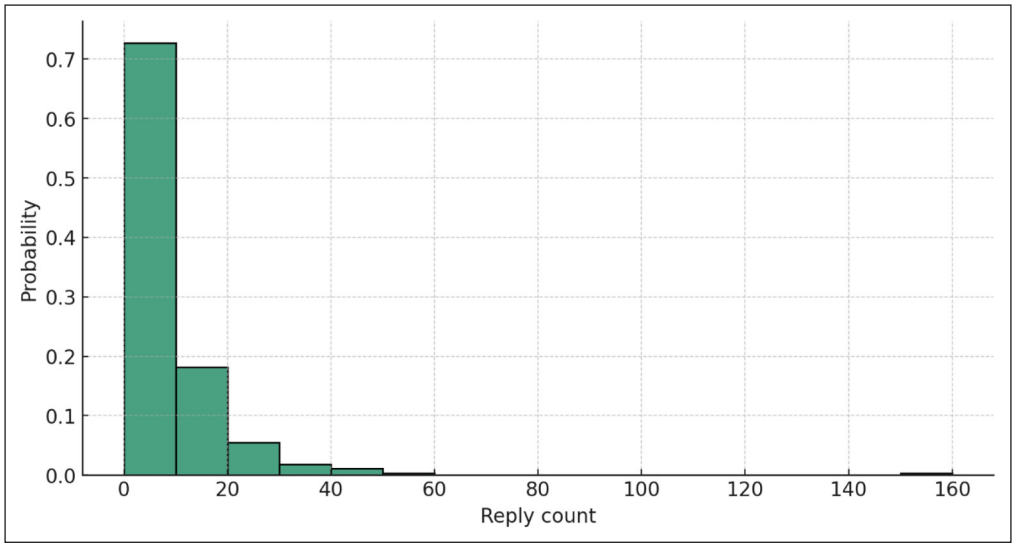

Figure 5.21[b] Normalized distribution of replies for tweets related to the vote on Proposal #88.

Distribution of the number of likes: Most tweets have less than 50 likes (Figures 5.22[a], 5.22[b]).

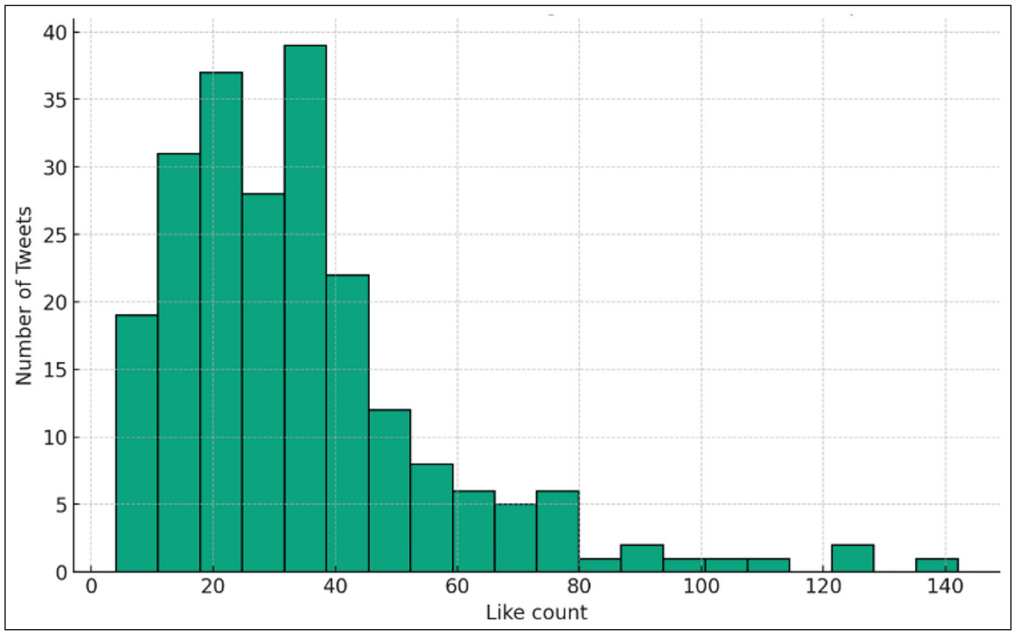

Figure 5.22[a] Distribution of likes for tweets related to the vote on Proposal #88.

