

The Role of Bitcoin Halving in Influencing the Dynamics of Bitcoin Trends in 2012-2025

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ABSTRACT

This study aims to analyze the influence of Bitcoin Halving on the dynamics of Bitcoin price trends during the period 2012 to 2025. Using a descriptive quantitative approach, data is obtained through documentation of Bitcoin's historical price from various reliable sources. The sample was determined by purposive sample in the period before and after the halving in 2012, 2016, 2020, and 2024. The analysis was conducted using the Moving Average Convergence Divergence (MACD) indicator to observe trend change patterns. The results show that any halving event is generally followed by a significant upward trend in prices, reflecting an imbalance between demand and supply. Additionally, the MACD has proven to be effective in identifying trend change signals related to halvings. External factors such as regulation and market sentiment also strengthen its impact. This research makes a theoretical contribution to the digital financial literature and practical recommendations for crypto investors.

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1. INTRODUCTION

Bitcoin, as the first cryptocurrency introduced by Satoshi Nakamoto in 2008, has revolutionized the global financial system by carrying the concept of a decentralized peer-to-peer payment system [1]. Without the need for a central authority such as a central bank, Bitcoin uses blockchain technology as a foundation to create transparency, security, and efficiency in every transaction [2]. Without the need for a central authority such as a central bank, Bitcoin uses blockchain technology as a foundation to create

transparency, security, and efficiency in every transaction [2].

One of the important mechanisms that distinguishes Bitcoin from other assets is the Bitcoin Halving phenomenon, which is the event of halving the block reward for miners every 210,000 blocks [4]. This mechanism has been consistent since Bitcoin's launch, in 2012, 2016, 2020, and most recently in 2024 [5]. The main goal of the halving is to keep the supply scarcity in check by suppressing the pace of new Bitcoin distribution to the market. Theoretically, if demand stays or increases while new supply decreases, there will be upward pressure on the price of Bitcoin.

