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Social Influence, Market Manipulators, Hardware and Software as New Factors for Cryptocurrency Pricing: A Survey

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Abstract. In the last decade, cryptocurrencies have been confidently setting the trend in global financial markets. Nevertheless, a certain degree of mistrust toward the use of cryptocurrencies persists among investors and researchers due to the lack of reliable models for predicting their dynamics. Such models can be constructed based on a comprehensive consideration of the factors that determine the price of cryptocurrencies. This article provides: (a) a brief overview of known factors affecting cryptocurrency pricing, and (b) a more detailed review of new factors, including those related to computational resources and software tools. This review may be useful for researchers and practitioners building mathematical models for cryptocurrency forecasting.

Keywords. Cryptocurrency pricing, social factors, market manipulators, hardware-technological factors, software-algorithmic factors.

1 Introduction

In recent years, cryptocurrencies have become an integral part of the global financial system, attracting the attention of both investors and regulators. Since the emergence of the first cryptocurrency, Bitcoin, in 2009, the market for these digital assets has shown incredible volatility and rapid development. The market capitalization of cryptocurrencies has reached hundreds of billions of dollars in a short period, indicating their significant impact on the economy and global financial infrastructure. However, despite their growing popularity, the mechanisms of cryptocurrency pricing remain complex and insufficiently studied.

Traditional approaches to pricing analysis, which are applied to fiat currencies and classic financial assets, do not always effectively explain the price fluctuations in the cryptocurrency market. This is due to the unique characteristics of crypto assets, such as decentralization, limited supply, transaction anonymity, and a high degree of speculative activity.

As a result of these features, it is necessary to consider not only traditional macroeconomic and financial factors but also new phenomena, such as socio-economic influences, market manipulation, and technological changes.

This article provides an overview of the factors influencing cryptocurrency pricing, emphasizing the need to expand the existing classification of factors to include new, less-studied aspects. Separate sections are devoted to the consideration of hardware-technological and software-algorithmic factors.

Discussing these factors will deepen the understanding of the processes underlying

cryptocurrency price dynamics, which is important for both researchers and market participants.

2 Traditional Factors

Traditional factors typically include fundamental, macroeconomic, financial, behavioral, and infrastructural aspects, as identified by the scientific community [1-5].

2.1 Fundamental Factors

Fundamental factors reflect basic decisions, such as the adoption of cryptocurrencies as a means of payment and regulatory changes. These factors lay the foundation for cryptocurrency price growth. Short-term fluctuations can be caused by speculation and changes in market sentiment [6].

2.2 Macroeconomic Factors

These involve market conditions and macroeconomic indicators, such as liquidity, trading volume, and the influence of social media, which significantly impact the stability and volatility of cryptocurrencies. Regulatory changes also have a strong effect on the market [7].

2.3 Financial Factors

This category includes factors affecting the pricing of cryptocurrency options and other financial derivatives, as well as the role of market expectations in cryptocurrency pricing. Additionally, cryptocurrencies can serve as a hedging tool against political and economic uncertainty [8].

2.4 Behavioral Factors

Psychological aspects, such as speculation and media attention, contribute to the formation of "bubbles" in the cryptocurrency market. Public sentiment, expressed on social media, can also predict price changes [9].

2.5 Infrastructural Factors

Parameters like mining difficulty, hash rate, and the concentration of mining pools also play a significant role in cryptocurrency pricing. Changes in these indicators can affect the scarcity of cryptocurrencies and their volatility [10].

3 Social Influence Factors

Free access to the Internet has revealed various manifestations of the influence of socio-economic factors on cryptocurrency pricing. In this review, we highlight two of them: trust in financial institutions and the role of social media.

3.1 Level of Trust in Financial Institutions

Social factors, such as the level of trust in financial institutions and the degree of economic freedom, significantly impact the price formation process of cryptocurrencies [11].

Trust in financial organizations plays a crucial role in determining the willingness of individuals and companies to use cryptocurrencies as alternative financial instruments. A higher level of trust leads to increased demand for cryptocurrencies, which in turn positively affects their market value.

The degree of economic freedom is also an important factor influencing the adoption of cryptocurrencies. In countries with a high level of economic freedom, where there are fewer regulatory barriers to trade and investment, cryptocurrencies are more rapidly integrated into the economic structure, serving as means of exchange and capital accumulation. In such conditions, cryptocurrencies become a key element of the financial system, helping to maintain their value at a higher level.

Additionally, in study [8], cryptocurrencies are examined in terms of their applicability and functionality in society. Beyond traditional financial factors, such as volatility, liquidity, and risks, their economic value is also influenced by utility, purpose, and level of adoption in the economy. The more extensively cryptocurrencies are used in real economic operations, the higher their market value.