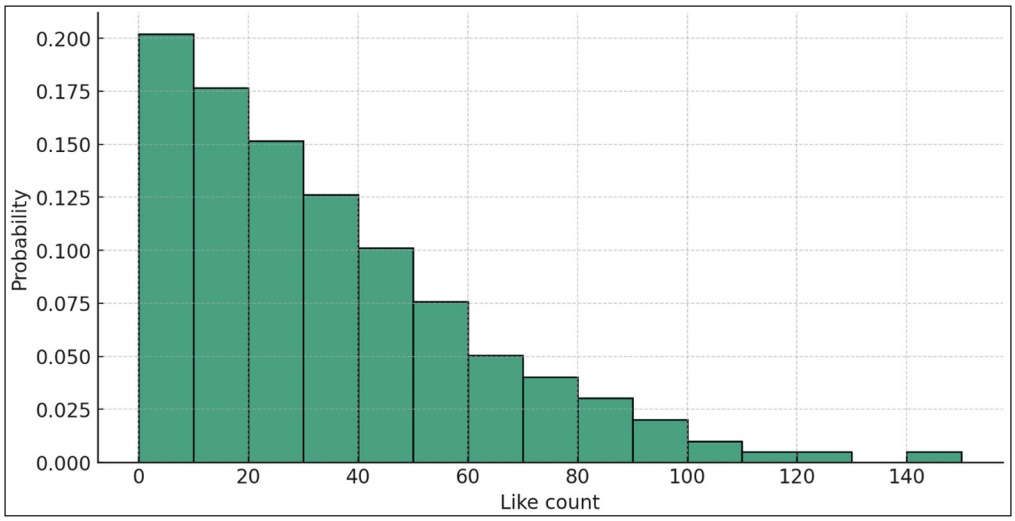

Figure 5.22[b] Normalized distribution of likes for tweets related to the vote on Proposal #88.

Distribution of the number of quotes.

Very few tweets have been quoted (Figure 5.23).

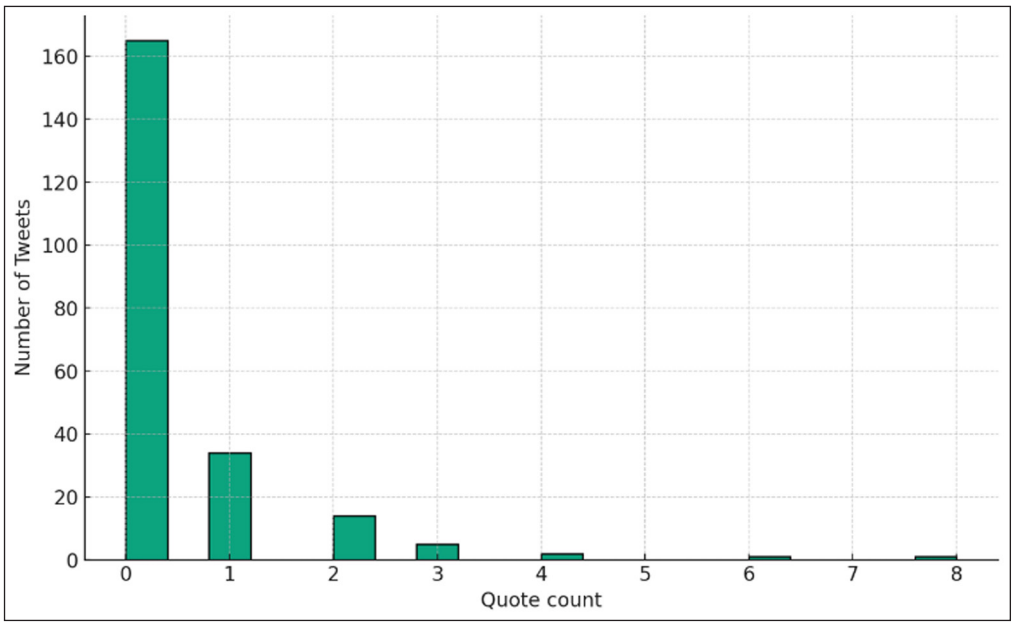

Figure 5.23 Distribution of quotes for tweets related to the vote on Proposal #88.