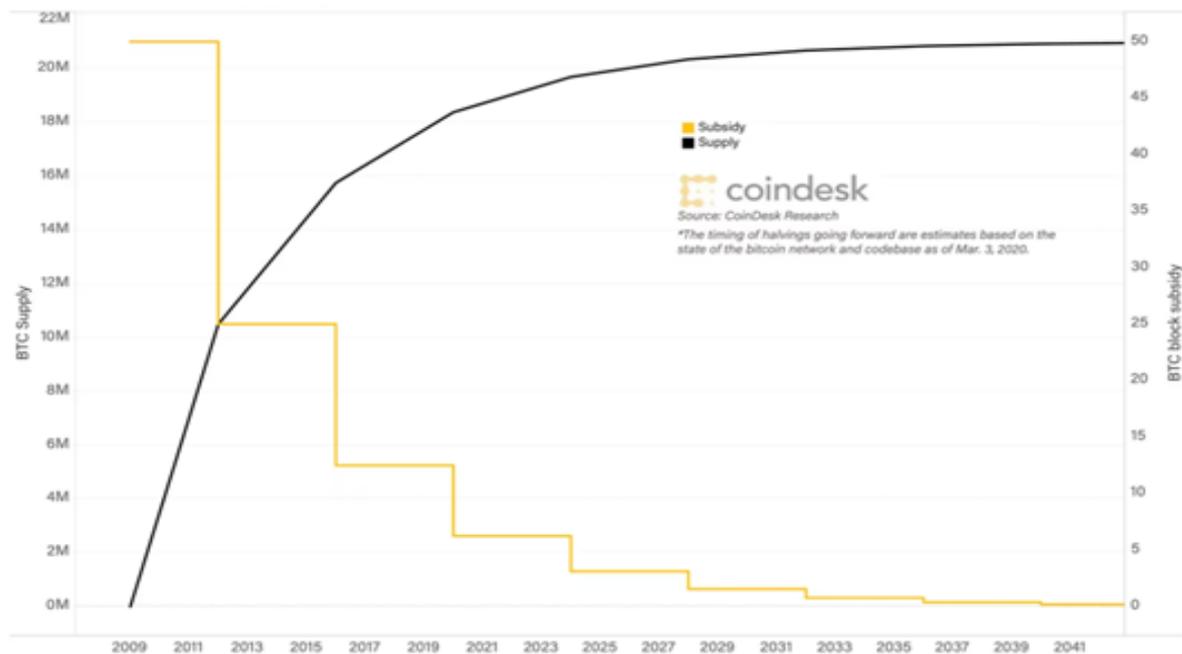


Figure 1. Bitcoin Supply and Block Subsidy Per Year
Source: CoinDesk Research

An illustration of the relationship between the amount of Bitcoin's supply and the value of the block's rewards over time can be seen in Figure 1 above. This chart was compiled by CoinDesk Research and depicts a slowing trend in supply growth (black line) in line with the progressive decline in block rewards (yellow line), which is a visual representation of the halving mechanism and its impact on supply [6].

This phenomenon has sparked great interest from investors and researchers because it historically shows a post-halving upward trend pattern. For example, after the 2012 halving, the price of Bitcoin jumped from around \$12 to over \$200. A similar phenomenon occurred in the halving of 2016 and 2020, which each showed a significant price increase within a few months until the following year [7]. This pattern reflects a supply-demand imbalance in response to supply reductions [8].

In analyzing the pattern of price trend changes, technical indicators such as the Moving Average Convergence Divergence (MACD) are an important tool because they are able to detect trend change signals visually and quantitatively [9]. This indicator measures price momentum based on the

difference between the two Exponential Moving Averages (EMAs) and helps identify potential trend reversal points. The use of the MACD in the context of halving provides strategic value for investors in making more informed investment decisions [5].

However, the dynamics of the Bitcoin market are not only influenced by technical aspects and internal mechanisms. External factors such as government regulations, global sentiment, and political events also have a significant influence. For example, in 2024, the surge in the price of Bitcoin will also be influenced by market expectations of the new administration's pro-crypto policies in the United States [10]. This global context reinforces the understanding that Bitcoin trend analysis should include both endogenous (halving) and exogenous (regulation and market sentiment) factors [11].

This study aims to analyze the impact of the Bitcoin Halving on the dynamics of Bitcoin price trends for the period 2012–2025 with a quantitative descriptive approach using the MACD indicator. Through this approach, it is hoped that the research will be able to make an academic contribution in understanding the halving cycle to the

formation of price trends, as well as provide practical implications for crypto investors in investment decision-making based on historical and technical data.

2. LITERATURE REVIEW

2.1 *Technical Analysis*

Technical analysis is an approach to evaluating and predicting the price movements of an asset based on historical data, such as price and trading volume. This approach assumes that prices reflect all the information available in the market and tend to form repetitive patterns due to the psychological behavior of market participants [9]. Therefore, technical analysis is used to identify market trends, determine the entry and exit points of transactions, and read market sentiment.

One of the most commonly used technical indicators is the Moving Average Convergence Divergence (MACD). This indicator calculates the difference between two exponential moving averages (EMAs), namely EMA 12 and EMA 26, and is complemented by a signal line (EMA 9) [12]. The MACD is able to show the moment of line crossing that is a buy or sell signal. This indicator is considered effective in detecting momentum and trend strength, particularly in high-risk assets such as cryptocurrencies.

2.2 *Investment Decision*

Investment decisions refer to the process of selecting assets by considering the risks and potential profits to be obtained in the future. Investors usually consider a number of factors such as the rate of return, risk, macroeconomic conditions, and market information before making a decision [13]. In addition, investor characteristics such as risk preferences and time horizons also influence the decisions made.

Investment strategies often involve diversification to minimize unsystematic risks. In the context of the crypto market, investment decisions tend to be more influenced by high volatility, technological developments, and market

sentiment. Therefore, mastery of technical analysis and understanding of the dynamics of digital assets are important in forming rational investment decisions.

2.3 *Cryptocurrency*

Cryptocurrency is a form of digital currency that uses cryptographic techniques to ensure transaction security and recording validity. The basic technology used is blockchain, which allows transactions to take place peer-to-peer without intermediaries such as banks or financial institutions [1]. This decentralized nature makes cryptocurrencies resistant to third-party manipulation and transparent in the transaction recording process [4].

