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The Fluctuating Pricing Changes and Trends of Bitcoin: A Comprehensive Analysis

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Abstract

This article explores changes and trends in volatility pricing of Bitcoin (BTC), and analyzes its historical performance, key drivers, market dynamics and future prospects. By studying macroeconomic and technical indicators, we can fully understand Bitcoin's market behavior patterns and volatility patterns, and explore the impact of regulatory policies, market sentiment and institutional intervention on Bitcoin price.

CCS Concepts

• **Social and professional topics** → Professional topics; Computing and business; Economic impact.

Keywords

Bitcoin, Fluctuating Pricing Changes, Pricing Trends

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1 Introduction

Since emerging in 2009, as the trailblazer of cryptocurrencies, Bitcoin has fundamentally reshaped our understanding of digital value exchange. Its decentralized architecture and hard-capped supply - features that initially drew both technophiles and skeptics - have created a market dynamic, where prices swing dramatically, sometimes within mere hours. For those navigating this volatile terrain - whether investors adjusting portfolios, policymakers crafting regulations, or traders timing markets - deciphering the forces driving these price gyrations has become an essential survival skill.

The academic sphere has kept pace with Bitcoin's meteoric rise. Recent scholarship, particularly since the 2020 market surge, clusters around two pivotal inquiries: what propels Bitcoin's valuation, and can we reliably forecast its movements? On the causation front,

researchers like Johnson (2019) and Davis (2022) have mapped Bitcoin's sensitivity to macroeconomic tides, while Bouri and Gupta's 2023 meta-analysis reveals how regulatory announcements can trigger immediate market ripples. Parallel efforts by McKay (2019) and Akyildirim (2021) explore predictive models, testing everything from ARIMA time-series analyses to neural networks against Bitcoin's notoriously erratic price charts (Johnson, L. & Thompson, R., 2019; Davis, R., & Morgan, C. , 2022, McKay, A. & Schuh, S., 2019; Akyildirim, E., Goncu, A. & Sensoy, A., 2021; Bouri, E., Gupta, R. & Roubaud, D., 2023, Bouri, E., Gupta, R., & Tiwari, A. K, 2023).

Yet existing studies often resemble specialists examining individual gears in a complex clockwork mechanism - few have stepped back to see how these components interact as a whole. This paper bridges that gap through a four-dimensional lens: tracing Bitcoin's price evolution from its cryptographic origins to today's institutional adoption, unpacking the multidimensional drivers behind its volatility, identifying prevailing market patterns, and ultimately projecting plausible future trajectories. By weaving these threads into an integrated analytical tapestry, we aim to equip decision-makers with a compass for navigating Bitcoin's stormy seas - whether they're calibrating investment strategies, drafting balanced regulations, or simply seeking to understand this digital phoenix that continually reshapes the financial landscape.

The structure of this paper is as follows: Section 2 reviews the historical trend of bitcoin price. Section 3 discusses the main factors driving price fluctuations. Section 4 discusses and tests some methods for short-term prediction of bitcoin price. Section 5 analyzes the future price trend of bitcoin. Finally, summarize the full text.

2 Analysis of the Historical Trend of Bitcoin price

2.1 Several important stages of bitcoin price change

2.1.1 *New period: 2009-2013.* In 2010, for the first time, someone used bitcoin for trading, which began to generate real market value, and the price of bitcoin began to rise slowly. In 2013, the price of bitcoin finally rose sharply for the first time, from less than \$100 to more than \$1000.