Distribution of number of impressions: Most tweets have less than 5,000 impressions (Figures 5.24[a], 5.24[b]).

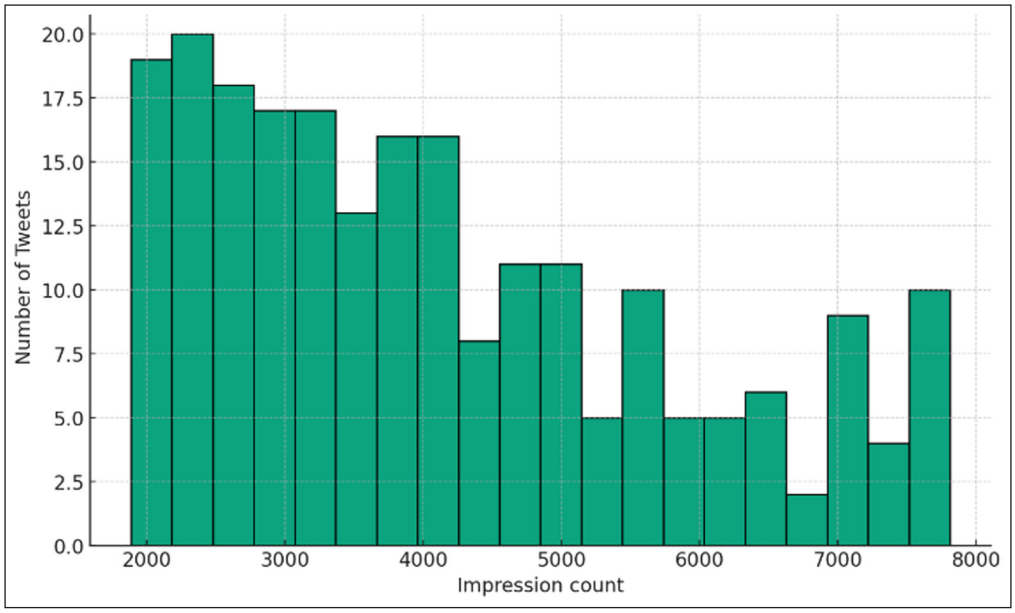

Figure 5.24[a] Distribution of impressions for tweets related to the vote on Proposal #88.

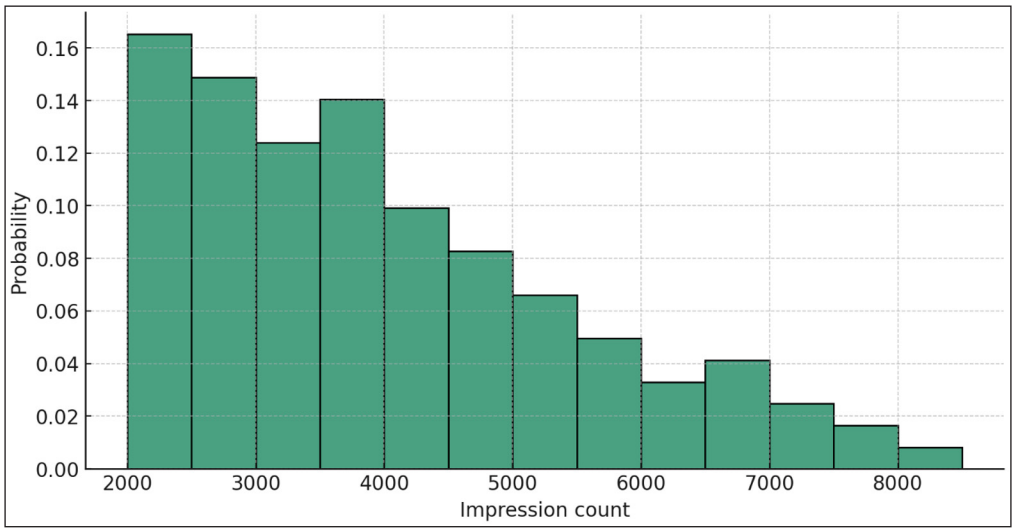

Figure 5.24[b] Normalized distribution of impressions for tweets related to the vote on Proposal #88.