Bitcoin is the most popular example of a cryptocurrency and has been used as both a medium of exchange and an investment asset. In practice, cryptocurrencies are traded globally and have high volatility characteristics. In addition to being used as a medium of exchange, cryptocurrencies are also seen as a speculative investment asset by most market participants.

2.4 *Blockchain*

Blockchain is a decentralized digital ledger system and allows for permanent, transparent, and encrypted recording of data. Each transaction that occurs will be stored in a block that is connected to each other in chronological order [14]. Due to its immutable nature, data in the blockchain cannot be changed without the approval of the majority of the network [4].

In the context of digital finance, blockchain serves as the main foundation of cryptocurrency technology. The advantages of blockchain include process efficiency, reduced transaction costs, and improved data security. Additionally, the application of blockchain has expanded to various sectors such as logistics, government, and healthcare, signaling the potential of this technology as the future infrastructure of the digital economy.

2.5 Bitcoin

Bitcoin was the first cryptocurrency launched in 2008 by an anonymous individual or group named Satoshi Nakamoto. Designed as a peer-to-peer electronic payment system, Bitcoin allows for direct transactions between users without involving a central authority. The main characteristic of Bitcoin is its limited number of only 21 million coins, which makes it a deflationary digital asset [3].

Over time, Bitcoin was not only seen as a medium of exchange, but also as an alternative investment asset and store of value. Its popularity has increased due to distrust of the conventional financial system, as well as being driven by institutional adoption and legal recognition in some countries. Despite its high volatility, Bitcoin is considered to have long-term potential in the global financial ecosystem.

2.6 Bitcoin Halving

Bitcoin Halving is the process of cutting block rewards given to miners by 50% per 210,000 blocks, or about every four years [1]. This mechanism is designed to control the pace of Bitcoin's supply and ensure continued scarcity. Halving has been part of the Bitcoin protocol since its inception and has occurred four times, in 2012, 2016, 2020, and 2024 [8].

3. METHODS

3.1 Types of research

This study uses a quantitative approach with a descriptive method. The main goal of this approach is to describe the Bitcoin price trend pattern before and after the halving event. This approach is suitable for observing price changes based on historical numerical data.

The descriptive method was chosen because it is able to describe market phenomena systematically without manipulating variables. This research is also *ex post facto* because the data used comes from past events. With this method, the analysis can be carried

out based on events that have taken place in real life.

3.2 Population and Sample

The population in this study is all Bitcoin price data recorded from 2012 to 2025. The data is obtained from online sources such as CoinMarketCap, TradingView, and other crypto platforms. The population covers the entire daily Bitcoin price movement curve throughout the observation period.

The sample was purposively selected, covering only the periods before and after the Bitcoin halving in 2012, 2016, 2020, and 2024. This selection aims to specifically observe the effect of halving events on price trends. The observation time interval was about 6 months before and 18 months after each halving.

3.3 Data Types and Sources

This research uses secondary data in the form of historical data on the price of Bitcoin. The data is obtained through documentation from credible and open crypto market platforms. Major sources include CoinMarketCap, TradingView, and reports from digital asset analysis agencies.

The type of data used is quantitative data in time series format. The data includes daily prices (open, close, high, low) and Bitcoin trading volume. This data is needed to construct price charts and technically process MACD indicators.

3.4 Data Collection Techniques

The data collection technique in this study was carried out with a documentation approach. This documentation aims to obtain accurate and valid numerical data as a basis for analysis in research. Data collection is done through documentation of Bitcoin price charts from trusted sites, such as Tradingview, CoinMarketCap, Token Terminal, and various other financial analytics platforms.

Furthermore, the data is classified by the period before and after the halving. The data in each period was analyzed to observe differences in price patterns. The entire documentation process is carried out systematically to maintain the validity of the data.