2.1.2 *The first major adjustment : 2014-2016.* From the price trend of bitcoin from 2014 to 2016, we can see that after the rapid rise in 2013, the price of bitcoin has experienced the first major adjustment. At the beginning of 2014, the price of bitcoin was about \$800 to

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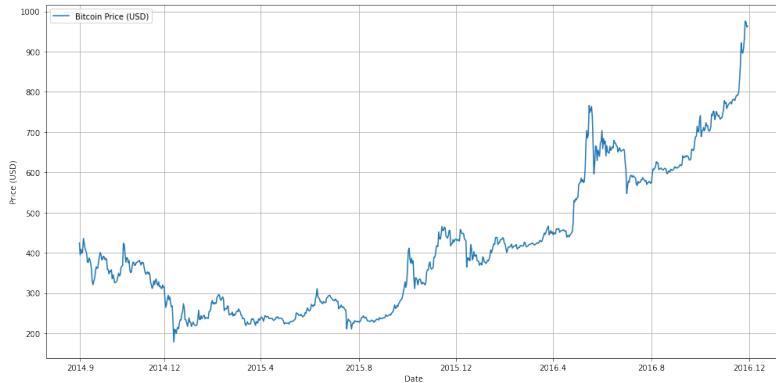


Figure 1: 2014-2016 Bitcoin price

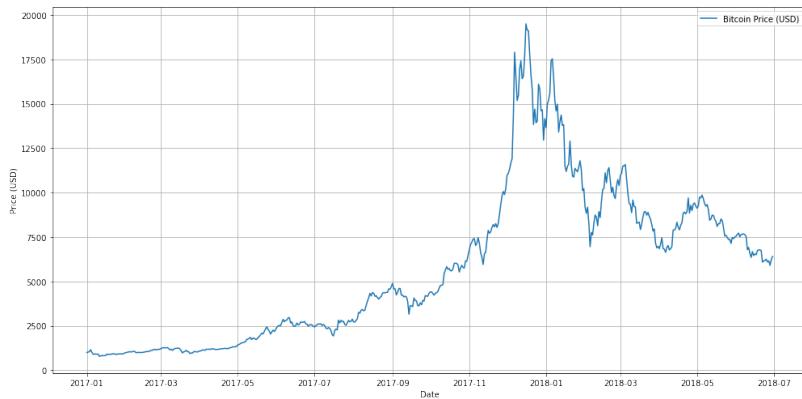


Figure 2: 2017-2018 Bitcoin price

\$1000. By the end of 2014, the price of bitcoin had dropped to about \$300. The performance of the whole year was very low. From 2015 to 2016, it slowly returned to the level of nearly \$1000 at the beginning of 2014.

2.1.3 Historic first bull market: 2017. In 2017, bitcoin ushered in the historic first bull market. From the price trend from 2017 to 2018, the price of bitcoin experienced a volatile market of sharp rise and fall, soaring to a record high of nearly \$20000 at the end of 2017, with an annual increase of 1700%. The bull market continued for about two months.

2.1.4 Bear market period after bull market: 2018-2019. After the bull market in 2017, the price of bitcoin has been fluctuating and falling in 2018, with a downward trend for most of the year. By the end of 2018, the price of bitcoin had fallen below \$4000, a sharp drop of 80%, resulting in a long-term bear market, which gradually recovered to about \$8000 in 2019.

2.1.5 Epidemic period: 2020-2021. Affected by the corona epidemic, at the beginning of 2020, the bitcoin market was depressed, and the price once fell to a low level, hovering between \$5000 and \$9000. However, the corona epidemic has also brought significant macroeconomic changes. Institutions began to accept bitcoin. From

mid-2020 to 2021, bitcoin prices continued to rise, hitting a record high of more than \$60000.

2.1.6 Recovery period: 2022-2024. Under the influence of macroeconomic pressure, the price of bitcoin has undergone a major adjustment in 2022. The price fell back below \$20000 and remained depressed for nearly a year. It did not show a certain rebound trend until 2023, and rebounded to above \$60000 in 2021 at the beginning of 2024.

2.2 Important events in the fluctuation of bitcoin price

From the trend of the price of bitcoin in each stage, we can see that the price trend of bitcoin not only shows a certain cyclical boom and bust, but also has some non cyclical violent fluctuations. Combined with the market situation and macro environment of each period, the author summarizes the key events and factors affecting the price fluctuation of bitcoin, as shown in Table 1.