Average values for various metrics in average positive tweets (Table 5.4).

Avg. sentiment	0.154
Positive tweets	54.55%
Neutral tweets	35.84%
Negative tweets	9.62%

Table 5.4 Analyzing sentiment of tweets related to Proposal #88.

As part of researching the discussion of the vote on Proposal #88 ('Increase the Community Pool Tax on the Cosmos Hub') on Twitter, a comprehensive analysis of user sentiment and interaction was conducted. The research included the following key aspects:

Avg. number of retweets	6.18
Avg. number of answers	4.45
Avg. number of likes	34.55
Avg. number of citations	0.45
Avg. number of impressions	4115.19

Table 5.5 Interaction analysis of tweets related to Proposal #88.

Votes 'FOR'	99.27% (116,105,830 ATOM)
Votes 'AGAINST'	0.67% (787,124 ATOM)
VETO votes	0.06% (68,994 ATOM)
Abstentions	1.55% (1,840,742 ATOM)
Turnout	47.7% (118,802,691 ATOM)

Table 5.6 Comparison with voting results of Proposal #88.

Positive Reaction (Table 5.4): The analysis confirms a positive reaction to the proposal on Twitter, which is consistent with the high level of support in the voting results.

Engagement (Table 5.5): Medium positive tweets show active user interaction, which may indicate widespread support for the offer among active users.

Consistency with Twitter discussion (Table 5.6): The overall positive sentiment according to the voting results indicates consistency between online discussion and formal voting.

5.3.2.2 Voting 88, impact of voting results on economic performance

Next, consider the impact of voting results on the economic performance of the ATOM blockchain.

In this analysis, we look at the evolution of staked ratio and inflation over the period from November 1, 2022, to January 31, 2023, which includes the Proposal #88 voting period.

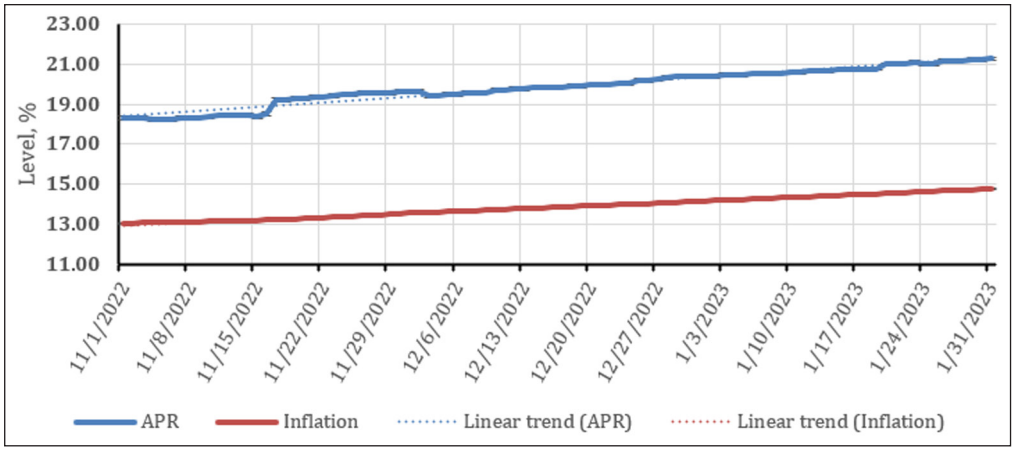

Figure 5.25 Dynamics of change of APR and inflation in time.

Figures 5.25 and 5.26 show that during the voting period there is a slight increase in the staked ratio at the moment after the vote is passed.