3.5 Data Analysis Techniques

a. Historical Data Collection

Daily historical price data of Bitcoin were collected for the period before and after each halving event (2012, 2016, 2020, and 2024), sourced from platforms such as TradingView and CoinMarketCap.

b. Visual Trend Analysis

The price data were visualized using line charts to illustrate price movements and to highlight patterns or anomalies occurring around each halving event.

c. Indicator Selection

The Moving Average Convergence Divergence (MACD) indicator was selected due to its effectiveness in detecting changes in price momentum and trend direction in volatile markets like cryptocurrency.

d. MACD Application

The MACD is calculated from the difference between the EMA 12 and EMA 26, and is compared to the EMA 9 as a signal line. The crossover between the MACD and the signal line, as well as the color and size of the histogram, are interpreted to confirm a potential trend reversal.

e. Calculation of Estimated Peak Price

The estimated peak time of Bitcoin's post-halving 2024 price is calculated based on the historical patterns of previous halvings, namely 2012, 2016, and 2020. This analysis uses the approach of averaging the time difference between the halving date and the subsequent peak of the price. The average calculation formula is:

$$\bar{x} = \Sigma x/n$$

where:

\bar{x} : Mean

Σx : Amount of data

N : A lot of data

4. RESULTS AND DISCUSSION

4.1 Results

a. The First Bitcoin Halving (2012)



Figure 2. Bitcoin Halving Pertama
Source: TradingView

Bitcoin experienced its first halving on November 28, 2012, where

the block reward was reduced from 50 to 25 BTC. The price before the

halving was around USD 2.10 and experienced a sharp increase to touch USD 1,200 within 371 days. This increase of 9,700% indicates a very positive market reaction to the drastic decline in supply.

The MACD indicator for this period shows the appearance of an increasing green histogram, indicating strong buying momentum.

The MACD line crossed the signal line upwards right after the halving, signaling the start of a significant bullish trend. This trend continued for almost a year, reinforcing the interpretation that the first halving was an important catalyst in the formation of Bitcoin's price cycle.

b. The Period Between the First and Second Halving (2012–2016)

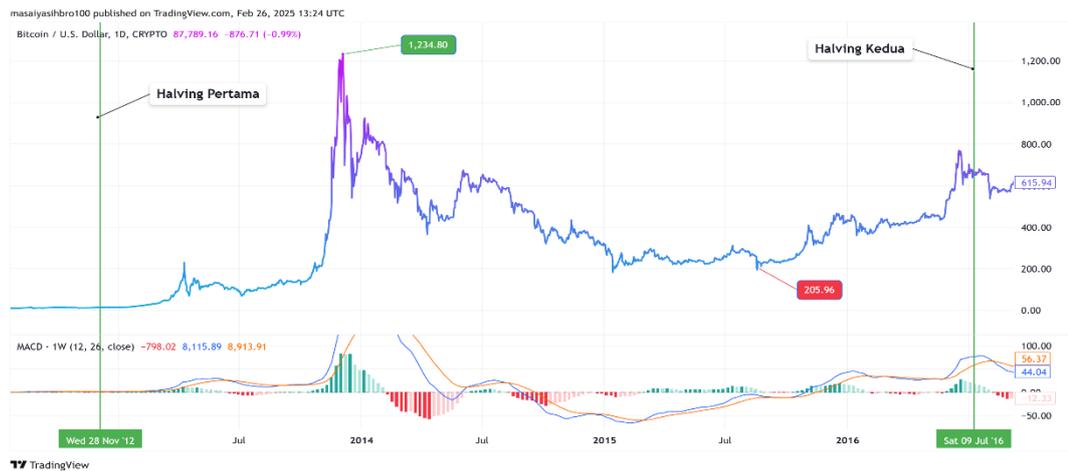


Figure 3. The Period Between the First and Second Halving
Source: TradingView

The period between the first and second halves shows a volatile price pattern but remains in an upward long-term trend. After peaking at USD 1,200 in late 2013, the price of Bitcoin experienced a sharp decline to the USD 169 range in early 2015. Nonetheless, the Bitcoin ecosystem is growing significantly, marked by an increase in market capitalization from USD 1 billion to over USD 10 billion [15].

External events such as the collapse of Mt. Gox in 2014 briefly shook the market, but adoption has continued [16]. Companies like Microsoft and Dell are starting to

accept Bitcoin as a means of payment [17]. The MACD indicator in this period showed a bullish signal at the beginning of the recovery phase, and strengthened again ahead of the second halving, indicating investors' accumulation of potential for a new cycle.