3 Key factors affecting the price fluctuation of Bitcoin

From the analysis in part 2, we can see that in different stages, the events and factors that cause the price fluctuation of bitcoin are

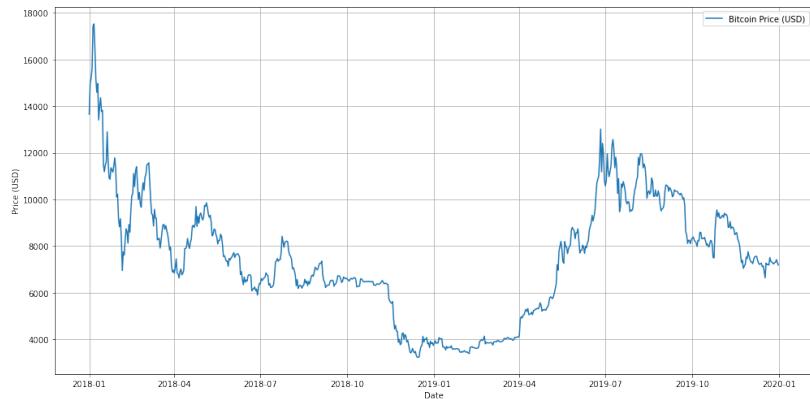


Figure 3: 2018-2019 Bitcoin price

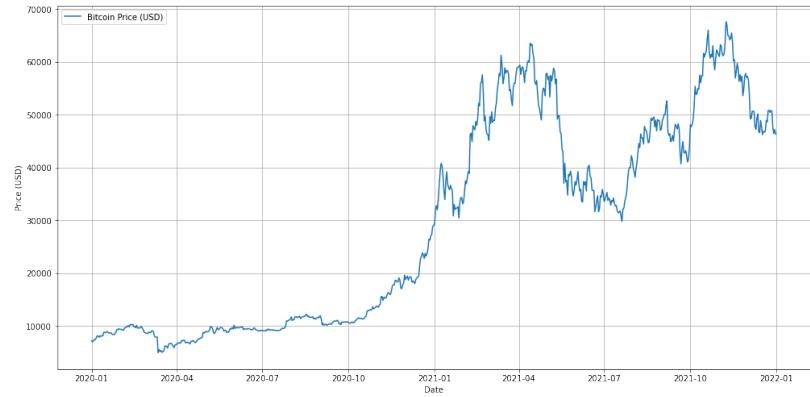


Figure 4: 2020-2021 Bitcoin price

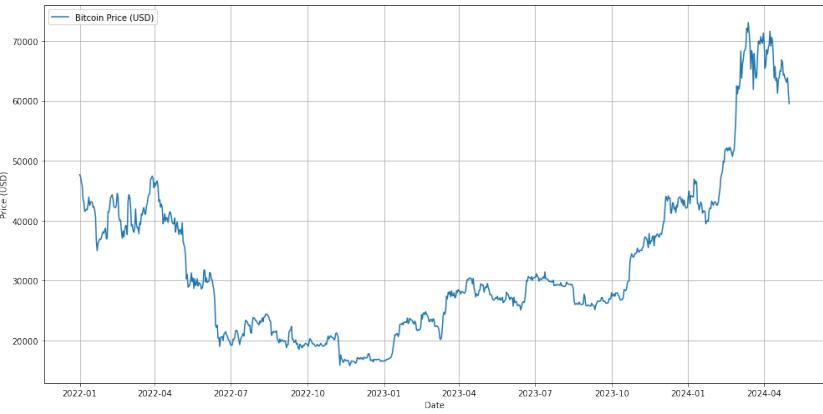


Figure 5: 2022-2024 Bitcoin price

different. Some of these factors come from bitcoin itself, such as the supply mechanism and technology development of bitcoin, and most of the events and factors come from the external environment. In this section, the author will analyze the influencing factors and

mechanisms of the price fluctuation of bitcoin from the internal and external factors that affect the price of bitcoin.