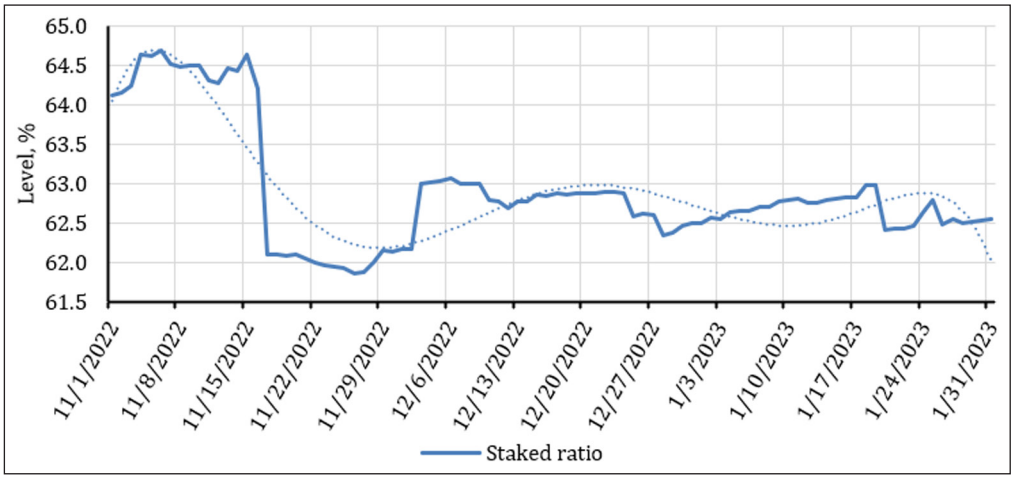

Figure 5.26 Dynamics of change of staked ratio in time.

At the same time, we see that inflation shows an upward trend during this period. This is also in line with our expectations because, as we discussed earlier, inflation is rising as the staked ratio is less than 67%.

Figure 5.25 shows the APR for the period from November 1, 2022, to January 31, 2023. There is a tendency to increase APR in the period under consideration. It may be noted that after the change in community pool tax to 10% APR the growth should be reduced, but in fact this is not shown in the graph.

For the next point of analysis we will look at two key metrics: total staking and the ATOM token price. Both of these metrics were examined for the period from November 1, 2022, to January 31, 2023, which covers the period of the vote on the community tax increase proposal (Figure 5.27).

Figure 5.27 Dynamics of change of total stake and price in time.

Correlation analysis of these two indicators showed a positive relationship, with a correlation coefficient of approximately 0.54. This means that when the total volume of staking increases, the price of ATOM token also tends to increase, and vice versa.

This relationship can be clearly seen in the graph, where both indicators are plotted over time. During the voting period, the total staking volume and ATOM price show an overall upward trend. This can be attributed to an increase in interest in blockchain participation and, by extension, participation in staking in response to the proposal to increase the community tax. An increase in the tax rate may incentivize participants to participate more in staking, which in turn may affect the price of ATOM.

Based on our analysis of the economic performance of the ATOM blockchain for the period from November 1, 2022, to January 31, 2023, covering the Proposal 88 voting period, the following conclusions can be drawn:

Changes in staking: During the voting period, there is an increase in the staked ratio. This increase is particularly pronounced after voting decisions have been made.

Inflation dynamics: The increase in inflation during the analyzed period correlates with the statement that inflation rises when the staked ratio is less than 67%. This means that a smaller volume of tokens in staking leads to higher inflation.

APR trend: Despite the expected decrease in APR growth after the changes in the community pool tax, real data show its continued growth. This indicates the possible influence of other economic or market factors on APR.

Correlation of staking volume and ATOM price: The positive correlation between total staking volume and ATOM price (with a correlation coefficient of 0.54) confirms that when staking participation increases, ATOM price also tends to increase.

5.4 CONCLUSIONS ABOUT THE SOCIAL MEDIA ANALYSIS

Overall, based on our analysis, we can conclude that Twitter activity has a significant impact on various aspects of blockchain project performance, including validator stacking, token price, trading volume, APR, and voting outcomes. These findings open new perspectives for further research on the impact of social media on the performance of blockchain projects.

Online Community Reaction: Interactions and sentiment from Twitter users demonstrate that social media actively reflects the sentiment and preferences of the blockchain community. Discussion of votes on Proposals #797 and #88 (Tables 5.7–5.12) shows a positive trend in line with the results of official votes.