The MACD indicator shows an uptrend in the first third of the period, where a bullish cross marked with a red ellipse indicates a possible continuation of the uptrend, which indicates a reversal of direction towards a bullish trend and indicates that the price is likely to continue to rise.

c. Bitcoin Halving Second Year 2016



Figure 4. Second Bitcoin Halving
Source: TradingView

The second halving occurred on July 9, 2016, with the reward reduced to 12.5 BTC. The price of Bitcoin rose by about 289% from a low of USD 165 to USD 665 before the halving, then reached a peak of USD 19,300 in the 525 days post-halving. This increase of 2,750% shows that the bullish trend is repeating itself historically.

The MACD signal confirms the positive momentum, with the

MACD line cutting the signal line from below and the positive divergence getting wider. After a small correction after the halving, the histogram returned to the green, reinforcing the uptrend that occurred. The price increase was driven by market enthusiasm, investor speculation, and wider adoption.

d. The Period Between the Second and Third Bitcoin Halving (2016–2020)



Figure 5. The Period Between the Second and Third Bitcoin Halving
Source: TradingView

This period was marked by a surge in the price of Bitcoin to USD 19,300 at the end of 2017, followed by

a sharp correction to the level of USD 3,190 in December 2018. This correction was followed by a slow

recovery until it reached USD 8,000–10,000 ahead of the third halving. These fluctuations show high volatility but remain in an uptrend structure. Despite the significant decline, Bitcoin still showed an upside from the price point before the second halving.

External factors such as the launch of futures contracts on the CME and CBOE Futures Exchange (CFE) as well as media exposure accelerated the price surge [18]. However, the failure of many ICO projects led to regulatory pressure and investor hesitation [19]. The MACD indicator shows a strong

bullish phase at the beginning of the period and a bearish crossover as the correction begins, followed by a recovery phase towards the third halving.

The MACD indicator also shows a strong bullish phase before a bearish crossover that marks the beginning of a deep price correction. In this period, the MACD indicator shows an illusion that is easy to understand with the crossing of two lines, namely the MACD line (blue) and the signal line (red) which shows bullish and bearish.

e. Bitcoin Halving Third Year 2020



Figure 6. Third Bitcoin Halving
Source: TradingView

The third halving took place on May 11, 2020, with the reward reduced to 6.25 BTC. The price of Bitcoin rose from USD 3,000 to USD 9,500 before the halving, and then surged to reach USD 65,000 in 553 days. This ±640% increase was triggered by institutional adoption, economic uncertainty due to COVID-19, and the perception of Bitcoin as an alternative store of value.

Before the halving, the MACD indicator shows bearish pressure with a red histogram and a

crossover of the MACD line as well as signals that reflect market uncertainty. Towards the halving, the histogram starts to turn green but is not yet accompanied by a clear crossover. After the halving, there is a brief price correction, then the MACD shows a bullish signal through a crossover from below and a strengthening green histogram. The widening divergence between the MACD line and the signal reinforces Bitcoin's upward trend in this phase.

f. The Period Between the Third and Fourth Halving (2020–2024)



Figure 7. The Period Between the Third and Fourth Halving (2020–2024)
Source: TradingView

This period was marked by a surge in the price of Bitcoin to USD 65,000 at the end of 2021, followed by a sharp correction to the level of USD 16,000. External factors such as high interest rates from the Fed and the collapse of major crypto platforms such as FTX have also deepened the price decline [20]. Despite the significant decline, Bitcoin still showed an increase from the price point before the second halving.

Ahead of the fourth halving, Bitcoin rallied again to reach the USD 70,000 range in early 2024. This price increase can be understood as the market's response to expectations of reduced supply due to the halving, which increases the perception of scarcity and boosts demand from investors and traders. Other supporting factors such as increased Bitcoin adoption, interest from major institutions, and global economic uncertainty also strengthen the positive sentiment in the market. The combination of these factors drives increased investment ahead of the halving, which is often seen as the main trigger for price spikes.

The MACD is showing a shift from bearish to bullish signals as prices begin to recover in late 2023. The MACD histogram strengthened, indicating positive momentum ahead of the halving. Market expectations of supply reductions and a global recovery are the catalysts that drive significant accumulation and price increases.

g. Price Peak Estimated Time Calculation

1. Historical Analysis

By calculating the average time it takes to reach a price peak, researchers can estimate the likelihood of future periods of accumulation and price appreciation.