Table 1: Key events and factors

Period (year)	Key events	price changes
New period: (2009-2013)	Greek debt crisis and Cyprus financial crisis in 2013 The exposure of mainstream media such as Forbes and the Wall Street Journal has increased significantly Increased market recognition	rise rise rise
The first major adjustment (2014-2016)	In February, 2014, Mt., the world's largest bitcoin trading platform GOx declares bankruptcy due to hacker attack Governments in many countries began to carry out stricter review and supervision on cryptocurrency	fall fall
Historic first bull market (2017)	A large number of ICO projects emerged in 2017 Media pay more attention to bitcoin and blockchain Technology	rise rise
Bear market period after bull market (2018-2019)	In November, 2018, bitcoin cash bifurcation war Many countries around the world began to strengthen the supervision of cryptocurrency Market The US Securities and Exchange Commission (SEC) has strengthened the supervision of ICO	fall fall fall
Epidemic period (2020-2021)	The outbreak of the epidemic has led to turmoil in the global economy The traditional financial market was impacted, and investors began to look for new safe haven assets Governments and central banks of various countries implement large-scale fiscal stimulus measures and quantitative easing policies	fall rise rise
Recovery period (2022-2024)	The application of bitcoin in payment, finance, insurance and other fields has been further expanded The number of practical applications of network technology, blockchain technology and cryptocurrency continues to increase More and more platforms and payment systems support bitcoin transactions	rise rise rise

3.1 Internal mechanism affecting bitcoin price

The price of bitcoin will first be affected by its own factors, mainly including the supply mechanism of bitcoin and the development of digital money technology.

3.1.1 bitcoin supply mechanism. Unlike traditional financial assets, the total amount of bitcoin is limited, only 21million. According to the pre-set rules, the issuance of bitcoin is halved every four years, and the reduction of supply will inevitably increase the scarcity of bitcoin, thus pushing up the price of bitcoin. At present, bitcoin has experienced four times of halving. The author analyzed the bitcoin prices before and after the first four times of halving, and found that the halving event did not seem to cause significant changes in the price of bitcoin in the short term, but in a longer period of time, about one year, the price of bitcoin increased significantly, but whether these increases were due to the halving event remains to be determined.

3.1.2 technical development of digital currency. Like traditional financial assets, the price of bitcoin is determined by its intrinsic value, which in turn determines the price of bitcoin. The technological development of digital currency is one of the important factors supporting the intrinsic value of bitcoin. The development of digital currency technology can affect the price of bitcoin in three ways.

(1) The development of digital currency technology has improved the efficiency and security of transactions. For example, the emergence of lightning network enables small transactions of bitcoin

to be conducted off the chain, greatly speeding up the speed of transaction confirmation and reducing transaction costs. This improvement in transaction efficiency increases the practicability of bitcoin as a payment tool, which may drive its price rise.

(2) The development of digital technology has lowered the threshold for the use of bitcoin. The compatibility of bitcoin technology with other financial systems and payment systems continues to improve. For example, some traditional financial institutions have begun to provide bitcoin related services, such as bitcoin custody, trading, etc. This improvement in compatibility will help bitcoin to be applied in a wider range of scenarios, thus having a positive impact on its price.

(3) The development of digital technology has expanded the application scenarios of bitcoin. With the development of technology, bitcoin is more than just a digital currency. Based on bitcoin technology, smart contracts and more decentralized applications have been derived. For example, the use of bitcoin as a bottom asset or payment tool in the defi project and supply chain management project has increased the demand for bitcoin.