For example, the use of cryptocurrencies in international remittances, e-commerce, and decentralized finance (DeFi) applications enhances their economic significance and, consequently, increases their market value.

3.2 Social Media

Social media plays a vital role in the adoption and dissemination of cryptocurrencies, acting as both an indicator of public sentiment and a factor influencing price formation. The popularity and discussions of cryptocurrencies on platforms like Twitter and Reddit [12, 13, 22] create significant informational impact on market expectations and investor behavior.

Studies show that mentions of cryptocurrencies on social media correlate with price fluctuations, making these platforms important indicators of public acceptance. Discussions of cryptocurrencies on social media not only reflect current societal sentiment but can also provoke large-scale market changes, creating a self-fulfilling prophecy effect. Positive mentions and discussions often lead to increased interest and investments, while negative sentiment can result in decreased trust and falling prices [14, 15].

Moreover, social media facilitates the decentralized spread of information about new projects, cryptocurrencies, and blockchain technologies, making the adoption process more dynamic. Such discussions accelerate the acceptance of cryptocurrencies by influencing public awareness and expanding the user base. Social media also serves as a platform for informational campaigns, educational materials, and discussions, contributing to increased trust in cryptocurrencies and their integration into everyday economic processes.

4 Market Manipulators

In a review article by Felix Eigelshoven, André Ullrich, and Douglas Parry [16], various methods of manipulation in the cryptocurrency market and their impact on prices are analyzed. The authors highlight several key methods of market manipulation:

4.1 Pump-and-Dump Schemes

This method involves artificially inflating cryptocurrency prices through coordinated buying, followed by a quick sell-off at inflated prices. Manipulators often organize groups on social media to attract inexperienced investors, leading to short-term price spikes. Pump-and-dump schemes contribute to increased volatility and sharp price fluctuations, especially in markets with low capitalization.

4.2 Wash Trading

This approach involves creating fake trading volumes through self-dealing, which gives the false impression of high liquidity. It attracts other traders, misleading them about the real trading volumes and market activity.

4.3 Insider Trading

The use of non-public information, such as before the official announcement of a new cryptocurrency listing on an exchange, allows traders to gain a competitive advantage. Insider trading undermines market transparency and fairness, potentially leading to sharp price changes in the short term.

4.4 DDoS Attacks

These attacks target the temporary shutdown or performance degradation of cryptocurrency exchanges, which can be used to manipulate prices by creating an artificial liquidity shortage. As a result, significant price fluctuations in cryptocurrencies can occur during such attacks.

4.5 Manipulations Using Stablecoins

An example of this is the stablecoin Tether, which is issued in large volumes to buy cryptocurrencies during periods of price decline. This temporarily stabilizes the market and supports cryptocurrency prices. However, such manipulations may pose risks to the long-term sustainability of the market.

Market manipulation in the cryptocurrency space remains a significant challenge, negatively affecting investor trust and market stability as a

whole. The main issues stem from a lack of adequate regulation, the anonymity of participants, and the absence of established standards. Addressing these problems requires stricter regulatory measures and increased transparency on cryptocurrency exchanges.

5 Hardware-technological Factors

Hardware-technological factors are typically associated only with equipment costs. However, current realities require consideration of other equally significant circumstances. In this review, we identify two subgroups: equipment and mining costs, and halving.

5.1 Equipment and Mining Costs

Here, equipment refers to the hardware used for cryptocurrency mining, such as Graphics Processing Units (GPUs), Application-Specific Integrated Circuits (ASICs), and server capacities that support blockchain operations. The efficiency of mining equipment directly impacts parameters like hash rate, which in turn influences the value of cryptocurrencies.

As mining difficulty increases, more powerful equipment is required, leading to higher electricity and equipment costs. This can result in an increase in cryptocurrency prices. The concentration of mining pools and the high energy costs of mining can significantly affect the value of cryptocurrencies.

5.2 Halving

Halving is a process embedded in the protocol of most Proof of Work (PoW)-based cryptocurrencies, in which the reward for mining new blocks is halved at regular intervals. This mechanism is used to control cryptocurrency inflation and gradually reduce the number of new coins entering the market.

Halving has a significant impact on cryptocurrency pricing, especially for assets like Bitcoin. As the supply of new coins decreases, if demand remains stable or increases, the cryptocurrency's price can rise substantially. Historically, halvings have been accompanied by significant price fluctuations, including strong increases. This phenomenon can be explained by the economic principle that a restriction in supply amid stable demand leads to an increase in asset value.

A study on Bitcoin [17] showed that the halvings in 2012, 2016, and 2020 were followed by a significant rise in cryptocurrency prices in the subsequent months and years. These events create a supply shortage, stimulating the market and potentially leading to more bullish sentiment among investors.