Account:

- a. Price peak at halving 1 = 371 days (2012)
- b. Price peak on halving 2 = 525 days (2016)
- c. Price peak at halving 3 = 553 days (2020)

So, to calculate the average (day to the peak) is:

$$\begin{aligned} \text{Average} &= (371+525+553)/3 \\ &= 1449/3 \\ &= 483 \text{ hari} \end{aligned}$$

If the 4th halving occurs in April 2024, then the peak point of Bitcoin's price is expected to be reached about 483 days after the halving, i.e. in September 2025.

h. Technical analysis



Figure 8. Technical Analysis
Source: TradingView

Technical analysis of the Bitcoin price shows that the long-term trend is still in a bullish condition, characterized by an uptrend line that serves as the main support. Since 2023, the price of Bitcoin has experienced a significant increase, especially after successfully breaking through the main resistance which then transformed into a new support area.

This upward momentum was reinforced by breakout signals seen from price charts and technical indicators. A breakout of resistance after a long period of consolidation indicates the dominance of buying pressure in the market, while the MACD indicator indicates the emergence of the Golden Cross when the MACD line crosses the signal line from the bottom to the top which is the initial signal of a momentum shift from bearish to bullish. The

combination of the price breakout and the Golden Cross on the MACD provides double confirmation that an uptrend is underway, thus increasing investors' confidence in the continuation of positive movements.

Nevertheless, the latest movement indicates a fairly sharp price correction, which can be interpreted as a natural pullback phase or an early potential weakening of the trend. The MACD histogram is starting to print negative values indicating a diminishing strength of bullish momentum. In this situation, there are two possibilities: if the price is able to hold above the support level and the indicator starts to show a recovery signal, the bullish trend may continue; conversely, if support is broken and selling pressure increases, the price of Bitcoin risks a deeper correction.

Therefore, close monitoring of price dynamics, MACD, and trading volume is crucial in determining the next investment step.

4.2 Discussion

a. Bitcoin Halving Against Price Patterns

The findings in this study show that whenever a halving occurs, Bitcoin's price trend tends to see a significant increase in the medium to long term. This phenomenon reflects the basic principle of economics that when supply decreases while demand remains or increases, prices will be pushed up. Historical data supports this pattern: after the first halving of 2012, the price rose from USD 12 to more than USD 1,150, in the second halving of 2016 from USD 650 to around USD 19,500, and in the third halving of 2020 from USD 8,000 to more than USD 60,000. For the final halving in 2024, although the price peak has not yet formed, the initial trend shows a similar upward trend.

This pattern of price increases is not instantaneous, but rather requires an accumulation time that varies between 6 to 18 months, as also suggested by [21] and [5]. The delay reflects the process of market adjustment and the influence of various external factors such as regulation, institutional adoption, and global macroeconomic dynamics. In addition, the behavior of investors who tend to hold Bitcoin before and after the halving also strengthens supply pressures, thus strengthening the upward trend in prices. By combining historical evidence up to 2024 as well as a technical approach to analyzing trends, the study confirms that the Bitcoin Halving has a significant influence on price patterns and shapes market cycles that can be studied for analysis purposes as well as medium-term investment strategies.

b. Bitcoin Halving Event as an Early Marker of Bitcoin Price Trend Change

Bitcoin Halving is a core mechanism in the Bitcoin protocol that automatically reduces block rewards by 50% every 210,000 blocks, or about every four years. This mechanism is designed to control the rate of inflation and create a programmatic supply scarcity. In a classical economic framework, a decrease in supply with constant or increasing demand will tend to push prices up. Therefore, halvings act as fundamental indicators that have a direct impact on price dynamics and are often used as a basis for predicting the direction of market trends.

Historical data shows that each halving cycle in 2012, 2016, and 2020 was followed by a rise in the price of Bitcoin in the medium to long term. This increase generally does not occur directly, but rather shows a delayed effect (lag effect), with buying pressure starting to form a few months after the halving. Studies [21] show that the scarcity generated by halving triggers asset accumulation and forms an uptrend, while [5] found that price peaks typically occur around 19 months post-halving. This repeating pattern makes halving a reliable cyclical indicator.