3.2 External factors affecting bitcoin price

3.2.1 macroeconomic environment. From the analysis in part 2, we can draw a conclusion that every sharp fluctuation in the price of bitcoin is accompanied by the development of some important international events, such as the Greek debt crisis and the Cyprus financial crisis in 2013, which led people to mistake bitcoin as a new

digital asset and stimulated the rise in the price of bitcoin. For another example, the outbreak of the corona epidemic has severely hit the global economy, and the price of bitcoin has also fallen. When governments of various countries adopted loose fiscal and monetary policies, the price of bitcoin rebounded. Facts have proved that the price of bitcoin, like other financial assets, is affected by the macroeconomic environment. The difference is that in times of global economic instability, the characteristics of bitcoin determine that it can also be used as a hedging tool against inflation and value storage, and its price can also remain strong in times of economic instability.

3.2.2 regulatory policies of various countries. From the analysis in part 2, we can see that the regulatory policies of countries around the world have a significant impact on the price of the special currency, which is mainly reflected in the following three aspects:

(1) Affect the legitimacy and availability of bitcoin. For example, when a country imposes a ban or strict regulation on bitcoin, this may lead to a sharp decline in the market demand for bitcoin in that country, which will lead to a decline in the price. On the contrary, if the government takes a tolerant or supportive stance, it may push up the price of bitcoin.

(2) Affect investor confidence and market expectations. Active regulatory policies can enhance the confidence of investors in bitcoin and make them believe that bitcoin has greater development potential and application scenarios in the future, so they are more willing to hold or buy bitcoin and drive up the price. On the contrary, strict regulatory policies or uncertainty may weaken the confidence of investors, make them pessimistic about the future of bitcoin, reduce investment or withdraw funds, leading to price decline.

(3) Affect the application scenarios and requirements of bitcoin. Reasonable regulatory policies can promote the application of bitcoin in legal compliance scenarios, such as promoting the application of bitcoin in cross-border payment, supply chain management and other fields, which will increase the actual demand for bitcoin, thus driving up the price (Kristoufek, L., & Vosvrda, M., 2023).

3.2.3 impact of market sentiment and media. Market sentiment is the subjective judgment and emotional tendency of market participants on the trend of specific financial assets or the overall market value. In the field of cryptocurrency, as a typical value target, the price fluctuation of bitcoin often reflects the dynamic balance between optimistic expectations and risk aversion of investors. The formation mechanism of this group cognition is essentially derived from the expected game and psychological resonance of market players in the environment of asymmetric information.

In the information dissemination mechanism, the news media plays a key role. When the authoritative media disclose the breakthrough progress of bitcoin underlying technology or the strategic layout of mainstream financial institutions, this information diffusion can often effectively boost investor confidence and form a price upward thrust. On the contrary, the in-depth investigation of security vulnerabilities or the policy interpretation of the strengthened regulatory framework may trigger the systematic risk revaluation of the market and trigger the structural adjustment of capital flows. It is worth noting that media reports are not simply

information transmission. Their narrative framework and agenda setting constitute the shaping process of market expectations.

As an important part of modern financial information ecology, social platform has built a multi-dimensional information dissemination matrix. The real-time interactive discussion community not only accelerates the diffusion rate of market information, but also forms a cognitive reinforcement effect through the content production mechanism of emotional polarization. Opinion leaders with network influence (KOL) can produce significant cognitive guidance effect in specific investor groups through professional analysis or emotional expression. This phenomenon is particularly prominent in the field of encryption assets with significant decentralized characteristics.

3.2.4 institutional investment. During the structural evolution of the cryptocurrency market, the main players represented by institutional investors, hedge funds and multinational enterprises (such as MicroStrategy, Tesla, etc.) are entering the market and are reshaping the value anchoring mechanism and price formation paradigm of bitcoin (Corbet, S., Lucey, B., & Yarovaya, L., 2023). This qualitative change in capital structure is not only reflected in the leap in the magnitude of the transaction scale, but also in the transfer of market pricing power from retail investors to professional investors.