Vote #797:

Avg. sentiment	0.1734
Positive tweets	66.43%
Neutral tweets	28.67%
Negative tweets	4.90%

Table 5.7 Analyzing Sentiment of tweets related to Proposal #797.

Avg. number of retweets	4.23
Avg. number of answers	3.57
Avg. number of likes	41.21
Avg. number of citations	0.78
Avg. number of impressions	4521.94

Table 5.8 Interaction Analysis of tweets related to proposal #797.

Votes 'FOR'	86.07% (101,237,334 ATOM)
Votes 'AGAINST'	13.92% (16,374,473 ATOM)
VETO votes	0.01% (6,738 ATOM)
Abstentions	12.53% (16,847,684 ATOM)
Turnout	54.7% (134,466,229 ATOM)

Table 5.9 Comparison with voting results of Proposal #797.

Voting #88:

Avg. sentiment	0.154
Positive tweets	54.55%
Neutral tweets	35.84%
Negative tweets	9.62%

Table 5.10 Analyzing sentiment of tweets related to Proposal #88.

Avg. number of retweets	6.18
Avg. number of answers	4.45
Avg. number of likes	34.55
Avg. number of citations	0.45
Avg. number of impressions	4115.19

Table 5.11 Interaction Analysis of tweets related to proposal #88.

Votes 'FOR'	99.27% (116,105,830 ATOM)
Votes 'AGAINST'	0.67% (787,124 ATOM)
VETO votes	0.06% (68,994 ATOM)
Abstentions	1.55% (1,840,742 ATOM)
Turnout	47.7% (118,802,691 ATOM)

Table 5.12 Comparison with voting results of Proposal #88.

The analysis confirms the positive reaction to the proposal on Twitter, which is consistent with the high level of support in the voting results.

1. Changes in staking: There was a noticeable increase in the staked ratio after both votes were approved, indicating active community participation in the blockchain activities, as well as on the active response and increase in the percentage of funds withdrawn after the vote to add five validators was passed.
2. Inflation dynamics: Inflation and its relationship with the staked ratio confirm the complex economic mechanisms of the ATOM blockchain. It is observed that inflation increases with less tokens in staking, suggesting that a certain level of participation in staking needs to be maintained to stabilize inflation.
3. APR and market factors: Despite changes in the voting record #88, the APR continued to rise, indicating the possible impact of other market and economic factors, which caused the APR to increase despite the passage of the community pool rate-hike vote.
4. The correlation does not suggest a direct causal relationship but highlights a possible interaction between Twitter activity and the financial dynamics of blockchain projects.
5. Correlation with ATOM price and total stake: The positive correlation between these indicators indicates an important relationship between staking participation and the ATOM market price. Also note that if we track the correlation between staking volume and ATOM price, the analysis with a monthly and quarterly window shows a moderate negative correlation between the two, with a smoother line when using a 90-day window.
6. We observed a complex interplay of economic indicators, where each change in one indicator triggers a chain of changes in others. These dynamics emphasize the close relationship between voting, validator activity, and the blockchain economic environment.

Based on these points, we recommend the following improvements and directions for future research:

1. Extend the analysis to other social media such as Facebook, Reddit, and Telegram to gain a more comprehensive understanding of the impact of social media on the blockchain projects.
2. Deepen the research on the interaction between social media and economic conditions to better understand how external factors can influence outcomes.
3. Examine the influence of specific communities and influential social media personalities on blockchain projects to determine which factors and comments have the greatest impact on market participants' decisions.
4. Sociological analysis of community reaction: Detailed research of the motives and reasons for community reaction to the ballot proposals will help to better understand the dynamics and underlying drivers of participant behavior.
5. Incentivizing participation in staking: Explore possible methods and tools to incentivize participation in staking in order to optimize inflation and other economic indicators.
6. Innovation impact research: Assessing how various technical and economic innovations in the ATOM blockchain ecosystem affect the dynamics of its economic performance.
7. .Benchmarking: Researching other blockchains and their ecosystems to compare with ATOM can help identify unique features and develop common development strategies.