Halving also changes the economic incentives for miners. With the reduction in block rewards, miners face increased mining costs, which can result in a decrease in the number of participants in mining, especially if the cryptocurrency price does not compensate for the reduced reward. This can also lead to a temporary decrease in hash rate and a slowdown in transaction processing until the balance between supply and demand is restored.

Research indicates that halving creates complex macroeconomic conditions for cryptocurrency markets. In the study by Dyhrberg and other researchers [17], it was noted that halving can lead to long-term price growth due to the creation of a supply shortage, but it can also cause short-term high volatility and uncertainty in the market.

Halving is a key event in the cryptocurrency economy, affecting both the value of coins and the incentives for miners. The impact of halving on prices has been confirmed by historical data and research, and this mechanism continues to be an important factor in analyzing future trends in the cryptocurrency market.

6 Software-Algorithmic Factors

Software-algorithmic factors influencing cryptocurrency markets include algorithm improvements, the creation of new blockchains, and the launch of new networks. These technological changes significantly impact the efficiency, security, and popularity of cryptocurrencies, as well as their market value.

6.1 Consensus Algorithms

Consensus algorithms such as Proof of Work (PoW) and Proof of Stake (PoS) [18] play a key role in maintaining the security and decentralization of blockchain networks. Improvements to these algorithms or a shift to more efficient protocols can greatly affect network performance, transaction speed, and energy consumption.

For example, Ethereum's transition from PoW to PoS in the Ethereum 2.0 upgrade aimed to reduce energy consumption and improve network scalability [19]. This upgrade not only reduced mining costs but also increased interest in the network by decreasing its environmental footprint and enhancing transaction processing speeds.

Such changes can influence cryptocurrency prices, as improvements in performance and reduced transaction costs make the network more attractive to users and investors. The introduction of new algorithms can also promote the scalability of blockchains, which is crucial for projects aiming for widespread adoption.

6.2 New Blockchains

The launch of new blockchains is another important software factor that can affect the cryptocurrency market. For example, the emergence of new networks such as Polkadot and Solana [20], with improved transaction speeds and cross-chain compatibility, has been a significant event for the crypto industry.

These networks offer users and developers enhanced capabilities compared to earlier blockchains like Bitcoin and Ethereum, attracting new investors and developers of decentralized applications (dApps).

Each new network provides unique technical solutions and opportunities for scalability and security. In the case of Polkadot, its parachain system allows separate blockchains to interact with each other, paving the way for complex decentralized ecosystems. This attracts investor attention and increases the value of associated tokens.

6.3 New Networks

The emergence of new networks and Layer 2 solutions, such as the Lightning Network [21] for Bitcoin and Optimism for Ethereum, plays an essential role in improving scalability and reducing transaction fees. These solutions operate on top of the main blockchain network, allowing more transactions to be processed without overloading the main blockchain. This reduces costs and enhances the user experience, positively affecting cryptocurrency adoption.

The success of such networks depends on their ability to solve current scalability and transaction speed issues. For instance, the Lightning Network [22] increases the processing speed of microtransactions on the Bitcoin network, making it more appealing for everyday use. Optimism and other Layer 2 solutions help Ethereum handle high fees and slow transaction speeds, increasing its competitiveness among other blockchains.

Software factors, such as consensus algorithm improvements, the creation of new blockchains, and the launch of new networks, are key drivers of the cryptocurrency market's development. These technological innovations contribute to better scalability, reduced costs, and enhanced network security, ultimately influencing the attractiveness of cryptocurrencies for users and investors. The evolution of software factors continues to impact market dynamics and the value of crypto assets.

7 Conclusions

The review of cryptocurrency pricing factors covers both traditional and new, relevant aspects influencing their value dynamics. Traditional factors, such as fundamental, macroeconomic, financial, behavioral, and infrastructural elements, continue to play a vital role in forming cryptocurrency prices. However, as cryptocurrency technology and markets evolve, it becomes evident that the existing classification needs to be supplemented with new factors.

Current realities demand consideration of new phenomena, such as socio-economic influences, market manipulation, as well as hardware-technological and software-algorithmic factors,

including blockchain innovations, consensus algorithm improvements, and the emergence of new networks. These new factors significantly impact the market, creating both opportunities and risks for its further development.

Therefore, to gain a deeper understanding of the mechanisms of cryptocurrency pricing and develop reliable forecasting models, it is necessary to update and expand the existing classification of factors. Greater attention should be given to new technological and market trends, which will not only improve the understanding of price dynamics but also enable the development of more accurate risk management strategies in the rapidly growing cryptocurrency market.

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