From the perspective of market microstructure theory, the strategic layout of institutional investors essentially constitutes an important participant in the price discovery mechanism. This institutional feature significantly improves the efficiency of market price information, but it may also lead to the vulnerability of liquidity level due to the convergence of strategies.

In terms of liquidity transmission mechanism, the continuous injection of institutional funds has produced a significant liquidity premium effect. According to the market depth model, when the proportion of institutional positions exceeds the threshold, the price gap in the bitcoin market will narrow by 40% to 60% of the basic level. This improvement in liquidity not only enhances the price shock resistance, but also forms a price stability anchor through the forward basis structure of futures contracts. However, we should be vigilant that under extreme market conditions, the programmed position closing operation of institutional investors may trigger a liquidity spiral, which has been proved in the market circuit breaker event in March 2020.

4 short term prediction of bitcoin price

According to the previous analysis, the price of bitcoin is affected by many factors, among which internal factors determine the long-term trend of the price of bitcoin, but the fluctuation of the price of bitcoin is more affected by external factors. These factors have a greater impact on the price of bitcoin than traditional investment tools. Therefore, compared with the price of financial instruments in the traditional financial market, the fluctuation of virtual currency is more intense. It is difficult to accurately predict the short-term price of bitcoin (Smith, J., & Dwight, S., 2021). Scholars in various countries have adopted various methods and models to predict the price of bitcoin. This paper summarizes these methods and tries to test the accuracy of these methods by using these methods.

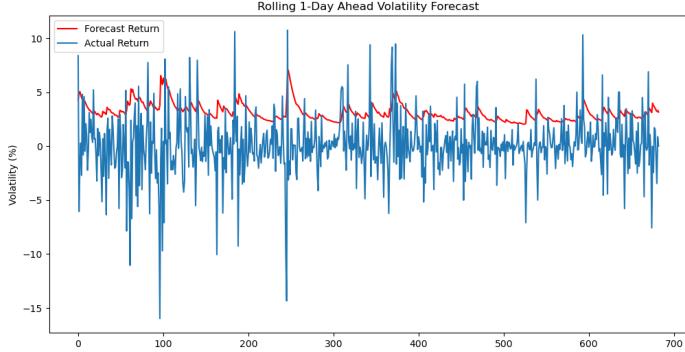


Figure 6: volatility forecast

Summing up the research of scholars at present, the short-term forecasting tools of bitcoin price are mainly divided into two categories. One is the traditional financial forecasting tools, such as ARIMA model for time series analysis and GARCH model for income volatility analysis; One is prediction tools based on machine learning, such as random forest model, LSTM model, etc., and some scholars combine the two. Using the price data of bitcoin from 2014 to 2024, this paper briefly describes and tests three common methods.

4.1 ARIMA model

ARIMA model is a non-stationary time series analysis and prediction model, and it is also the most commonly used model. In this paper, we first use this model to analyze and predict the price of special currency. According to the analysis steps of the model, we took the price of bitcoin, that is, the daily closing price, as the analysis object, and tested the ADF stationarity of the price series. It was found that the series was non-stationary and stable after first-order difference. Then, the parameters p and Q were determined by ACF and PACF diagrams, and the results showed that there was no obvious tailing and truncation characteristics. This indicates that the model may not be suitable, or has a more complex dynamic structure, or the model is random walk.

Therefore, we tried the SARIMA model of seasonal influence and tested it, and the results were still the same as ARIMA model.

Therefore, we conclude that ARIMA model is not suitable for the analysis and prediction of bitcoin price. Of course, the sample selected in this paper is daily transaction data, and different data samples may have different results.

4.2 GARCH model

Since bitcoin price series is not suitable for traditional model analysis, let's try to analyze the price fluctuation of bitcoin.

We convert the price series of bitcoin into yield and get the yield time series.

Then take 80% of the sample data as the training data, use GARCH (1,1) model for training and model estimation, and use the estimation results for rolling window prediction to obtain the yield prediction results, as shown in the figure.