As a result, further research in the above directions will enable a deeper and more complete understanding of the ATOM blockchain ecosystem, predict possible changes, and make informed decisions at various levels of governance.

6. DISCUSSION

In our research, we investigated the impact of Twitter activity on various aspects of blockchain project performance, including validator stacking, token price, trading volumes, APR, and voting outcomes. Our results indicate a correlation between these elements, which supports our hypothesis of a meaningful impact of social media on blockchain projects. Specifically:

1. The correlation between Twitter activity and token price was 0.54, indicating that when Twitter activity increases, the ATOM price also tends to increase.
2. The positive average sentiment on Twitter (0.154 on a scale of –1 to 1) coincides with the high level of support for Proposal #88 in the poll results (99.27% of 'FOR' votes).
3. Average user interactions on Twitter, such as 6.18 retweets, 34.55 likes, and 4.45 replies, indicate active participation and discussion of the proposal on social media.

However, it is important to note that correlation does not indicate direct causation. Additional factors such as external economic conditions, market trends, and the characteristics of individual blockchain projects may also influence these results.

For future research, we recommend:

1. An in-depth analysis of other social platforms: In addition to Twitter, platforms like Facebook, Reddit, Telegram, and Discord play a key role in shaping public opinion in the cryptocurrency community. Exploring their influence can provide additional perspective.
2. Investigating the influence of influencers: Assessing the influence of key personalities in the cryptocurrency space in shaping public opinion.
3. Cross-correlation analysis: Examining the interaction between different metrics to identify more complex relationships.
4. Analyzing long-term trends: Analyzing how long-term trends in social media affect blockchain projects in the long-term.
5. To fully understand the impact of social media on blockchain projects, other factors such as external economic conditions, market trends, and the specifics of individual projects should also be considered.
6. Extend the scope to include other POS networks and examine the influence of platforms like Twitter, to test whether the hypotheses hold across different blockchain environments.
7. Investigating the impact of automated entities in the Cosmos ecosystem and recent Twitter developments: This research aims to delve deeper into the influence of automated agents and bots within the Cosmos ecosystem, particularly focusing on their effects on voting dynamics and user interactions. Special attention should be given to recent events such as the mass removal of bots on Twitter, to investigate how such actions impact the dynamics and user engagement in blockchain projects (Reuters 2022). This will allow for an assessment of how the cleanup of social media from automated accounts can affect public perception and activity within the blockchain ecosystem, as well as strategies for community management and optimization of user interaction.

In conclusion, this analysis highlights the importance of social media for blockchain projects, confirming the need for further research in this area to better understand interactions and influences. We hope that our findings will serve as a starting point for the next stages of research.

7. CONCLUSIONS AND PROSPECTS

During the research process, a number of important correlations were found between Twitter activity and various aspects of Cosmos ecosystem functioning. Based on these results, we can conclude that Twitter plays a significant role in the dynamics of this ecosystem.

This important discovery indicates that Twitter interactions are not just a social activity, but a factor that can have a powerful impact on the economic and operational dynamics of blockchain projects. With the growing influence of cryptocurrencies and blockchain technologies

on the global economy, social networks, especially Twitter, are becoming a key element in the decision-making system of blockchain projects.

With this in mind, it is recommended that market participants make greater use of social media, particularly Twitter, as a tool for analyzing and forecasting market behavior. This can help them better understand current trends, make informed decisions, and possibly anticipate future developments.

For in-depth analyses of this area, we suggest additional research directions such as: – exploring the impact of other social media (e.g. Reddit, Telegram, Discord) on blockchain projects and a detailed analysis of Twitter's impact on other aspects of blockchain projects such as partnerships, integrations, and strategic decisions.

Conducted research results not only confirm the relevance of social media to the blockchain ecosystem, but also emphasize the need for further research into this impact. We hope that our findings will be useful for researchers, developers, market participants and all those interested in the impact of social media on blockchain projects.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Appendices.** Appendix A and B. DOI: https://doi.org/10.5334/dsj-2024-008.s1

COMPETING INTERESTS

The authors have no competing interests to declare.

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