In addition to structural effects on supply, halving also has significant psychological effects. Market expectations of scarcity often trigger accumulation before the halving takes place, making the halving a leading indicator of trend changes. The concept of the super cycle of [22] and the findings [23] corroborate that halving plays a role in triggering an expansionary phase in crypto prices. Thus, Bitcoin Halving is not only technical, but also strategic in macro analysis of the crypto market and can be used by

investors as a reference for the formation of medium-term strategies.

c. The Effectiveness of MACD Indicators in Identifying Trends

The Moving Average Convergence Divergence (MACD) indicator is used in this study as a technical analysis tool to evaluate the direction of Bitcoin's price trend before and after the halving event. The results show that the MACD is consistently able to detect changes in market momentum, especially with the appearance of a golden cross signal after each halving i.e. when the MACD line crosses the signal line from the bottom up, which is an early indicator of a potential bullish trend. This pattern was identified after the 2016 and 2020 halvings, where bullish signals appeared in a time relatively close to the halving event and followed by a significant price spike. Similar signals have also emerged after the 2024 halving, signaling that the MACD remains relevant in monitoring the dynamics of the Bitcoin market post-halving. Its effectiveness is reinforced by the MACD histogram which shows bullish momentum strengthening after the halving, indicating that the market is entering an accumulation phase before the price jumps higher.

These findings are in line with research [5] and [6] which show that the MACD has a high sensitivity in identifying post-halving Bitcoin price trend transitions. In addition, the view [9] also confirms that the MACD is a reliable indicator in market conditions that are experiencing a change in trend direction, especially in high-volatility assets such as Bitcoin. However, the effectiveness of the MACD can decline in flat or sideways market conditions, where the signals produced have the potential to be false signals. Therefore, the use of the MACD needs to be combined with other technical

indicators, such as trading volume or RSI, to improve accuracy and reduce the risk of misleading interpretations in investment decision-making.

d. Bitcoin Price Trend Projection Post-Halving 2024 Based on Historical Patterns and Technical Indicators

Bitcoin's fourth halving in April 2024 marks the initial phase of a new market cycle that has the potential to create a significant upward price trend. Based on historical data from the previous three cycles (2012, 2016, 2020), the price of Bitcoin tends to peak within a 12 to 18-month post-halving timeframe. The average time needed is around 483 days, so the fourth post-halving price peak is expected to occur between September and December 2025. This period has historically been associated with a phase of market euphoria and the achievement of price highs.

Technical analysis strengthens this projection, particularly through the Moving Average Convergence Divergence (MACD) indicator, which shows bullish signals after the halving. Since the end of 2023, the price of Bitcoin has broken through major resistance and formed a pattern of higher highs and higher lows, signaling a strong uptrend. The appearance of the Golden Cross on the MACD indicator where the MACD line crosses the signal line from the bottom up is an early confirmation signal of a bullish phase that could potentially continue in the current cycle, as it did after the 2020 halving. The combination of the price breakout and the Golden Cross on the MACD provides double confirmation that an uptrend is underway.

Research [5] shows that technical indicators such as MACD and RSI are effective in detecting price movements before and after the halving. With technical signals

emerging consistent with historical patterns, the 2024 halving is likely to be the initial trigger for a longer uptrend.

The combination of historical and technical approaches provides a solid basis for projecting that the bullish trend will last until 2025, making the halving an important reference in medium-term investment strategies.

5. CONCLUSION

The study concludes that Bitcoin Halving plays a significant role in shaping Bitcoin's price trend, with every halving event in 2012, 2016, and 2020 followed by significant price increases in the medium to long term. This happens because a decrease in supply creates scarcity and pushes prices up,

especially when demand remains high. Halving is also a fundamental indicator in predicting price trend changes due to an imbalance between supply and demand. Investors can take advantage of this pattern to strategize their investments, especially supported by technical indicators such as the MACD which effectively indicate the beginning of a post-halving bullish trend. Based on historical projections, the peak of Bitcoin's price after the fourth halving in April 2024 is expected to occur about 483 days later, i.e. in September 2025 or the third to fourth quarters of the year. This projection is reinforced by the initial uptrend that is starting to take shape as well as a strengthening signal from the MACD which indicates that the bullish trend is still ongoing and is likely to continue according to the pattern of the previous cycle.

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