The prediction accuracy MSE is 149 and MAE is 10.

From the prediction results, GARCH model can better predict the yield of bitcoin.

4.3 LSTM model

LSTM model is a special kind of Recurrent Neural Network (RNN) model, which can capture the long-term dependence in the bitcoin price series, thus making the prediction more accurate.

We first compared the price of special currency for standardization. As above, we took the first 80% of the sample data as the training sample, built the LSTM model, trained the training sample, and then predicted the last 20% of the data. The comparison chart of the prediction results is as follows:

Although there is a certain lag, the prediction results fit the real data well.

5 Long term trend of bitcoin price

5.1 Volatility, periodicity and long-term growth

Recession recession cyclical pattern. Since 2014, bitcoin has experienced four fluctuation cycles. The author believes that in the future, the price of bitcoin will continue to fluctuate periodically, and when it happens depends on external drivers.

Although it has experienced many fluctuation cycles, the price of bitcoin has risen on the whole. In the long run, the growth of bitcoin will continue. As we all know, the supply of bitcoin is quite limited. In the future, the supply will be less and less, and the price will naturally rise. Furthermore, with the digital transformation of the global economy and the continuous development of blockchain technology, cryptocurrency will become an indispensable part of the global financial system, it will enhance the value and status of bitcoin, then increasing investor confidence, and promoting long-term price growth.

5.2 Enhanced correlation with the stock market and gold

In the early days, people only regarded it as a safe haven asset, which had little correlation with the financial market. Yet, with the deepening of people's understanding of bitcoin, and the maturing of bitcoin market, there are more and more investors in bitcoin, and the correlation between bitcoin and traditional financial markets will also increase.

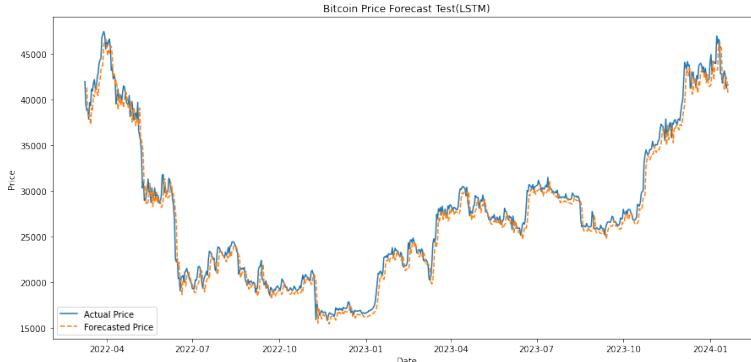


Figure 7: price forecast

Gold has been recognized as a safe haven asset for a long time, and bitcoin is also regarded as "digital gold" at some times, which has a certain safe haven attribute, and the prices of the two have a certain correlation. For example, from 2024 to early 2025, due to changes in the pattern of World War, as a safe haven asset, the price of gold and bitcoin soared. In the future, bitcoin's hedging property will be enhanced, and its correlation with gold will be greater.

5.3 Will be affected by CBDC

Central banks around the world have begun to study and deploy their own digital currencies, which is bound to have a huge impact on the current pattern of the digital money market. CBDC is directly issued and supervised by the central banks of various countries, and has a very strong centralized control attribute; In contrast, the issuance and circulation of bitcoin are completely independent of any central institution or government regulatory system. This essential difference may lead to the popularity of CBDC, which may weaken the core competitiveness of bitcoin as a decentralized digital asset to a certain extent.

6 Conclusion

The price of bitcoin is affected by a series of internal and external factors, showing strong volatility, which also makes it difficult to accurately predict the fluctuation of bitcoin price. However, bitcoin

still shows strong periodicity and growth. With the progress of technology and the continuous improvement of the regulatory framework, bitcoin will still play an important role in the new world financial structure.

Acknowledgments

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